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| For Academic Affairs and Research Use Only |
| Proposal Number | SM03 |
| CIP Code:  |  |
| Degree Code: |  |

**New or Modified Course Proposal Form**

**[X] Undergraduate Curriculum Council**

**[ ] Graduate Council**

|  |
| --- |
| **[ ]New Course, [ ]Experimental Course (1-time offering), or [X]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.

|  |  |
| --- | --- |
| Virginie Rolland 2/10/2022**Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**COPE Chair (if applicable)** |
| Stephen J. Mullin 2/10/2022**Department Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Head of Unit (if applicable)**   |
| John Hershberger 2/10/2022 Enter date…**College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Undergraduate Curriculum Council Chair** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Director of Assessment (new courses only)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…**Graduate Curriculum Committee Chair** |
| Lynn Boyd 3/2/2022**College Dean** | Alan Utter 3/14/2022**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 2022, AY 2022-2023.

**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** | **N/A** |
| **Number\*** | **3033** | **4083** |
| **Title** | **Evolution** | **N/A** |
| **Description\*\*** | A critical review of evolutionary principles, primarily the neo Darwinian theory, with comparisons to newly emerging theories. Lecture, selected readings, writings, and group discussions. Special course fees may apply. Prerequisites, BIOL 1001 and 1003 or higher. Spring.  | **A thorough overview of evolutionary biology, including how evolutionary theory relates to genetics, ecology, behavior, biodiversity, and human health. Limited to students with BS-Biological Sciences, BS-Wildlife, BS-Biological Sciences Education, and BS-Environmental Science majors. Prerequisites: BIO 1303 and 1301, 1503 and 1501, 3013 and 3011. Fall, spring.** |

 ***\**** (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? Yes]**

(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?

**BIO 1303/1301 (Biology of Animals and Lab), BIO 1503/1501 (Biology of Plants and Lab), BIO 3013/3011 (Genetics and Lab)**

* 1. Why or why not?

T**he proposed pre-requisite courses will give students a necessary foundation in plant and animal biology. This Evolution course also focuses heavily on genetics, so students should have enough background in genetics to grasp the content (Biology of the Cell, BIO 2013 and 2011, is required for Genetics). Currently, these courses are not required for Evolution, but students often struggle with basic concepts, particularly in genetics, which should not be the case in a 3000-level (and certainly not a 4000-level) biology course.**

1. **Yes** Is this course restricted to a specific major?
	1. If yes, which major? **Changing the course prerequisites will restrict the course to students in BS-Biological Sciences, BS-Wildlife, BS-Biological Sciences Education, and BS-Environmental Science. Students from other majors have taken Evolution in previous semesters, but these students are relatively infrequent and often struggle even more with basic concepts**.
2. **Proposed course frequency [Modification requested? Yes]**

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

Fall, Spring

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

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**

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.

 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? Yes]**

(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; Hypotheses and scientific evidence**

**Week 2: The history of evolutionary theory; Fossils**

**Week 3: Reading and interpreting phylogenetic trees; Mutations and inheritance (basics of genetic inheritance)**

**Week 4: Population genetics: genetic drift, selection, and gene flow**

**Week 5: Quantitative genetics; Quantitative traits; Exam 1**

**Week 6: Evolution of genes and genomes**

**Week 7: Evolution and developmental biology; Genetic toolkits**

**Week 8: Natural selection**

**Week 9: Sexual selection; Exam 2**

**Week 10: Evolution of life history; Species and species concepts**

**Week 11: Macroevolution**

**Week 12: Coevolution**

**Week 13: Evolution and behavior; Exam 3**

**Week 14: Human evolution**

**Week 15: Evolution and medicine**

**Final, cumulative exam**

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

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

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

No changes. Instructor of record and a lecture space that is available four times a week for 50-minutes.

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)

The **request is for three modifications for the Evolution course: 1) changing to a 4000-level course, 2) requiring different prerequisites, and 3) offering the course in both Fall and Spring semesters. These changes would greatly improve the course by enabling students to maximize their potential for learning the material.**

**Evolutionary theory is truly a nexus for all areas of biology, which makes the course an excellent capstone experience for biology students. Requiring students to have taken more biology courses, and changing the course to 4000-level, will help ensure that students can draw from their previous coursework to solidify what is taught in the Evolution course. For example, having a basic understanding of genetics and cellular processes (e.g., from taking Genetics) will help students to grasp concepts related to mutations and quantitative genetics. Additionally, as a 4000-level course, Evolution will require students to synthesize information and ideas from previous specialized coursework, such as Herpetology or Embryology.**

**Finally, increasing the frequency of the course (from Spring-only to Fall and Spring) will be necessary to accommodate other proposed changes to make Evolution required for all Biology majors. Offering the course every semester will keep class sizes smaller and provide more opportunities for students to fulfill the requirement.**

**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)

 Enter text...

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.

 Enter text...

c. Student population served.

Enter text...

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

Enter text...

**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?

Enter text...

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.*

|  |  |
| --- | --- |
| **Program-Level Outcome 1 (from question #19)** | Type outcome here. What do you want students to think, know, or do when they have completed the course? |
| Assessment Measure | Please include direct and indirect assessment measure for outcome.  |
| Assessment Timetable | What semesters, and how often, is the outcome assessed? |
| Who is responsible for assessing and reporting on the results? | Who (person, position title, or internal committee) is responsible for assessing, evaluating, and analyzing results, and developing action plans? |

 *(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?

|  |  |
| --- | --- |
| **Outcome 1** | Type outcome here. What do you want students to think, know, or do when they have completed the course? |
| Which learning activities are responsible for this outcome? | List learning activities. |
| Assessment Measure  | What will be your assessment measure for this outcome?  |

*(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 275:**

**Before:**

Department of English and Philosophy Minors

Minor in Cognitive Science

Completion of the minor will require eighteen hours in courses related to cognition, learning, development and the mind - at least nine of which must be upper-level courses, and no more than six of which are in the student’s major. Students must also complete courses from two of the three main research areas of Psychology, Philosophy and Biology.

|  |  |
| --- | --- |
| **Required Courses:**  | **Sem. Hrs.**  |
| PHIL 2403, Introduction to Cognitive Science  | 3  |
| **Select fifteen hours from the following:** BIO 3033, Evolution BIO 4443 **AND** 4441, Animal Physiology and Laboratory BIO 4133 **AND** 4131, Cell Biology and Laboratory PHIL 4403, Metaphysics PHIL 4443, Philosophy of Mind POSC 4003, Political Psychology PSY 3403, Child Psychology PSY 3303, Motivation PSY 3413, Adolescent Psychology PSY 2133, Developmental Psychology PSY 4323, Physiological Psychology PSY 4363, Cognitive Psychology SOC 3293, Self and Society SOC 4213, Sociology of Childhood and Adolescence  | 15  |
| **Total Required Hours:**  | **18**  |

**After:**

Department of English and Philosophy Minors

Minor in Cognitive Science

Completion of the minor will require eighteen hours in courses related to cognition, learning, development and the mind - at least nine of which must be upper-level courses, and no more than six of which are in the student’s major. Students must also complete courses from two of the three main research areas of Psychology, Philosophy and Biology.

|  |  |
| --- | --- |
| **Required Courses:**  | **Sem. Hrs.**  |
| PHIL 2403, Introduction to Cognitive Science  | 3  |
| **Select fifteen hours from the following:** ~~BIO 3033, Evolution~~ BIO 4443 **AND** 4441, Animal Physiology and Laboratory BIO 4133 **AND** 4131, Cell Biology and Laboratory PHIL 4403, Metaphysics PHIL 4443, Philosophy of Mind POSC 4003, Political Psychology PSY 3403, Child Psychology PSY 3303, Motivation PSY 3413, Adolescent Psychology PSY 2133, Developmental Psychology PSY 4323, Physiological Psychology PSY 4363, Cognitive Psychology SOC 3293, Self and Society SOC 4213, Sociology of Childhood and Adolescence  | 15  |
| **Total Required Hours:**  | **18**  |

**Page 410:**

**Before:**

**Major in Biological Sciences (cont.)**

**Bachelor of Science**

**Emphasis in Biology**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

|  |  |
| --- | --- |
| **Emphasis Area (Biology):**  | **Sem. Hrs.**  |
| BIO 3033, Evolution  | 3  |
| BIO 3302 **AND** 3312, Comparative Anatomy and Laboratory  | 4  |
| BIO 3303 **AND** 3301, General Entomology and Laboratory **OR** BIO 3322 **AND** 3332, Invertebrate Zoology and Laboratory  | 4  |
| BIO 4443 **AND** 4441, Comparative Animal Physiology and Laboratory **OR** BIO 4513, Plant Physiology  | 3-4  |
| BIO 4104, Microbiology  | 4  |
| BIO 4133 **AND** BIO 4131, Cell Biology and Laboratory **OR** CHEM 4243, Biochemistry  | 3-4  |
| BIO 4332 **AND** 4342, Animal Histology and Laboratory **OR** BIO 4343 **AND** 4341, Animal Embryology and Laboratory  | 4  |
| BIO 4542 **AND** 4541, Mycology and Laboratory **OR** BIO 4552 **AND** 4551, Medical Mycology and Laboratory  | 3  |
| BIO 4704, Plant Systematics **OR** BIO 4522 **AND** 4521, Wetland Plant Ecology and Laboratory  | 3-4  |
| STAT 3233, Applied Statistics I  | 3  |
| Electives (BIO prefix)  | 5-8  |
| **Sub-total**  | **42**  |
| **Total Required Hours:**  | **120**  |

**After:**

**Major in Biological Sciences (cont.)**

**Bachelor of Science**

**Emphasis in Biology**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

|  |  |
| --- | --- |
| **Emphasis Area (Biology):**  | **Sem. Hrs.**  |
| BIO 3302 **AND** 3312, Comparative Anatomy and Laboratory  | 4  |
| BIO 3303 **AND** 3301, General Entomology and Laboratory **OR** BIO 3322 **AND** 3332, Invertebrate Zoology and Laboratory  | 4  |
| BIO 4083, Evolution  | 3  |
| BIO 4443 **AND** 4441, Comparative Animal Physiology and Laboratory **OR** BIO 4513, Plant Physiology  | 3-4  |
| BIO 4104, Microbiology  | 4  |
| BIO 4133 **AND** BIO 4131, Cell Biology and Laboratory **OR** CHEM 4243, Biochemistry  | 3-4  |
| BIO 4332 **AND** 4342, Animal Histology and Laboratory **OR** BIO 4343 **AND** 4341, Animal Embryology and Laboratory  | 4  |
| BIO 4542 **AND** 4541, Mycology and Laboratory **OR** BIO 4552 **AND** 4551, Medical Mycology and Laboratory  | 3  |
| BIO 4704, Plant Systematics **OR** BIO 4522 **AND** 4521, Wetland Plant Ecology and Laboratory  | 3-4  |
| STAT 3233, Applied Statistics I  | 3  |
| Electives (BIO prefix)  | 5-8  |
| **Sub-total**  | **42**  |
| **Total Required Hours:**  | **120**  |
|  |  |

**Page 413:**

**Before:**

**Major in Biological Sciences**

**Bachelor of Science**

**Emphasis in Botany**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *MATH 1023, College Algebra or MATH course that requires MATH 1023 as a prerequisite* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **35**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a Biological Sciences Major. (Refer to Department of Biological Sciences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 4021, Biological Seminar  | 1  |
| CHEM 1023 **AND** 1021, General Chemistry II and Laboratory  | 4  |
| CHEM 3103 **AND** 3101, Organic Chemistry I and Laboratory  | 4  |
| CHEM 3113 **AND** 3111, Organic Chemistry II and Laboratory  | 4  |
| MATH 2194, Survey of Calculus **OR** MATH 2204, Calculus I  | 4  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| **Sub-total**  | **40**  |
| **Emphasis Area (Botany):**  | **Sem. Hrs.**  |
| BIO 3033, Evolution  | 3  |
| BIO 3303 **AND** 3301, General Entomology and Laboratory **OR** BIO 3313 **AND** 3311, Economic Entomology and Laboratory  | 4  |
| BIO 3542 **AND** 3541, Plant Pathology and Laboratory **OR** BIO 4542 **AND** 4541, Mycology and Laboratory **OR** BIO 4552 **AND** 4551, Medical Mycology and Laboratory  | 3  |
| BIO 4104, Microbiology  | 4  |
| BIO 4513, Plant Physiology  | 3  |
| BIO 4522 **AND** 4521, Wetland Plant Ecology and Laboratory  | 3  |
| BIO 4704, Plant Systematics  | 4  |
| STAT 3233, Applied Statistics I **OR** CHEM 4243, Biochemistry  | 3  |
| **Sub-total**  | **27**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives (two hours must be upper-level)  | **15**  |
| **Total Required Hours:**  | **120** |

**After:**

**Major in Biological Sciences**

**Bachelor of Science**

**Emphasis in Botany**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| --- |
| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *MATH 1023, College Algebra or MATH course that requires MATH 1023 as a prerequisite* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **35**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a Biological Sciences Major. (Refer to Department of Biological Sciences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 4021, Biological Seminar  | 1  |
| CHEM 1023 **AND** 1021, General Chemistry II and Laboratory  | 4  |
| CHEM 3103 **AND** 3101, Organic Chemistry I and Laboratory  | 4  |
| CHEM 3113 **AND** 3111, Organic Chemistry II and Laboratory  | 4  |
| MATH 2194, Survey of Calculus **OR** MATH 2204, Calculus I  | 4  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| **Sub-total**  | **40**  |
| **Emphasis Area (Botany):**  | **Sem. Hrs.**  |
| BIO 3303 **AND** 3301, General Entomology and Laboratory **OR** BIO 3313 **AND** 3311, Economic Entomology and Laboratory  | 4  |
| BIO 3542 **AND** 3541, Plant Pathology and Laboratory **OR** BIO 4542 **AND** 4541, Mycology and Laboratory **OR** BIO 4552 **AND** 4551, Medical Mycology and Laboratory  | 3  |
| BIO 4083, Evolution  | 3  |
| BIO 4104, Microbiology  | 4  |
| BIO 4513, Plant Physiology  | 3  |
| BIO 4522 **AND** 4521, Wetland Plant Ecology and Laboratory  | 3  |
| BIO 4704, Plant Systematics  | 4  |
| STAT 3233, Applied Statistics I **OR** CHEM 4243, Biochemistry  | 3  |
| **Sub-total**  | **27**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives (two hours must be upper-level)  | **15**  |
| **Total Required Hours:**  | **120** |

**Page 418:**

**Before:**

**Major in General Science**

**Bachelor of Science in Education**

**Emphasis in Biology**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *MATH 2194, Survey of Calculus* ***OR*** *MATH 2204, Calculus 1* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *POSC 2103, Introduction to United States Government* *PSY 2013, Introduction to Psychology* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **36**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a General Science - Biology Major. (Refer to Department of Biological Sciences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 3033, Evolution  | 3  |
| BIO 4104, Microbiology  | 4  |
| CHEM 1023 **AND** 1021, General Chemistry II and Laboratory  | 4  |
| CHEM 3103, Organic Chemistry I  | 3  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| **Earth Science Electives (select three of the following):** GEOG 3723, Introduction to Physical Geography **OR** GEOG 4633, Climatology GEOL 1003, Environmental Geology PHYS 1103, Introduction to Space Science **OR** PHYS 3133, Astronomy PHYS 3043, Atmospheric Dynamics  | 9  |
| **Sub-total**  | **46** |

**After:**

**Major in General Science**

**Bachelor of Science in Education**

**Emphasis in Biology**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *MATH 2194, Survey of Calculus* ***OR*** *MATH 2204, Calculus 1* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *POSC 2103, Introduction to United States Government* *PSY 2013, Introduction to Psychology* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **36**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a General Science - Biology Major. (Refer to Department of Biological Sciences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 4083, Evolution  | 3  |
| BIO 4104, Microbiology  | 4  |
| CHEM 1023 **AND** 1021, General Chemistry II and Laboratory  | 4  |
| CHEM 3103, Organic Chemistry I  | 3  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| **Earth Science Electives (select three of the following):** GEOG 3723, Introduction to Physical Geography **OR** GEOG 4633, Climatology GEOL 1003, Environmental Geology PHYS 1103, Introduction to Space Science **OR** PHYS 3133, Astronomy PHYS 3043, Atmospheric Dynamics  | 9  |
| **Sub-total**  | **46** |

**Page 423:**

**Before:**

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| **Choose any of the courses below among the five focus areas. Students can choose to stay within one focus area, or may take courses from any focus area depending on interest and career aspirations:** **Biology Focus** BIO 3033, Evolution BIO 3313 AND 3311, Economic Entomology and Laboratory BIO 4333, Marine Biology BIO 4373 AND 4371, Animal Ecology and Laboratory BIO 4813, Curation of Collections BIO 4823, Natural History Collections Research Design **Agriculture / Sustainability Focus** AGRI 4223, Agriculture and the Environment AGRI 4433, Organic Agriculture Production CE 3263, Introduction ot Environmental Engineering GEOG 4613, Conservation of Natural Resources HORT 3253, Urban Forestry PSSC 2811, Soils Laboratory PSSC 4813, Soil Fertility RET 3113, Fundamentals and Applications of Renewable Energy RET 4023, Advanced Bioenergy RET 4113, Advanced Renewable Energy Systems RET 4123, Energy Conservation and Efficiency **Geospatial Focus** AGST 3543, Fundamentals of GIS/GPS AGST 4543, Understanding Geographic Information Systems AGST 4773, Remote Sensing GEOG 3603, World Regional Geography GEOG 3723, Introduction to Physical Geography, Weather, and Climate **Economic / Policy / Social Focus** CRIM 2043, Community Relations in the Administration of Justice POSC 3503, Principles of Public Administration POSC 3513, Public Budgeting Process POSC 4143, Public Opinion and Public Policy POSC 4503, Public Policy, Politics and Power POSC 4513, Disaster Response Operation Management POSC 4523, Public Personnel Administration POSC 4633, Environmental Law and Administration **Communication Focus** MDIA 4003, Communications Law and Ethics COMS 3243, Principles of Persuasion COMS 3253, Principles of Listening COMS 4253, Intercultural Communication COMS 4263, Organizational Communication COMS 4773, Conflict Resolution STCM 4023, Public Opinion, Propaganda and the Mass Media STCM 4603, Crisis Communication STCM 2143, Strategic Writing STCM 3043, Principles of Strategic Communication STCM 3143, Strategic Writing II STCM 4073, Strategic Communication Law and Ethics STCM 4213, Social Media in Strategic Communication STCM 4503, Seminar in Non Profit Communication STCM 4763, Strategic Communication Campaigns  | 42  |
| **Sub-total**  | **69**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives  | **13**  |
| **Total Required Hours:**  | **120** |

**After:**

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| **Choose any of the courses below among the five focus areas. Students can choose to stay within one focus area, or may take courses from any focus area depending on interest and career aspirations:** **Biology Focus** BIO 3313 AND 3311, Economic Entomology and Laboratory BIO 4083, Evolution BIO 4333, Marine Biology BIO 4373 AND 4371, Animal Ecology and Laboratory BIO 4813, Curation of Collections BIO 4823, Natural History Collections Research Design **Agriculture / Sustainability Focus** AGRI 4223, Agriculture and the Environment AGRI 4433, Organic Agriculture Production CE 3263, Introduction ot Environmental Engineering GEOG 4613, Conservation of Natural Resources HORT 3253, Urban Forestry PSSC 2811, Soils Laboratory PSSC 4813, Soil Fertility RET 3113, Fundamentals and Applications of Renewable Energy RET 4023, Advanced Bioenergy RET 4113, Advanced Renewable Energy Systems RET 4123, Energy Conservation and Efficiency **Geospatial Focus** AGST 3543, Fundamentals of GIS/GPS AGST 4543, Understanding Geographic Information Systems AGST 4773, Remote Sensing GEOG 3603, World Regional Geography GEOG 3723, Introduction to Physical Geography, Weather, and Climate **Economic / Policy / Social Focus** CRIM 2043, Community Relations in the Administration of Justice POSC 3503, Principles of Public Administration POSC 3513, Public Budgeting Process POSC 4143, Public Opinion and Public Policy POSC 4503, Public Policy, Politics and Power POSC 4513, Disaster Response Operation Management POSC 4523, Public Personnel Administration POSC 4633, Environmental Law and Administration **Communication Focus** MDIA 4003, Communications Law and Ethics COMS 3243, Principles of Persuasion COMS 3253, Principles of Listening COMS 4253, Intercultural Communication COMS 4263, Organizational Communication COMS 4773, Conflict Resolution STCM 4023, Public Opinion, Propaganda and the Mass Media STCM 4603, Crisis Communication STCM 2143, Strategic Writing STCM 3043, Principles of Strategic Communication STCM 3143, Strategic Writing II STCM 4073, Strategic Communication Law and Ethics STCM 4213, Social Media in Strategic Communication STCM 4503, Seminar in Non Profit Communication STCM 4763, Strategic Communication Campaigns  | 42  |
| **Sub-total**  | **69**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives  | **13**  |
| **Total Required Hours:**  | **120** |

**Page 425:**

**Before:**

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| **Choose any of the courses below among the five focus areas. Students can choose to stay within one focus area, or may take courses from any focus area depending on interest and career aspirations:** **Biology Focus** BIO 3013 AND 3011, Genetics and Laboratory BIO 3033, Evolution BIO 4104, Microbiology BIO 4333, Marine Biology BIO 4373 AND 4371, Animal Ecology and Laboratory BIO 4623, Environmental Microbiology BIO 4633, Environmental Toxicology Mechanisms and Impacts **Chemistry Focus** CHEM 3054, Quantitative Analysis CHEM 3153, Survey of Physical Chemistry CHEM 4043, Environmental Chemistry CHEM 4243, Biochemistry CHEM 4241, Biochemistry Laboratory **Agriculture / Sustainability Focus** AGRI 4223, Agriculture and the Environment CE 3263, Introduction ot Environmental Engineering GEOG 4613, Conservation of Natural Resources PSSC 4813, Soil Fertility **Geospatial Focus** AGST 3543, Fundamentals of GIS/GPS AGST 4543, Understanding Geographic Information Systems AGST 4773, Remote Sensing GEOG 3723, Introduction to Physical Geography, Weather, and Climate **Economic / Policy / Social Focus** ECON 4363, Global Environmental Policies GEOG 4113, Water Resource Planning PHIL 4733, Environmental Ethics POSC 4633, Environmental Law and Administration  | 19  |
| **Sub-total**  | **72**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives  | **9**  |
| **Total Required Hours:**  | **120** |

**After:**

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| **Choose any of the courses below among the five focus areas. Students can choose to stay within one focus area, or may take courses from any focus area depending on interest and career aspirations:** **Biology Focus** BIO 3013 AND 3011, Genetics and Laboratory BIO 4083, Evolution BIO 4104, Microbiology BIO 4333, Marine Biology BIO 4373 AND 4371, Animal Ecology and Laboratory BIO 4623, Environmental Microbiology BIO 4633, Environmental Toxicology Mechanisms and Impacts **Chemistry Focus** CHEM 3054, Quantitative Analysis CHEM 3153, Survey of Physical Chemistry CHEM 4043, Environmental Chemistry CHEM 4243, Biochemistry CHEM 4241, Biochemistry Laboratory **Agriculture / Sustainability Focus** AGRI 4223, Agriculture and the Environment CE 3263, Introduction ot Environmental Engineering GEOG 4613, Conservation of Natural Resources PSSC 4813, Soil Fertility **Geospatial Focus** AGST 3543, Fundamentals of GIS/GPS AGST 4543, Understanding Geographic Information Systems AGST 4773, Remote Sensing GEOG 3723, Introduction to Physical Geography, Weather, and Climate **Economic / Policy / Social Focus** ECON 4363, Global Environmental Policies GEOG 4113, Water Resource Planning PHIL 4733, Environmental Ethics POSC 4633, Environmental Law and Administration | 19  |
| **Sub-total**  | **72**  |
| **Electives:**  | **Sem. Hrs.**  |
| Electives  | **9**  |
| **Total Required Hours:**  | **120** |

**Page 426:**

**Before:**

**Major in Wildlife, Fisheries and Conservation**

**Bachelor of Science**

**Emphasis in Fisheries**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *Students with this major must take the following:* *MATH 1054, Precalculus Mathematics or MATH course that requires MATH 1023* *as a prerequisite* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **36**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a Major in Wildlife, Fisheries and Conservation Major. (Refer to Department of Biological Sci­ences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| See emphasis area below.  | **-**  |
| **Emphasis Area (Fisheries):**  | **Sem. Hrs.**  |
| AGST 3543, Fundamentals of GIS/GPS  | 3  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 3033, Evolution **OR** BIO 4333, Marine Biology  | 3  |
| BIO 4021, Biological Seminar  | 1  |
| BIO 4301 AND 4302, Aquatic Entomology and Laboratory  | 3  |
| BIO 4312 AND 4311, Fisheries Biology and Laboratory  | 3  |
| BIO 4362, Applied Aquaculture **OR** BIO 4372, Applied Fisheries  | 2  |
| BIO 4402 AND 4401, Ichthyology and Laboratory  | 3  |
| BIO 4413, Fisheries Program Internship  | 3  |
| BIO 4603 AND 4601, Limnology and Laboratory  | 4  |
| CHEM 1023 AND 1021, General Chemistry II and Laboratory  | 4  |
| MATH 2194, Survey of Calculus **OR** MATH 2204, Calculus I  | 4  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| STAT 3233, Applied Statistics I  | 3  |
| **Select two of the following:** BIO 3673, Human Dimensions of Natural Resources BIO 4613, Conservation Biology POSC 4633, Environmental Law and Administration  | 6 |

**After:**

**Major in Wildlife, Fisheries and Conservation**

**Bachelor of Science**

**Emphasis in Fisheries**

A complete 8-semester degree plan is available at https://www.astate.edu/info/academics/degrees/

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| **University Requirements:**  |
| See University General Requirements for Baccalaureate degrees (p. 47)  |
| **First Year Making Connections Course:**  | **Sem. Hrs.**  |
| BIO 1013, Making Connections - Biology  | **3**  |
| **General Education Requirements:**  | **Sem. Hrs.**  |
| See General Education Curriculum for Baccalaureate degrees (p. 84) **Students with this major must take the following:** *Students with this major must take the following:* *MATH 1054, Precalculus Mathematics or MATH course that requires MATH 1023* *as a prerequisite* *CHEM 1013* ***AND*** *1011, General Chemistry I and Laboratory* *BIO 2013* ***AND*** *2011, Biology of the Cell and Laboratory* *COMS 1203, Oral Communication (Required Departmental Gen. Ed. Option)*  | **36**  |
| **Language Requirement:**  | **Sem. Hrs.**  |
| *A student must complete the foreign language requirements before being considered a Major in Wildlife, Fisheries and Conservation Major. (Refer to Department of Biological Sci­ences Foreign Language Requirement).*  |
| **Major Requirements:**  | **Sem. Hrs.**  |
| See emphasis area below.  | **-**  |
| **Emphasis Area (Fisheries):**  | **Sem. Hrs.**  |
| AGST 3543, Fundamentals of GIS/GPS  | 3  |
| BIO 1303 **AND** 1301, Biology of Animals and Laboratory  | 4  |
| BIO 1503 **AND** 1501, Biology of Plants and Laboratory  | 4  |
| BIO 3013 **AND** 3011, Genetics and Laboratory  | 4  |
| BIO 3023, Principles of Ecology  | 3  |
| BIO 4083, Evolution **OR** BIO 4333, Marine Biology  | 3  |
| BIO 4021, Biological Seminar  | 1  |
| BIO 4301 AND 4302, Aquatic Entomology and Laboratory  | 3  |
| BIO 4312 AND 4311, Fisheries Biology and Laboratory  | 3  |
| BIO 4362, Applied Aquaculture **OR** BIO 4372, Applied Fisheries  | 2  |
| BIO 4402 AND 4401, Ichthyology and Laboratory  | 3  |
| BIO 4413, Fisheries Program Internship  | 3  |
| BIO 4603 AND 4601, Limnology and Laboratory  | 4  |
| CHEM 1023 AND 1021, General Chemistry II and Laboratory  | 4  |
| MATH 2194, Survey of Calculus **OR** MATH 2204, Calculus I  | 4  |
| PHYS 2054, General Physics I  | 4  |
| PHYS 2064, General Physics II  | 4  |
| STAT 3233, Applied Statistics I  | 3  |
| **Select two of the following:** BIO 3673, Human Dimensions of Natural Resources BIO 4613, Conservation Biology POSC 4633, Environmental Law and Administration  | 6 |

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**Before:**

**BIO 2221. Human Anatomy and Physiology II Laboratory** Major sense organs, autonomic nervous system and internal environment, neuro endocrine control mechanisms, respiratory and cardiovascular functions, oxygen and carbon dioxide transport, liver functions, digestive, renal and reproductive processes. Three hours per week. Special course fees may apply. Prerequisites, BIO 2201 and BIO 2203. It is recommended this course be taken concur­rently with BIO 2223. Fall, Spring. (ACTS#: BIOL 2414)

**BIO 2223. Human Anatomy and Physiology II** Major sense organs, autonomic nervous system and internal environment, neuro endocrine control mechanisms, respiratory and cardio­vascular functions, oxygen and carbon dioxide transport, liver functions, digestive, renal and reproductive processes. Three hours per week. Special course fees may apply. It is recom­mended this course be taken concurrently with BIO 2221. Fall, Spring. (ACTS#: BIOL 2414)

**BIO 3011. Genetics Laboratory** DNA observation, DNA isolation, heredity and varia­tion with applications to bacteria, plants and animals will be investigated in the laboratory. Three hours per week. It is recommended this course be taken concurrently with BIO 3013. Special course fees may apply. Fall, Spring.

**BIO 3013. Genetics** A study of the principles of heredity including Mendelian genetics, population and evolutionary genetics, and molecular genetics with a focus on patterns of human inheritance. Special course fees may apply. Prerequisites, BIO 2013 and BIO 2011. Fall, Spring.

**BIO 3023. Principles of Ecology** An introduction to the study of relationships and interactions of organisms and their environment. Special course fees may apply. Prerequisites, BIO 1501, BIO 1503, BIO 1301, and BIO 1303. Fall, Spring.

**~~BIO 3033. Evolution~~** ~~A critical review of evolutionary principles, primarily the neo Darwin­ian theory, with comparisons to newly emerging theories. Lecture, selected readings, writings, and group discussions. Special course fees may apply. Prerequisites, BIOL 1001 and 1003 or higher.~~

**BIO 3051. Try Out the Classroom** Introductory classroom experience led by ASU STEM faculty and area teachers. Topics include Arkansas science/math curriculum, classroom man­agement, laboratory safety, and basic teaching skills. Students will develop and present science/ math activities in area classrooms and campus outreach. Prerequisites, 8 BIO credit hours.

**BIO 3201. Introduction to Medical and Dental Practices** This course introduces stu­dents to the diversity of specialty practices within the fields of medicine and dentistry. Enrollment limited to students seeking a career in dentistry, medicine, podiatry, or optometry. Graded pass or fail, credit cannot be applied to degree requirements. Special course fees may apply. Spring.

**BIO 3203. Pathophysiology** The physiology of pathological disturbances and inborn er­rors. Mechanism of disturbance, body compensating efforts, and adaptive responses of humans. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2223 and BIO 2221, or BIO 3233 and BIO 3231. Fall, Spring.

**BIO 3211. Techniques for Medical Exam Test Taking** This course introduces students to the Medical College Aptitude Test, MCAT. Basic scientific principles and test taking strategies within the fields of medicine will be covered. Prerequisites, enrollment limited to students seek­ing a career in medicine. Graded pass or fail, credit cannot be applied to degree requirements. Spring.

**BIO 3221. Human Structure and Function I Laboratory** Two hours per week. Special course fees may apply. Special course fees may apply. It is recommended this course be taken concurrently with BIO 3223. Fall, Spring.

**BIO 3223. Human Structure and Function I** This course covers the structure and func­tion of the human organism. Topics covered include, cellular function, skeletal, muscular and nervous systems. Special course fees may apply. Prerequisite, BIO 1301, BIO 1303, CHEM 1023 and 1021. Fall, Spring.

**After:**

**BIO 2221. Human Anatomy and Physiology II Laboratory** Major sense organs, autonomic nervous system and internal environment, neuro endocrine control mechanisms, respiratory and cardiovascular functions, oxygen and carbon dioxide transport, liver functions, digestive, renal and reproductive processes. Three hours per week. Special course fees may apply. Prerequisites, BIO 2201 and BIO 2203. It is recommended this course be taken concur­rently with BIO 2223. Fall, Spring. (ACTS#: BIOL 2414)

**BIO 2223. Human Anatomy and Physiology II** Major sense organs, autonomic nervous system and internal environment, neuro endocrine control mechanisms, respiratory and cardio­vascular functions, oxygen and carbon dioxide transport, liver functions, digestive, renal and reproductive processes. Three hours per week. Special course fees may apply. It is recom­mended this course be taken concurrently with BIO 2221. Fall, Spring. (ACTS#: BIOL 2414)

**BIO 3011. Genetics Laboratory** DNA observation, DNA isolation, heredity and varia­tion with applications to bacteria, plants and animals will be investigated in the laboratory. Three hours per week. It is recommended this course be taken concurrently with BIO 3013. Special course fees may apply. Fall, Spring.

**BIO 3013. Genetics** A study of the principles of heredity including Mendelian genetics, population and evolutionary genetics, and molecular genetics with a focus on patterns of human inheritance. Special course fees may apply. Prerequisites, BIO 2013 and BIO 2011. Fall, Spring.

**BIO 3023. Principles of Ecology** An introduction to the study of relationships and interactions of organisms and their environment. Special course fees may apply. Prerequisites, BIO 1501, BIO 1503, BIO 1301, and BIO 1303. Fall, Spring.

**BIO 3051. Try Out the Classroom** Introductory classroom experience led by ASU STEM faculty and area teachers. Topics include Arkansas science/math curriculum, classroom man­agement, laboratory safety, and basic teaching skills. Students will develop and present science/ math activities in area classrooms and campus outreach. Prerequisites, 8 BIO credit hours.

**BIO 3201. Introduction to Medical and Dental Practices** This course introduces stu­dents to the diversity of specialty practices within the fields of medicine and dentistry. Enrollment limited to students seeking a career in dentistry, medicine, podiatry, or optometry. Graded pass or fail, credit cannot be applied to degree requirements. Special course fees may apply. Spring.

**BIO 3203. Pathophysiology** The physiology of pathological disturbances and inborn er­rors. Mechanism of disturbance, body compensating efforts, and adaptive responses of humans. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2223 and BIO 2221, or BIO 3233 and BIO 3231. Fall, Spring.

**BIO 3211. Techniques for Medical Exam Test Taking** This course introduces students to the Medical College Aptitude Test, MCAT. Basic scientific principles and test taking strategies within the fields of medicine will be covered. Prerequisites, enrollment limited to students seek­ing a career in medicine. Graded pass or fail, credit cannot be applied to degree requirements. Spring.

**BIO 3221. Human Structure and Function I Laboratory** Two hours per week. Special course fees may apply. Special course fees may apply. It is recommended this course be taken concurrently with BIO 3223. Fall, Spring.

**BIO 3223. Human Structure and Function I** This course covers the structure and func­tion of the human organism. Topics covered include, cellular function, skeletal, muscular and nervous systems. Special course fees may apply. Prerequisite, BIO 1301, BIO 1303, CHEM 1023 and 1021. Fall, Spring.

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**Before:**

**BIO 4063. Biosafety and Ethics in Research** Biosafety in the workplace, including chemical and radiation safety. Examination of moral and ethical issues in the laboratory and in research, including the concepts of transgenics, intellectual property and writing in research. Lecture three hours per week. Prerequisite, BIO 2013. Fall.

**BIO 4103. Virology** The structure, function, and classification of viruses, and their im­pact on modern society and the biological world. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2103 or BIO 3013 or BIO 4104 or BIO 4133.

**BIO 4104. Microbiology** Morphology, physiology, taxonomy and cultivation of bacteria, viruses, fungi, and protozoans with an emphasis on medically relevant bacteria. Relationship of microorganisms to animals, plants, and the environment. Lecture two hours per week and laboratory four hours per week. Prerequisites, CHEM 1023 and BIO 2013 or instructor permis­sion. Special course fees may apply. Fall, Spring.

**BIO 4111. Immunology Laboratory** Study of classical and current immunology techniques such as ELISA, immuno electrophoresis and Western Blot analysis. Laboratory 3 hours per week. Special course fees may apply. Prerequisites, BIO 2013 and CHEM 1013. Fall.

**BIO 4113. Immunology** Study of the human immune system. Topics include innate and acquired immunity, complement fixation and disorders of the immune system. Lecture 3 hours per week. Special course fees may apply. Prerequisites, BIO 2013 and CHEM 1013. Fall.

**BIO 4123. Cell Signaling** This course will provide an understanding of key concepts about cellular signaling mechanisms, major signaling pathways identified to date, and about the methods used to study these pathways. Three hours per week during spring semester. Special course fees may apply. Prerequisites, BIO 2013 or BIO 4133, or permission of the instructor.

**BIO 4131. Cell Biology Lab** Two hours per week. To be taken concurrently with BIO 4133. Special course fees may apply. Spring.

**BIO 4133. Cell Biology** Organization and activities of cells, with emphasis on the ultra­structure and function of cellular organelles. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2011, BIO 2013, CHEM 1023 and CHEM 1021. Spring.

**BIO 4143. Pharmacology** The study of drugs and their mechanisms of action at the system, cellular, and molecular levels. Special course fees may apply. Prerequisites, BIO 2203 and BIO 2223, or BIO 3223 and BIO 3233, BIO 4104, and CHEM 4243.

**BIO 4153. Laboratory in BioTechniques I** Laboratory techniques in protein chemis­try and analytical techniques. Techniques also include a variety of chromatographic methods, electrophoresis, UV-vis spectroscopy and radiochemistry. Laboratory 6 hours per week. Special course fees may apply. Prerequisites, BIO 3011, BIO 3013, BIO 4131, BIO 4133, CHEM 4241, and CHEM 4243; or instructor permission. Fall.

**BIO 4163. Laboratory in BioTechniques II** Laboratory techniques in DNA/RNA isola­tion, analysis and applications, including PCR, reverse transcriptase PCR, recombinant DNA and the production of gene expression products. Laboratory 6 hours per week. Special course fees may apply. Prerequisite, BIO 4153. Spring.

**BIO 4173. Molecular Biology** Fundamental principles of molecular biology and their ap­plication. Emphasis on integrating technologies, past and present, to explore gene structure, regulation and function in driving biological processes. Prerequisite, BIO 3013 or instructor permission. Spring.

**BIO 4201. Issues in Human Ecology Laboratory** Two hours per week. To be taken concurrently with BIO 4202. Special course fees may apply.

**After:**

**BIO 4063. Biosafety and Ethics in Research** Biosafety in the workplace, including chemical and radiation safety. Examination of moral and ethical issues in the laboratory and in research, including the concepts of transgenics, intellectual property and writing in research. Lecture three hours per week. Prerequisite, BIO 2013. Fall.

**BIO 4083. A thorough overview of evolutionary biology, including how evolutionary theory relates to genetics, ecology, behavior, biodiversity, and human health. Prerequisites: BIO 1303 and 1301, 1503 and 1501, 3013 and 3011. Fall, spring.**

**BIO 4103. Virology** The structure, function, and classification of viruses, and their im­pact on modern society and the biological world. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2103 or BIO 3013 or BIO 4104 or BIO 4133.

**BIO 4104. Microbiology** Morphology, physiology, taxonomy and cultivation of bacteria, viruses, fungi, and protozoans with an emphasis on medically relevant bacteria. Relationship of microorganisms to animals, plants, and the environment. Lecture two hours per week and laboratory four hours per week. Prerequisites, CHEM 1023 and BIO 2013 or instructor permis­sion. Special course fees may apply. Fall, Spring.

**BIO 4111. Immunology Laboratory** Study of classical and current immunology techniques such as ELISA, immuno electrophoresis and Western Blot analysis. Laboratory 3 hours per week. Special course fees may apply. Prerequisites, BIO 2013 and CHEM 1013. Fall.

**BIO 4113. Immunology** Study of the human immune system. Topics include innate and acquired immunity, complement fixation and disorders of the immune system. Lecture 3 hours per week. Special course fees may apply. Prerequisites, BIO 2013 and CHEM 1013. Fall.

**BIO 4123. Cell Signaling** This course will provide an understanding of key concepts about cellular signaling mechanisms, major signaling pathways identified to date, and about the methods used to study these pathways. Three hours per week during spring semester. Special course fees may apply. Prerequisites, BIO 2013 or BIO 4133, or permission of the instructor.

**BIO 4131. Cell Biology Lab** Two hours per week. To be taken concurrently with BIO 4133. Special course fees may apply. Spring.

**BIO 4133. Cell Biology** Organization and activities of cells, with emphasis on the ultra­structure and function of cellular organelles. Lecture three hours per week. Special course fees may apply. Prerequisites, BIO 2011, BIO 2013, CHEM 1023 and CHEM 1021. Spring.

**BIO 4143. Pharmacology** The study of drugs and their mechanisms of action at the system, cellular, and molecular levels. Special course fees may apply. Prerequisites, BIO 2203 and BIO 2223, or BIO 3223 and BIO 3233, BIO 4104, and CHEM 4243.

**BIO 4153. Laboratory in BioTechniques I** Laboratory techniques in protein chemis­try and analytical techniques. Techniques also include a variety of chromatographic methods, electrophoresis, UV-vis spectroscopy and radiochemistry. Laboratory 6 hours per week. Special course fees may apply. Prerequisites, BIO 3011, BIO 3013, BIO 4131, BIO 4133, CHEM 4241, and CHEM 4243; or instructor permission. Fall.

**BIO 4163. Laboratory in BioTechniques II** Laboratory techniques in DNA/RNA isola­tion, analysis and applications, including PCR, reverse transcriptase PCR, recombinant DNA and the production of gene expression products. Laboratory 6 hours per week. Special course fees may apply. Prerequisite, BIO 4153. Spring.

**BIO 4173. Molecular Biology** Fundamental principles of molecular biology and their ap­plication. Emphasis on integrating technologies, past and present, to explore gene structure, regulation and function in driving biological processes. Prerequisite, BIO 3013 or instructor permission. Spring.

**BIO 4201. Issues in Human Ecology Laboratory** Two hours per week. To be taken concurrently with BIO 4202. Special course fees may apply.