# 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
 NEW

 Prefix BIOL
 Course# 506
 Title MOLECULAR EVOLUTION

 Units (4)
 Units (4)
 Units (4)

 3 hours lecture per week
 3 hours lecture per week
 3 hours lecture per week

 3 hours blank per week
 3 hours laboratory per week

x Prerequisites: BIOL 400 or BIOL 401 or permission of instructor

x Consent of Instructor Required for Enrollment

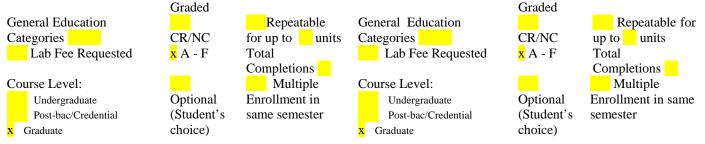
Corequisites:

**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.

x Prerequisites: BIOL 504

x Consent of Instructor Required for Enrollment Corequisites:

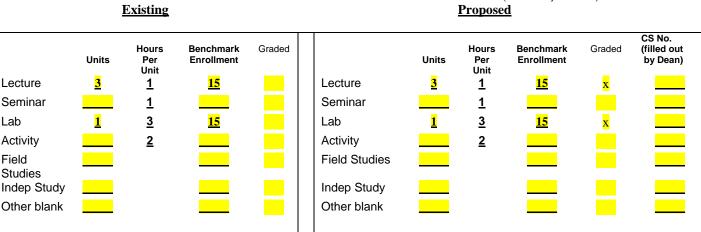
**Catalog Description** (Do not use any symbols): Examines evolutionary change at the molecular level. Topics include: The driving forces behind the evolutionary process, the effects of the various molecular mechanisms on the structure of genes, proteins, and genomes, the methodology for dealing with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



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



(Provided by the Dean)



Hegis Code(s)

# 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: <a href="http://senate.csuci.edu/comm/curriculum/resources.htm">http://senate.csuci.edu/comm/curriculum/resources.htm</a>
 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

Submit Program Modification if this course changes your program.

#### 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 Elective for the Major/Minor Free Elective
- **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
- 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	I. Genes, Genetic Codes, and Mutation
Nucleotide Sequences	Nucleotide Sequences
Genomes and DNA Replication	Genomes and DNA Replication
LE 00 1 0	

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 SequencesNucleotide Substitution in a DNA SequenceNumber of Nucleotide Substitutions between Two DNASequencesNumber of Amino Acid Replacements between Two ProteinsAlignment 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 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			
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 x			

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:

If YES, what course(s) and provide a justification of the overlap.

- 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 <u>No x</u> 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

Prefix/suffix Course number Units Staffing formula and enrollment limits x Prerequisites/Corequisites x 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 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 15<sup>th</sup>.

Ching-Hua Wang

Proposer(s) of Course Modification Type in name. Signatures will be collected after Curriculum approval. 10-15-09

Date

# **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