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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**

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| **[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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| David F. Gilmore 1/2/2021**Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**COPE Chair (if applicable)** |
| Stephen J. Mulin 2/2/2021**Department Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Head of Unit (if applicable)**   |
| John Hershberger 2/9/2021**College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Undergraduate Curriculum Council Chair** |
| Mary Elizabeth Spence 2/9/2021**Office of Assessment (new courses only)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Graduate Curriculum Committee Chair** |
| Lynn Boyd 2/12/2021**College Dean** | Alan Utter 11/29/2021**Vice Chancellor for Academic Affairs** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**General Education Committee Chair (if applicable)**   |  |

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

Dr. Kyle Gustafson [kgustafson@astate.edu](file:///C%3A%5CUsers%5Ckgustafson%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CRLU5038R%5Ckgustafson%40astate.edu) 870-972-3174

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

**Spring 2022**

**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\*** |  | **5604** |
| **Title** |  | **Conservation Genomics** |
| **Description\*\*** |  | **Theory and applications of genomics in wildlife conservation and management. Development of bioinformatics pipelines to analyze high-throughput, population-genomic data.**  |

 ***\**** (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? No]**

(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. **NO** Are there any prerequisites?
	1. If yes, which ones?
	2. Why or why not?
2. **NO** Is this course restricted to a specific major?
	1. If yes, which major? Enter text...
3. **Proposed course frequency [Modification requested? /No]**

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

**Spring, even**

1. **Proposed course type [Modification requested? /No]**

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? /No]**

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

Standard letter

1. **NO** 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.

 **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? /No]**

(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 to Conservation Genomics; BASH and SLURM coding basics**

**Week 2: Evolution of small populations; quality control of genomic data (FastQC)**

**Week 3: Inbreeding; Demultiplexing (STACKS2)**

**Week 4: Low genetic diversity and adaptation; aligning reads to genome (bwa)**

**Week 5: Population genetic fragmentation; Filtering SNPs and haplotypes (samtools/bcftools/vcftools)**

**Week 6: Genetic rescue; Filtering SNPs and haplotypes (samtools/bcftools/vcftools)**

**Week 7: Outbreeding depression; Outputting data and data structures (vcf, genind, genlight, plink, etc)**

**Week 8: Mating systems; linear population structure with PCA, DAPC, & sPCA (adegenet)**

**Week 9: Delineating species; linear population structure with PCA, DAPC, & sPCA (adegenet)**

**Week 10: Population genetic structure; population structure in fastStructure and tess3r**

**Week 11: Augmented gene flow; population structure in fastStructure and tess3r**

**Week 12: Genetic management with limited information; loci under selection (tess3r, pcadapt, BayeScan)**

**Week 13: Genetic management based on kinship; genetic diversity (STACKS2, samtools, adegenet)**

**Week 14: Climate change; Linkage disequilibrium and effective population size (NEstimator)**

**Week 15: Current and future sequencing technologies; gene–environment interactions (gemma)**

1. **Proposed special features** **[Modification requested? /No]**

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

**This course would benefit from being programmed in a computer lab, but it is not required.**

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

**Assistant professor Dr. Gustafson will teach as part of his teaching rotation**

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)

Enter text...

**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)

 **The field of population and conservation genetics has quickly moved away from studies that use a few molecular markers (e.g., <50), to studies that use thousands of markers or whole genomes. Although a high density of molecular markers allows researchers to ask new questions regarding the evolution of species, it also introduces a major challenge of how to store and manipulate data files that can no longer be opened using standard programs (e.g., Excel). Further, the bioinformatics tools used are continuously changing, making it difficult for early professionals to navigate the field. This course is designed to address those 3 key points: (1) students will learn how the new sequencing technologies have been used in conservation practices (2) students will learn the contemporary models for analyzing population genomic datasets, and (3) students will develop bioinformatic scripts to analyze population genomic data on a high-performance computing cluster. By the end of the course, students will understand theories and applications in conservation genomics, will have analyzed contemporary papers in the field, and will have produced scripts in multiple programming languages that they can use and modify for their own research.**

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 this major 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 government conservation agencies, academic avenues including bioinformatics, and this course is designed to facilitate the research of each student taking the course.**

c. Student population served.

**Graduate students in the EVS, MBS, and Biology programs would benefit from this course.**

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

**It is most suitable for graduate students who are engaged in literature reviews and who have already acquired some analytical skills. This course will require students to have a developed project and have established at least a basic working knowledge of the primary literature of their project.**

**Assessment**

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

1. **NO** 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?

**This course will be available to BIO, MBS, and ENV students. However, it will be listed as a BIO course.**

**MS Biology Program-Level Student Learning Outcomes (SLO)**

1. **Students will be able to understand that science is a process as well as a body of knowledge.**
2. **Students will be able to demonstrate the importance of research by designing and conducting a scientific study.**
3. **Students will be able to prepare, communicate and defend original research in writing and in an oral presentation.**
4. **Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.**
5. **Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.**

 **Above is the list of SLOs in the BIO program. This course will directly relate to SLO 1, 4, 5. For SLO 1, students will understand the science behind the bioinformatics. For example, the purpose of the genomic bioinformatics is to apply scientific knowledge to solve a problem in the field of conservation. For SLO 4, students will learn how to filter and analyze genomic data, but must learn to do so in a professional manner. For SLO 5, bioinformatics is a critical skill for future biologists because the field is increasingly becoming a “big-data science”. The skills learned in the lab are highly sought after by employers.**

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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| **Biology Program-Level Outcome 1** | **Students will be able to understand that science is a process as well as a body of knowledge** |
| Assessment Measure | Master of Science: Successful defense of thesis/dissertationMaster of Arts: Successful completion of practicum IIMaster 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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| **Biology Program-Level Outcome 4** | **Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.**  |
| Assessment Measure | Master of Science: Successful defense of thesis/dissertationMaster of Arts: Successful completion of practicum IIMaster 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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| **Biology Program-Level Outcome 5** | **Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.** |
| Assessment Measure | Master of Science: Successful defense of thesis/dissertationMaster of Arts: Successful completion of practicum IIMaster 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. |

**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** | **Understand how sequencing technologies have been implemented in conservation** |
| Which learning activities are responsible for this outcome? | Lectures & primary literature discussions |
| Assessment Measure  | Exams, quizzes, and participation in discussion |

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| **Outcome 2** | **Comprehend contemporary and foundational models for population genomics** |
| Which learning activities are responsible for this outcome? | Lecture & primary literature discussions; Laboratory methods; writing scripts in various programming languages |
| Assessment Measure  | Exams, quizzes, participation in discussion, written scripts |

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| **Outcome 3** | **Develop and evaluate bioinformatics scripts and analyze population genomic data** |
| Which learning activities are responsible for this outcome? | Laboratory methods; writing scripts in various programming languages |
| Assessment Measure  | Scripts submitted with completed analysis and interpretation |

**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.**  |

**BIO 5421. Laboratory for Ornithology** Three hours per week. To be taken concurrently with BIO 5423. Special course fees may apply.

**BIO 5423. Ornithology** A study of the evolution, taxonomy, behavior, ecology, population biology, physiology, and conservation of birds. Lecture three hours per week. Prerequisites, BIO 1301, 1303.

**BIO 5433. Field Experience in Marine Environments** Hands-on experience with living and non-living components of marine environments. Emphasis on marine organisms and habitats but will incorporate human interactions associated with marine environments. Course is comprised of an intensive 10 day (10 hrs per day) field trip to an appropriate marine environment.

**BIO 5441. Comparative Animal Physiology Laboratory** Three hours per week. Special course fees may apply. To be taken concurrently with BIO 5443.

**BIO 5443. Comparative Animal Physiology** Examination of physiological systems and processes across vertebrate and invertebrate groups. Broad topics include energetic relationships, integrating systems, reproduction, internal transport, and maintenance of internal balance. Prerequisites, BIO 1301, BIO 1303, BIO 2013, CHEM 1021, and CHEM 1023 BIO

**5444. Wildlife Population Modeling** Introduction to population models, techniques to estimate demographic parameters (e.g., survival, breeding success). Statistical background recommended. Fall of even years. No pre-requisite although a statistical background such as Biological Data Analysis is recommended.

**BIO 5511. Laboratory for Plant Physiology** Three hours per week. To be taken concurrently with BIO 5513. Special course fees may apply.

**BIO 5513. Plant Physiology** General principles of conduction, cellular reactions, respiration, growth, photosynthesis, movement, hormones, and metabolism in plants. Lecture three hours per week. Prerequisites, BIO 1501, 1503; CHEM 3103, CHEM 3101.

**BIO 5521. Laboratory for Wetlands Plant Ecology** Two hours per week. To be taken concurrently with BIO 5522. Special course fees may apply.

**BIO 5522. Wetlands Plant Ecology** A study of plant responses to environmental factors during germination, growth, reproduction, and dormancy. Lecture two hours per week. Prerequisites, BIO 3123 or permission of professor or chair.

**BIO 5541. Laboratory for Mycology** Two hours per week. To be taken concurrently with BIO 5542. Special course fees may apply.

**BIO 5542. Mycology** Morphology, cytology, genetics, and physiology of fungi. Lecture two hours per week. Prerequisites, BIO 3012, 3022; CHEM 3103, CHEM 3101.

**BIO 5551. Laboratory for Medical Mycology** Two hours per week. To be taken concurrently with BIO 5552. Special course fees may apply.

**BIO 5552. Medical Mycology** A study of cutaneous, systemic, and opportunistic fungal diseases (mycoses) of man and other animals. Lecture two hours per week. Prerequisites, BIO 1501, 1503.

**BIO 5601. Laboratory for Limnology** Two hours per week. To be taken concurrently with BIO 5603. Special course fees may apply.

**BIO 5603. Limnology** Physicochemical conditions of fresh water, and their effects on aquatic life; plankton analysis and bottom fauna studies. Lecture three hours per week. Prerequisites, BIO 1301, 1303; CHEM 1023, CHEM 1021.

**BIO 5604. Conservation Genomics** Theory and applications of genomics in wildlife conservation and management. Development of bioinformatics pipelines to analyze high-throughput, population-genomic data.

**BIO 5611. Radiation in Our World** Introduction to the biological effects and physics of radiation and radioactivity, radiation in our environment and society, and the interactions of radiation with organisms. Prerequisite, instructor permission. Fall, Spring