SENATE

OCT 25

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ORIGINAL

PROPOSAL SCC #99/00- 723

CURRICULUM PROPOSAL FORM 1999-2000

NON-GENERAL EDUCATION PROCESS A

*DEADLINES: Deadline dates for 1999/2000 submissions: Regular proposals: October 22, 1999 to be implemented in Fall 2000; Short-Term proposals: December 10, 1999 to be implemented in Fall, 2000; Regular proposals February 18, 2000 to be implemented in Spring, 2001; March 24, 2000 for short-term courses to be implemented in Spring 2001.

0401.310

PROPOSAL TITLE: Evolution

SPONSOR(S): Dr. Luke Holbrook, Assistant Professor

DEPARTMENT: Biological Sciences

COLLEGE: Liberal Arts & Sciences

IF LAS CHECK ONE: ___ History/Humanities ✓ Math/Sciences ___ Social/Behavioral Sciences

Check one: ✓ Undergraduate ___ Graduate

THE ATTACHED *NON-GEN-ED* PROPOSAL IS BEST DESCRIBED BY THE ITEM(S) CHECKED.

✓ New non-gen-ed course

___ Short-term non-gen-ed course

___ Minor curricular changes (fewer than three) to:

___ existing non-gen-ed course

___ non-gen-ed degree requirements

___ major

___ minor, specialization, concentration, track, certificate program

RECEIVED

DEPARTMENT
(Signature indicates approval)

Dept. Curriculum Chair / Date

Dept. Chairperson / Date

ACADEMIC DEAN

Approved ✓ Not Approved ___ Comments:

Dean's Signature/Date 10-21-99

COLLEGE CURRICULUM COMMITTEE

Date of open hearing (if necessary) 1/27/00 Approved X Not Approved _____

Comments: Modified by addition of lab description - provided & approved

Signature of College Chair/Date: [signature] 1/27/00

UNIVERSITY CURRICULUM COMMITTEE

Date Received/Processed 2/3/00

Comments:

Curriculum Chair Signature [signature] Date Announced At Senate 2/4/00

EXECUTIVE VICE PRESIDENT/PROVOST

Approved ✓ Not Approved _____ If no, reasons are as follows:

Student Credit Hours _____ Faculty Load Hours _____ Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date): _____ Executive VP/Provost Signature/Date [signature] 2/4/00

REGISTRAR

Date Approved Course Description Received _____ Hegis Taxonomy & Course Number Assigned 0401.310

Registrar Signature/Date Robert A. Kubat 2/15/00

NOTIFICATION FORWARD

_____Senate Curriculum Committee Chairperson _____Academic Dean(s)

_____Department Chairpersons _____Registrar _____Sponsor(s)

Revised + Approved
1/27/00

Rowan University
Department of Biological Sciences

New Course Proposal

Evolution

1. DETAILS

1a. Course title: Evolution 0401.310

1b. Sponsors: Department of Biological Sciences
Dr. Luke Holbrook, Assistant Professor

1c. Credit Hours: 4 s.h.

1d. Course Level: Undergraduate (300-level HEGIS number requested)

1e. Curricular Effect: This laboratory course will serve as a Biology Elective for Biological Sciences majors.

1f. Prerequisites: Biology I and II or permission of instructor.

1g. Suggested Time and Scale of Implementation: Fall 2000, to be offered annually.

1h. Adequacy of Present Staff, Resources, and Library Facilities:

The department hired Dr. Holbrook in part specifically to develop this course and the proposed course in Systematics and Evolutionary Mechanisms, because the department feels that these courses are an important component of the curriculum for Biological Sciences majors. With current staffing conditions, this requires the department to reallocate some of its personnel resources in order for this course to be offered on a regular basis. The proposed course, however, is an integral component of the biological sciences curriculum that has been absent for too long, and the department is committed to providing it, even if some other courses will not be taught as frequently. Other resources and facilities are adequate.

1i. Short-Term Evaluation:

The Department Curricular Committee and the entire Department routinely evaluate all courses to ensure that they meet the standards of the Department, the College, and the University.

2. RATIONALE

The concept of organic evolution is a central concept of biology. An understanding of evolutionary principles, processes, and patterns is necessary for understanding modern biology.

It is therefore important that majors in Biological Sciences have the opportunity to learn about evolution in depth, because it will provide an important context for subsequent classes and other experiences in biology. In particular, numerous upper-level classes (e.g., Comparative Vertebrate Anatomy, Mammalogy, Ornithology, Ichthyology, Herpetology, Entomology, Animal Behavior, Invertebrate Zoology, Ecology, Plant Diversity, etc.) are taught from an evolutionary perspective.

Evolutionary biology is a thriving discipline that draws from and impinges upon numerous other disciplines. Aspects of evolution are introduced in various courses, but the quantity and significance of the topics covered by evolutionary biology deserve to be presented as a separate course, where the concepts can be presented in detail with ample opportunities for discussion and application.

The department currently offers a graduate course, Evolutionary Theory, but that course is designed for graduate students and has a very different syllabus. The proposed course will provide a thorough background in evolution for undergraduates and particularly for underclassmen, in order to provide the necessary preparation for advanced courses that have an evolutionary perspective.

3. ESSENCE OF THE COURSE

3a. Objectives

The objective of this course is to provide the student with a clear and profound understanding of the theory of organic evolution, the processes that govern it, the patterns of evolution during the history of life, and the significance of these for other aspects of biology. Evolution is a concept that influences every facet of biology and has had a profound impact on ideas, culture, and society, beyond the boundaries of biological science. Students taking this course will be equipped to apply evolutionary concepts to their knowledge of biology, and they will be able to critically evaluate other scientific and non-scientific applications (and abuses) of the theory of evolution.

3b. Course Outline

The instructor may choose to modify the content of the course, but the following topics are likely to be included:

History of Evolutionary Thought
Darwin and Natural Selection
Adaptation
Sexual Selection
Ecology and Evolution
Genetics and Variation in Populations
Development and Evolution
Speciation

Phylogeny and Systematics
Patterns of Diversity: Origination and Extinction
Biogeography
Tempo and Mode in Evolution
Molecular Evolution

The Fossil Record
Origin of Life
Origin of Eukaryotes
The Cambrian Explosion
Adaptations to Terrestrial Life and the Permian Extinction
Mesozoic Life: Rise and Fall of the Dinosaurs
Mammalian Evolution
Origin and Evolution of Humans

(See also attached list of potential lab exercises.)

3c. Evaluation and Grading of Students

The specifics of grading are left up to the instructor, but it is expected that written exams, laboratory reports, written assignments (including a term paper), and performance and participation in class will all contribute to the final grade.

3d. Course Evaluation:

The Biological Sciences Department routinely reviews its courses to assess whether each course is meeting the standards and objectives of the Department, the College, and the University.

4. RESULTS OF CONSULTATION:

Dr. Holbrook and other department members have discussed the creation of this course since Dr. Holbrook was hired. Furthermore, the department as a whole has had the opportunity to review the proposal, and their comments have been incorporated. The department as a whole officially endorses this proposal.

5. POSSIBLE TEXTBOOKS:

There are few textbooks that adequately cover the range of material considered here. Much of the reading of the course will be taken from individual papers in the scientific literature and the articles written for more popular consumption. Besides the suggested text given below, the students will be provided with papers by a variety of authors that discuss various topics.

Evolutionary Biology. Douglas Futuyma, Sinauer Associates, Inc., 3rd edition, 1997.

6. CATALOG DESCRIPTION: See next page.

LAB EXERCISES

A more detailed list of laboratory exercises is provided. This list is not exhaustive but provides a sampling of the types of exercises that would be undertaken during the lab time, some of which may require more than one lab period.

Population genetics and evolution: Evolution is sometimes defined as changes in allele frequencies in a population over time. Two types of exercises can be performed to illustrate this concept. Students can model behavior of genes and populations using an analog, such as colored beans or decks of cards. For instance, the students can act as the individuals in the population, using cards to represent the alleles they possess (e.g., red or black). They can then simulate the production of a new generation of individuals, with or without adherence to the requirements of Hardy-Weinberg equilibrium.

There are also a number of software packages that allow one to model allele frequencies in a population, so that students can observe changes in a population due to mutation, gene flow, drift, non-random mating, and selection. An example of such a program is Drift, available free from the University of Washington. The importance of this topic and the variety of parameters involved in both types of exercises are sufficient for two lab periods.

Competition and natural selection: This lab would allow students to investigate the effects of competition between and within species, as well as the role of the environment in natural selection. These exercises are facilitated by software, such as Evolve from the BIOQuest Library and EvolveIT produced by California State University. These phenomena can also be modeled using real organisms, such as bacteria in growth media modified to provide several different "environments."

Phylogeny, character evolution, and biogeography: Using pre-made data sets, the program MacClade will be used to introduce students to cladograms and characters. Students will learn the basics of cladistic methods and will examine the effect of "branch-swapping" on interpreting character evolution and biogeography.

Systematic and phylogenetic methods: Students will be given objects or organisms and asked to classify them. They will have to provide a rationale for their classification that reflects the evolution of the group. (In some cases they will discover that there is no "right" answer.) Students will also be provided with real data sets that they will use to create phylogenies.

Phylogenetic reconstruction and parsimony: Students will use the program PAUP* to perform parsimony analyses of provided data sets and data sets that they construct themselves from examining provided objects or organisms.

Molecular evolution: Molecular biology has had a profound effect on evolutionary biology, and students will be exposed to some of the techniques that look at evolution from a molecular perspective. These include allozyme electrophoresis and molecular systematics. Using pre-prepared subjects, students will learn how electrophoresis is used to examine genetic variation

within and between species. Students will also examine how sequence data is used in a phylogenetic analysis.

Diversity and the origin of Life: The department currently possesses software that models the possible origin of Life under the physical and chemical conditions of the early Earth. In addition to this exercise, students will use the Tree of Life web site to examine the phylogeny of particular groups of organisms.

Major features of plant, animal, and vertebrate evolution: This actually represents two or three labs that will largely consist of demonstrations. Students will examine specimens representing various groups of organisms and learn to recognize their most significant characteristics. By the end of the lab, students will be able to provide a phylogeny of the group and discuss the evolution of some of its characters.

CATALOG DESCRIPTION

(04xx.3xx) 0401.310 4 s.h.
Evolution
(Prerequisites: 0401.100, 0401.101, or permission of instructor)

This laboratory course considers organic evolution, including its conceptual basis, its historical development, the processes that produce it, and the evolutionary history of life on Earth. Laboratory exercises will include simulations of evolutionary processes, demonstrations illustrating patterns of evolution in the past, and opportunities to utilize research techniques of evolutionary biology.