

**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 of 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 i f cross-listed)*

**OLD**

Prefix **BIOL** Course# **506** Title **MOLECULAR EVOLUTION**  
Units **(4)**  
**3** hours lecture per week  
**3** hours blank per week

☒ Prerequisites: **BIOL 400 or BIOL 401 or permission of instructor**

☒ Consent of Instructor Required for Enrollment

☐ Corequisites: **\_\_\_\_\_**

**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	<input type="checkbox"/>	Graded	<input type="checkbox"/>	Repeatable	<input type="checkbox"/>
Categories	<input type="checkbox"/>	CR/NC	<input type="checkbox"/>	for up to <input type="checkbox"/> units	
<input type="checkbox"/> Lab Fee Requested		<input checked="" type="checkbox"/> A - F		Total	
				Completions <input type="checkbox"/>	
Course Level:	<input type="checkbox"/>	<input type="checkbox"/>		Multiple	
<input type="checkbox"/> Undergraduate		Optional		Enrollment in	
<input type="checkbox"/> Post-bac/Credential		(Student's		same semester	
<input checked="" type="checkbox"/> Graduate		choice)			

**NEW**

Prefix **BIOL** Course# **506** Title **MOLECULAR EVOLUTION**  
Units **(4)**  
**3** hours lecture per week  
**3** hours laboratory per week

☒ Prerequisites: **BIOL 504**

☒ Consent of Instructor Required for Enrollment

☐ Corequisites: **\_\_\_\_\_**

**Catalog Description** (Do not use any symbols): Examines 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	<input type="checkbox"/>	Graded	<input type="checkbox"/>	Repeatable for	<input type="checkbox"/>
Categories	<input type="checkbox"/>	CR/NC	<input type="checkbox"/>	up to <input type="checkbox"/> units	
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				Completions <input type="checkbox"/>	
Course Level:	<input type="checkbox"/>	<input type="checkbox"/>		Multiple	
<input type="checkbox"/> Undergraduate		Optional		Enrollment in same	
<input type="checkbox"/> Post-bac/Credential		(Student's		semester	
<input checked="" type="checkbox"/> Graduate		choice)			

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

**Hegis Code(s)** \_\_\_\_\_  
(Provided by the Dean)

**Existing**

**Proposed**

	Units	Hours Per Unit	Benchmark Enrollment	Graded		Units	Hours Per Unit	Benchmark Enrollment	Graded	CS No. (filled out by Dean)
Lecture	<b>3</b>	<b>1</b>	<b>15</b>	<input type="checkbox"/>	Lecture	<b>3</b>	<b>1</b>	<b>15</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Seminar	<input type="checkbox"/>	<b>1</b>	<input type="checkbox"/>	<input type="checkbox"/>	Seminar	<input type="checkbox"/>	<b>1</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lab	<b>1</b>	<b>3</b>	<b>15</b>	<input type="checkbox"/>	Lab	<b>1</b>	<b>3</b>	<b>15</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Activity	<input type="checkbox"/>	<b>2</b>	<input type="checkbox"/>	<input type="checkbox"/>	Activity	<input type="checkbox"/>	<b>2</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Field Studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Field Studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Indep Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Indep Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other blank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other blank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 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.

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

#### **NEW**

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

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

**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>)

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

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

#### **NEW**

- Describe how molecular data can be used to construct a phylogenetic tree
- Characterize the rates and causes of nucleotide substitutions
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- 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

Genes and Gene Structure  
Proteins and Translation  
Mutation

II. Dynamics of Genes in Populations  
Changes in Allele Frequencies  
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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

GC Content in Bacteria  
Compositional Organization of the Vertebrate Genome  
Emergence of Nonuniversal Genetic Codes

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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**

Graur and Li (2000). Fundamentals of Molecular Evolution, 2nd Edition. Sinauer Associates, Inc.

Kumar and Nei (2000). Molecular Evolution and Phylogenetics. Oxford University Press.

Page and Holmes (1998). Molecular Evolution: A phylogenetic approach. Blackwell Science, Inc.

Hall (2001). Phylogenetics trees made Easy: A how-to manual for molecular biologists. Sinauer Associates, Inc.

**NEW**

Graur and Li (2000). Fundamentals of Molecular Evolution, 2nd Edition. Sinauer Associates, Inc.

Kumar and Nei (2000). Molecular Evolution and Phylogenetics. Oxford University Press.

Page and Holmes (1998). Molecular Evolution: A phylogenetic approach. Blackwell Science, Inc.

Hall (2001). Phylogenetics trees made Easy: A how-to manual for molecular biologists. Sinauer Associates, Inc.

**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

☐ Prefix/suffix  
☐ Course number  
☐ Units  
☐ Staffing formula and enrollment limits  
☒ Prerequisites/Corequisites  
☒ Catalog description  
☐ Mode of Instruction

☐ Course Learning Objectives  
☐ References  
☐ GE  
☐ Other ☐  
☐ Reactivate Course

**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 ☒**

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 15<sup>th</sup>**.

Ching-Hua Wang

10-15-09

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Proposer(s) of Course Modification

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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		
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Signature

Date

Program Chair		
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Signature

Date

Program Chair		
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Signature

Date

General Education Chair		
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Signature

Date

Center for Intl Affairs Director		
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Signature

Date

Center for Integrative Studies Director		
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Signature

Date

Center for Multicultural Engagement Director		
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Signature

Date

Center for Civic Engagement and Service Learning Director		
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Signature

Date

Curriculum Chair		
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Signature

Date

Dean of Faculty		
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Signature

Date