Curriculum Proposal Cover Sheet – **form is available on-line as an interactive PDF**

LSC Use Only Proposal No: LSC Action-Date:	*UWUCC Use Only* Proposal No: 12-139n. UWUCC Action-Date: App-5/7/13 Senate Action Date: APP-9/10/13

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit **Biology**	Phone **724-357-2352**

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

__X__ New Course _____ Course Prefix Change _____ Course Deletion

_____ Course Revision _____ Course Number and/or Title Change _____ Catalog Description Change

Current course prefix, number and full title: _____

Proposed course prefix, number and full title, if changing: **BIOL 451/551 Evolutionary Biology**

2. Liberal Studies Course Designations, as appropriate

_____ This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

_____ Learning Skills _____ Knowledge Area _____ Global and Multicultural Awareness _____ Writing Intensive (include W cover sheet)

_____ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

_____ Global Citizenship _____ Information Literacy _____ Oral Communication

_____ Quantitative Reasoning _____ Scientific Literacy _____ Technological Literacy

3. Other Designations, as appropriate

_____ Honors College Course _____ Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

_____ Catalog Description Change _____ Program Revision _____ Program Title Change _____ New Track

_____ New Degree Program _____ New Minor Program _____ Liberal Studies Requirement Changes _____ Other

Current program name: _____

Proposed program name, if changing: _____

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)		7 Dec. 2012
Department Chairperson(s)		Dec 7 2012
College Curriculum Committee Chair		4/24/13
College Dean		4/29/13
Director of Liberal Studies (as needed)		
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail Sechrist	Received 5/7/13

1. SYLLABUS OF RECORD

I. Catalog Description

BIOL 451/551 Evolutionary Biology 2c-3l-3cr

Prerequisites: BIOL 201, 203

A comprehensive survey of evolution and evolutionary biology, including the history of evolutionary theory, natural selection, microevolutionary and macroevolutionary processes, and the phylogenetic history and classification of life on earth. In laboratory, students will focus on learning current methods in population-level and phylogenetic analysis, and presenting and leading peer discussions of important and current research in the field.

II. Course Outcomes:

Students will be able to:

1. Understand the origins of life on earth within the context of geological time, plate tectonics, natural selection, and phylogeny.

2. Apply important concepts of microevolution (genetic variation, mutation, gene flow, genetic drift, and non-random mating) to understand the mechanisms driving macroevolutionary changes (speciation, extinction).

3. Understand how various reproductive isolation mechanisms give rise to species under allopatric, parapatric, and sympatric circumstances.

4. Analyze evolutionary data, including the formulation, testing, and refinement of evolutionary hypotheses using phylogenetic analyses of genetic and morphological data.

5. Evaluate modern methodological approaches to phylogenetic analysis, including Bayesian inference and maximum likelihood based methods.

6. Apply evolutionary concepts to evaluate the diversification of an extant group of organisms.

III. Detailed Course Outline

Lecture Schedule (28 hrs)

A. Rise of Modern Evolutionary Theory & Investigation — 5 hr
   1. Pre-Darwinian concepts, Darwin, Wallace
   2. Mayr, Gould, Wiley, and Modern Synthesis
   3. Evolution revealed through Phylogeny
      i. Morphology, Synapomorphies, Homoplasy
      ii. Molecular Systematics
      iii. Phylogenomics

B. Evolution of Life on Earth — 5 hr
   1. Origins of Life
   2. Prokaryotes
      i. Archaea and Bacteria
   3. Eukaryotes
      i. Protista
      ii. Plants
      iii. Fungi
      iv. Animals
      v. Humans

Exam 1 — 1 hr

C. Speciation and Macroevolution — 10 hr
   1. Speciation
      i. Species concepts
      ii. Vicariance and Dispersal
      iii. Speciation modes (Allopatric, Parapatric, Sympatric)
      iv. Adaptive vs. Nonadaptive Radiation
      v. Niche conservatism
   2. Biogeography
      i. Plate Tectonics
      ii. Environmental Stochasticity
      iii. Island Biogeography
      iv. Phylogeography and Evolutionary Biogeography
   3. The Fossil Record
      i. Major Periods of Evolutionary Activity
      ii. Gaps in the Record
      iii. Extinction

Exam 2 — 1 hr

D. Population Genetics and Microevolutionary Processes — 6 hr
   1. Basic Principles of Genetics

i. Mendelian Inheritance
ii. Hardy-Weinberg Equilibrium

2. Genetic Variation
   i. Genetic Drift
   ii. Gene Flow
   iii. Ecological Sources of Variation
   iv. Behavioral Sources of Variation

Final Exam 2 hr

Lab Schedule

Week 1	Introduction to Phylogenetic Principles - Caminicules
Week 2	Traditional Cladistics: Evaluating and Coding Morphological Data
Week 3	Using Morphological Data in Phylogeny Building
Week 4	Student Presentations/Discussion: Foundations of Evolutionary Biology
Week 5	Introduction to working with DNA Sequence Data: Alignment and BLASTN
Week 6	Models of DNA Evolution
Week 7	Parsimony and Distance-based Methods
Week 8	Maximum Likelihood and Bayesian Inference
Week 9	Student Presentations/Discussion: Comparing Methods of Phylogenetic Inference
Week 10	Population-level Genetic Markers
Week 11	Conservation Genetics – Applications for Population and Phylogenetic Datasets
Week 12	Student Presentations/Discussion: Case Studies in Conservation Genetics
Week 13	Graduate Paper Presentations
Week 14	Undergraduate Paper Presentations

IV. Evaluation Methods

The final grade will be determined as follows:

45% Exams (3 x 15% each)
10% Presentation/Discussion Leader (2 x 5% each)
25% Term paper and presentation (15% paper, 10% presentation)
20% Short Lab Reports (4 x 5% each)

V. Example Grading Scale

Grading Scale: A: ≥90% B: 80-89% C: 70-79% D: 60-69% F: <60%

VI. Attendance Policy

The attendance policy will be in accordance with University guidelines as outlined in the undergraduate catalog.

VII. Required textbooks, supplemental books and readings

Bergstrom, C.T. and Dugatkin, L.A. 2011. Evolution. W.W. Norton Company, Inc.

Hall, B.G. 2011. Phylogenetic Trees Made Easy: A How-To Manual (4th Ed.). Sinauer Associates, Inc.

VIII. Special resource requirements

None (software resources needed for laboratory are freeware).

IX. Bibliography

Avise, J.C. 2000. Phylogeography: The History and Formation of Species. Harvard University Press.

Avise, J.C. 2004. Molecular Markers, Natural History, and Evolution. Sinauer Associates, Inc.

Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B., and Patel, N.H. 2007. Evolution. Cold Spring Harbor Laboratory Press.

Baum, D. and Smith, S. 2012. Tree Thinking: An Introduction to Phylogenetic Biology. Roberts and Company Publishers.

Carroll, S. B. 2006. Endless Forms Most Beautiful: The New Science of Evo Devo. W. W. Norton & Company.

Cox, C.B. and Moore, P.D. 2010. Biogeography: An Ecological and Evolutionary Approach (8th Ed.). Wiley-Blackwell.

Felsenstein, J. 2004. Inferring Phylogenies. Sinauer Associates, Inc.

Freeman, S. and Herron, J. 2007. Evolutionary Analysis (4th Ed.). Pearson/Prentice Hall.

Futuyma, D.J. 2009. Evolution (2nd Ed.). Sinauer Associates, Inc.

Gould, S.J. 1990. Wonderful Life: The Burgess Shale and the Nature of History. W. W. Norton & Company.

Gould, S.J. 2002. The Structure of Evolutionary Theory. The Belknap Press of Harvard University Press.

Hennig, W. 1966. Phylogenetic Systematics. University of Illinois Press.

Lemey, P., Salemi, M., and Vandamme, A. 2009. The Phylogenetic Handbook: A Practical Approach to Phylogenetic Analysis and Hypothesis Testing. Cambridge University Press.

Losos, J.B. and Ricklefs, R.E. (eds.). 2010. The Theory of Island Biogeography Revisited. Princeton University Press.

MacArthur, R.H. and Wilson, E.O. 1967. The Theory of Island Biogeography. Princeton University Press.

Mayr, E. 1942. Systematics and the Origin of Species. Columbia University Press.

Mayr, E. 1993. One Long Argument: Charles Darwin and the Genesis of Modern Biological Thought. Harvard University Press.

Mayr, E. 2002. What Evolution Is. Basic Books.

Nei, M. and Kumar, S. 2000. Molecular Evolution and Phylogenetics. Oxford University Press.

Ridley, M. 2004. Evolution (3rd Ed.). Wiley-Blackwell.

Wiley, E.O. and Lieberman, B.S. 2011. Phylogenetics: Theory and Practice of Phylogenetic Systematics (2nd Ed.). Wiley-Blackwell.

Wiley, E.O., Siegel-Causey, D., Brooks, D.R., and Funk, V.A. 1991. The Compleat Cladist: A Primer of Phylogenetic Procedures. University of Kansas Museum Of Natural History Special Publication No. 19.

Appendix 1. Graduate enrollment

Students who take this class for graduate credit will be required to complete an additional assignment, a semester-long project based on conducting an phylogenetic analysis of a particular group (determined by the students) of organisms. Graduate students will work in teams of three, and will produce a 10-20 page manuscript (double spaced, not including figures) in the format of a peer-reviewed scientific paper. This paper will include a comprehensive literature review of their topic, summary of publicly available genetic data, and phylogenetic analysis using multiple methods. Students will peer-review completed drafts of two other student projects.

The final grade will be determined as follows:

30% Exams (3 x 10% each)
10% Presentation/Discussion Leader (2 x 5% each)
35% Term paper and presentation (5% complete draft for peer-review, 20% final paper, 10% final presentation)
5% Peer Review of Two Draft Project Papers
20% Short Lab Reports (4 x 5% each)

COURSE ANALYSIS QUESTIONAIRE

Section A: Details of the Course

A1 How does this course fit into the programs of the department? For what students is the course designed? (majors, students in other majors, liberal studies). Explain why this content cannot be incorporated into an existing course.

This course is designed for upper division undergraduate biology majors and biology graduate students. It will replace BIOL 271 Evolution, supplementing the lecture content previously offered in BIOL 271 with a laboratory that will provide biology students with detailed hands-on instruction in the theory, methods, and application of evolutionary analysis. This course will be required for the Ecology, Conservation, and Environmental Biology Track, and will be controlled elective available for all other biology tracks.

A2 Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

This course will replace BIOL 271 Evolution, which will be deleted, and will replace the BIOL 271 requirement in the Ecology, Conservation, and Environmental Biology Track.

A3 Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students).

This course has not been previously offered in its proposed form.

A4 Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.

This course is dual-level.

A5 If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

This course is not offered for variable credit.

A6 Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).

Other institutions offer courses in evolutionary biology that include a laboratory component. Examples include:

University of Wisconsin Lacrosse – Evolutionary Biology (BIO 429/529) (http://www.uwlax.edu/biology/faculty/perez/Perez/PerezLab/Teaching/Evolution/Perez_Evolution_syllabus.pdf)

Brigham Young University - Evolutionary Biology (BIO 420/520) and Evolutionary Biology Lab (BIO 421/521)

(http://biology.byu.edu/Portals/2/docs/Syllabi/Fall%202012/12FBio420-D.%20Rogers.pdf)

Villanova University – Evolution (Biology 4305)

(http://todd.jackman.villanova.edu/SyllabusBiology4305.pdf)

A7 Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.

No external agency monitors the content or skills of this course.

Section B: Interdisciplinary Implications

B1 Will this course be taught by instructors from more than one department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

This course will be taught by instructors from the Biology Department.

B2 What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).

The content of this course does not overlap with courses offered in other departments.

B3 Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.

This course will not be cross-listed in other departments.

Section C: Implementation

C1 Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated workload will be assigned for this course.

Faculty resources are adequate. This course would account for five hours of faculty work load (2 lecture + 3 laboratory) for a single faculty member. The course is required for ECEB Track students and will be offered every other year, ensuring a minimal enrollment of 24 students per offering.

C2 What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy?

Other resources are adequate. Existing space will be utilized, including the Instructional Computer Classroom for laboratory meetings. All software needed for laboratory activities is freeware. Equipment, laboratory supplies, and other comsumable goods are not needed for this course. Library materials are adequate. Travel funds are not needed for this course.

C3 Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

Resources for this course are not funded by a grant.

C4 How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

This course is expected to be offered every other year, and is not required to be implemented during any particular season or semester.

C5 How many sections of this course do you anticipate offering in any single semester?

One lecture section and at least one laboratory section would be offered at a time.

C6 How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?

Laboratory sections will be limited to a maximum of 24 students, since this is the maximum capacity of the laboratory room.

C7 Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

No professional society recommends enrollment limits or parameters for this course.

C8 If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.

This course is not a distance education course.

Section D: Miscellaneous

None.