

UNDERGRADUATE CURRICULUM PROPOSAL COVER SHEET

Title of Proposal - Must begin with Department Abbreviation:
BIOL/ESC Request to offer ESC533 for undergraduate BIOL and ESC credit

ESC BIOL 433

Check One: [X] Full Proposal or [ ] Information Item

Effective Date for Curricular Offering: Spring 2009

FROM: Margaret J. Kovach, Biological & Environmental Science, Holt 121, (423) 425-4397, Margaret-Kovach@utc.edu
(proposal originator: include spokesperson's name, department, office number, telephone, e-mail)

Does this require new resources from the originating department or other department? NO
Please attach explanation if yes.

Faculty of the originating department approved this proposal on October 10, 2008 (date),
by a vote of 17 aye votes; 0 nay votes; 0 abstentions; 0 eligible voting members absent

The following have examined this proposal:

Dept Head/Director: John C. Tucker (printed name), John C. Tucker (signature), [X] approve, [ ] neutral, [ ] disapprove\*

College Curriculum Committee Date: \_\_\_\_\_ Vote: \_\_\_\_\_ Signature of Chair: \_\_\_\_\_

Spokespersons for Affected Departments:

(name, department, date) signature approve neutral disapprove\*

Dean/Director: H. Burhenn (printed name), H. Burhenn (signature), [X] approve, [ ] neutral, [ ] disapprove\*

University Registrar: Linda Orth (printed name), Linda Orth (signature), [ ] approve, [ ] neutral, [ ] disapprove\*

Provost: Phil Oldham (printed name), Phil Oldham (signature), [X] approve, [ ] neutral, [ ] disapprove\*

\*Those who disapprove may attach an explanation

Table with 3 columns: ACTIONS on this proposal, Curriculum Committee, Faculty Senate. Rows include Date the proposal was considered, Vote of the body, Accepted as information item, Approved as submitted, Approved with amendments, and Signature of Chair.

# MEMORANDUM

TO: Ed Rozema, Chair, Curriculum Committee  
FROM: Margaret J. Kovach, Department of Biological and Environmental Sciences  
DATE: October 2, 2008  
RE: Environmental Genetics course (ESC 535) as a new undergraduate course

The Biological and Environmental Sciences Department requests a change to offer a currently approved graduate course, ESC 535 (Environmental and Ecological Genetics), for both graduate and undergraduate students. We currently allow undergraduate students in the course via a temporary ESC/BIOL 499 course offering on a case-by-case basis. We would like to offer the course as both a graduate and an undergraduate course each time it is taught.

In a separate Graduate Curriculum proposal we are requesting to rename and modify the catalog description for ESC 535 to more accurately reflect the course content, format and appropriate prerequisites. Please see proposed catalog description:

## A. CATALOG DESCRIPTION:

### 1. Proposed New Catalog Description

ESC 435 and BIOL 435 Environmental and Ecological Genetics (3 credits)

This course integrates ecology, genetics, and evolutionary biology with emphasis on applications of genetic concepts in three major areas: molecular analysis, developmental and population genetics. Contemporary approaches to studying evolution in natural populations will be presented, including analyzing heritability of ecologically important traits, using molecular techniques to determine genotypes, evaluating the affect of environmental agents on the genetics and development of organisms, and using models to predict evolution in natural populations. Includes case studies and journal readings to examine evolutionary effects of ecological interactions among organisms. *Prerequisites: Junior standing, BIOL325 or instructor approval. Credit not allowed in both Biology and Environmental Science 435.*

## B. PEDAGOGICAL OBJECTIVES:

1. To understand the genetic basis of continuous traits, including the roles of genetics, environment, and their interactions.
2. To understand methods for measuring genetic variation
3. To gain a basic theoretical grasp of describing the distribution of population genetic variation
4. To understand the roles of mutation, gene flow, population size, selection and recombination, and how these factors interact to influence evolution
5. To gain an understanding of molecular evolution and basic phylogenetic analysis

## C. SYLLABUS: See attached.

#### D. EVALUATION METHODS:

Three semester examinations will be given (100 pts each) – one each by Drs. Kovach, Carver and Shaw, respectively. Graduate students enrolled in the course will have the responsibility of leading the discussion of at least two topics, chosen by the faculty, by providing a PowerPoint presentation on background information and a written review of the article. The review will be written as if you are reviewing the paper for its publication and the discussion will come from your leading the class discussion on that day. ALL students (graduate and undergraduate) are required to read each article and participate in the discussion of the papers chosen as part of the reading material for this course. The content of each term exam will not be comprehensive but rather cover all new material given since the previous exam.

To distinguish between undergraduate and graduate students in the new undergraduate ESC435/BIOL435 and ESC535 course, graduate students will be required to write a critical review and lead the discussion of two journal articles on topics covered in the course. Undergraduates will not have this requirement.

#### Grading

Exam I	100 pts	90%-100%	= A	(315-350 pts)
Exam II	100 pts	80%-89%	= B	(280-314 pts)
Exam III	100 pts	70%-79%	= C	(245-279 pts)
Case Study I (G)	50 pts	60%-69%	= D	(210-244 pts)
Participation (UG)	50 pts	< 60%	= F	(< 244 pts)
TOTAL*	350 pts			

\* G = Graduate students

\*UG = Undergraduate students

#### E. RATIONALE FOR CHANGE:

Currently, ESC 535 is offered as an elective course as part of the MS in ESC by the Department of Biological and Environmental Sciences. It is a natural continuation of the BIOL 325 (Introductory Genetics) course, with an educationally advanced focus on applying a basic knowledge of genetics to ecological and environmental studies. By offering ESC 535 to our juniors and seniors, we will give our undergraduate students the opportunity to learn more about the cross-disciplinary field of genetics and its application to environmental studies, possibly focusing them on graduate programs in this growing field.

#### F. ECONOMIC AND PEDAGOGICAL ANALYSIS OF PROPOSAL:

This proposed change would offer another elective to our undergraduate students completing BS in BIOL or ESC degrees. Since the course is currently taught as a graduate course, there should be minimal changes to curriculum, and the economics of running departmental courses.

#### G. RELATION OF PROPOSAL TO REQUIREMENTS AND RESOURCES IN OTHER DEPARTMENTS OR PROGRAMS:

Not applicable.

**SYLLABUS**  
**ENVIRONMENTAL AND ECOLOGICAL GENETICS**  
**(ESC 535/ESC 435/BIOL 435)**

**Instructors:**

Dr. Margaret Kovach

Office: 121 Holt Hall

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Dr. Ethan Carver

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Dr. Joey Shaw

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**Pre-requisites:** BIOL 325

**Course Description:**

This course will cover the fundamentals of modern ecological, evolutionary and environmental genetics. The class has a lecture component as well as weekly meetings to discuss papers published in the primary research literature. The course begins with an overview of inheritance, molecular biology and genetic variation, its measurement, and the forces responsible for the origin and maintenance of variation. The remainder of the course describes the ecological and evolutionary forces that shape genetic variation within and between species and how knowledge of genetics can be applied to ecological and environmental studies. Emphasis will be placed on experimental studies of natural populations, and the relationship between theory and experiments. Examples of possible topics will include: heritability and how the heritability of traits is measured, sources of genetic variation, the biological impact of environmental toxins, the genetic structure of populations and genetic drift, models of gene flow, effects of selection on gene frequencies. In each of the section, the students are introduced to basic tools, methods and applications of the subject area, as well as to contemporary research problems with examples from literature and current research.

**Course Objective:**

The overall objective of this course is to obtain a general understanding of the relationships between genes and the environment. Specifically this course will introduce students to population and evolutionary genetic concepts in experimentally applied frameworks. As a result of this course the student should gain an understanding of methods for measuring genetic

variation; a basic theoretical grasp of describing the distribution of population genetic variation; an understanding of the roles of mutation, gene flow, population size, selection and recombination, and how these factors interact to influence evolution; an understanding of molecular evolution and basic phylogenetic analysis; an understanding of the genetic basis of continuous traits, including the roles of genetics, environment, and their interactions.

**Attendance Policy:**

You will be evaluated on your participation in lecture and group discussions. If missing class is unavoidable, please contact the instructor(s) prior to the absence in order to make arrangements to accommodate missed material.

**Tentative grading scheme:**

Three semester examinations will be given (100 pts each) – one each by Drs. Kovach, Carver and Shaw, respectively. Graduate students enrolled in the course will have the responsibility of leading the discussion of at least two topics, chosen by the faculty, by providing a PowerPoint presentation on background information and a written review of the article. The review will be written as if you are reviewing the paper for its publication and the discussion will come from your leading the class discussion on that day.

Your review should be no more than 5 pages and organized as follows\*:

- 1) provide a brief introduction to the topic, including assigned papers (with some background information)
- 2) state the objectives of the studies and how they relate (ie are important) to the general field of study.
- 3) generally describe the methods used and evaluate the suitability of these methods to the project (suggest better approaches if possible)
- 4) describe the results and the author’s interpretation of those results and their significance as a contribution to the topic in general.
- 5) identify the goals of the paper and evaluate whether these goals have been met by the study.

\*see attached appendix for detailed format of written reviews.

ALL students (graduate and undergraduate) are required to read each article and participate in the discussion of the papers chosen (by instructors) as part of the reading material for this course. The content of each term exam will not be comprehensive but rather cover all new material given since the previous exam.

**Grading**

Exam I	100 pts	90%-100%	= A	(315-350 pts)
Exam II	100 pts	80%-89%	= B	(280-314 pts)
Exam III	100 pts	70%-79%	= C	(245-279 pts)
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<u>Participation (UG)</u>	<u>50 pts</u>	< 60%	= F	(< 244 pts)
TOTAL*	350 pts			

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**Check your UTC email** address (firstname-lastname@utc.edu) for all communications. (See <http://onenet.utc.edu> for your exact address.) Please check your UTC email on a regular basis. If you have problems with accessing your email account, contact the Help Desk at 423/425-2678.

**Disabilities:** If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think you might need special assistance or a special accommodation in this class or any other class, please speak with your professor as soon as possible. You may also contact the UTC Office for Students with Disabilities at 425-4006 or go by their office in 110 Frist Hall on the UTC campus.

**Counseling and Career Planning Center:** If you find that personal problems, career indecision, study and time management difficulties, etc. are adversely impacting your successful progress at UTC, please contact the Counseling and Career Planning Center at 425-4438.

**ESC 535/ESC 435/BIOL 435 Tentative Course Schedule:**

**MOLECULAR ANALYSIS OF POPULATIONS:**

WEEK 1: Transmission Genetics and Inheritance

WEEK 2: Central Dogma of Molecular Biology, Genome Variation and Mutation

WEEK 3: (Case Studies - Papers to read, review, and discuss)

WEEK 4: (Case Studies - Papers to read, review, and discuss)

WEEK 5: Test I

**TERATOGENIC EFFECT OF ENVIRONMENTAL AGENTS:**

WEEK 6: Developmental Genetics and Cellular Signaling

WEEK 7: (Case Studies - Papers to read, review, and discuss)

WEEK 8: (Case Studies - Papers to read, review, and discuss)

WEEK 9: (Case Studies - Papers to read, review, and discuss)

WEEK 10: Exam II

**POPULATION AND EVOLUTIONARY GENETICS:**

WEEK 11: Geographical Genetic Variation, Phylogeny/Phylogeography/Population Genetics

SPRING BREAK

WEEK 12: (Case Studies - Papers to read, review, and discuss)

WEEK 13: (Case Studies - Papers to read, review, and discuss)

WEEK 14: (Case Studies - Papers to read, review, and discuss)

WEEK 15: Exam III