CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS

COURSE MODIFICATION PROPOSAL

Courses must be submitted by November 2, 2009, to make the next catalog (2010--2011) production

DATE (CHANGE DATE EACH TIME REVISED):  10-15-09; REV 12.8.09

PROGRAM AREA(S) : BIOLOGY

Directions: All sections of this form must be completed for course modifications. All documents are stand alone sources of course information.

1. Course Information.
   (Follow accepted catalog format.) (Add additional prefixes if cross-listed)

<table>
<thead>
<tr>
<th>OLD</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefix</td>
<td>BIOL</td>
</tr>
<tr>
<td>Units (4)</td>
<td>Title MOLECULAR EVOLUTION</td>
</tr>
<tr>
<td>3 hours lecture per week</td>
<td>3 hours lecture per week</td>
</tr>
<tr>
<td>3 hours blank per week</td>
<td>3 hours laboratory per week</td>
</tr>
<tr>
<td>x Prerequisites: BIOL 400 or BIOL 401 or permission of instructor</td>
<td>x Prerequisites: BIOL 504</td>
</tr>
<tr>
<td>x Consent of Instructor Required for Enrollment</td>
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</tr>
<tr>
<td>Corequisites:</td>
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</tr>
</tbody>
</table>

   **Catalog Description** (Do not use any symbols): This course will examine evolutionary change at the molecular level. Topics include: The driving forces behind the evolutionary process, the effects of the various molecular mechanisms on the structure of genes, proteins, and genomes, the methodology for dealing with molecular data from an evolutionary perspective and the logic of molecular hypothesis testing.

   - General Education Categories
   - Lab Fee Requested
   - Graded
   - Repeatable for up to 4 units
   - Total Completions
   - Multiple Enrollment in same semester
   - Course Level:
     - Undergraduate
     - Graduate
   - Optional (Student’s choice)

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     - Graduate
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2. Mode of Instruction (Hours per Unit are defaulted)

   **Existing**

<table>
<thead>
<tr>
<th>Units</th>
<th>Hours Per Unit</th>
<th>Benchmark Enrollment</th>
<th>Graded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>3</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lab</td>
<td>1</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Field Studies</td>
<td></td>
<td></td>
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<tr>
<td>Indep Study</td>
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<td></td>
<td></td>
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<tr>
<td>Other blank</td>
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</tbody>
</table>

   **Proposed**

<table>
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   Hegis Code(s)________________________________________ (Provided by the Dean)

9.15.08 km2
3. Course Attributes:

General Education Categories: All courses with GE category notations (including deletions) must be submitted to the GE website: http://summit.csuci.edu/geapproval. Upon completion, the GE Committee will forward your documents to the Curriculum Committee for further processing.

A (English Language, Communication, Critical Thinking)
- A-1 Oral Communication
- A-2 English Writing
- A-3 Critical Thinking

B (Mathematics, Sciences & Technology)
- B-1 Physical Sciences
- B-2 Life Sciences – Biology
- B-3 Mathematics – Mathematics and Applications
- B-4 Computers and Information Technology

C (Fine Arts, Literature, Languages & Cultures)
- C-1 Art
- C-2 Literature Courses
- C-3a Language
- C-3b Multicultural

D (Social Perspectives)

E (Human Psychological and Physiological Perspectives)

UDIGE/INTD Interdisciplinary
- Meets University Writing Requirement
- Meets University Language Requirement

American Institutions, Title V Section 40404:
- Government
- US Constitution
- US History

Refer to website, Exec Order 405, for more information: http://senate.csuci.edu/comm/curriculum/resources.htm

Service Learning Course (Approval from the Center for Community Engagement must be received before you can request this course attribute).

4. Justification and Requirements for the Course. [Make a brief statement to justify the need for the course]

OLD
Molecular evolution is an elective course for graduate students in the Professional Master of Science Degree Program in Biotechnology and Bioinformatics.

NEW
Molecular evolution is an elective course for graduate students in the Professional Master of Science Degree Program in Biotechnology and Bioinformatics.

Submit Program Modification if this course changes your program.

5. Learning Objectives. (List in numerical order. You may wish to visit resource information at the following website: http://senate.csuci.edu/comm/curriculum/resources.htm)

OLD
- Requirement for the Major/Minor
- Elective for the Major/Minor
- Free Elective

NEW
- Requirement for the Major/Minor
- Elective for the Major/Minor
- Free Elective

Upon completion of the course, the student will be able to:

OLD
- Describe how molecular data can be used to construct a phylogenetic tree
- Characterize the rates and causes of nucleotide substitutions
- Explain how a gene/protein family arises
- Explain the mechanisms which underlie evolution at the molecular level

NEW
- Describe how molecular data can be used to construct a phylogenetic tree
- Characterize the rates and causes of nucleotide substitutions
- Explain how a gene/protein family arises
- Explain the mechanisms which underlie evolution at the molecular level

6. Course Content in Outline Form. (Be as brief as possible, but use as much space as necessary)

OLD
- I. Genes, Genetic Codes, and Mutation
- Nucleotide Sequences
- Genomes and DNA Replication

NEW
- I. Genes, Genetic Codes, and Mutation
- Nucleotide Sequences
- Genomes and DNA Replication
Genes and Gene Structure
Proteins and Translation
Mutation

II. Dynamics of Genes in Populations
Changes in Allele Frequencies
Natural Selection
Random Genetic Drift
Effective Population Size
Gene Substitution and Genetic Polymorphism
Genetic Polymorphism
The Driving Forces in Evolution

III. Evolutionary Change in Nucleotide Sequences
Nucleotide Substitution in a DNA Sequence
Number of Nucleotide Substitutions between Two DNA Sequences
Number of Amino Acid Replacements between Two Proteins
Alignment of Nucleotide and Amino Acid Sequences

IV. Rates and Patterns of Nucleotide Substitution
Rates of Nucleotide Substitution and causes of variation in substitution rates
Positive Selection
Patterns of Substitution and Replacement
Evaluation of the Molecular Clock Hypothesis
Rates of Substitution in Organelle DNA

V. Molecular Phylogenetics
The Use of Molecular Data in Phylogenetic Studies
Terminology of Phylogenetic Trees
Construction of Phylogenetic trees
Problems Associated with Phylogenetic Reconstructions

VI. Gene Duplication and Exon Shuffling
Gene Duplication
Formation of Gene Families and the Acquisition of New Functions
Dating Gene Duplications
Gene Loss
The Globin Superfamily of Genes
Prevalence of Gene Duplication, Gene Loss, and Functional Divergence
Exon Shuffling

VII. Evolution by Transposition
Transposition and Retroposition
Transposable Elements
Retroelements and Retrosequences
Genetic and Evolutionary Effects of Transposition
Horizontal Gene Transfer

VIII. Genome Evolution
Genome Size in Prokaryotes
Genome Size in Eukaryotes
Mechanisms for Global Increases in Genome Size
The Repetitive Structure of the Eukaryotic Genome
Mechanisms for Regional Increases in Genome Size
Chromosomal Evolution
Mechanisms for Changes in Gene Order and Gene Distribution among Chromosomes
Does this course content overlap with a course offered in your academic program?  Yes ☑  No ☒
If YES, what course(s) and provide a justification of the overlap. 

Does this course content overlap a course offered in another academic area?  Yes ☑  No ☒
If YES, what course(s) and provide a justification of the overlap. 

Overlapping courses require Chairs’ signatures.

7. Cross-listed Courses (Please note each prefix in item No. 1)
   A. List cross-listed courses (Signature of Academic Chair(s) of the other academic area(s) is required).
   B. List each cross-listed prefix for the course: 
   C. Program responsible for staffing: 

8. References. [Provide 3-5 references]

   OLD

   NEW

9. Tenure Track Faculty qualified to teach this course.
   Biology faculty 

10. Requested Effective Date or First Semester offered:  S 2011

11. New Resource Requested:  Yes ☑  No ☒
    If YES, list the resources needed.
    A. Computer Needs (data processing, audio visual, broadcasting, other equipment, etc.)
    B. Library Needs (streaming media, video hosting, databases, exhibit space, etc.)
    C. Facility/Space/Transportation Needs:
    D. Lab Fee Requested: Yes ☑  No ☒  (Refer to the Dean’s Office for additional processing)
    E. Other. 

12. Indicate Changes and Justification for Each.  [Check all that apply and follow with justification.  Be as brief as possible but, use as much space as necessary.]
    ☑ Course title  ☑ Course Content
Justification: Since BIOL 504 is a foundation course for the MS Biotechnology and Bioinformatics program, students are advised to take BIOL 504 early on during their program of study and then take other required and elective courses. However, in the last few years of offering the program, we realized that some students have postponed taking BIOL 504, sometimes to the last term. To make sure students complete their foundation course first, BIOL 504 is included as a prerequisite course for BIOL 506, which requires the knowledge of 504 for students to succeed.

13. Will this course modification alter any degree, credential, certificate, or minor in your program? Yes [ ] No [X]

If, YES attach a program update or program modification form for all programs affected.
Priority deadline for New Minors and Programs: October 5, 2009 of preceding year.
Priority deadline for Course Proposals and Modifications: November 2, 2009.
Last day to submit forms to be considered during the current academic year: April 15th.

Ching-Hua Wang 10-15-09

Proposer(s) of Course Modification Date
Type in name. Signatures will be collected after Curriculum approval.
Approval Sheet

Course: [ ]

If your course has a General Education Component or involves Center affiliation, the Center will also sign off during the approval process.

Multiple Chair fields are available for cross-listed courses.

Program Chair

Signature  Date

Program Chair

Signature  Date

Program Chair

Signature  Date

General Education Chair

Signature  Date

Center for Intl Affairs Director

Signature  Date

Center for Integrative Studies Director

Signature  Date

Center for Multicultural Engagement Director

Signature  Date

Center for Civic Engagement and Service Learning Director

Signature  Date

Curriculum Chair

Signature  Date

Dean of Faculty

Signature  Date