

# Biological Sciences (BISC)

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Department of Biological Sciences Website (<http://fulbright.uark.edu/departments/biology>)

The Department of Biological Sciences offers a supportive training environment across the full spectrum of biology, bridging the disciplines of cell and molecular biology, physiology, development, genetics, molecular systematics, microbiology, neurobiology, ecology, and evolutionary biology. Through course selection both within and outside the department, our students are prepared to enter research and professional training programs (health, secondary education, law, etc.) or enter careers in government and a broad range of businesses that rely on a technology-literate workforce with analytical and problem-solving skills.

For information on advanced degrees in biology, see the Graduate School Catalog (<http://catalog.uark.edu/graduatecatalog/programsofstudy/biologicalsciencesbisc>).

## Requirements for a B.S. Degree with a Major in Biology

A minimum of 120 hours is required, including 40 hours in the major as specified below.

- BIOL 1584 Biology for Majors<sup>1</sup>
- Biology Core (13 hours):
 

BIOL 2533	Cell Biology	3
BIOL 2323	General Genetics	3
BIOL 3023	Evolutionary Biology	3
BIOL 3863	General Ecology	3
and a minimum of 1 hour of Core Laboratory selected from:		1
BIOL 2531L	Cell Biology Laboratory	
BIOL 2321L	General Genetics Laboratory	
BIOL 3861L	General Ecology Laboratory	
- An additional 23 hours of electives in biology and/or biology related electives including:
  - At least 2 elective courses numbered 2000 or higher which are lab courses. This includes Core Labs taken in addition to the basic Core requirement. Courses whose catalog description explicitly excludes them from counting toward the major may not be used to meet this requirement. (Laboratory courses also include BIOL 480V, BIOL 480VH, BIOL 499V, and BIOL 499VH.)

- At least 18 hours in BIOL courses numbered 3000 or higher, of which at least 12 hours must be from courses numbered 4000 or higher.
- A course meeting the Fulbright College writing requirement. (The means of meeting the writing requirement are listed following the description of Requirements for Departmental Honors in Biology.)
- No more than 4 hours of elective courses at the 1000 level are permitted. BIOL 1543/BIOL 1541L Principles of Biology/Principles of Biology Laboratory may not be applied to the elective requirement.

**Note:** Biology related electives that are not taught by the Department of Biological Sciences must be approved using the "Exception Request for Major or Minor Requirements" form.

- A student who, after completing BIOL 1543/BIOL 1541L Principles of Biology/Lab with a grade of B or better in both courses, wishes to substitute BIOL 1543/BIOL 1541L for the required BIOL 1584 may petition the Department of Biological Sciences to do so. These petitions will be considered on a case by case basis for approval.

## Requirements in cognate science and mathematics include the following:

### Chemistry

CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab) (may be completed by advanced placement)	4
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	4
CHEM 3603 & CHEM 3601L	Organic Chemistry I and Organic Chemistry I Laboratory	4
CHEM 3613 & CHEM 3611L	Organic Chemistry II and Organic Chemistry II Laboratory	4
CHEM 3813	Elements of Biochemistry	3

### Physics

PHYS 2013 & PHYS 2011L	College Physics I (ACTS Equivalency = PHYS 2014 Lecture) and College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab)	3
and		
PHYS 2033 & PHYS 2031L	College Physics II (ACTS Equivalency = PHYS 2024 Lecture) and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)	3

### Or

PHYS 2054	University Physics I (ACTS Equivalency = PHYS 2034)	3
and		
PHYS 2074	University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	3

### Mathematics

MATH 2554	Calculus I (ACTS Equivalency = MATH 2405) (MATH 2564 is recommended)	4
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### Statistics

Select one of the following: 3-4

STAT 2023 Biostatistics

STAT 4003 Statistical Methods  
& STAT 4001L and Statistics Methods Laboratory**Requirement in Philosophy, must include one of the following:**

PHIL 2103 or PHIL 2203 or PHIL 3113 or PHIL 4213.

**Writing Requirement:** The college writing requirement for majors in biology may be met by one of the following:

1. Completion of an honors thesis,
2. Completion of a senior thesis (BIOL 498V) supervised by a faculty member in biological sciences,
3. Completion of a required term paper with a grade of B or above in a BIOL course numbered 3000 or above on a topic approved by the instructor, or
4. Completion of a paper, supervised by a Biological Sciences faculty member, in Special Topics (BIOL 480V)

Note: A student exercising Option 3 or 4 may not use the paper written for that option for credit in BIOL 498V

## Biology B.S. Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy>) for university requirements of the program. Core requirement hours may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute a three-hour (or more) general elective in place of a core area. Students must complete at least 120 hours, and this must be considered when scheduling upper-level hours in the senior year.

First Year	Units	
	Fall	Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013)	3	
Select one of the following:	3-4	
MATH 1213 Plane Trigonometry (ACTS Equivalency = MATH 1203)		
MATH 1284C Precalculus Mathematics (ACTS Equivalency = MATH 1305)		
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) <sup>1</sup>		
BIOL 1584 Biology for Majors	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	4	
Select one of the following:	3	
HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)		
Core from Fine Arts		

ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023)		3
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) <sup>1</sup>		4
or MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		4
Select one of the following:		3
University/state core Fine Arts		
or US History Requirement from		
HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)		
General Elective		1
Year Total:	17	15

Second Year	Units	
	Fall	Spring
BIOL 2533 Cell Biology (BIOL 2531L optional) <sup>1</sup>	3-4	
CHEM 3603 Organic Chemistry I & CHEM 3601L Organic Chemistry I Laboratory <sup>1,2</sup>	4	
University/State Core Social Science Requirement or PHIL Requirement	3	
BIOL Lab Course or Approved BIOL-related Elective 2000-level or Above	4	
BIOL 2323 General Genetics & BIOL 2321L General Genetics Laboratory <sup>1</sup>		4
CHEM 3613 Organic Chemistry II & CHEM 3611L Organic Chemistry II Laboratory <sup>1,2</sup>		4
University/Core from Social Science		3
PHIL requirement or University/State Core from Social Science (as needed)		3
General Elective		3
Year Total:	15	17

Third Year	Units	
	Fall	Spring
BIOL 3023 Evolutionary Biology <sup>1,2</sup>	3	
CHEM 3813 Elements of Biochemistry <sup>1,2</sup>	3	
Select one of the following:	4	
PHYS 2013 College Physics I (ACTS Equivalency = PHYS 2014 Lecture) & PHYS 2011L College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab) <sup>1</sup>		
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034)		
Core from Humanities (if needed) or Core from Social Science		3

Core from Social Science (as needed) or General Elective	3	
Select one of the following:	3-4	
BIOL 3023 Evolutionary Biology (if still needed) <sup>1,2</sup>		
BIOL 3000-4000 Level Elective <sup>1,2</sup>		
BIOL 3863 General Ecology (BIOL 3861L optional) <sup>1,2</sup>	3-4	
Select one of the following:	4	
PHYS 2033 College Physics II (ACTS Equivalency = PHYS 2024 Lecture) & PHYS 2031L College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab) <sup>1</sup>		
PHYS 2074 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) <sup>1</sup>		
BIOL Lab Course 2000-level or Above	4	
Year Total:	16	15

Fourth Year	Units	
	Fall	Spring
BIOL 3000-4000 Level Elective <sup>1,2</sup>	3-4	
BIOL 4000 Level Elective <sup>1,2</sup>	3-4	
STAT 2023 Biostatistics <sup>1</sup>	3	
General Elective	3	
General Elective	3	
BIOL 3000-4000 Level Elective <sup>1,2</sup>		3
BIOL 4000 Level Elective <sup>1,2</sup>		3-4
BIOL 4000 Level Elective <sup>1,2</sup>		3-4
General Elective		1-3
Year Total:	15	10
Total Units in Sequence:		120

<sup>1</sup> Meets 40-hour advanced credit hour requirement. See 3 on Graduation Requirements Checklist or see the Catalog of Studies.

<sup>2</sup> Meets 24-hour rule (24 hours of 3000-4000 level courses in Fulbright College), in addition to meeting the 40-hour rule. See 2b on Graduation Requirements Checklist or see the Catalog of Studies.

## Requirements for a B.A. Degree with a Major in Biology:

A minimum of 120 hours is required, including:

- BIOL 1584 Biology for Majors. Majors may substitute another 1000-level BIOL course (BIOL 1603/BIOL 1601L Principles of Zoology or BIOL 1613/BIOL 1611L Plant Biology) for BIOL 1584; a maximum of four 1000-level credits may be applied toward the major. A student who, after completing BIOL 1543/BIOL 1541L Principles of Biology/Lab with a grade of B or better in both courses, wishes to substitute BIOL 1543/BIOL 1541L Principles of Biology for BIOL 1584 may petition the Department of Biological Sciences to do so. These petitions will be considered on a case by case basis for approval.
- An additional 26 hours of biological sciences, including:
  - Biology Core (13 hours):

BIOL 2533	Cell Biology	3
BIOL 2323	General Genetics	3

BIOL 3023	Evolutionary Biology	3
BIOL 3863	General Ecology	3
and a minimum of one hour of Core Laboratory selected from:		
BIOL 2531L	Cell Biology Laboratory	
BIOL 2321L	General Genetics Laboratory	
BIOL 3861L	General Ecology Laboratory	

- Biology Electives (13 hours): must include at least 9 hours in BIOL courses numbered 3000 or higher and at least one course numbered 2000 or higher with a laboratory. (Laboratory courses also include BIOL 480V, BIOL 480VH, BIOL 499V, and BIOL 499VH.)

3. Requirements in cognate science and mathematics include:

**A.**

CHEM 1103 & CHEM 1101L	University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) and University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	4
CHEM 1123 & CHEM 1121L	University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	4

Select one of the following: 4-8

CHEM 2613 & CHEM 2611L	Organic Physiological Chemistry (ACTS Equivalency = CHEM 1224 Lecture) and Organic Physiological Chemistry Laboratory (ACTS Equivalency = CHEM 1224 Lab)	
CHEM 3603 & CHEM 3601 & CHEM 3613 & CHEM 3611	Organic Chemistry I and Organic Chemistry I Laboratory and Organic Chemistry II and Organic Chemistry II Laboratory	

**B.**

PHYS 2013 & PHYS 2011L	College Physics I (ACTS Equivalency = PHYS 2014 Lecture) and College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab)	4
PHYS 2033 & PHYS 2031L	College Physics II (ACTS Equivalency = PHYS 2024 Lecture) and College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab)	4

**C.**

MATH 2043	Survey of Calculus (ACTS Equivalency = MATH 2203)	3-4
	or MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)	

**D.**

Select one of the following: 3-4

STAT 2023	Biostatistics	
STAT 2303	Principles of Statistics (ACTS Equivalency = MATH 2103)	
STAT 4003 & STAT 4001L	Statistical Methods and Statistics Methods Laboratory	
MATH 2183	Mathematical Reasoning in a Quantitative World	

- Requirement in Philosophy

Select one of the following: 3

PHIL 2103	Introduction to Ethics (ACTS Equivalency = PHIL 1003)	
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PHIL 2203	Logic (ACTS Equivalency = PHIL 1003)
PHIL 3113	Environmental Ethics
PHIL 4213	Philosophy of Science

5. Students must complete a minimum of 20 credit hours at the 3000-level or higher from requirements 2, 3, and 4 listed above or from a combination of requirements 2, 3, and 4 above and from additional 3000-level or higher BIOL upper-level electives.

**Writing Requirement:** The college writing requirement for majors in biology may be met by one of the following:

1. Completion of an honors thesis,
2. Completion of a senior thesis (BIOL 498V) supervised by a faculty member in biological sciences,
3. Completion of a required term paper with a grade of B or above in a BIOL course numbered 3000 or above on a topic approved by the instructor, or
4. Completion of a paper, supervised by a Biological Sciences faculty member, in Special Topics (BIOL 480V)

Note: A student exercising Option 3 or 4 may not use the paper written for that option for credit in BIOL 498V

## Biology B.A. Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (<http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy>) for university requirements of the program. Core requirement hours may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute a three-hour (or more) general elective in place of a core area.

First Year	Units	
	Fall	Spring
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013)	3	
Select one of the following:	3-4	
MATH 1213 Plane Trigonometry (ACTS Equivalency = MATH 1203)		
MATH 1284C Precalculus Mathematics (ACTS Equivalency = MATH 1305)		
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) <sup>1</sup>		
BIOL 1584 Biology for Majors	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) & CHEM 1101L University Chemistry I Laboratory (ACTS Equivalency = CHEM 1414 Lab)	4	
General Elective	0-1	
ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023)		3
MATH 2043 Survey of Calculus (ACTS Equivalency = MATH 2203) <sup>1</sup> or MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)		3

CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)	4
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Select one of the following: 3

HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)

HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)

PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)

Core from Fine Arts 3

Year Total: 15 16

### Second Year

	Fall	Spring	Units
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BIOL 2533 Cell Biology (BIOL 2531L optional) <sup>1</sup>	3		
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Select from the following: 4

CHEM 3603 Organic Chemistry I & CHEM 3601L Organic Chemistry I Laboratory<sup>1,2</sup>

or

BIOL 2323 General Genetics & BIOL 2321L General Genetics Laboratory<sup>1</sup>

University/state core from Social Science 3

University/state core from Social Science (as needed) or General Elective 3

General Elective 3

Select one of the following: 3-4

BIOL 2323 General Genetics & BIOL 2321L General Genetics Laboratory<sup>1</sup>

Biology elective

BIOL 3023 Evolutionary Biology<sup>1,2</sup>

Select one of the following: 4

CHEM 3613 Organic Chemistry II & CHEM 3611L Organic Chemistry II Laboratory<sup>1,2</sup>

CHEM 2613 Organic Physiological Chemistry (ACTS Equivalency = CHEM 1224 Lecture) & CHEM 2611L Organic Physiological Chemistry Laboratory (ACTS Equivalency = CHEM 1224 Lab)<sup>1</sup>

Select one of the following: 3

PHIL 2103 Introduction to Ethics (ACTS Equivalency = PHIL 1003)

PHIL 2203 Logic (ACTS Equivalency = PHIL 1003)<sup>1</sup>

PHIL 3113 Environmental Ethics<sup>1,2</sup>

PHIL 4213 Philosophy of Science<sup>1,2</sup>

University/state core Social Science requirement (as needed)

University/state core from Humanities (as needed) or General Elective 3

General Elective or Core from Social Science (as needed) 3

Year Total: 16 16

Third Year	Units	
	Fall	Spring
One of the following:	3-4	
BIOL 3023 Evolutionary Biology <sup>1,2</sup>		
BIOL 3863 General Ecology & BIOL 3861L General Ecology Laboratory <sup>1,2</sup>		
Biology Elective		
Biology elective	3-4	
PHYS 2013 College Physics I (ACTS Equivalency = PHYS 2014 Lecture)	4	
& PHYS 2011L College Physics I Laboratory (ACTS Equivalency = PHYS 2014 Lab) <sup>1</sup>		
Select one of the following:	3-4	
STAT 2023 Biostatistics <sup>1</sup>		
STAT 2303 Principles of Statistics (ACTS Equivalency = MATH 2103) <sup>1</sup>		
STAT 4003 Statistical Methods & STAT 4001L Statistics Methods Laboratory <sup>1,2</sup>		
MATH 2183 Mathematical Reasoning in a Quantitative World <sup>1,2</sup>		
Select one of the following as needed:	3	
Core from social science (if needed)		
PHIL 2103 Introduction to Ethics (ACTS Equivalency = PHIL 1003)		
PHIL 2203 Logic (ACTS Equivalency = PHIL 1003) <sup>1</sup>		
PHIL 3113 Environmental Ethics <sup>1,2</sup>		
PHIL 4213 Philosophy of Science <sup>1,2</sup>		
Select one of the following:	3-4	
BIOL 3863 General Ecology & BIOL 3861L General Ecology Laboratory <sup>1,2</sup>		
BIOL 3023 Evolutionary Biology ((if still needed) or) <sup>1,2</sup>		
BIOL 3000-4000 Level Elective <sup>1,2</sup>		
BIOL 3000-4000 Level Elective <sup>1,2</sup>	3-4	
PHYS 2033 College Physics II (ACTS Equivalency = PHYS 2024 Lecture)	4	
& PHYS 2031L College Physics II Laboratory (ACTS Equivalency = PHYS 2024 Lab) <sup>1</sup>		
General Electives	6	
Year Total:	18	18

Fourth Year	Units	
	Fall	Spring
BIOL 3000-4000 Level Biology Elective <sup>1,2</sup>	3-4	
BIOL 3000-4000 Level Biology Elective <sup>1,2</sup>	3-4	
General Electives	6	
BIOL 3000-4000 Level Elective <sup>1,2</sup>	3-4	
BIOL 3000-4000 Level Elective <sup>1,2</sup>	3-4	
Upper Level Elective in Fulbright College (if needed for 24-hour rule) or General Elective	3	
General Electives (as needed to total 120 degree hours)	3-4	

Year Total: 12 9

Total Units in Sequence: 120

- <sup>1</sup> Meets 40-hour advanced credit hour requirement. See College Academic Regulations (<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences>).
- <sup>2</sup> Meets 24-hour rule (24 hours of 3000-4000 level courses in Fulbright College), in addition to meeting the 40-hour rule. See College Academic Regulations (<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences>).

#### Requirements for a Minor in Biology:

Students must complete at least 19 credit hours of BIOL courses that include:

- BIOL 1584 Biology for Majors or BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)/BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)
- Three of the four biology core courses: BIOL 2533 Cell Biology, BIOL 2323 General Genetics, BIOL 3023 Evolutionary Biology, BIOL 3863 General Ecology.
- Two additional BIOL courses, one of which must be a BIOL course numbered 3000 or above. This may include an additional BIOL core course.

Students must notify their academic dean's office of their intent to minor in biology.

**Requirements for Departmental Honors in Biology:** The biological sciences honors program is designed to provide students an opportunity to investigate questions in biology through an expanded reading program and research experience. Biological science majors may apply to enter the program between the second semester of the sophomore year and the end of the junior year. Application is made through both Honors Studies (MAIN 517) and the Department of Biological Sciences (SCEN 601). Applicants must have a 3.5 grade-point average. Students should consult with their adviser to identify and contact a potential faculty research mentor. The student's research activities will then be directed by the departmental faculty member who agrees to sponsor the student.

Students may enroll for up to four hours of credit in BIOL 499VH during the junior year and up to eight hours of credit in BIOL 499VH during the senior year. A maximum of six of these credits may be applied toward a major. Participants must complete and defend an honors thesis and take 12 hours in Honors Studies, which may include six hours of thesis. The honors thesis is based on an original research project and presented orally before a committee composed of two faculty from the biological sciences, a person from outside the biological sciences, and a representative from the Honors Council. This committee makes a recommendation concerning the award of the honors distinction to the Honors Council. Students who successfully complete the departmental honors program usually graduate as "Departmental Scholar *Cum Laude*." Higher degree distinctions are recommended only in exceptional cases and are based upon the candidate's entire involvement in the honors program. Completion of an honors thesis fulfills the writing requirement in biological sciences, which precludes credit for BIOL 498V (Senior Thesis) for the same body of work.

**Biology (B.A. or B.S.) Life/Earth Science Teacher Licensure Requirements:** Please refer to the Secondary Education Requirements (<http://catalog.uark.edu/undergraduatecatalog/collegesandschools/>)

williamfulbrightcollegeofartsandsciences/#fieldsofstudytext) for Fulbright College Students.

Students wishing to pursue licensure through the UAteach undergraduate curriculum should consult with a UAteach adviser, [uteach@uark.edu](mailto:uteach@uark.edu).

## Faculty

**Alrubaye, Adnan Ali Khalaf**, Ph.D., M.Ed. (University of Arkansas), M.S., B.V.M. (University of Baghdad, Iraq), Clinical Assistant Professor, 2013.

**Alverson, Andrew James**, Ph.D. (University of Texas at Austin), M.S. (Iowa State University), B.S. (Grand Valley State University), Assistant Professor, 2012.

**Barabote, Ravi Damodar**, Ph.D. (Texas Tech University), M.S. (Madurai Kamaraj University, Madurai, India), B.S. (Osmania University, Hyderabad, India), Assistant Professor, 2012.

**Beaulieu, Jeremy M.**, Ph.D. (Yale University), M.S., B.S. (California Polytechnic State University), Assistant Professor, 2016.

**Beaupre, Steven J.**, Ph.D. (University of Pennsylvania), M.S., B.S. (University of Wisconsin), Professor, 1995.

**Catanzaro, Donald G.**, Ph.D. (University of Arkansas), A.B. (University of California, Los Angeles), Research Assistant Professor, 2014.

**Ceballos, Ruben M.**, Ph.D. (University of Montana), M.A. (University of Alabama-Birmingham), B.S. (University of Alabama-Huntsville), Assistant Professor, 2016.

**Coleman, James S.**, Ph.D., M.S., M.Phil (Yale University), B.S. (University of Maine), Professor, 2017.

**Douglas, Michael Edward**, Ph.D. (University of Georgia), M.S., B.S. (University of Louisville), Professor, 2011.

**Douglas, Marlis R.**, Ph.D., M.S., B.S. (University of Zurich), Professor, 2012.

**Du, Yuchun**, Ph.D. (Kagoshima University, Japan), B.S. (Shaanxi University of Technology, China), Associate Professor, 2007.

**DuRant, Sarah Elizabeth**, Ph.D. (Virginia Polytechnic Institute and State University), B.S. (University of South Carolina), Assistant Professor, 2017.

**Durdik, Jeannine M.**, Ph.D. (Johns Hopkins University), B.S. (Purdue University), Professor, 1994.

**Entrekin, Sally A.**, Ph.D. (University of Notre Dame), Adjunct Assistant Professor, 2014.

**Etges, William J.**, Ph.D. (University of Rochester), M.S. (University of Georgia), B.S. (North Carolina State University), Professor, 1987.

**Evans, Timothy A.**, Ph.D. (Indiana University), B.S. (Slippery Rock University), Assistant Professor, 2013.

**Evans-White, Michelle Allayne**, Ph.D. (University of Notre Dame), M.S., B.S. (Kansas State University), Associate Professor, 2008.

**Goforth, Robyn**, Ph.D., B.S. (University of Arkansas), Research Assistant Professor, 2001.

**Henry, Ralph Leroy**, Ph.D., M.S. (University of Florida), B.S.E. (University of Kansas), Distinguished Professor, 1996.

**Ivey, Mack**, Ph.D., B.S. (University of Georgia), Associate Professor, 1992.

**Iyer, Shilpa**, Ph.D. (University of Georgia), M.Sc., B.Sc. (University of Pune, India), Assistant Professor, 2016.

**Jennings, Jackson**, Ph.D. (University of Jyväskylä), M.S. (University of Arkansas), B.A. (Hendrix College), Clinical Assistant Professor, 2013.

**Jennings, Tameka A.**, Ph.D. (University of Arkansas), B.S. (University of Arkansas-Pine Bluff), Clinical Assistant Professor, 2017.

**Kral, Timothy Alan**, Ph.D. (University of Florida), B.S. (John Carroll University), Professor, 1981.

**LaRue, Cheri Sue**, M.S. (University of Tennessee), B.S. (Appalachian State University), Instructor, 2010.

**Lehmann, Michael Herbert**, Ph.D., Diploma in Biology (Philipps University of Marburg, Germany), Associate Professor, 2002.

**Lessner, Daniel J.**, Ph.D. (University of Iowa), B.S. (University of Wisconsin-Stevens Point), Associate Professor, 2008.

**Lessner, Faith H.**, Ph.D. (University of Iowa), B.S. (Cornell University), Instructor, 2016.

**Lewis, Jeffrey A.**, Ph.D. (University of Wisconsin-Madison), B.S. (University of California-Santa Barbara), Assistant Professor, 2013.

**Lorince, Tammy**, M.A., B.S. (University of Arkansas), Instructor, 2000.

**Magoulick, Daniel D.**, Ph.D. (University of Pittsburgh), M.S. (Eastern Michigan University), B.S. (Michigan State University), Research Professor, 2000.

**McNabb, David S.**, Ph.D. (Louisiana State University Health Sciences Center), B.S. (University of Texas at Arlington), Associate Professor, 2000.

**Naithani, Kusum**, Ph.D. (University of Wyoming), M.Sc. (G.B. Pant University of Agriculture and Technology-India), B.Sc. (University of Lucknow-India), Assistant Professor, 2014.

**Nakanishi, Nagayasu**, Ph.D. (University of California, Los Angeles), B.S. (University of California, San Diego), Assistant Professor, 2017.

**Pinto, Ines**, Ph.D. (Louisiana State University Health Sciences Center), M.S., B.S. (University of Chile), Associate Professor, 2000.

**Rhoads, Douglas Duane**, Ph.D. (Kansas State University), M.A., B.A. (Wichita State University), University Professor, 1990.

**Shadwick, John D.L.**, M.S. (University of Arkansas), B.S. (University of Central Arkansas), Instructor, 2011.

**Siepielski, Adam M.**, Ph.D. (University of Wyoming-Laramie), M.S. (New Mexico State University), B.S. (Pennsylvania State University-University Park), Assistant Professor, 2015.

**Smith, Kimberly G.**, Ph.D. (Utah State University), M.S. (University of Arkansas), B.S. (Tufts University), Distinguished Professor, 1981.

**Spiegel, Frederick W.**, Ph.D. (University of North Carolina at Chapel Hill), B.A. (Drew University), Distinguished Professor, 1982.

**Stephenson, Steven Lee**, Ph.D., M.S. (Virginia Polytechnic Institute and State University), B.S. (Lynchburg College), Research Professor, 2003.

**Tipsmark, Christian K.**, Ph.D., M.S. (University of Southern Denmark), Associate Professor, 2010.

**Vo, Charles**, D.C. (Parker College of Chiropractic), M.A. (University of Arkansas), B.S. (University of Missouri), Instructor, 2013.

**Walker, James M.**, Ph.D. (University of Colorado-Boulder), M.S., B.S. (Louisiana Polytechnic Institute), Professor, 1965.

**Walker, Kate Ireton**, M.S. (University of Arkansas), B.S. (Kansas State University), Instructor, 2014.

**Westerman, Erica L.**, Ph.D. (Yale University), M.Sc. (University of New Hampshire), B.S. (Yale University), Assistant Professor, 2016.

**Willson, John David**, Ph.D. (University of Georgia), B.S. (Davidson College), Assistant Professor, 2012.

## Courses

### **BIOL 1001L. Environmental Science Laboratory. 1 Hour.**

Laboratory, field trip, and discussion sessions covering the concepts and information allowing students to critically evaluate environmental issues. Topics will include: laboratory safety, recycling, composting, geographic information systems, soil testing, water quality, hazardous wastes, waste disposal, wetlands, wastewater treatment, and sustainable food systems. Laboratory 2 hours per week. Corequisite: BIOL 1003.

This course is cross-listed with ENSC 1001L.

### **BIOL 1003. Environmental Science. 3 Hours.**

Series of lectures and discussions introducing the topic of environmental science including factors related to water, soil, and air quality. If taking course for University core Natural Science credit, BIOL 1001L is a corequisite. Corequisite: BIOL 1001L. This course is cross-listed with ENSC 1003.

**BIOL 1524. Biological Principles. 4 Hours.**

Integrated lecture and laboratory focusing on the overriding principles of Biology. Designed to convey biological reasoning to non-science majors. May not count as prerequisite for advanced courses in BIOL. Corequisite: Lab component.

**BIOL 1541L. Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab). 1 Hour.**

Experimental and observational techniques used in biology with emphasis on the acquisition and interpretation of results that illustrate major biological principles. Corequisite: BIOL 1543.

**BIOL 1541M. Honors Principles of Biology Laboratory. 1 Hour.**

This course is designed for the well prepared student in the Honors program. It focuses on teaching students experimental and observational techniques used in the science of biology. It emphasizes the acquisition and interpretation of results that illustrate the major principles of biology. Corequisite: BIOL 1543H or BIOL 1543. This course is equivalent to BIOL 1541L.

**BIOL 1543. Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture). 3 Hours.**

Principles that unify biology with emphasis on scientific study that demonstrates how all organisms are the product of evolution and are parts of interacting systems from the molecular to the ecosystem level. Corequisite: BIOL 1541L.

**BIOL 1543H. Honors Principles of Biology. 3 Hours.**

This course is designed for the well prepared student in Honors program. It focuses on the principles that unify the science of biology. Students will be exposed to how scientific principles have been used to demonstrate that all organisms are the products of evolution and are parts of interacting systems from the molecular to the ecosystem level. Corequisite: BIOL 1541M or BIOL 1541L. This course is equivalent to BIOL 1543.

**BIOL 1584. Biology for Majors. 4 Hours.**

Integrated lecture and laboratory course designed to prepare Biology Majors to enter the rest of the Biology Core of Cell Biology, General Genetics, Evolutionary Biology, and General Ecology. Pre- or Corequisite: CHEM 1103 or CHEM 1203.

**BIOL 1584H. Honors Biology for Majors. 4 Hours.**

Integrated lecture and laboratory course designed to prepare Biology Majors to enter the rest of the Biology Core of Cell Biology, General Genetics, Evolutionary Biology, and General Ecology. Pre or Corequisite: CHEM 1103 or CHEM 1203. This course is equivalent to BIOL 1584.

**BIOL 1601L. Principles of Zoology Laboratory (ACTS Equivalency = BIOL 1054 Lab). 1 Hour.**

(Formerly ZOOL 1611L) Laboratory exercises illustrating animal structure, physiology, genetics, and ecology. Corequisite: BIOL 1603.

**BIOL 1601M. Honors Principles of Zoology Laboratory. 1 Hour.**

(Formerly ZOOL 1611M) Laboratory exercises illustrating animal structure, physiology, genetics, and ecology. Corequisite: BIOL 1603. This course is equivalent to BIOL 1601L.

**BIOL 1603. Principles of Zoology (ACTS Equivalency = BIOL 1054 Lecture). 3 Hours.**

(Formerly ZOOL 1613) Introduction to zoological principles relating to cells, organ systems, development, genetics, ecology, and animal phyla. Corequisite: BIOL 1601L or BIOL 1601M. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

**BIOL 1611L. Plant Biology Laboratory (ACTS Equivalency = BIOL 1034 Lab). 1 Hour.**

(Formerly BOTY 1611L) Pre- or Corequisite: BIOL 1613.

**BIOL 1611M. Honors Plant Biology Laboratory. 1 Hour.**

(Formerly BOTY 1611M.) Pre- or Corequisite: BIOL 1613. This course is equivalent to BIOL 1611L.

**BIOL 1613. Plant Biology (ACTS Equivalency = BIOL 1034 Lecture). 3 Hours.**

(Formerly BOTY 1613) Consideration of basic flowering plant structure, growth, development, physiology, genetics, ecology, and a brief survey of other plant groups. Lecture 3 hours per week. BIOL 1611L is recommended as a corequisite and both are required for partial fulfillment of the Fulbright College natural sciences requirement. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

**BIOL 2011L. General Microbiology Laboratory (ACTS Equivalency = BIOL 2004 Lab). 1 Hour.**

Techniques for handling microorganisms. Does not count toward BS in Biology. Corequisite: BIOL 2013.

**BIOL 2011M. Honors General Microbiology Laboratory. 1 Hour.**

Techniques for handling microorganisms. Does not count towards BS in Biology. Corequisite: BIOL 2013. This course is equivalent to BIOL 2011L.

**BIOL 2013. General Microbiology (ACTS Equivalency = BIOL 2004 Lecture). 3 Hours.**

Basic concepts of microbiology including diversity, genetics, metabolism, growth, control of growth, pathogenesis, and immunology. Does not count towards BS in Biology. Corequisite: BIOL 2011L. Prerequisite: (BIOL 1543 and BIOL 1541L) or BIOL 1584) and (CHEM 1073 and CHEM 1071L or CHEM 1103 or CHEM 1123 and CHEM 1121L or CHEM 1203 and CHEM 1201L).

**BIOL 2211L. Human Physiology Laboratory (ACTS Equivalency = BIOL 2414 Lab). 1 Hour.**

(Formerly ZOOL 2211L) Exercises include experiments on osmosis, reflexes, senses, muscle, cardiovascular system, ventilation, metabolism, renal function, etc. Data collection, analysis, and report writing. Does not satisfy the Fulbright College writing requirement. Does not count toward BS in Biology. Corequisite: BIOL 2213.

**BIOL 2213. Human Physiology (ACTS Equivalency = BIOL 2414 Lecture). 3 Hours.**

(Formerly ZOOL 2213) Fundamental concepts of physiology with emphasis in the human. Does not count toward BS in Biology. Corequisite: BIOL 2211L. Prerequisite: (CHEM 1073 and CHEM 1071L) or (CHEM 1103) or (CHEM 1123 and CHEM 1121L) and MATH 1203.

**BIOL 2321L. General Genetics Laboratory. 1 Hour.**

Analysis of genetic problems and experiments with emphasis on "hands-on" experience with a variety of organisms. May require time outside laboratory period. Laboratory 3 hours per week. Pre- or Corequisite: BIOL 2323.

**BIOL 2323. General Genetics. 3 Hours.**

Surveys of Mendelian, molecular, and population mechanisms of inheritance and gene expression in prokaryotes and eukaryotes. Lecture 3 hours per week. Prerequisite: (BIOL 1584 or BIOL 1543 and BIOL 1541L) and (CHEM 1123 and CHEM 1121L or CHEM 1223 and CHEM 1221L) and (MATH 1203 or STAT 2023 or equivalent).

**BIOL 2441L. Human Anatomy Laboratory (ACTS Equivalency = BIOL 2404 Lab). 1 Hour.**

Laboratory 3 hours exercises in mammalian anatomy. Cannot be taken without prior credit in BIOL 2443 or concurrent enrollment in BIOL 2443. Does not count toward BS in Biology. Corequisite: BIOL 2443.

**BIOL 2443. Human Anatomy (ACTS Equivalency = BIOL 2404 Lecture). 3 Hours.**

Description of human body as a series of organ systems and their interrelationships. Does not count towards BS in Biology. Corequisite: BIOL 2441L. Prerequisite: Four hours of biological sciences.

**BIOL 2531L. Cell Biology Laboratory. 1 Hour.**

Introduction to methods and techniques used in Cell Biology research. Laboratory experiences to highlight topics covered in BIOL 2533. Pre- or Corequisite: BIOL 2533.

**BIOL 2533. Cell Biology. 3 Hours.**

Introduction to cell structure, cell processes, biological polymers, energetics, and diversity. An introduction to biochemistry and cell chemistry. Pre- or Corequisite: (CHEM 1123 and CHEM 1121L) or (CHEM 1223 and CHEM 1221L) or equivalent. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

**BIOL 3004. Principles of Plant Pathology. 4 Hours.**

Examination of the causes and symptoms of plant disease and the genetics of plant disease. Physiology, and ecology of host-pathogen interactions. Spread of disease and principles of disease control. Corequisite: Lab component. This course is cross-listed with PLPA 3004.

**BIOL 3011L. Introduction to Insect Identification Lab. 1 Hour.**

Introductory lab course on insect identification, collection, and curation techniques, primarily designed as an intensive add-on to BIOL 3013 for students wanting a more in-depth examination of insect diversity. Insect collection required. Course includes field trips. Students are encouraged to contact instructor before enrolling. Pre- or corequisite: BIOL 3013.

This course is cross-listed with ENTO 3011L.

**BIOL 3013. Introduction to Entomology. 3 Hours.**

Fundamentals of insect biology including structure and function, development, ecology, behavior, plant feeding and disease transmission. Lecture 3 hours/week. Students interested in a more intensive examination of insects, including collection, curation, and identification techniques, should sign up for the separate one credit lab BIOL 3011L. Students are strongly encouraged to take BIOL 1543 before registering for this course.

This course is cross-listed with ENTO 3013.

**BIOL 3023. Evolutionary Biology. 3 Hours.**

An introduction to the mechanisms and patterns of evolutionary change. Seeks to develop logical, scientific skills and to apply them in understanding how life has changed during the history of the earth. Corequisite: Drill component. Prerequisite: (BIOL 1584 or BIOL 1543, BIOL 1541L) and BIOL 2323.

**BIOL 3123. Prokaryote Biology. 3 Hours.**

An in-depth coverage of prokaryote diversity, genetics, metabolism, growth, structures and functions. Prerequisite: BIOL 2533.

**BIOL 3123H. Honors Prokaryote Biology. 3 Hours.**

An in-depth coverage of prokaryote diversity, genetics, metabolism, growth, structures and functions. Prerequisite: BIOL 2533.

This course is equivalent to BIOL 3123.

**BIOL 3273. UAteach Research Methods. 3 Hours.**

A project-based course for prospective science and mathematics teachers utilizing scientific research methods and inquiry to solve research problems. Prerequisite: ARSC 1201 and ARSC 1221.

This course is cross-listed with PHYS 3273, CHEM 3273.

**BIOL 3273H. Honors UAteach Research Methods. 3 Hours.**

A project-based course for prospective science and mathematics teachers utilizing scientific research methods and inquiry to solve research problems. Prerequisite: ARSC 1201 and ARSC 1221, junior standing and honors.

This course is cross-listed with PHYS 3273, CHEM 3273, BIOL 3273.

**BIOL 3404. Comparative Vertebrate Morphology. 4 Hours.**

Anatomy of selected vertebrate animals with emphasis upon homologous structures in various animal groups. The recommended anatomy course for Biology BS majors. Lecture 2 or 3 hours, laboratory 4 or 6 hours per week. Corequisite: Lab component. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

**BIOL 3861L. General Ecology Laboratory. 1 Hour.**

General ecology lab. Pre-or Corequisite: BIOL 3863.

**BIOL 3863. General Ecology. 3 Hours.**

Ecological principles and concepts; environmental factors and interactions that determine distribution and abundance of organisms. Prerequisite: 7 hours of biological science.

**BIOL 3923H. Honors Colloquium. 3 Hours.**

Covers a special topic or issue, offered as part of the honors program. Prerequisite: honors candidacy (not restricted to candidacy in biological sciences). May be repeated for degree credit.

**BIOL 4003L. Laboratory in Prokaryote Biology. 3 Hours.**

Laboratory techniques in prokaryote culture, identification, physiology, metabolism, and genetics. Laboratory 6 hours per week. Prerequisite: BIOL 3123.

**BIOL 4013. Insect Behavior and Chemical Ecology. 3 Hours.**

Basic concepts in insect senses and patterns of behavioral responses to various environmental stimuli. Previous knowledge of basic entomology is helpful, but not required. Lecture 2 hours, laboratory/discussion 2 hours per week. Corequisite: Lab component.

This course is cross-listed with ENTO 4013.

**BIOL 4024. Insect Diversity and Taxonomy. 4 Hours.**

Principles and practices of insect classification and identification with emphasis on adult insects. Corequisite: Lab component. Prerequisite: ENTO 3013.

This course is cross-listed with ENTO 4024.

**BIOL 4053. Insect Ecology. 3 Hours.**

To develop understanding of important ecological concepts through study of dynamic relationships among insects and their environment. To become familiar with the literature of insect ecology, and interpretation and critique of ecological research. Previous knowledge of basic entomology and/or ecology will be assumed. Corequisite: Lab component.

This course is cross-listed with ENTO 4053.

**BIOL 4104. Taxonomy of Flowering Plants. 4 Hours.**

Identifying, naming, and classifying of wildflowers, weeds, trees, and other flowering plants. Emphasis is on the practical aspects of plant identification. Lecture 3 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: BIOL 1613 and BIOL 1611L and BIOL 2323 and BIOL 3023.

**BIOL 4114. Dendrology. 4 Hours.**

Morphology, classification, geographic distribution, and ecology of woody plants. Lecture 3 hours, laboratory 3 hours per week, and fieldtrips. Prerequisite: BIOL 3863.

**BIOL 4122. Food Microbiology. 2 Hours.**

The study of food microbiology including classification/taxonomy, contamination, preservation and spoilage of different kinds of foods, pathogenic microorganisms, food poisoning, sanitation, control and inspection and beneficial uses of microorganisms. Prerequisite: BIOL 2013 and BIOL 2011L or BIOL 2533.

This course is cross-listed with FDSC 4122.

**BIOL 4133. Plant Disease Control. 3 Hours.**

Principles, methods and mechanics of plant disease control. Emphasis is given to the integration of control measures and epidemiology of plant diseases. Lecture 3 hours per week. Prerequisite: PLPA 3004.

This course is cross-listed with PLPA 4223.

**BIOL 4143. Advanced Methods in Microscopy. 3 Hours.**

Stand alone course on laboratory methods course emphasizing techniques in modern microscopy. Individual research project required. Prerequisite: BIOL 2533 and BIOL 2531L. May be repeated for up to 6 hours of degree credit.

**BIOL 4153. Biology of Global Change. 3 Hours.**

Covers impact of global change on sustainability and adaptability of biological systems. Corequisite: BIOL 4252. Prerequisite: BIOL 1543 and BIOL 1541L.



**BIOL 4154H. Honors Biology of Global Change. 4 Hours.**

Covers impact of global change on sustainability and adaptability of biological systems. Prerequisite: (BIOL 1584 or BIOL 1543 and BIOL 1541L) and junior standing.

This course is equivalent to BIOL 4153.

**BIOL 4163. Dynamic Models in Biology. 3 Hours.**

Mathematical and computational techniques for developing, executing, and analyzing dynamic models arising in the biological sciences. Both discrete and continuous time models are studied. Applications include population dynamics, cellular dynamics, and the spread of infectious diseases. Prerequisite: MATH 2554. This course is cross-listed with MATH 4163.

**BIOL 4174. Conservation Genetics. 4 Hours.**

Covers concepts of biodiversity identification and illustrates how genetic data are generated and analyzed to conserve and restore biological diversity. Corequisite: Lab component and drill. Prerequisite: BIOL 3023, BIOL 3863 and STAT 2023 (or equivalent), and Junior standing.

**BIOL 4213. Biological Regulation and Subcellular Communication. 3 Hours.**

Combines lectures, review of primary literature, student presentations, and small group discussions to explore a diversity of topics related to mechanisms of biological regulation and subcellular communication. Prerequisite: BIOL 2323 and BIOL 2533.

**BIOL 4233. Genomics and Bioinformatics. 3 Hours.**

Principles of molecular and computational analyses of genomes. Prerequisite: BIOL 2533 and BIOL 2323.

**BIOL 4233H. Honors Genomics and Bioinformatics. 3 Hours.**

Principles of molecular and computational analyses of genomes. Prerequisite: BIOL 2533 and BIOL 2323.

This course is equivalent to BIOL 4233.

**BIOL 4234. Comparative Physiology. 4 Hours.**

Comparison of fundamental physiological mechanisms in various animal groups. Adaptations to environmental factors at both the organismal and cellular levels are emphasized. Lecture 3 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: BIOL 2533 and CHEM 3613 and (CHEM 3611L or CHEM 3612M).

**BIOL 4252. Biology of Global Change Seminar. 2 Hours.**

Readings, essays, and group discussions that parallel the 27 lectures in BIOL 4153 and which dissect the resulting impacts of global change on sustainability and adaptability of biological systems. Corequisite: BIOL 4153. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

**BIOL 4252H. Honors Biology of Global Change Seminar. 2 Hours.**

Readings, essays, and group discussions that parallel the 27 lectures in BIOL 4153 and which dissect the resulting impacts of global change on sustainability and adaptability of biological systems. Corequisite: BIOL 4153. Prerequisite: BIOL 1584 or BIOL 1543 and BIOL 1541L.

This course is equivalent to BIOL 4252.

**BIOL 4263. Cell Physiology. 3 Hours.**

In-depth molecular coverage of cellular processes involved in growth, metabolism, transport, excitation, signalling and motility, with emphasis on function and regulation in eukaryotes, primarily animals. Prerequisite: BIOL 2533 and BIOL 2323 and CHEM 3813 and PHYS 2033.

**BIOL 4263H. Honors Cell Physiology. 3 Hours.**

In-depth molecular coverage of cellular processes involved in growth, metabolism, transport, excitation, signalling and motility, with emphasis on function and regulation in eukaryotes, primarily animals. Prerequisite: BIOL 2533 and BIOL 2323 and CHEM 3813 and PHYS 2033.

This course is equivalent to BIOL 4263.

**BIOL 4273. Endocrinology. 3 Hours.**

In endocrinology we study hormonal integration of living processes as all levels from molecule to organism. We will work with the mechanisms of hormone action, the endocrine control axes and hormones physiological role. The course will include paper discussions and student presentations on topics of special interest. Prerequisite: BIOL 2533 or equivalent.

**BIOL 4303. Plant Physiology. 3 Hours.**

An introductory course in plant physiology focusing on cellular processes that support the metabolic, developmental, and reproductive needs of plants. Prerequisite: BIOL 2533 or CHEM 3813 or CHEM 5843.

**BIOL 4313. Molecular Cell Biology. 3 Hours.**

In-depth molecular coverage of transcription, cell cycle, translation, and protein processing in eukaryotes and prokaryotes. Prerequisite: BIOL 2533 and BIOL 2323 and CHEM 3603 and CHEM 3601L and CHEM 3613 and CHEM 3611L.

**BIOL 4313H. Honors Molecular Cell Biology. 3 Hours.**

In-depth molecular coverage of transcription, cell cycle, translation, and protein processing in eukaryotes and prokaryotes. Prerequisite: BIOL 2533 and BIOL 2323 and CHEM 3603 and CHEM 3601L and CHEM 3613 and CHEM 3611L. This course is equivalent to BIOL 4313.

**BIOL 4323. Comparative Neurobiology. 3 Hours.**

Exploration of modern research approaches to understanding the development and function of animal nervous systems, with emphasis on molecular and cellular approaches in non-human animal models commonly used in biomedical research. Format combines lectures, group discussions, and student presentations using examples from the primary neurobiology literature. Prerequisite: BIOL 2323 and BIOL 2533 or equivalents.

**BIOL 4333. Biotechnology in Agriculture. 3 Hours.**

Discussion of the techniques, applications, and issues of biotechnology as it is being used in modern agriculture. Coverage includes the basics of molecular biology, production of transgenic plants and animals, and new applications in the agricultural, food, and medical marketplace. Lecture and discussion, 3 hours per week. This course is cross-listed with PLPA 4333.

**BIOL 4353. Ecological Genetics/Genomics. 3 Hours.**

Analysis of the genetics of natural and laboratory populations with emphasis on the ecological bases of evolutionary change. Prerequisite: BIOL 2323 and BIOL 2321L and MATH 2554 and STAT 2023 or equivalents.

**BIOL 4404. Comparative Botany. 4 Hours.**

A comparative approach to organisms classically considered to be plants with emphasis on morphology, life history, development, and phylogeny. Three hours lecture, 4 hours lab per week. Corequisite: Lab component. Prerequisite: BIOL 2323 and BIOL 2533.

**BIOL 4424. Mycology. 4 Hours.**

Form and function of the fungi. Lecture 2 hours, laboratory 4 hours per week. Corequisite: Lab component. Prerequisite: BIOL 2323 and BIOL 2533.

**BIOL 4433. Principles of Evolution. 3 Hours.**

Advanced survey of the mechanisms of evolutionary change with special emphasis on advances since the Modern Synthesis. Historical, theoretical, and population genetics approaches are discussed. Recommended BIOL 3023 and BIOL 2321L and BIOL 3861L. Prerequisite: BIOL 2323 and BIOL 3863.

**BIOL 4463. Physiological Ecology. 3 Hours.**

Interactions between environment, physiology, and properties of individuals and populations on both evolutionary and ecological scales. Prerequisite: BIOL 3863 and BIOL 4234 and its lab component.

**BIOL 4511L. Population Ecology Laboratory. 1 Hour.**

Population Ecology Lab. Pre- or Corequisite: BIOL 4513.

**BIOL 4513. Population Ecology. 3 Hours.**

Survey of theoretical and applied aspects of population processes stressing models of growth, interspecific interactions, and adaptation to physical and biotic environments. Prerequisite: BIOL 3863.

**BIOL 4523. Plant Ecology. 3 Hours.**

To develop understanding of important ecological concepts through study of dynamics relationships among plants and their environment. To become familiar with the literature of plant ecology, and interpretation and critique of ecological research. Prerequisite: BIOL 3863.

**BIOL 4543. Developmental Biology. 3 Hours.**

An analysis of the principles and mechanisms of development emphasizing the embryonic and postembryonic development of animals. Prerequisite: BIOL 2533 and BIOL 2323.

**BIOL 4554. Developmental Biology with Laboratory. 4 Hours.**

An analysis of the concepts of mechanisms of development emphasizing the experimental approach. Lecture 3 hours, laboratory 3 hours per week. Students may not receive degree credit for both BIOL 4543 and BIOL 4554. Corequisite: Lab component. Prerequisite: BIOL 2533 and BIOL 2323 or graduate standing.

**BIOL 4563. Cancer Biology. 3 Hours.**

An introduction to the fundamentals of cancer biology. Prerequisite: BIOL 2533. May be repeated for up to 6 hours of degree credit.

**BIOL 4613. Primate Adaptation and Evolution. 3 Hours.**

Introduction to the biology of the order Primates. This course considers the comparative anatomy, behavioral ecology and paleontology of our nearest living relatives. Prerequisite: BIOL 3023 or ANTH 1013. This course is cross-listed with ANTH 4613.

**BIOL 4634. Wetlands Ecology and Management. 4 Hours.**

To familiarize students with the ecology and management of wetlands. Students will be exposed to the characteristics of wetlands, the environmental factors that produce wetland types, and the management techniques used to meet desired wetland goals. Primary lecture topics will include: wetland definition, wetlands of the world, wetland status, trends, laws, wetland hydrology, wetland soils, wetland plants, wetland plant adaptations, wetland wildlife, wetland wildlife adaptations, wetland ecosystem development, and wetland management. Lecture 2 hours, Laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: BIOL 3863.

**BIOL 4693. Forest Ecology. 3 Hours.**

Introduction to the various biological, ecological and historical aspects of forest communities, with particular emphasis on the forests of the central and southeastern United States. Prerequisite: BIOL 3863.

**BIOL 4703. Mechanisms of Pathogenesis. 3 Hours.**

A survey of the events causing human disease at the molecular, cellular and genetic levels. Seeks to develop an appreciation that both the tricks pathogens use and the body's own defenses contribute to pathology. Prerequisite: BIOL 2533.

**BIOL 4703H. Honors Mechanisms of Pathogenesis. 3 Hours.**

A survey of the events causing human disease at the molecular, cellular and genetic levels. Seeks to develop an appreciation that both the tricks pathogens use and the body's own defenses contribute to pathology. Prerequisite: BIOL 2533.

This course is equivalent to BIOL 4703.

**BIOL 4711L. Basic Immunology Laboratory. 1 Hour.**

Basic immunology laboratory. Corequisite: BIOL 4713.

**BIOL 4713. Basic Immunology. 3 Hours.**

(Formerly MBIO 4714) A general overview of immunity with emphasis on the underlying cellular, molecular, and genetic events, and discussions of more specialized issues in immunology, such as disease states involving the immune system, and other interesting problems in modern immunology. Lecture 2 hours, laboratory 4 hours per week. Prerequisite: BIOL 2323 and BIOL 2533.

**BIOL 4713H. Honors Basic Immunology. 3 Hours.**

A general overview of Immunity with emphasis on the underlying cellular, molecular, and genetic events, and discussions of more specialized issues in Immunology, such as disease states involving the Immune system, and other interesting problems in modern Immunology. Prerequisite: BIOL 2323 and BIOL 2533.

This course is equivalent to BIOL 4713.

**BIOL 4724. Protistology. 4 Hours.**

The biology of eukaryotes other than animals, land plants, and fungi with emphasis on morphology and modern approaches to phylogenetic systematics. Three hours lecture, four hours lab/week. Involves writing term papers. Corequisite: Lab component. Prerequisite: BIOL 2533 and BIOL 2323.

**BIOL 4734. Wildlife Management Techniques. 4 Hours.**

To familiarize students with techniques used in the management of wildlife populations. Students will be exposed to field methods, approaches to data analysis, experimental design, and how to write a scientific paper. Management applications will be emphasized. Lecture 3 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: BIOL 3863.

**BIOL 4744. Fish Biology. 4 Hours.**

Morphology, classification, life history, population dynamics, and natural history of fishes and fish-like vertebrates. Lecture 3 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: 12 hours of biological science.

**BIOL 4753. General Virology. 3 Hours.**

An introduction to viral life-cycles, structure, and host cell interactions. Emphasis placed on molecular and biochemical aspects of virology. Two hour lecture and one hour discussion. Prerequisite: BIOL 2533 and BIOL 2323.

**BIOL 4763. Ornithology. 3 Hours.**

Taxonomy, morphology, physiology, behavior, and ecology of birds. Lecture, laboratory, and field work. Corequisite: Lab component. Prerequisite: BIOL 3863

**BIOL 4774. Biometry. 4 Hours.**

Students learn biological statistics and experimental design by actually designing experiments and analyzing data, as well as through lecture, discussion, reading, writing, and problem solving. Lecture 3 hours, laboratory 3 hours each week. Corequisite: Lab component. Prerequisite: STAT 2023 or equivalent, BIOL 3863.

**BIOL 4783. Mammalogy. 3 Hours.**

Lectures and laboratory dealing with classification, morphology, distribution, ecology, behavior, and physiology of mammals. Two hours lecture, 4 hours laboratory. Corequisite: Lab component. Prerequisite: 10 hours Biological Sciences.

**BIOL 4793. Introduction to Neurobiology. 3 Hours.**

Exploration of the neurological underpinnings of perception, action, and experience including: how sense receptors convert information in the world into electricity, how information flows through the nervous systems, how neural wiring makes vision possible, how the nervous system changes with experience, and how the system develops. Prerequisite: BIOL 2533.

**BIOL 480V. Special Topics in Biological Sciences. 1-6 Hour.**

Consideration of new areas of biological sciences not yet treated adequately in other courses. Prerequisite: 8 hours of biological sciences. May be repeated for degree credit.

**BIOL 480VH. Honors Special Topics in Biological Sciences. 1-6 Hour.**

Consideration of new areas of biological sciences not yet treated adequately in other courses. Prerequisite: 8 hours of biological sciences. May be repeated for degree credit.

This course is equivalent to BIOL 480V.

**BIOL 4814. Limnology. 4 Hours.**

Physical, chemical and biological conditions of inland waters. Lecture 3 hours, laboratory by arrangement. Corequisite: Lab component. Prerequisite: (CHEM 1123 and CHEM 1121L) or equivalent and BIOL 3863 or instructor's permission.

**BIOL 4833. Animal Behavior. 3 Hours.**

Organization, regulation, and phylogeny of animal behavior, emphasizing vertebrates. Lecture, laboratory, and field work. Corequisite: Lab component.

**BIOL 4844. Community and Ecosystem Ecology. 4 Hours.**

Survey of theoretical and applied aspects of community processes stressing structure, trophic dynamics, community interactions, and major community types. Corequisite: Lab component. Prerequisite: BIOL 3863.

**BIOL 485V. Field Ecology. 1-3 Hour.**

Project oriented approach employing current field and laboratory techniques, experimental design, and data analysis. Field trip is required.

**BIOL 4863. Analysis of Animal Populations. 3 Hours.**

Basic principles of design and analysis for population studies of fish and wildlife species. Students will be instructed in the use of the latest software for estimating population parameters. Focus will be on both concepts and applications. Management applications of estimated parameters will be emphasized. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: BIOL 3863.

**BIOL 4873. Microbial Molecular Genetics and Informatics. 3 Hours.**

Fundamentals of microbial genomics and bioinformatics. Course covers microbial genetics, genetic structure, genome organization, proteome organization, approaches for the analysis of DNA, RNA, and proteins, cellular metabolic pathways, genetic regulation, small RNA molecules, functional genomics, metagenomics, and bioinformatics approaches for analysis of microbial genomes. Prerequisite: BIOL 2323 or BIOL 2533.

**BIOL 4873H. Honors Microbial Molecular Genetics and Informatics. 3 Hours.**

Fundamentals of microbial genomics and bioinformatics. Course covers microbial genetics, genetic structure, genome organization, proteome organization, approaches for the analysis of DNA, RNA, and proteins, cellular metabolic pathways, genetic regulation, small RNA molecules, functional genomics, metagenomics, and bioinformatics approaches for analysis of microbial genomes. Prerequisite: BIOL 2323 or BIOL 2533.

This course is equivalent to BIOL 4873.

**BIOL 496V. Culture and Environment: Field Studies. 1-6 Hour.**

May be taken by students participating in overseas study programs or other domestic field study programs approved by the department. May be repeated for up to 12 hours of degree credit.

**BIOL 496VH. Honors Culture and Environment: Field Studies. 1-6 Hour.**

May be taken by students participating in overseas study programs or other domestic field study programs approved by the department. May be repeated for up to 12 hours of degree credit.

This course is equivalent to BIOL 496V.

**BIOL 498V. Senior Thesis. 1-6 Hour.**

Senior thesis.

**BIOL 499V. Research In Biological Sciences. 1-4 Hour.**

Research. Prerequisite: Senior standing. May be repeated for up to 8 hours of degree credit.

**BIOL 499VH. Honors Research in Biological Sciences. 1-4 Hour.**

Honors research. Prerequisite: Senior standing. May be repeated for up to 8 hours of degree credit.

This course is equivalent to BIOL 499V.