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| For Academic Affairs and Research Use Only |
| Proposal Number |  |
| CIP Code:  |  |
| Degree Code: |  |

**New or Modified Course Proposal Form**

**[ ] Undergraduate Curriculum Council**

**[X] Graduate Council**

|  |
| --- |
| **[X]New Course, [ ]Experimental Course (1-time offering), or [ ]Modified Course (Check one box)** |

Signed paper copies of proposals submitted for consideration are no longer required. Please type approver name and enter date of approval.

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| --- | --- |
| Virginie Rolland 8/4/2022**Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**COPE Chair (if applicable)** |
| Stephen J. Mullin 8/5/2022**Department Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Head of Unit (if applicable)**   |
| John Hershberger 8/22/2022 Enter date…**College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Undergraduate Curriculum Council Chair** |
| Mary Elizabeth Spence 8/22/2022**Office of Assessment (new courses only)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Graduate Curriculum Committee Chair** |
| Lynn Boyd 8/24/2022**College Dean** | Alan Utter 9/20/2022**Vice Chancellor for Academic Affairs** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**General Education Committee Chair (if applicable)**   |  |

1. **Contact Person (Name, Email Address, Phone Number)**

Andrew Sweet, asweet@astate.edu, 870-680-8480

1. **Proposed starting term and Bulletin year for new course or modification to take effect**

Fall 2023, AY 2023-2024.

**Instructions:**

*Please complete all sections unless otherwise noted. For course modifications, sections with a “Modification requested?” prompt need not be completed if the answer is “No.”*

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| --- | --- | --- |
|  | **Current (Course Modifications Only)** | **Proposed (New or Modified)** *(Indicate “N/A” if no modification)* |
| **Prefix** |  | **BIO** |
| **Number\*** |  | **5114** |
| **Title** |  | **Phylogenetics and Systematics** |
| **Description\*\*** |  | **Theory, history, and application of phylogenetic methods, especially in the context of understanding evolution, taxonomy, biodiversity, and genetics. Lecture three hours and lab three hours per week. Fall, odd.** |

 ***\**** (Confirm with the Registrar’s Office that number chosen has not been used before and is available for use. For variable credit courses, indicate variable range. *Proposed number for experimental course is 9*. )

\*\*Forty words or fewer as it should appear in the Bulletin.

1. **Proposed prerequisites and major restrictions** **[Modification requested?]**

(Indicate all prerequisites. If this course is restricted to a specific major, which major. If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

1. **Yes** Are there any prerequisites?
	1. If yes, which ones?

Enter text...

* 1. Why or why not?

**The proposed new course is an advanced evolution course that requires students to have a firm understanding of genetics. However, any student admitted to the MS Biology program would typically have a BS degree in Biology, which all include a Genetics course. Students in relevant disciplines (e.g., computer science) will be able to take the course at the discretion of the instructor.**

1. **No** Is this course restricted to a specific major?
	1. If yes, which major? Enter text...
2. **Proposed course frequency [Modification requested?]**

(e.g. Fall, Spring, Summer; if irregularly offered, please indicate, “irregular.”) *Not applicable to Graduate courses.*

**Fall, odd years**

1. **Proposed course type [Modification requested?]**

Will this course be lecture only, lab only, lecture and lab, activity (e.g., physical education), dissertation/thesis, capstone, independent study, internship/practicum, seminar, special topics, or studio? Please choose one.

**Lecture and lab**

1. **Proposed grade type [Modification requested?]**

What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental, or other [please elaborate])

**Standard letter**

1. **Yes** Is this course dual-listed (undergraduate/graduate)?
2. **No** Is this course cross-listed?

*(If it is, all course entries must be identical including course descriptions. Submit appropriate documentation for requested changes. It is important to check the course description of an existing course when adding a new cross-listed course.)*

**a.** – If yes, please list the prefix and course number of the cross-listed course.

 Enter text...

 **b.** – **Yes / No** Can the cross-listed course be used to satisfy the prerequisite or degree requirements this course satisfies?

 Enter text...

1. **No** Is this course in support of a new program?

a. If yes, what program?

 Enter text...

1. **No** Will this course be a one-to-one equivalent to a deleted course or previous version of this course (please check with the Registrar if unsure)?

a. If yes, which course?

Enter text...

**Course Details**

1. **Proposed outline** **[Modification requested?]**

(The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

**Week 1: Introduction; Nomenclature**

**Week 2: Classification**

**Week 3: Characters, states, and polarity**

**Week 4: Maximum parsimony**

**Week 5: Types of data**

**Week 6: Sequence alignment; Exam 1**

**Week 7: Maximum likelihood; models**

**Week 8: Distance methods**

**Week 9: Bayesian inference**

**Week 10: Phylogenomics**

**Week 11: Gene tree discordance; Supertrees and networks**

**Week 12: Assessing support and discordance; Exam 2**

**Week 13: Divergence time; Biogeography**

**Week 14: Comparative methods; Trait evolution**

**Week 15: Cophylogenetics; Phylodynamics; Community phylogenetics**

**Final, cumulative exam**

1. **Proposed special features** **[Modification requested?]**

(e.g. labs, exhibits, site visitations, etc.)

**One 2hr 50min lab period per week**

1. **Department staffing and classroom/lab resources**

**Lecture room and a computer lab (e.g., LSE 205) for labs**

1. Will this require additional faculty, supplies, etc.?

**No**

1. **No** Does this course require course fees?

 *If yes: please attach the New Program Tuition and Fees form, which is available from the UCC website.*

**Justification**

**Modification Justification (Course Modifications Only)**

1. Justification for Modification(s)

**New Course Justification (New Courses Only)**

1. Justification for course. Must include:

 a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

 **Phylogenetics (reconstructing the evolutionary history among different organisms) is a major component of biology, particularly for graduate students conducting independent research. Ecology, evolution, biotechnology, medicine, and many other fields rely on phylogenetic methods to better understand the world around us. However, phylogenetic theory and application is often very technical, requiring specific training for students to grasp the concepts and apply it to research questions or an advanced understanding of biology. The proposed course will fill this training gap by providing students with A) a thorough overview of the theory and application of phylogenetic methods and B) a hands-on computer lab that allows students to apply concepts they learn in class to real datasets and problems. Students will also complete an independent project to further apply their skills to a relevant question in their field(s) of interest. Students will need to give an oral presentation of their project to the class and submit a final paper. By completing this course, students will obtain A) a thorough understanding of phylogenetics theory, B) an understanding of how phylogenetics links to taxonomic classification, B) experience applying theoretical knowledge of phylogenetics to real-world problems in biology, C) gaining proficiency in computational and bioinformatic techniques, including writing computer code and analyzing large data sets.**

b. How does the course fit with the mission of the department? If course is mandated by an accrediting or certifying agency, include the directive.

 **The stated career path for a graduate degree in Biology is as follows: “The MS Biology Program prepares students for a variety of careers in government, academia and research.” This course will help students entering these fields by providing specific training in bioinformatics, analytical methods, and advanced evolutionary theory.**

c. Student population served.

**Graduate students in the Biology, Environmental Sciences (EVS), Molecular Biosciences (MBS), and Biotechnology programs.**

d. Rationale for the level of the course (lower, upper, or graduate).

**The proposed course will be an advanced evolution course. The content will be most appropriate for graduate or advanced undergraduate students. The course also counts as two skills course credits for students in the MBS Ph.D. program.**

**Assessment**

**Assessment Plan Modifications (Course Modifications Only)**

1. Do the proposed modifications result in a change to the assessment plan?

 *If yes, please complete the Assessment section of the proposal*

**Relationship with Current Program-Level Assessment Process (Course modifications skip this section unless the answer to #18 is “Yes”)**

1. What is/are the intended program-level learning outcome/s for students enrolled in this course? Where will this course fit into an already existing program assessment process?
2. **Students will be able to understand that science is a process as well as a body of knowledge**
3. **Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.**
4. **Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.**

**This course will address all three of these outcomes by focusing on advanced theory in evolutionary biology, specifically related to phylogenetic theory and application. The course fills a need for graduate students in the various biology-focused graduate programs, who currently do not have many options for advanced courses in evolution and bioinformatics.**

1. Considering the indicated program-level learning outcome/s (from question #19), please fill out the following table to show how and where this course fits into the program’s continuous improvement assessment process.

*For further assistance, please see the ‘Expanded Instructions’ document available on the UCC - Forms website for guidance, or contact the Office of Assessment at 870-972-2989.*

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| **Program-Level Outcome 1 (from question #19)** | **Students will be able to understand that science is a process as well as a body of knowledge** |
| Assessment Measure | Masters of Science: Successful defense of thesis/dissertation; Masters of Arts: Successful completion of practicum II; Master of Science Education: Successful completion of program  |
| Assessment Timetable | Final Semester of degree |
| Who is responsible for assessing and reporting on the results? | The student’s committee and department chair are responsible for assessing this outcome. |

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| **Program-Level Outcome 2 (from question #19)** | **Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.**  |
| Assessment Measure | Masters of Science: Successful defense of thesis/dissertation; Masters of Arts: Successful completion of practicum II; Master of Science Education: Successful completion of program  |
| Assessment Timetable | Final Semester of degree |
| Who is responsible for assessing and reporting on the results? | The student’s committee and department chair are responsible for assessing this outcome. |

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| **Program-Level Outcome 3 (from question #19)** | **Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.** |
| Assessment Measure | Masters of Science: Successful defense of thesis/dissertation; Masters of Arts: Successful completion of practicum II; Master of Science Education: Successful completion of program  |
| Assessment Timetable | Final Semester of degree |
| Who is responsible for assessing and reporting on the results? | The student’s committee and department chair are responsible for assessing this outcome. |

*(Repeat if this new course will support additional program-level outcomes)*

 **Course-Level Outcomes**

1. What are the course-level outcomes for students enrolled in this course and the associated assessment measures?

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| **Outcome 1** | Students will be able to interpret phylogenetic trees. |
| Which learning activities are responsible for this outcome? | Lecture, paper discussions, labs |
| Assessment Measure  | Exams, paper reflections, lab assignments, project and paper |

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| **Outcome 2** | Students will be able to identify the different schools of classification.  |
| Which learning activities are responsible for this outcome? | Lecture, labs |
| Assessment Measure  | Exams, lab assignments |

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| **Outcome 3** | Students will be able to evaluate different methods for estimating phylogenetic trees.  |
| Which learning activities are responsible for this outcome? | Lecture, paper discussions, labs |
| Assessment Measure  | Exams, paper reflections, lab assignments, project and paper |

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| **Outcome 4** | Students will be able to apply computation approaches for estimating and analyzing phylogenetic trees.  |
| Which learning activities are responsible for this outcome? | Labs |
| Assessment Measure  | Lab assignments, project and paper |

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| **Outcome 5** | Students will be able to explain evolutionary and genetic processes that can lead to discordant phylogenies. |
| Which learning activities are responsible for this outcome? | Lecture, paper discussions, labs |
| Assessment Measure  | Exams, paper reflections, lab assignments, project and paper |

*(Repeat if needed for additional outcomes)*

**Bulletin Changes**

|  |
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| **Instructions**  |
| **Please visit** [**http://www.astate.edu/a/registrar/students/bulletins/index.dot**](http://www.astate.edu/a/registrar/students/bulletins/index.dot) **and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Please include a before (with changed areas highlighted) and after of all affected sections.** **\*Please note: Courses are often listed in multiple sections of the bulletin. To ensure that all affected sections have been located, please search the bulletin (ctrl+F) for the appropriate courses before submission of this form.**  |

**Page 414:**

**Before:**

|  |
| --- |
| **Biology** |
|    | •  [BIO 504V - Special Topics in the Biological Sciences](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=203) |
|    | •  [BIO 638V - Thesis](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=204) |
|    | •  [BIO 680V - Independent Study](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=205) |
|    | •  [BIO 5001 - Laboratory Techniques in Electron Microscopy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=104) |
|    | •  [BIO 5003 - Laboratory for Laboratory Techniques in Electron Microscopy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=105) |
|    | •  [BIO 5013 - Population Genetics](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=106) |
|    | •  [BIO 5033 - Bioinformatics and Applications](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=107) |
|    | •  [BIO 5043 - Biometry](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=108) |
|    | •  [BIO 5053 - Applications in Biotechnology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=109) |
|    | •  [BIO 5063 - Biosafety and Ethics in Research](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=110) |
|    | •  [BIO 5103 - Virolog](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=111) |
|    | •  [BIO 5104 - Microbiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=112) |
|    | •  [BIO 5113 - Immunology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=113) |
|    | •  [BIO 5123 - Cell Signaling](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=114) |
|    | •  [BIO 5131 - Laboratory for Cell Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=115) |
|    | •  [BIO 5133 - Cell Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=116) |
|    | •  [BIO 5143 - Pharmacology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=117) |
|    | •  [BIO 5153 - Laboratory in BioTechniques I](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=118) |
|    | •  [BIO 5163 - Laboratory in BioTechniques II](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=119) |
|    | •  [BIO 5201 - Laboratory for Issues in Human Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=120) |
|    | •  [BIO 5202 - Issues in Human Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=121) |
|    | •  [BIO 5213 - Human Genetics](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=122) |
|    | •  [BIO 5301 - Aquatic Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=123) |
|    | •  [BIO 5302 - Laboratory for Aquatic Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=124) |
|    | •  [BIO 5311 - Fishery Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=125) |
|    | •  [BIO 5312 - Laboratory for Fishery Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=126) |
|    | •  [BIO 5322 - Biology of Marine Mammals Laboratory](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=127) |
|    | •  [BIO 5323 - Biology of Marine Mammals](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=128) |
|    | •  [BIO 5332 - Animal Histology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=129) |
|    | •  [BIO 5333 - Marine Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=130) |
|    | •  [BIO 5341 - Laboratory for Animal Embryology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=131) |
|    | •  [BIO 5342 - Laboratory for Animal Histology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=132) |
|    | •  [BIO 5343 - Animal Embryology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=133) |
|    | •  [BIO 5354 - Mammalogy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=134) |
|    | •  [BIO 5361 - Laboratory for Mammalian Neurobiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=135) |
|    | •  [BIO 5362 - Applied Aquaculture](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=136) |
|    | •  [BIO 5363 - Mammalian Neurobiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=137) |
|    | •  [BIO 5371 - Laboratory for Animal Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=138) |
|    | •  [BIO 5372 - Applied Fisheries](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=139) |
|    | •  [BIO 5373 - Animal Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=140) |
|    | •  [BIO 5384 - Parasitology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=141) |
|    | •  [BIO 5401 - Laboratory for Ichthyology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=142) |
|    | •  [BIO 5402 - Ichthyology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=143) |
|    | •  [BIO 5403 - Comparative Vertebrate Reproduction](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=144) |
|    | •  [BIO 5411 - Laboratory for Herpetology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=145) |
|    | •  [BIO 5421 - Laboratory for Ornithology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=146) |
|    | •  [BIO 5423 - Ornithology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=147) |
|    | •  [BIO 5433 - Field Experience in Marine Environments](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=148) |
|    | •  [BIO 5441 - Comparative Animal Physiology Laboratory](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=149) |
|    | •  [BIO 5443 - Comparative Animal Physiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=150) |
|    | •  [BIO 5444 - Wildlife Population Modeling](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=151) |
|    | •  [BIO 5453 - Herpetology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=152) |
|    | •  [BIO 5511 - Laboratory for Plant Physiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=153) |
|    | •  [BIO 5513 - Plant Physiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=154) |
|    | •  [BIO 5521 - Laboratory for Wetlands Plant Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=155) |
|    | •  [BIO 5522 - Wetlands Plant Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=156) |
|    | •  [BIO 5541 - Laboratory for Mycology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=157) |
|    | •  [BIO 5542 - Mycology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=158) |
|    | •  [BIO 5551 - Laboratory for Medical Mycology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=159) |
|    | •  [BIO 5552 - Medical Mycology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=160) |
|    | •  [BIO 5601 - Laboratory for Limnology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=161) |
|    | •  [BIO 5603 - Limnology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=162) |
|    | •  [BIO 5611 - Radiation in Our World](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=163) |
|    | •  [BIO 5623 - Environmental Microbiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=164) |
|    | •  [BIO 5633 - Environmental Toxicology: Mechanisms and Impacts](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=165) |
|    | •  [BIO 5684 - Biological Data Analyses](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=166) |
|    | •  [BIO 5704 - Plant Systematics](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=167) |
|    | •  [BIO 5714 - Dendrology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=168) |
|    | •  [BIO 5813 - Curation of Collections](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=169) |
|    | •  [BIO 5823 - Natural History Collections Research Design](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=170) |
|    | •  [BIO 6001 - Biological Seminar](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=171) |
|    | •  [BIO 6003 - Scientific Methods and Research Design](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=172) |
|    | •  [BIO 6013 - Evolutionary Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=173) |
|    | •  [BIO 6043 - The Anatomy of a Grant](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=174) |
|    | •  [BIO 6113 - Advanced Cell Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=175) |
|    | •  [BIO 6123 - Specialized Biochemistry](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=176) |
|    | •  [BIO 6143 - Introduction to Biotechnology & Research Design](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=177) |
|    | •  [BIO 6196 - Internship in Biotechnology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=178) |
|    | •  [BIO 6301 - Aquatic Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=179) |
|    | •  [BIO 6302 - Laboratory for Aquatic Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=180) |
|    | •  [BIO 6311 - Laboratory for Medical and Veterinary Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=181) |
|    | •  [BIO 6313 - Medical and Veterinary Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=182) |
|    | •  [BIO 6321 - Laboratory for Insect Taxonomy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=183) |
|    | •  [BIO 6322 - Insect Taxonomy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=184) |
|    | •  [BIO 6331 - Laboratory for Comparative Ethology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=185) |
|    | •  [BIO 6332 - Comparative Ethology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=186) |
|    | •  [BIO 6342 - Natural History of the Vertebrates](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=187) |
|    | •  [BIO 6343 - Cell & Molecular Neurobiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=188) |
|    | •  [BIO 6352 - Laboratory for Natural History of the Vertebrates](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=189) |
|    | •  [BIO 6371 - Practicum I](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=190) |
|    | •  [BIO 6372 - Practicum II](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=191) |
|    | •  [BIO 6503 - Mechanisms of Speciation](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=192) |
|    | •  [BIO 6513 - Global Change Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=193) |
|    | •  [BIO 6601 - Laboratory for Environmental Systems Analysis](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=194) |
|    | •  [BIO 6603 - Environmental Systems Analysis](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=195) |
|    | •  [BIO 6621 - Laboratory for Case Studies in Ecosystem Management](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=196) |
|    | •  [BIO 6623 - Case Studies in Ecosystem Management](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=197) |
|    | •  [BIO 6633 - Population Community Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=198) |
|    | •  [BIO 6653 - Aquatic Ecotoxicology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=199) |
|    | •  [BIO 6684 - Biological Data Analyses](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=200) |

**After:**

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| **Biology** |
|    | •  [BIO 504V - Special Topics in the Biological Sciences](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=203) |
|    | •  [BIO 638V - Thesis](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=204) |
|    | •  [BIO 680V - Independent Study](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=205) |
|    | •  [BIO 5001 - Laboratory Techniques in Electron Microscopy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=104) |
|    | •  [BIO 5003 - Laboratory for Laboratory Techniques in Electron Microscopy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=105) |
|    | •  [BIO 5013 - Population Genetics](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=106) |
|    | •  [BIO 5033 - Bioinformatics and Applications](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=107) |
|    | •  [BIO 5043 - Biometry](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=108) |
|    | •  [BIO 5053 - Applications in Biotechnology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=109) |
|    | •  [BIO 5063 - Biosafety and Ethics in Research](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=110) |
|    | •  [BIO 5103 - Virolog](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=111) |
|    | •  [BIO 5104 - Microbiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=112) |
|    | •  [BIO 5113 - Immunology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=113) |
|  | BIO 5114 – Phylogenetics and Systematics**BIO 5114 – Phylogenetics and Systematics**Sem. Hrs.: 4Theory, history, and application of phylogenetic methods, especially in the context of understanding evolution, taxonomy, biodiversity, and genetics. Lecture three hours and lab three hours per week. Fall, odd |
|    | •  [BIO 5123 - Cell Signaling](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=114) |
|    | •  [BIO 5131 - Laboratory for Cell Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=115) |
|    | •  [BIO 5133 - Cell Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=116) |
|    | •  [BIO 5143 - Pharmacology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=117) |
|    | •  [BIO 5153 - Laboratory in BioTechniques I](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=118) |
|    | •  [BIO 5163 - Laboratory in BioTechniques II](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=119) |
|    | •  [BIO 5201 - Laboratory for Issues in Human Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=120) |
|    | •  [BIO 5202 - Issues in Human Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=121) |
|    | •  [BIO 5213 - Human Genetics](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=122) |
|    | •  [BIO 5301 - Aquatic Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=123) |
|    | •  [BIO 5302 - Laboratory for Aquatic Entomology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=124) |
|    | •  [BIO 5311 - Fishery Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=125) |
|    | •  [BIO 5312 - Laboratory for Fishery Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=126) |
|    | •  [BIO 5322 - Biology of Marine Mammals Laboratory](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=127) |
|    | •  [BIO 5323 - Biology of Marine Mammals](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=128) |
|    | •  [BIO 5332 - Animal Histology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=129) |
|    | •  [BIO 5333 - Marine Biology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=130) |
|    | •  [BIO 5341 - Laboratory for Animal Embryology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=131) |
|    | •  [BIO 5342 - Laboratory for Animal Histology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=132) |
|    | •  [BIO 5343 - Animal Embryology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=133) |
|    | •  [BIO 5354 - Mammalogy](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=134) |
|    | •  [BIO 5361 - Laboratory for Mammalian Neurobiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=135) |
|    | •  [BIO 5362 - Applied Aquaculture](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=136) |
|    | •  [BIO 5363 - Mammalian Neurobiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=137) |
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|    | •  [BIO 5372 - Applied Fisheries](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=139) |
|    | •  [BIO 5373 - Animal Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=140) |
|    | •  [BIO 5384 - Parasitology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=141) |
|    | •  [BIO 5401 - Laboratory for Ichthyology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=142) |
|    | •  [BIO 5402 - Ichthyology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=143) |
|    | •  [BIO 5403 - Comparative Vertebrate Reproduction](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=144) |
|    | •  [BIO 5411 - Laboratory for Herpetology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=145) |
|    | •  [BIO 5421 - Laboratory for Ornithology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=146) |
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|    | •  [BIO 5444 - Wildlife Population Modeling](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=151) |
|    | •  [BIO 5453 - Herpetology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=152) |
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|    | •  [BIO 5513 - Plant Physiology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=154) |
|    | •  [BIO 5521 - Laboratory for Wetlands Plant Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=155) |
|    | •  [BIO 5522 - Wetlands Plant Ecology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=156) |
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|    | •  [BIO 5552 - Medical Mycology](https://catalog.astate.edu/preview_course_nopop.php?catoid=2&coid=160) |
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