

Oct 25

CURRICULUM PROPOSAL FORM 1999-2000

RECEIVED 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.

0401.407

PROPOSAL TITLE: Systematics and Evolutionary Mechanisms
SPONSOR(S): Dr. Luke Holbrook, Assistant Professor
DEPARTMENT: Biological Sciences
COLLEGE: Liberal Arts and Sciences
IF LAS CHECK ONE: Math/Sciences
Check one: Undergraduate

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 [checked] Not Approved
Comments:
Dean's Signature/Date

COLLEGE CURRICULUM COMMITTEE

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

Comments: modified by addition of lab description provided + approved

Signature of College Chair/Date: [Signature]

UNIVERSITY CURRICULUM COMMITTEE

Date Received/Processed 2/5/00

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. 407

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

NOTIFICATION FORWARD

____ Senate Curriculum Committee Chairperson _____ Academic Dean(s)
____ Department Chairpersons _____ Registrar _____ Sponsor(s)

New Course Proposal

Systematics and Evolutionary Mechanisms

1. DETAILS

1a. Course Title: Systematics and Evolutionary Mechanisms 0401. 407

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

1c. Credit Hours: 4 s.h.

1d. Course Level: Undergraduate (400-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.

1g. Suggested Time and Scale of Implementation: Spring 2001, to be offered every other year.

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 Evolution, 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

Systematics is one of the oldest of biological disciplines. Modern systematics is intimately connected to the concept of evolution. It is convenient to discuss systematics and the

mechanisms of evolution in the same course, because these topics shed light on each other. Biological Sciences majors should have the opportunity to look at these issues in depth, to read the original literature upon which important evolutionary concepts are based, and to look at systematics and evolutionary biology as a thriving area of scientific investigation.

3. ESSENCE OF THE COURSE

3a. Objectives of the course:

This course will describe the discipline of systematics and its constituent fields and demonstrate the relationship between systematics and evolution. The course will examine the historical development of concepts in systematics and evolution, investigate the biological basis of systematics and evolution, and introduce the student to the scientific literature in this field.

3b. Course Outline:

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

Historical Development of Systematics and Evolution
Species and Species Concepts
Mechanisms of Speciation
Adaptation
Natural Selection
Sexual and Social Selection
Tempo and Mode: Gradualism vs. Punctuated Equilibrium
Phylogeny Reconstruction
Taxonomy and Classification
Biogeography

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

The department as a whole has reviewed this proposal. Comments were incorporated into the present version, and the department as a whole has officially endorsed this proposal.

5. POSSIBLE TEXTBOOKS

One objective of this course is to get students to understand the topics by reading the publications of those that formulated and refined these ideas. There is no textbook that adequately covers the array of topics discussed in this course. Instead, the students will read original papers and books relevant to the subject.

6. CATALOG DESCRIPTION: See next page.

CATALOG DESCRIPTION

(04xx.4xx) *0401.407* 4 s.h.
Systematics and Evolutionary Mechanisms
(Prerequisites: 0401.100, 0401.101)

This laboratory course considers the field of systematics and its relationship to evolution. The course will cover a variety of topics, including species concepts, evolutionary mechanisms, phylogenetic analysis, and taxonomy. Laboratory exercises include demonstrations and actual applications of investigative techniques used to study systematics and evolution, including exercises in analyzing phylogeny. This course may not be offered annually.

LAB EXERCISES

A primary purpose of lab will be to give students hands-on experience in doing phylogenetic analysis. Although other instructors may alter the content of labs to their own preferences, it is suggested here that students do a semester-long project, where they will choose a group of organisms whose phylogeny they will examine in detail, producing at the end of the semester a presentation and paper describing their results and interpretations. Along the way, students will also perform other lab exercises that teach them various techniques that they will ultimately use for their own projects. Some of these exercises are discussed below.

Taxonomy and dichotomous keys: Students will come up with their own classification scheme for a group of objects or organisms. The students will learn to use a dichotomous key to identify species of organisms.

Characters and coding: Students will be given a group of "organisms" (real organisms or objects representing organisms) and will have to identify characters that vary among the organisms. The students will learn to code the characters for phylogenetic analysis, including coding binary and multistate characters. Students will be given a selection of outgroups to determine polarity of characters. Finally, they will produce a phylogeny for the group and identify shared derived characters.

Data input and MacClade: Students will produce character matrices in MacClade. They will then use MacClade to manipulate trees, examine character evolution, and output trees to files and to a printer. (Note: MacClade is a Mac-only program, but a similar program, CLADOS, is available for the PC.)

Tree statistics: Students will learn to calculate and interpret the tree length, consistency index, homoplasy index, retention index, and rescaled consistency index for a tree or set of trees.

Parsimony and PAUP*: Students will perform parsimony analyses using the program PAUP*. They will learn to create Nexus files, import data from MacClade, perform heuristic, branch-and-bound, and exhaustive searches, display and print trees, and compute different types of consensus trees.

Weighting, ordering, and reconstructing character evolution: Students will examine the effects of weighting characters and of using different weighting schemes on an analysis. They will also examine the effects of ordering multistate characters and different ways to parsimoniously reconstruct character evolution on a tree.

DNA sequence data: Students will download DNA sequences from on-line databases, align sequences, and analyze them with PAUP*, using parsimony and maximum likelihood methods of phylogeny reconstruction.

Multiple data sets: Students will perform phylogenetic analyses of the same group using different data sets and examine the issues of reconciling discordant results or analyzing a combined data set.

Bootstrapping and jackknifing: Students will use these statistical methods to test how robust the results of an analysis are and to test the sensitivity of results to removal of characters or taxa.

Biogeography and stratigraphy: Students will use phylogenies to make inferences about biogeographic and stratigraphic patterns and examine proposed methods for incorporating stratigraphic information into an analysis a priori.

Comparative analysis: Using the program CAIC (free from the University of Oxford), students will examine how phylogenies can be incorporated into comparative studies using continuous variables.