

## Biology Undergraduate Program

Interim Director: Val Smith, (785) 864-5883, [vsmith@ku.edu](mailto:vsmith@ku.edu)  
 Haworth Hall, 1200 Sunnyside Ave., Room 2045  
 Lawrence, KS 66045-7534, [www.kuub.ku.edu](http://www.kuub.ku.edu), (785) 864-4301  
 Degrees offered: B.A., B.S.

**Why study biology?** Study biology because undergraduates should have the opportunity to explore the breadth of biology that allows them to succeed in their chosen paths beyond the university.

The KU Undergraduate Biology program administers the B.A. and B.S. in biochemistry, B.A. in biology, B.S. in biology (cell biology), B.S. in biology (ecology and evolutionary biology), B.S. in biology (genetics), B.S. in biology (neurobiology), B.S. in biology (organismal biology), B.A. in human biology, B.A. and B.S. in microbiology, and B.S. in molecular biosciences (KU Edwards Campus).

### Courses for Nonmajors

BIOL 100 Principles of Biology, BIOL 110 Microorganisms in Your World, BIOL 116 Introduction to Evolutionary Biology, BIOL 120 Insects in Your World, and BIOL 215 Evolution and Diversity in Shaping Our World offer nonmajors an introduction to biology and biological facts or concepts. A laboratory, BIOL 102, supplements BIOL 100. Honors sections (BIOL 101/BIOL 103) are offered for students with superior academic records. Except when specifically listed in the major requirements, these courses do not count toward a biology major.

### Majors

Bachelor's degree requirements in biology are modified as necessary. Up-to-date requirements are available in the KUUB office and at [www.kuub.ku.edu](http://www.kuub.ku.edu). Major programs are offered in biochemistry, biology, human biology, and microbiology. Students may choose to concentrate in a range of specialties in the biological sciences, such as botany, cellular biology, developmental biology, environmental biology, ecology, entomology, genetics, marine biology, molecular biology, neurobiology, paleontology, physiology, systematics, or zoology (invertebrate or vertebrate). See also Environmental Studies in this chapter of the catalog.

**First- and Second-year Preparation.** Because biology study requires preparation in other sciences, students should begin meeting major requirements in the first year. It is particularly important to take CHEM 184 and CHEM 188 in the first year and, for several majors, to take CHEM 624, CHEM 625, CHEM 626, and CHEM 627 in the second year. Ideally, most majors should also take BIOL 150 and BIOL 152 during the first year. Students who have taken BIOL 100 and BIOL 102, have earned an A or B in both courses, and have decided to major in a biological science should consult a KUUB adviser to request permission to substitute BIOL 100 and BIOL 102 for BIOL 150.

**Requirements for the B.S. Degrees in Biochemistry, Biology, Microbiology, or Molecular Biosciences** (33 hours). The following general education requirements must be completed by all students pursuing a B.S. in biochemistry, biology, microbiology, or molecular biosciences. For general requirements for the B.A. degree, see CLAS General Education Degree Requirements in the College of Liberal Arts and Sciences: General Requirements chapter of this catalog.

|                                                                                                                                                                                                                                                                                                                                      |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| English: ENGL 101, ENGL 102 (or ENGL 105), ENGL 203 (or ENGL 205, ENGL 209, ENGL 210, ENGL 211) .....                                                                                                                                                                                                                                | 9 |
| Western civilization: HWC 204 (or HWC 114) and HWC 205 (or HWC 115) .....                                                                                                                                                                                                                                                            | 6 |
| Argument and reason: COMS 130/COMS 230, PHIL 148/PHIL 310, or exemption/examination .....                                                                                                                                                                                                                                            | 3 |
| Principal course and/or foreign language requirements (No more than one course from each topical subgroup on the principal course list can be applied toward this requirement. See the Schedule of Classes, <a href="http://www.registrar.ku.edu">www.registrar.ku.edu</a> , for a list of principal courses and topical subgroups.) |   |
| One course in the social sciences .....                                                                                                                                                                                                                                                                                              | 3 |
| One course in the humanities .....                                                                                                                                                                                                                                                                                                   | 3 |
| Three additional courses selected from the social sciences or humanities principal course list and/or foreign language courses .....                                                                                                                                                                                                 | 9 |

In addition to the general College requirements for a B.A. or B.S. degree, the following are required for majors in biological sciences.

### Biochemistry Majors

Prospective majors in biochemistry should complete BIOL 150, BIOL 152, CHEM 184, CHEM 188, CHEM 624, CHEM 625, CHEM 626, CHEM 627, MATH 121, and MATH 122 (or MATH 115 and MATH 116 for the B.A. degree) by the end of the second year. Courses in biochemistry (BIOL 636, BIOL 637, BIOL 638, and BIOL 639) should be taken during the junior year.

**Requirements for the B.A. Biochemistry Major.** Students must complete at least 124 hours (45 junior/senior hours) to graduate.

#### Biochemistry Requirements (25 hours)

|                                                                               |   |
|-------------------------------------------------------------------------------|---|
| BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. | 4 |
| BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology .....          | 4 |
| BIOL 350 Principles of Genetics .....                                         | 3 |
| BIOL 636 Biochemistry I .....                                                 | 3 |
| BIOL 637 Introductory Biochemistry Laboratory .....                           | 2 |
| BIOL 638 Biochemistry II .....                                                | 3 |
| BIOL 639 Advanced Biochemistry Laboratory .....                               | 2 |
| BIOL 672 Gene Expression .....                                                | 3 |
| BIOL 599 Senior Seminar in Biochemistry (must be taken in senior year) .....  | 1 |

#### General Science Requirements (35-39 hours)

|                                                                                                                                |      |
|--------------------------------------------------------------------------------------------------------------------------------|------|
| CHEM 184 and CHEM 188 Foundations of Chemistry I and II .....                                                                  | 10   |
| CHEM 624 Organic Chemistry I .....                                                                                             | 3    |
| CHEM 625 Organic Chemistry I Laboratory .....                                                                                  | 2    |
| CHEM 626 Organic Chemistry II .....                                                                                            | 3    |
| CHEM 640 Biological Physical Chemistry .....                                                                                   | 3    |
| *MATH 121 Calculus I (5) and *MATH 122 Calculus II (5) <b>or</b><br>MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... | 6-10 |
| *Students who plan to attend graduate school should enroll in MATH 121 and MATH 122.                                           |      |
| PHSX 211 and PHSX 212 General Physics I and II (8) <b>or</b><br>PHSX 114 and PHSX 115 College Physics I and II (8) .....       | 8    |

**Elective Requirements** (6 hours). Biology courses numbered 400 or higher, pertinent to the major and selected in consultation with a biochemistry adviser. Suggested courses are BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors), BIOL 408 Physiology of Organisms, BIOL 416 Cell Structure and Function, BIOL 417 Biology of Development, BIOL 424 Independent Study, BIOL 646 Mammalian Physiology. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement.

**Requirements for the B.S. Biochemistry Major.** Students must complete at least 124 hours (45 junior/senior hours) to graduate. College requirements are described under Majors in this section.

#### Biochemistry Requirements (25 hours)

|                                                                               |   |
|-------------------------------------------------------------------------------|---|
| BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. | 4 |
| BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology .....          | 4 |
| BIOL 350 Principles of Genetics .....                                         | 3 |
| BIOL 636 Biochemistry I .....                                                 | 3 |
| BIOL 637 Introductory Biochemistry Laboratory .....                           | 2 |
| BIOL 638 Biochemistry II .....                                                | 3 |
| BIOL 639 Advanced Biochemistry Laboratory .....                               | 2 |
| BIOL 672 Gene Expression .....                                                | 3 |
| BIOL 599 Senior Seminar in Biochemistry (must be taken in senior year) .....  | 1 |

#### General Science Requirements (45 hours)

|                                                                                                                          |    |
|--------------------------------------------------------------------------------------------------------------------------|----|
| CHEM 184 and CHEM 188 Foundations of Chemistry I and II .....                                                            | 10 |
| CHEM 516 Analytical Chemistry .....                                                                                      | 3  |
| CHEM 624 Organic Chemistry I .....                                                                                       | 3  |
| CHEM 625 Organic Chemistry I Laboratory .....                                                                            | 2  |
| CHEM 626 Organic Chemistry II .....                                                                                      | 3  |
| CHEM 627 Organic Chemistry II Laboratory .....                                                                           | 2  |
| CHEM 640 Biological Physical Chemistry (3) <b>or</b><br>CHEM 646 Physical Chemistry I (3) .....                          | 3  |
| MATH 121 Calculus I (5) and MATH 122 Calculus II (5) .....                                                               | 10 |
| PHSX 211 and PHSX 212 General Physics I and II (8) <b>or</b><br>PHSX 114 and PHSX 115 College Physics I and II (8) ..... | 8  |

**Elective Requirements** (12 hours). Biology courses numbered 400 or higher, pertinent to the major and selected in consultation with a biochemistry adviser. Suggested courses are BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors), BIOL 408 Physiology of Organisms, BIOL 416 Cell Structure and Function, BIOL 424 Independent Study, BIOL 430 Laboratory in Molecular Biology, BIOL 518 Microbial Genetics, BIOL 688 The Molecular Biology of Cancer, or biology courses with a biochemistry course as a prerequisite. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement.

### Biology Majors

**Requirements for the B.A. Biology Major.** Students must complete at least 124 hours (45 junior/senior hours) to graduate.

#### Biology Core Requirements (24-25 hours)

|                                                                               |   |
|-------------------------------------------------------------------------------|---|
| BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. | 4 |
| BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology .....          | 4 |

BIOL 350 Principles of Genetics ..... 3  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 599 Senior Seminar in Biology (must be taken in senior year) ..... 1  
 One of the following three courses: ..... 3  
     BIOL 413 History and Diversity of Organisms (3)  
     BIOL 414 Principles of Ecology (3)  
     BIOL 550 Introduction to Systematics (3)  
 Two of the following five courses: ..... 6-7  
     BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) (3)  
     BIOL 408 Physiology of Organisms (3)  
     BIOL 416 Cell Structure and Function (3)  
     BIOL 417 Biology of Development (3)  
     BIOL 600 Introductory Biochemistry, Lectures (4)

**General Science Requirements (28-29 hours)**  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
     CHEM 624 Organic Chemistry I (3) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 MATH 121 Calculus I (5) **or**  
     MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
     PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

**Elective and Laboratory Requirements (10 hours).** Biology courses numbered 400 or higher, including at least 4 hours of laboratory credit, are required. Courses above that have not been used to meet requirements may be used as electives. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement. No more than 2 hours of BIOL 424 can be applied toward the laboratory requirement.

**Requirements for the B.S. Degrees in Biology.** Students must complete at least 124 hours (45 junior/senior hours) to graduate. College requirements are described under Majors in this section.

**Cell Biology**

*General Biology Requirements (21 hours)*  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 408 Physiology of Organisms ..... 3  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 600 Introductory Biochemistry, Lectures ..... 4

*General Science Requirements (31-32 hours)*  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 624 Organic Chemistry I (required for cell biology) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 CHEM 626 Organic Chemistry II ..... 3  
 MATH 121 Calculus I (5) **or**  
     MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
     PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

*Cell Biology Requirements (19 hours)*  
 BIOL 416 Cell Structure and Function ..... 3  
 BIOL 417 Biology of Development ..... 3  
 BIOL 426 Laboratory in Cell Biology ..... 3  
 BIOL 599 Senior Seminar in Cell Biology (must be taken in senior year) ..... 1  
 Cell biology electives from the following list: ..... 9  
     BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors), BIOL 402 Fundamentals of Microbiology Laboratory, BIOL 435 Introduction to Neurobiology, BIOL 503 Immunology, BIOL 504 Immunology Laboratory, BIOL 512 General Virology, BIOL 513 Virology Laboratory, BIOL 570 Introduction to Biostatistics, BIOL 646 Mammalian Physiology, BIOL 673 Cellular and Molecular Neurobiology, BIOL 688 The Molecular Biology of Cancer, BIOL 719 Light and Electron Microscopy, BIOL 752 Cell Biology, BIOL 755 Mechanisms of Development, BIOL 756 Cell and Tissue Culture Laboratory

*Seminar/Laboratory Requirements (4 hours)*  
 At least 2 hours of biology laboratory credit (numbered 400 or higher) and 2 hours of a seminar/topics course: BIOL 419, BIOL 420, BIOL 701 ..... 4

**Ecology and Evolutionary Biology**

*General Biology Requirements (17-18 hours)*  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 BIOL 350 Principles of Genetics ..... 3  
 Two of the following four courses: ..... 6-7  
     BIOL 408 Physiology of Organisms (3)  
     BIOL 416 Cell Structure and Function (3)

BIOL 417 Biology of Development (3)  
 BIOL 600 Introductory Biochemistry, Lectures (4)  
*General Science Requirements (25-28 hours)*  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
     CHEM 624 Organic Chemistry I (3) ..... 3  
 MATH 121 Calculus I (5) **or**  
     MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 Two of the following courses: ..... 7-9  
     PHSX 114 College Physics I (4)  
     PHSX 115 College Physics II (4)  
     ATMO 105 Introductory Meteorology (5)  
     EPCS 138 Introduction to Computing: \_\_\_\_ (3)

*Ecology and Evolutionary Biology Requirements (18 hours)*  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 413 History and Diversity of Organisms ..... 3  
 BIOL 414 Principles of Ecology ..... 3  
 BIOL 415 Field and Laboratory Methods in Ecology ..... 2  
 BIOL 550 Introduction to Systematics ..... 3  
 BIOL 570 Introduction to Biostatistics ..... 3  
 BIOL 599 Senior Seminar in Ecology and Evolutionary Biology (must be taken in senior year) ..... 1

*Elective and Laboratory Requirements (13 hours)*  
 BIOL courses numbered 400 or higher, including at least 3 hours of laboratory credit and 2 hours of a seminar or topics course (BIOL 419, BIOL 420, BIOL 701) ..... 13  
 Courses above that have not been used to meet requirements may be used as electives. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement. No more than 2 hours of BIOL 424 can be applied toward the laboratory requirement.

**Genetics**

*General Biology Requirements (24 hours)*  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 One of the following three courses: ..... 3  
     BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) (3)  
     BIOL 408 Physiology of Organisms (3)  
     BIOL 417 Biology of Development (3)  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 416 Cell Structure and Function ..... 3  
 BIOL 570 Introduction to Biostatistics ..... 3  
 BIOL 600 Introductory Biochemistry, Lectures ..... 4

*General Science Requirements (28-29 hours)*  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
     CHEM 624 Organic Chemistry I (3) ..... 3  
 \*CHEM 625 Organic Chemistry I Laboratory ..... 2  
 \*Students who plan to attend graduate school (particularly those interested in applying molecular techniques) or medical school should also enroll in CHEM 626 and CHEM 627.  
 MATH 121 Calculus I (5) **or**  
     MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
     PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

*Genetics Requirements (15 hours)*  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 405 Laboratory in Genetics ..... 2  
 BIOL 672 Gene Expression ..... 3  
 BIOL 599 Senior Seminar in Genetics (must be taken in senior year) ..... 1  
 Two courses from the following list: ..... 6  
     BIOL 512 General Virology, BIOL 518 Microbial Genetics, BIOL 595 Human Genetics, BIOL 611 Molecular Systematics and Evolution, BIOL 688 The Molecular Biology of Cancer, BIOL 692 Developmental Genetics, BIOL 743 Population Genetics, BIOL 747 Quantitative Genetics, BIOL 755 Mechanisms of Development, ANTH 340 Human Variation and Evolution, ANTH 442 Anthropological Genetics, ANTH 652 Population Dynamics

*Elective and Laboratory Requirements (8 hours)*  
 BIOL courses numbered 400 or higher, including at least 3 hours of laboratory credit and 2 hours of a seminar or topics course (BIOL 419, BIOL 420, BIOL 701) ..... 8  
 Courses above that have not been used to meet requirements may be used as electives. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement. No more than 2 hours of BIOL 424 can be applied toward the laboratory requirement.

**Bachelor's degree requirements in biology are modified as necessary to keep them current and appropriate to the discipline. Up-to-date requirements are available in the KUUB office, 2045 Haworth Hall, and online at [www.kuub.ku.edu](http://www.kuub.ku.edu).**



# Biology Undergraduate Program

## Neurobiology

*General Biology Requirements* (21-23 hours)

BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 413 History and Diversity of Organisms (3) **or**  
 BIOL 414 Principles of Ecology (3) ..... 3  
 BIOL 600 Introductory Biochemistry, Lectures (4) **or**  
 BIOL 636 Biochemistry I (3) **and** BIOL 638 Biochemistry II (3) ..... 4-6

*General Science Requirements* (31-32 hours)

CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 624 Organic Chemistry I ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 CHEM 626 Organic Chemistry II ..... 3  
 MATH 121 Calculus I (5) **or**  
 MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
 PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

*Neurobiology Requirements* (19 hours)

BIOL 416 Cell Structure and Function ..... 3  
 BIOL 417 Biology of Development ..... 3  
 BIOL 426 Cell Biology Laboratory ..... 3  
 BIOL 435 Introduction to Neurobiology ..... 3  
 BIOL 650 Advanced Neurobiology ..... 3  
 BIOL 676 Mammalian Neuroanatomy ..... 3  
 BIOL 599 Senior Seminar in Neurobiology (must be taken in senior year) .... 1

*Neurobiology Electives* (9 hours)

Select at least two courses from the following list: ..... 6

BIOL 454 Brain Diseases and Neurological Disorders (3)  
 BIOL 570 Introduction to Biostatistics (3)  
 BIOL 646 Mammalian Physiology (4), BIOL 647 Mammalian Physiology Laboratory (2)  
 BIOL 652 Comparative Animal Behavior (3)  
 BIOL 672 Gene Expression (3)  
 BIOL 673 Cellular and Molecular Neurobiology (3)  
 BIOL 755 Mechanisms of Development (3)  
 BIOL 775 Chemistry of the Nervous System (3)  
 BIOL 777 Integrative and Developmental Neurobiology (3)

Additional electives chosen from the list above, or any BIOL courses at the 400 level or above ..... 3

**Organismal Biology**

*General Biology Requirements* (18 hours)

BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 412 Evolutionary Biology ..... 3  
 BIOL 600 Introductory Biochemistry, Lectures ..... 4

*General Science Requirements* (28-29 hours)

CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
 CHEM 624 Organic Chemistry I (3) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 MATH 121 Calculus I (5) **or**  
 MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
 PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

*Organismal Biology Requirements* (24 hours)

BIOL 408 Physiology of Organisms ..... 3  
 BIOL 409 Physiology of Organisms Laboratory ..... 2  
 BIOL 599 Senior Seminar in Organismal Biology (must be taken in senior year) .. 1

Two of the following three courses: ..... 6

BIOL 413 History and Diversity of Organisms (3)  
 BIOL 414 Principles of Ecology (3)  
 BIOL 550 Introduction to Systematics (3)

One of the following two courses: ..... 3

BIOL 416 Cell Structure and Function (3)  
 BIOL 417 Biology of Development (3)

At least one course from each of the following three groups: ..... 9

- Development Group: BIOL 417 Biology of Development, BIOL 545 Evolution of Development, BIOL 608 Developmental Plant Anatomy, BIOL 692 Developmental Genetics, BIOL 710 Insect Development, BIOL 717 Insect Ecology and Behavior
- Function Group: BIOL 435 Introduction to Neurobiology, BIOL 503 Immunology, BIOL 506 Pathogenic Microbiology, BIOL 555 General Plant Phys-

iology, BIOL 606 Ecological Plant Physiology, BIOL 644 Comparative Animal Physiology, BIOL 646 Mammalian Physiology, BIOL 673 Cellular and Molecular Neurobiology, BIOL 676 Mammalian Neuroanatomy, BIOL 708 External Morphology of Insects, BIOL 716 Insect Physiology and Internal Morphology

- Diversity Group: ANTH 440 Introduction to Primates, BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors), BIOL 493 Introduction to Ornithology, BIOL 494 Introduction to Mammalogy, BIOL 500 Biology of Insects, BIOL 505 Social Insects, BIOL 509 Biology of Spiders, BIOL 510 Comparative Anatomy, BIOL 511 Biology of Spiders Laboratory, BIOL 512 General Virology, BIOL 533 Biology of Fungi, BIOL 540 General Invertebrate Zoology, BIOL 583 Herpetology, BIOL 592 Ichthyology, BIOL 603 Systematic Botany, BIOL 610 Plant Kingdom, BIOL 613 Biology of Honeybees, BIOL 622 Paleontology, BIOL 640 The Biology and Evolution of Fossil Plants, BIOL 709 Immature Insects, BIOL 711 Insect Systematics, BIOL 783 Herpetology, BIOL 792 Ichthyology, BIOL 793 Ornithology

*Elective and Laboratory Requirements* (10 hours)

BIOL courses numbered 400 or higher, including at least 2 hours of laboratory credit and 1 hour of a seminar/topics course (BIOL 419, BIOL 420, BIOL 701) ..... 10

Courses above that have not been used to meet requirements may be used as electives. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement. No more than 2 hours of BIOL 424 can be applied toward the laboratory requirement.

## Human Biology Majors

The curriculum builds from a broad background of general science courses and adds depth in a set of five specialized disciplines. Courses in the disciplines emphasize topics related to humans and provide a solid understanding of each field of knowledge.

**Requirements for the B.A. Human Biology Major.** Students must complete at least 124 hours (45 junior/senior hours) to graduate and must choose one concentration from the five areas: anthropology, applied behavioral science, biology, psychology, speech-language-hearing science.

### Human Biology General Science Requirements (33 hours minimum)

ANTH 304 Fundamentals of Physical Anthropology ..... 3-4  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 MATH 115 and MATH 116 (6) **or** MATH 121 Calculus I (5) ..... 5-6  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 PHSX 114 College Physics I (4) **or** PHSX 211 General Physics I (4) ..... 4

\*BIOL 570 Introduction to Biostatistics (3) **or**  
 PSYC 300 Statistics in Psychological Research (3) **or**  
 MATH 365 Elementary Statistics (3) ..... 3

\*BIOL 570 is recommended for the anthropology and biology concentrations.

### Anthropology Concentration (30 hours minimum)

Organic Chemistry: CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
 CHEM 624 Organic Chemistry I (3) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2

Cell Biology: BIOL 416 Cell Structure and Function ..... 3

Genetics: BIOL 350 Principles of Genetics ..... 3

Seminar: BIOL 599 Senior Seminar in Human Biology (must be taken in senior year) ..... 1

Complete two of the following four categories: ..... 18-21

*Human Anatomy and Physiology* (12 hours)

BIOL 417 Biology of Development (3)

Nine hours selected from the following courses: ANTH 542 Biology of Human Nutrition, ANTH 648 Human Osteology, ANTH 650 Human Reproduction: Biology and Behavior, BIOL 426 Laboratory in Cell Biology, BIOL 440 Advanced Human Anatomy (lecture and lab), BIOL 600 Introductory Biochemistry, Lectures (lab BIOL 637), BIOL 646 Mammalian Physiology (lab BIOL 647)

*Human Population Biology* (9 hours selected from the following courses):

ANTH 340 Human Variation and Evolution, ANTH 442 Anthropological Genetics, ANTH 544 Physical Anthropology of American Indians, ANTH 545 Contemporary Health Issues in Africa, ANTH 652 Population Dynamics

*Human Adaptation and Evolution* (9 hours selected from the following courses):

ANTH 350 Human Adaptation, ANTH 352 Controversies on the Living and the Dead, ANTH 450 Disease and Adaptation, ANTH 503 Topics in Biological Anthropology, ANTH 549 Human Paleontology: Fossil Apes to Australopithecus, ANTH 550 Human Paleontology: Homo Erectus to Homo Sapiens

**Students who intend to major in biology should begin planning their programs during the first year.**

**See pages 49-56 of this catalog for complete CLAS degree requirements.**

**A B.S. degree in molecular biosciences is offered on KU's Edwards Campus. Call the CLAS undergraduate adviser at 864-8659 (from Lawrence) or (913) 897-8659 (outside of Lawrence) for information.**

*Human Biology and Behavior* (9 hours selected from the following courses): ANTH 359 Anthropology of Sex, ANTH 447 Human Behavioral Genetics, ANTH 461 Introduction to Medical Anthropology, ANTH 754 Biological Bases of Human Behavior, PSYC 370 Brain and Behavior, PSYC 536 The Psychology of Language

**Applied Behavioral Science Concentration** (32 hours minimum)  
 Genetics: BIOL 350 Principles of Genetics ..... 3  
 Behavioral Science: ABSC 100 Introduction to Applied Behavioral Science ... 3  
 Development: ABSC 160 Introduction to Child Behavior and Development (3) or PSYC 333 Child Psychology (3) ..... 3  
 Research Methods: ABSC 308 Research Methods and Application ..... 4  
 Seminar: BIOL 599 Senior Seminar in Human Biology (must be taken in senior year) ..... 1

Complete two of the following four categories: ..... 18  
*Applied Behavioral Science* (9 hours)

ABSC 304 The Principles and Procedures of Behavior Modification and Therapy (3)  
 Six hours selected from the following courses: ABSC 150 Community Leadership and ABSC 310/ABSC 311 Building Healthy Communities (prerequisite: ABSC 150), ABSC 350 The Behavioral Treatment of Children with Autism, ABSC 410 Behavioral Approaches in Working with Adolescents, ABSC 437 Independent Living and People with Disabilities  
*Development: Typical and Atypical* (9 hours)

ABSC 632 Advanced Child Behavior and Development (3)  
 Six hours selected from the following courses: ABSC 535 Developmental Psychopathology, ABSC 565 Applied Developmental Psychology, BIOL 417 Biology of Development, PSYC 510 Infant Behavior and Development  
*Biology of Behavior* (9 hours)

BIOL 408 Physiology of Organisms (3)  
 Six hours selected from the following courses: ANTH 542 Biology of Human Nutrition, BIOL 435 Introduction to Neurobiology, BIOL 440 Advanced Human Anatomy (lecture and lab), BIOL 454 Brain Diseases and Neurological Disorders, BIOL 646 Mammalian Physiology (lab BIOL 647), PSYC 370 Brain and Behavior, PSYC 380 Brain and Pathology  
*Evolution, Culture, and Behavior* (9 hours)

BIOL 412 Evolutionary Biology (3)  
 Six hours selected from the following courses: ANTH 341 Human Evolution, ANTH 415 The Rise of Civilization, ANTH 650 Human Reproduction: Biology and Behavior, ANTH 661 Cultural Dynamics, BIOL 410/GEOG 410 Human Biogeography, Honors, BIOL 550 Introduction to Systematics, BIOL 625 Behavioral Ecology and Sociobiology, BIOL 652 Comparative Animal Behavior  
 All students are encouraged to take BIOL 412 Evolutionary Biology. Although space is limited, an ABSC research practicum course is strongly recommended (e.g., ABSC 499, ABSC 679, ABSC 698). ABSC courses are suggested for fulfilling the requirements, but students are encouraged to explore the offerings of other departments participating in the program.

**Biology Concentration** (31 hours minimum)  
 Organic Chemistry: CHEM 622 Fundamentals of Organic Chemistry (3) or CHEM 624 Organic Chemistry I (3) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 Physics: PHSX 115 College Physics II (4) or PHSX 212 General Physics II (4) ... 4  
 Genetics: BIOL 350 Principles of Genetics ..... 3  
 Seminar: BIOL 599 Senior Seminar in Human Biology (must be taken in senior year) ..... 1

Complete two of the following four categories (Course selections must include at least 3 hours of laboratory credit): ..... 18-19  
*Development and Genetics* (9 hours)

BIOL 417 Biology of Development (3)  
 Six hours selected from the following courses: ABSC 535/PSYC 535 Developmental Psychopathology; ANTH 762 Human Growth and Development; BIOL 405 Laboratory in Genetics; BIOL 416 Cell Structure and Function; BIOL 595 Human Genetics; BIOL 688 The Molecular Biology of Cancer; PSYC 333 Child Psychology; PSYC 430 Cognitive Development; PSYC 531 Language Development; SPLH 566 Language Development  
*Anatomy and Physiology* (10 hours)

BIOL 646 Mammalian Physiology (3)  
 Six hours selected from the following courses: ANTH 542 Biology of Human Nutrition; ANTH 648 Human Osteology; BIOL 435 Introduction to Neurobiology; BIOL 440 Advanced Human Anatomy (lab and lecture); BIOL 600 Introductory Biochemistry, Lectures (lab BIOL 637); BIOL 647 Mammalian Physiology Laboratory; HSES 672 Exercise Physiology; PSYC 370 Brain and Behavior; PSYC 380 Brain and Pathology; PSYC 475 Cognitive Neuroscience  
*Evolution, Ecology, and Adaptation* (9 hours)

BIOL 412 Evolutionary Biology (3)  
 Six hours selected from the following courses: ANTH 340 Human Variation and Evolution; ANTH 341 Human Evolution; ANTH 350 Human Adaptation; ANTH 652 Population Dynamics; BIOL 410 Human Biogeography, Honors; BIOL 414 Principles of Ecology; BIOL 668 Evolutionary Ecology; PSYC 555 Evolutionary Psychology  
*Human Disease* (9 hours)

BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) (3) (lab BIOL 402)  
 Six hours selected from the following courses: ANTH 450 Disease and Adaptation; BIOL 503 Immunology (lab BIOL 504); BIOL 506 Pathogenic Microbiology (lab BIOL 507); BIOL 512 General Virology (lab BIOL 513); BIOL 518 Microbial Genetics (lab BIOL 519); BIOL 595 Human Genetics; BIOL 616 Medical Entomology; BIOL 688 The Molecular Biology of Cancer

**Psychology Concentration** (30 hours minimum)  
 Organic Chemistry: CHEM 622 Fundamentals of Organic Chemistry (3) or CHEM 624 Organic Chemistry I (3) ..... 3

CHEM 625 Organic Chemistry I Laboratory ..... 2  
 Genetics: BIOL 350 Principles of Genetics ..... 3  
 Research Methods: PSYC 310 Research Methods in Psychology ..... 3  
 Seminar: BIOL 599 Senior Seminar in Human Biology (must be taken in senior year) ..... 1

Complete two of the following four categories: ..... 18  
*Evolution, Adaptation, and Health* (9 hours selected from the following courses): PSYC 555 Evolutionary Psychology, PSYC 605 Health Psychology, ANTH 340 Human Variation and Evolution, ANTH 341 Human Evolution, ANTH 350 Human Adaptation, ANTH 442 Anthropological Genetics, ANTH 447 Human Behavioral Genetics, ANTH 450 Disease and Adaptation, ANTH 542 Biology of Human Nutrition, BIOL 412 Evolutionary Biology, BIOL 595 Human Genetics

*Human Development* (9 hours)  
 PSYC 333 Child Psychology (3)  
 Six hours selected from the following courses: PSYC 430 Cognitive Development, PSYC 510 Infant Behavior and Development; PSYC 535/ABSC 535 Developmental Psychopathology, PSYC 632/ABSC 632 Advanced Child Behavior and Development, BIOL 417 Biology of Development  
*Human Cognition and Language* (9 hours)

PSYC 318 Cognitive Psychology (3)  
 Six hours selected from the following courses: PSYC 418 Introduction to Cognitive Science, PSYC 482 Sensation and Perception, PSYC 518 Human Memory, PSYC 531 Language Development, PSYC 536 The Psychology of Language, SPLH 466 Language Science, SPLH 566 Language Development  
*Neuroscience* (9 hours selected from the following courses): PSYC 370 Brain and Behavior, PSYC 380 Brain and Pathology, PSYC 475 Cognitive Neuroscience, ANTH 650 Human Reproduction: Biology and Behavior, BIOL 435 Introduction to Neurobiology, BIOL 454 Brain Diseases and Neurological Disorders, SPLH 320 Introduction to the Neuroscience of Human Communication

Psychology courses are recommended for fulfilling at least some of the requirements, but students are also strongly encouraged to explore offerings of other departments participating in the program.

**Speech-Language-Hearing Science Concentration** (29 hours minimum)  
 Physics: SPLH 120 The Physics of Speech (4) or PHSX 115 College Physics II (4) ..... 4  
 Research Methods: SPLH 660 Research Methods in Speech-Language-Hearing ... 3  
 Genetics: BIOL 350 Principles of Genetics ..... 3  
 Seminar: BIOL 599 Senior Seminar in Human Biology (must be taken in senior year) ..... 1

Complete two of the following four categories: ..... 18-19  
*Development and Genetics* (9 hours)  
 BIOL 417 Biology of Development (3)  
 Six hours selected from the following courses: ANTH 762 Human Growth and Development, BIOL 405 Laboratory in Genetics, BIOL 416 Cell Structure and Function, BIOL 595 Human Genetics, PSYC 333 Child Psychology, PSYC 430 Cognitive Development, SPLH 464 Undergraduate Seminar in Infant Development, SPLH 764 Seminar in Infant Development, SPLH 466 Language Science, SPLH 566 Language Development  
*Anatomy and Physiology* (10)

BIOL 646 Mammalian Physiology (3)  
 Six hours selected from the following courses: BIOL 440 Advanced Human Anatomy (lecture and lab), BIOL 647 Mammalian Physiology Laboratory, SPLH 662 Principles of Speech Science, SPLH 663 Principles of Hearing Science, HSES 672 Exercise Physiology  
*Neuroscience* (9 hours)

BIOL 408 Physiology of Organisms (3)  
 Six hours selected from the following courses: BIOL 435 Introduction to Neurobiology, PSYC 370 Brain and Behavior; PSYC 380 Brain and Pathology, PSYC 475 Cognitive Neuroscience, SPLH 320 Introduction to the Neuroscience of Human Communication, SPLH 464 Undergraduate Seminar in Neural Bases of Speech and Voice, SPLH 464 Undergraduate Seminar in Speech Motor Control  
*Research Practicum* (9 hours selected from the following courses): SPLH 464 Undergraduate Seminar in Circuit Theory and Bioinstrumentation; SPLH 449 Laboratory/Field Work in Human Biology (Topics: Orofacial Neurophysiology, Deep Brain Stimulation in Progressive Neuromotor Disease, Perceptual Neuroscience and Functional Brain Imaging; Neuroscience of the Premature Human Infant; Brain-Behavior Mapping of Language); SPLH 499 Directed Study in Speech-Language-Hearing

SPLH courses are recommended for fulfilling the requirements. Research practicum courses must be arranged with the course instructor before enrollment.

**Microbiology Majors**  
 Course work allows students to study microbiology as part of their general education and provides a background for teachers. It also prepares students for work in medical, public health, research, and industrial laboratories; for graduate, medical, or dental school; or for the clinical laboratory sciences program.

**Requirements for the B.A. Major.** Students must complete at least 124 hours (45 junior/senior hours) to graduate.

**Microbiology Core Requirements** (9-10 hours)  
 BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) ..... 3  
 BIOL 402 Fundamentals of Microbiology Laboratory ..... 2  
 BIOL 599 Senior Seminar in Current Progress in Microbiology (must be taken in senior year) ..... 1

# Biology Undergraduate Program

One of the following two courses: ..... 3-4  
 BIOL 516 Microbial Physiology (3)  
 BIOL 600 Introductory Biochemistry, Lectures (4)

**General Science Requirements** (37-38 hours)  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 405 Laboratory in Genetics ..... 2  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 622 Fundamentals of Organic Chemistry (3) **or**  
 CHEM 624 Organic Chemistry I (3) ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 MATH 115 Calculus I (3) and MATH 116 Calculus II (3) **or**  
 MATH 121 Calculus I (5) ..... 5-6  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
 PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8

**Note:** Students planning graduate study should complete a year of organic chemistry (CHEM 624, CHEM 625, CHEM 626, CHEM 627) and a year of biochemistry (BIOL 636, BIOL 637, BIOL 638).

**Microbiology Electives and Laboratory Requirements** (15 hours)  
 Fifteen hours including three laboratory courses, selected from: ..... 15  
 BIOL 503 Immunology (3)  
 BIOL 504 Immunology Laboratory (2)  
 BIOL 506 Pathogenic Microbiology (3)  
 BIOL 507 Pathogenic Microbiology Laboratory (2)  
 BIOL 512 General Virology (3)  
 BIOL 513 Virology Laboratory (1)  
 BIOL 517 Microbial Physiology Laboratory (2)  
 BIOL 518 Microbial Genetics (3)  
 BIOL 519 Microbial Genetics Laboratory (2)

**Elective Requirements** (3 hours). Biology courses numbered 400 or higher selected in consultation with a microbiology adviser. A course listed above that has not been used to fulfill requirements or BIOL 423 may be used as an elective. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study can be applied toward the elective requirement.

**Requirements for the B.S. Microbiology Major.** College requirements are described under Majors in this section.

**Microbiology Requirements** (29 hours)  
 BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) ..... 3  
 BIOL 402 Fundamentals of Microbiology Laboratory ..... 2  
 BIOL 416 Cell Structure and Function ..... 3  
 BIOL 503 Immunology ..... 3  
 BIOL 504 Immunology Laboratory ..... 2  
 BIOL 506 Pathogenic Microbiology ..... 3  
 BIOL 507 Pathogenic Microbiology Laboratory ..... 2  
 BIOL 512 General Virology ..... 3  
 BIOL 513 Virology Laboratory ..... 2  
 BIOL 518 Microbial Genetics ..... 3  
 BIOL 519 Microbial Genetics Laboratory ..... 2  
 BIOL 599 Senior Seminar in Current Progress in Microbiology  
 (must be taken in senior year) ..... 1

**General Science Requirements** (49-50 hours)  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 350 Principles of Genetics ..... 3  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 624 Organic Chemistry I ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 CHEM 626 Organic Chemistry II ..... 3  
 CHEM 627 Organic Chemistry II Laboratory ..... 2  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
 PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8  
 MATH 121 Calculus I (5) **or**  
 MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 BIOL 570 Introduction to Biostatistics (3) **or**  
 MATH 365 Elementary Statistics (3) **or**  
 PSYC 300 Statistics in Psychological Research (3) ..... 3  
 BIOL 636 and BIOL 638 Biochemistry I and II ..... 6

**Elective Requirements** (6 hours). A minimum of 6 hours of biology courses numbered above 400. No more than 3 hours of BIOL 423 Nonlaboratory Independent Study or BIOL 424 Independent Study combined can be applied toward the elective requirement.

## Molecular Biosciences

**Requirements for the B.S. Molecular Biosciences Major (KU Edwards Campus).** General College Requirements are described under Majors in this section.

**Molecular Biosciences Requirements** (29 hours)  
 BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology .. 4  
 BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology ..... 4  
 BIOL 350 Principles of Genetics ..... 3  
 BIOL 400 Fundamentals of Microbiology (or BIOL 401 Honors) ..... 3  
 BIOL 402 Fundamentals of Microbiology Laboratory ..... 2  
 BIOL 405 Laboratory in Genetics ..... 2  
 BIOL 416 Cell Structure and Function ..... 3  
 BIOL 430 Laboratory in Molecular Biology ..... 3

BIOL 599 Senior Seminar in Molecular Biosciences  
 (must be taken in senior year) ..... 1  
 BIOL 600 Introductory Biochemistry, Lectures ..... 4

**General Science Requirements** (36-37 hours minimum)  
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II ..... 10  
 CHEM 624 Organic Chemistry I ..... 3  
 CHEM 625 Organic Chemistry I Laboratory ..... 2  
 CHEM 626 Organic Chemistry II ..... 3  
 CHEM 627 Organic Chemistry II Laboratory ..... 2  
 PHSX 114 and PHSX 115 College Physics I and II (8) **or**  
 PHSX 211 and PHSX 212 General Physics I and II (8) ..... 8  
 MATH 121 Calculus I (5) **or**  
 MATH 115 Calculus I (3) and MATH 116 Calculus II (3) ..... 5-6  
 BIOL 570 Introduction to Biostatistics (3) **or** MATH 365 Elementary Statistics (3)  
**or** PSYC 300 Statistics in Psychological Research (3) ..... 3

**Elective Requirements** (11 hours). Biology courses numbered 400 or higher, including 2 hours of laboratory credit and 2 hours of a seminar/topics course (BIOL 419, BIOL 420, BIOL 701). No more than 3 hours of BIOL 423 Nonlaboratory Independent Study and/or BIOL 424 Independent Study (combined) can be applied toward the elective requirement.

## Double Majors

Students may earn degrees in a biological science and an area outside biology by meeting the requirements of both degree programs and taking at least 15 hours of courses unique to each major.

## Student Organizations

Biology clubs such as Tri-Beta allow students to interact with faculty and students while expanding their interest in biology. The biology majors advisory committee—part of the KU biology club—advises the KUUB director on all undergraduate issues and provides a forum for concerns and suggestions. For further information, visit [www.kuub.ku.edu](http://www.kuub.ku.edu).

## Undergraduate Research Opportunities

The Undergraduate Biology Program encourages independent study and participation in faculty research programs. Consult an adviser or the KUUB Web site, [www.kuub.ku.edu](http://www.kuub.ku.edu), to find a faculty sponsor for research or independent study. After receiving permission, the student may enroll in that faculty member's section of BIOL 424 Independent Study for the number of hours specified by the faculty member. Three independent study hours can be applied to elective requirements in the major. Independent study is required for graduation with departmental honors. By special arrangement with a faculty member, students may earn independent study credit by participating in research programs offered by other units (e.g., faculty members in the School of Medicine or the Program in Experimental and Applied Ecology).

## Honors

Majors are eligible to graduate with honors in biology if they fulfill the following requirements:

1. Complete all course work required for the appropriate degree in biology.
2. Achieve a minimum grade-point average of 3.25 overall and 3.5 in the major.
3. Complete BIOL 419 Topics in: Advanced Biology Seminar with a grade of B or higher. (Exception: B.A. or B.S. microbiology students must complete one semester of BIOL 599 Senior Seminar in Current Progress in Microbiology with a grade of B or higher.)
4. Complete BIOL 699 Divisional Honors Research Colloquium with a grade of B or higher. (B.A. and B.S. majors in biochemistry may substitute BIOL 599 Senior Seminar in Biochemistry for BIOL 699.)
5. Complete an independent research project under the supervision of a faculty member in an area appropriate to the degree sought.
6. Submit an honors thesis to the honors committee once the research is complete and present the results of the completed research at the honors research symposium.

Specific guidelines and intent forms are available in the Undergraduate Biology Program office and online at [www.kuub.ku.edu](http://www.kuub.ku.edu). Candidates must declare their intent to graduate with honors at least two semesters before graduation.

## Study Abroad

Consult an adviser at least four months before undertaking study abroad. Consult the Office of Study Abroad, 108 Lippincott Hall, for information about study in one of the many countries (e.g., Scotland, Australia, Switzerland) with special arrangements with KU.

## Advising and Career Counseling

Advising information is available online at [www.kuub.ku.edu](http://www.kuub.ku.edu).

Students are encouraged to consult a faculty member as soon as possible to discuss degree options and course choices. Opportunities for independent study, research, field experience, student hourly employment, undergraduate teaching assistantships, and participation in student organizations are available. Students may consult faculty members in their areas of interest or contact the individuals listed here:

Val Smith, interim director, 2045 Haworth Hall, (785) 864-5883, [vsmith@ku.edu](mailto:vsmith@ku.edu)  
 Greg Burg, assistant director, advising coordinator, 2045 Haworth Hall, (785) 864-4143, [gburg@ku.edu](mailto:gburg@ku.edu)  
 Jan Elder, administrative assistant, 2045 Haworth Hall, (785) 864-5883, [jelder@ku.edu](mailto:jelder@ku.edu)  
 Dan W. Mueller, academic adviser, CLAS undergraduate services, 111A RC, Edwards Campus (B.S. in Molecular Biosciences degree), (913) 897-8659, [dmueller@ku.edu](mailto:dmueller@ku.edu)

Undergraduate Biology Program staff can direct students to faculty members. Brochures and information about curricula, careers, and opportunities in the biological and health-related sciences are available in the KUUB office, 2045 Haworth, or the Biology Teaching Resource Center, 1004 Haworth. See the career resource Web site, [www.kuub.ku.edu/jobs Careers](http://www.kuub.ku.edu/jobs Careers), for help with career choices and job searches.

## Biology Courses by Topics

### Anatomy and Histology

BIOL 240 Fundamentals of Human Anatomy  
 BIOL 241 Human Anatomy Observation Laboratory  
 BIOL 242 Human Anatomy Dissection Laboratory  
 BIOL 440 Advanced Human Anatomy  
 BIOL 510 Comparative Anatomy  
 BIOL 560 Histology  
 BIOL 608 Developmental Plant Anatomy  
 BIOL 676 Mammalian Neuroanatomy

### Animal Behavior

BIOL 505 Social Insects  
 BIOL 625 Behavioral Ecology & Sociobiology  
 BIOL 652 Comparative Animal Behavior  
 BIOL 654 Comparative Animal Behavior, Laboratory  
 BIOL 717 Insect Ecology & Behavior

### Biochemistry

BIOL 430 Laboratory in Molecular Biology  
 BIOL 600 Introductory Biochemistry, Lectures  
 BIOL 636 Biochemistry I  
 BIOL 637 Introductory Biochemistry Laboratory  
 BIOL 638 Biochemistry II  
 BIOL 639 Advanced Biochemistry Laboratory  
 BIOL 672 Gene Expression  
 BIOL 688 The Molecular Biology of Cancer  
 BIOL 718 Laboratory in Molecular Biology  
 BIOL 756 Cell & Tissue Culture Laboratory  
 BIOL 768 Plant Molecular Biology  
 BIOL 770 Plant Biochemistry  
 BIOL 775 Chemistry of the Nervous System

### Botany

BIOL 533 Biology of Fungi  
 BIOL 555 General Plant Physiology  
 BIOL 602 Plant Ecology  
 BIOL 603 Systematic Botany  
 BIOL 606 Ecological Plant Physiology  
 BIOL 607 Field & Laboratory Exercises in Plant Ecology  
 BIOL 608 Developmental Plant Anatomy  
 BIOL 610 Plant Kingdom  
 BIOL 767 The Vegetation of the Earth  
 BIOL 768 Plant Molecular Biology  
 BIOL 770 Plant Biochemistry

### Cellular Biology

BIOL 200 Basic Microbiology  
 BIOL 203 Introductory Microbiology Laboratory

BIOL 400 Fundamentals of Microbiology  
 BIOL 401 Fundamentals of Microbiology, Honors  
 BIOL 402 Fundamentals of Microbiology Laboratory  
 BIOL 416 Cell Structure & Function  
 BIOL 417 Biology of Development  
 BIOL 426 Laboratory in Cell Biology  
 BIOL 503 Immunology  
 BIOL 504 Immunology Laboratory  
 BIOL 536 Cell Structure & Function (Honors)  
 BIOL 688 The Molecular Biology of Cancer  
 BIOL 755 Mechanisms of Development  
 BIOL 756 Cell & Tissue Culture Laboratory

### Developmental Biology

BIOL 417 Biology of Development  
 BIOL 427 Developmental Biology Laboratory  
 BIOL 545 Evolution of Development  
 BIOL 688 The Molecular Biology of Cancer  
 BIOL 692 Developmental Genetics  
 BIOL 710 Insect Development  
 BIOL 755 Mechanisms of Development

### Diversity

BIOL 203 Introductory Microbiology Laboratory  
 BIOL 215 Evolution and Diversity in Shaping Our World  
 BIOL 400 Fundamentals of Microbiology  
 BIOL 401 Fundamentals of Microbiology, Honors  
 BIOL 413 History & Diversity of Organisms  
 BIOL 493 Introduction to Ornithology  
 BIOL 494 Introduction to Mammalogy  
 BIOL 500 Biology of Insects  
 BIOL 510 Comparative Anatomy  
 BIOL 533 Biology of Fungi  
 BIOL 540 General Invertebrate Zoology  
 BIOL 550 Introduction to Systematics  
 BIOL 583 Herpetology  
 BIOL 592 Ichthyology  
 BIOL 603 Systematic Botany  
 BIOL 610 Plant Kingdom  
 BIOL 711 Insect Systematics  
 BIOL 792 Ichthyology  
 BIOL 793 Ornithology  
 BIOL 794 Mammalogy  
 BIOL 795 Biology of Amphibians  
 BIOL 796 Biology of Reptiles

### Ecology

BIOL 414 Principles of Ecology  
 BIOL 415 Field & Laboratory Methods in Ecology  
 BIOL 514 Principles of Ecology (Honors)  
 BIOL 602 Plant Ecology  
 BIOL 606 Ecological Plant Physiology  
 BIOL 607 Field & Laboratory Exercises in Plant Ecology  
 BIOL 620 Physiological Ecology  
 BIOL 625 Behavioral Ecology & Sociobiology  
 BIOL 660 Lake Ecology  
 BIOL 661 Stream Ecology  
 BIOL 662 Aquatic Ecology Laboratory  
 BIOL 667 Chemical Communication in Sex, Feeding, & Fighting  
 BIOL 668 Evolutionary Ecology  
 BIOL 717 Insect Ecology & Behavior  
 BIOL 745 Laboratory in Experimental Ecology  
 BIOL 751 Plant Communities of North America  
 BIOL 782 Principles of Biogeography  
 BIOL 786 Fundamentals of Tropical Biology

### Entomology

BIOL 120 Insects in Your World  
 BIOL 500 Biology of Insects  
 BIOL 502 Laboratory in Insect Biology & Diversity  
 BIOL 505 Social Insects  
 BIOL 509 Biology of Spiders  
 BIOL 525 Aquatic Entomology  
 BIOL 613 Biology of Honeybees  
 BIOL 616 Medical Entomology  
 BIOL 708 External Morphology of Insects  
 BIOL 709 Immature Insects  
 BIOL 710 Insect Development

**To find a biology faculty sponsor for research or independent study, consult a faculty adviser at the KUUB office in 2045 Haworth Hall or the Web site, [www.kuub.ku.edu](http://www.kuub.ku.edu).**

**For information about the KU Edwards Campus, 12600 Quivira Rd., Overland Park, KS 66213-2402, call (from Lawrence): 864-8400 or (913) 897-8400, <http://edwardscampus.ku.edu>.**



BIOL 711 Insect Systematics  
 BIOL 716 Insect Physiology & Internal Morphology  
 BIOL 717 Insect Ecology & Behavior

### Evolution

BIOL 116 Introduction to Evolutionary Biology  
 BIOL 215 Evolution and Diversity in Shaping Our World  
 BIOL 412 Evolutionary Biology  
 BIOL 545 Evolution of Development  
 BIOL 611 Molecular Systematics & Evolution  
 BIOL 743 Population Genetics  
 BIOL 746 Principles of Systematics

### Field Courses

BIOL 415 Field & Laboratory Methods in Ecology  
 BIOL 607 Field & Laboratory Exercises in Plant Ecology  
 BIOL 797 Field Course in Vertebrate Paleontology

### General Biology

BIOL 100 Principles of Biology  
 BIOL 101 Principles of Biology, Honors  
 BIOL 102 Principles of Biology Laboratory  
 BIOL 103 Principles of Biology Laboratory, Honors  
 BIOL 120 Insects in Your World  
 BIOL 150 Principles of Molecular & Cellular Biology  
 BIOL 151 Principles of Molecular & Cellular Biology, Honors  
 BIOL 152 Principles of Organismal Biology  
 BIOL 153 Principles of Organismal Biology, Honors  
 BIOL 350 Principles of Genetics  
 BIOL 352 Heredity & Society  
 BIOL 408 Physiology of Organisms  
 BIOL 409 Physiology of Organisms, Laboratory  
 BIOL 412 Evolutionary Biology  
 BIOL 413 History & Diversity of Organisms  
 BIOL 414 Principles of Ecology  
 BIOL 416 Cell Structure & Function  
 BIOL 417 Biology of Development  
 BIOL 418 Laboratory in: \_\_\_\_\_  
 BIOL 419 Topics in: Advanced Biology  
 BIOL 420 Seminar: \_\_\_\_\_  
 BIOL 423 Nonlaboratory Independent Study  
 BIOL 424 Independent Study  
 BIOL 450 Cancer Biology  
 BIOL 460 Plants & Humans  
 BIOL 533 Biology of Fungi  
 BIOL 595 Human Genetics  
 BIOL 599 Senior Seminar: \_\_\_\_\_  
 BIOL 630 Conservation & Wildlife Biology  
 BIOL 694 The Art of Becoming a Professional Scientist  
 BIOL 701 Topics in: \_\_\_\_\_

### Genetics

BIOL 350 Principles of Genetics  
 BIOL 352 Heredity & Society  
 BIOL 405 Laboratory in Genetics  
 BIOL 430 Laboratory in Molecular Biology  
 BIOL 512 General Virology  
 BIOL 518 Microbial Genetics  
 BIOL 519 Microbial Genetics Laboratory  
 BIOL 595 Human Genetics  
 BIOL 611 Molecular Systematics & Evolution  
 BIOL 672 Gene Expression  
 BIOL 688 The Molecular Biology of Cancer  
 BIOL 692 Developmental Genetics  
 BIOL 718 Laboratory in Molecular Biology  
 BIOL 721 Microbial Genetics  
 BIOL 743 Population Genetics

BIOL 747 Quantitative Genetics  
 BIOL 755 Mechanisms of Development  
 BIOL 768 Plant Molecular Biology  
 Courses from outside biology that count toward degrees in genetics include  
 ANTH 340 Human Variation & Evolution  
 ANTH 442 Anthropological Genetics  
 ANTH 652 Population Dynamics

### Invertebrate Biology

BIOL 540 General Invertebrate Zoology  
 BIOL 622 Paleontology

### Methods

BIOL 210 Introduction to Clinical Laboratory Sciences  
 BIOL 561 Histological Technique  
 BIOL 570 Introduction to Biostatistics  
 BIOL 571 Introduction to Biostatistics Laboratory  
 BIOL 670 Natural History Museum Techniques  
 BIOL 694 The Art of Becoming a Professional Scientist  
 BIOL 702 Laboratory Practice: Radiation Safety Procedures  
 BIOL 703 Radioisotopes & Radiation Safety in Research  
 BIOL 704 Research Animal Methods  
 BIOL 720 Scientific Illustration  
 BIOL 785 Museum Management  
 BIOL 798 Principles & Practices of Museum Collection Management

### Microbiology

BIOL 110 Microorganisms in Your World  
 BIOL 200 Basic Microbiology  
 BIOL 203 Introductory Microbiology Laboratory  
 BIOL 210 Introduction to Clinical Laboratory Sciences  
 BIOL 400 Fundamentals of Microbiology  
 BIOL 401 Fundamentals of Microbiology, Honors  
 BIOL 402 Fundamentals of Microbiology Laboratory  
 BIOL 503 Immunology  
 BIOL 504 Immunology Laboratory  
 BIOL 506 Pathogenic Microbiology  
 BIOL 507 Pathogenic Microbiology Laboratory  
 BIOL 512 General Virology  
 BIOL 513 Virology Laboratory  
 BIOL 516 Microbial Physiology  
 BIOL 517 Microbial Physiology Laboratory  
 BIOL 518 Microbial Genetics  
 BIOL 519 Microbial Genetics Laboratory  
 BIOL 721 Microbial Genetics

### Organismal Biology

BIOL 120 Insects in Your World  
 BIOL 240 Fundamentals of Human Anatomy  
 BIOL 241 Human Anatomy Observation Laboratory  
 BIOL 242 Human Anatomy Dissection Laboratory  
 BIOL 408 Physiology of Organisms  
 BIOL 412 Evolutionary Biology  
 BIOL 413 History & Diversity of Organisms  
 BIOL 440 Advanced Human Anatomy  
 BIOL 493 Introduction to Ornithology  
 BIOL 494 Introduction to Mammalogy  
 BIOL 500 Biology of Insects  
 BIOL 502 Laboratory in Insect Biology & Diversity  
 BIOL 505 Social Insects  
 BIOL 509 Biology of Spiders  
 BIOL 510 Comparative Anatomy  
 BIOL 511 Biology of Spiders Laboratory  
 BIOL 525 Aquatic Entomology  
 BIOL 533 Biology of Fungi  
 BIOL 540 General Invertebrate Zoology  
 BIOL 550 Introduction to Systematics  
 BIOL 583 Herpetology  
 BIOL 592 Ichthyology  
 BIOL 603 Systematic Botany  
 BIOL 608 Developmental Plant Anatomy  
 BIOL 610 Plant Kingdom  
 BIOL 613 Biology of Honeybees  
 BIOL 616 Medical Entomology  
 BIOL 622 Paleontology  
 BIOL 630 Conservation & Wildlife Biology  
 BIOL 644 Comparative Animal Physiology  
 BIOL 646 Mammalian Physiology  
 BIOL 647 Mammalian Physiology Laboratory  
 BIOL 652 Comparative Animal Behavior  
 BIOL 654 Comparative Animal Behavior, Laboratory  
 BIOL 660 Lake Ecology  
 BIOL 662 Aquatic Ecology Laboratory  
 BIOL 669 Biology of Freshwater Invertebrates  
 BIOL 676 Mammalian Neuroanatomy  
 BIOL 708 External Morphology of Insects  
 BIOL 709 Immature Insects  
 BIOL 710 Insect Development  
 BIOL 711 Insect Systematics  
 BIOL 716 Insect Physiology & Internal Morphology  
 BIOL 746 Principles of Systematics

BIOL 751 Plant Communities of North America  
 BIOL 780 Fisheries  
 BIOL 781 Fisheries, Laboratory  
 BIOL 786 Fundamentals of Tropical Biology  
 BIOL 789 Field Course in Entomology  
 BIOL 790 Paleontology of Lower Vertebrates  
 BIOL 791 Paleontology of Higher Vertebrates  
 BIOL 792 Ichthyology  
 BIOL 793 Ornithology  
 BIOL 794 Mammalogy  
 BIOL 795 Biology of Amphibians  
 BIOL 796 Biology of Reptiles  
 BIOL 797 Field Course in Vertebrate Paleontology

**Physiology**

BIOL 246 Principles of Human Physiology  
 BIOL 247 Principles of Human Physiology Laboratory  
 BIOL 408 Physiology of Organisms  
 BIOL 409 Physiology of Organisms, Laboratory  
 BIOL 435 Introduction to Neurobiology  
 BIOL 516 Microbial Physiology  
 BIOL 517 Microbial Physiology Laboratory  
 BIOL 555 General Plant Physiology  
 BIOL 560 Histology  
 BIOL 606 Ecological Plant Physiology  
 BIOL 620 Physiological Ecology  
 BIOL 644 Comparative Animal Physiology  
 BIOL 646 Mammalian Physiology  
 BIOL 647 Mammalian Physiology Laboratory  
 BIOL 650 Advanced Neurobiology  
 BIOL 673 Cellular & Molecular Neurobiology  
 BIOL 716 Insect Physiology & Internal Morphology  
 BIOL 775 Chemistry of the Nervous System  
 BIOL 777 Integrative & Developmental Neurobiology

**Population Biology**

BIOL 742 Plant Population Biology  
 BIOL 743 Population Genetics

**Special Topics**

BIOL 419 Topics in: \_\_\_\_\_  
 BIOL 425 Teaching Apprenticeship in Biology  
 BIOL 560 Histology  
 BIOL 694 The Art of Becoming a Professional Scientist  
 BIOL 701 Topics in: \_\_\_\_\_  
 BIOL 799 Natural History Museum Apprenticeship

**Systematics**

BIOL 550 Introduction to Systematics  
 BIOL 603 Systematic Botany  
 BIOL 611 Molecular Systematics & Evolution  
 BIOL 711 Insect Systematics  
 BIOL 746 Principles of Systematics  
 BIOL 782 Principles of Biogeography

**Vertebrate Biology**

BIOL 493 Introduction to Ornithology  
 BIOL 494 Introduction to Mammalogy  
 BIOL 583 Herpetology  
 BIOL 592 Ichthyology  
 BIOL 630 Conservation & Wildlife Biology  
 BIOL 704 Research Animal Methods  
 BIOL 780 Fisheries  
 BIOL 781 Fisheries, Laboratory  
 BIOL 782 Principles of Biogeography  
 BIOL 790 Paleontology of Lower Vertebrates  
 BIOL 791 Paleontology of Higher Vertebrates  
 BIOL 792 Ichthyology  
 BIOL 793 Ornithology  
 BIOL 794 Mammalogy  
 BIOL 795 Biology of Amphibians  
 BIOL 796 Biology of Reptiles  
 BIOL 797 Field Course in Vertebrate Paleontology

**Related Biology Courses.** A biological course from departments outside the Undergraduate Biology Program may count toward a B.A. degree (up to 4 hours of credit). Check with a biology faculty adviser to determine whether nonbiology courses are acceptable to satisfy biology degree requirements.

**Bioinformatics Courses**

**BINF 701 Bioinformatics I** (5).  
**BINF 702 Bioinformatics II** (5).  
**BINF 709 Topics in:** \_\_\_\_\_ (1-3).

**Biology Courses**

**BIOL 100 Principles of Biology** (3). NB N Intended for non-science majors. The basic concepts of biology at the cellular, organismal, and population levels of organization and their applications to humans and modern society. An honors section, BIOL 101, is offered for students with superior academic records. BIOL 100 and BIOL 102 (or BIOL 101 and BIOL 103, honors) satisfy the College natural science with laboratory requirement. Concurrent enrollment in BIOL 102 is recommended. LEC

**BIOL 101 Principles of Biology, Honors** (3). NB N Intended for non-science majors with superior academic records. The basic concepts of biology at the cellular, organismal, and population levels of organization and their applications to humans and modern society. Concurrent enrollment in BIOL 103 is recommended. BIOL 101 and BIOL 103 satisfy the College natural science with laboratory requirement. Prerequisite: Membership in the College Honors Program or consent of instructor. LEC

**BIOL 102 Principles of Biology Laboratory** (1). N Intended for non-science majors. Exercises are designed to give the student hands-on experience with selected topics from the associated lecture course (BIOL 100). An honors laboratory (BIOL 103) is offered for students with superior academic records. Prerequisite: Concurrent enrollment in BIOL 100 is recommended. LAB

**BIOL 103 Principles of Biology Laboratory, Honors** (1). N Intended for non-science majors with superior academic records. Exercises are designed to give the students hands-on experience with selected topics from the associated lecture course (BIOL 101). Prerequisite: Membership in the College Honors Program or consent of instructor. Concurrent enrollment in BIOL 101 is recommended. LAB

**BIOL 110 Microorganisms in Your World** (3). NB N A course for students who are not science majors. Designed to acquaint students with some microbial activities which affect their lives. Includes the historical development of microbiology, the basic principles of microbial growth, disinfection, antibiotics, infection, and immunity; and some commercial, agricultural, and industrial uses of microorganisms. Emphasis is on infectious diseases. Not open to students with any credit in microbiology. May not be counted as a prerequisite for any other microbiology course. LEC

**BIOL 116 Introduction to Evolutionary Biology** (3). N An account of evolutionary thinking from classical to contemporary time. The emphasis is on mainstream developments (Darwinism, Mendelism, the Modern Synthesis, Cultural Ecology), but certain social issues will be examined (social Darwinism, creationism). LEC

**BIOL 120 Insects in Your World** (3). NB N Students will learn about the global impact of insects on human concerns, both positive (pollination and decomposition) and negative (competition with humans for food, fiber, and shelter, and disease transmission) while developing an appreciation for the ways in which scientists work with real problems involving insects. The course will cover the overwhelming abundance and diversity of insects, and their life history, ecology, behavior, and physiology. This course is intended for both nonbiology and biology majors. Format: two lectures and one discussion section per week. LEC

**BIOL 150 Principles of Molecular and Cellular Biology** (4). NB N An integrated lecture and laboratory course for biology majors and students planning to take additional courses in biology. This course covers basic biochemistry, cell structure and function, molecular biology, genetics, physiology, and development of plants and animals. Three hours of lecture and two hours of laboratory per week. An honors section (BIOL 151) is offered for students with superior academic records. Concurrent or prior enrollment in CHEM 184 is recommended. LEC

**BIOL 151 Principles of Molecular and Cellular Biology, Honors** (4). NB N An integrated lecture and laboratory course for students with superior academic records who are biology majors or who plan to take additional courses in biology. This course covers basic biochemistry, cell structure and function, molecular biology, genetics, physiology, and development of plants and animals. Three hours of lecture and two hours of laboratory per week. Concurrent or prior enrollment in CHEM 184 is recommended. Prerequisite: Membership in the University Honors Program or permission of instructor. LEC

**BIOL 152 Principles of Organismal Biology** (4). NB N An integrated lecture and laboratory course for biology majors and students who plan to take additional courses in biology. This course covers basic elements of plant and animal morphology and physiology, principles of evolution, organismal diversity and phylogeny, population biology, population genetics, ecology, and behavior. Three hours of lecture and two hours of laboratory per week. An honors section (BIOL 153) is offered for students with superior academic records. Prerequisite: BIOL 150 or BIOL 151. LEC

**BIOL 153 Principles of Organismal Biology, Honors** (4). NB N An integrated lecture and laboratory course for students with superior academic records who are biology majors or planning to take additional courses in biology. This course covers basic elements of plant and animal morphology and physiology, principles of evolution, organismal diversity

**“Memo to out-of-staters: Lawrence is not flat as a pancake and does not resemble Dorothy’s home in *The Wizard of Oz*. The University of Kansas has a gorgeous campus and is one of the premier college bargains in the United States.” —2008 Fiske Guide to Colleges**

**Special opportunities for undergraduate research in biology are available.**

## Biology Undergraduate Program

and phylogeny, population biology, population genetics, ecology, and behavior. Three hours of lecture and two hours of laboratory per week. Prerequisite: BIOL 150 or BIOL 151 and membership in the University Honors Program or consent of instructor. LEC

**BIOL 200 Basic Microbiology (3).** NB N Introduction to bacteria and viruses. Topics include historical development of microbiology, bacterial structure and growth, enzymes and energy production, disinfection, antibacterial drugs, gene transfer, viral replication, infection and immunity, with emphasis on infectious diseases. Can be substituted for BIOL 201 as a prerequisite for other microbiology courses by consent of department. Not open to those with credit in BIOL 110, BIOL 201, BIOL 400, or BIOL 401. Prerequisite: A course in high school biology and a course in high school chemistry. This course is not recommended for first semester freshmen. LEC

**BIOL 203 Introductory Microbiology Laboratory (2).** U Laboratory exercises to complement BIOL 200. Prerequisite: BIOL 200. May be taken concurrently. LAB

**BIOL 210 Introduction to Clinical Laboratory Sciences (1).** U An introductory overview of medical technology as a profession including types of analyses performed, specialties, interrelationships in the health care system and a visit to a clinical laboratory. This course will enable those considering a major in medical technology to have a clear definition of the profession. This course does not meet any degree requirements in biology. No prerequisite. (Same as CLS 210.) LEC

**BIOL 215 Evolution and Diversity in Shaping Our World (3).** NB N A principal course designed to examine the interaction of organisms and their physical environment — past, present, and future, focusing on the historical development of the biosphere and social implications of future changes. Not open to students with credit in GEOL 121. Two 1-hour lectures and one 1-hour discussion per week. LEC

**BIOL 240 Fundamentals of Human Anatomy (3).** N Introduction to the gross anatomy of the human body. Covers the spatial arrangement and appearance of structures throughout the body, including visual identification of these structures. Musculoskeletal relationships, and the anatomy of major organ systems, are emphasized. Not intended for biology majors. Prerequisite: BIOL 100, or equivalent. LEC

**BIOL 241 Human Anatomy Observation Laboratory (2).** U One of the two laboratories in gross anatomy designed to complement BIOL 240. Emphasizes the three-dimensional appearance and spatial relationships of anatomical structures through supervised observations of pre-dissected human cadavers. Limited to students enrolled in, or seeking admission to, programs that require a human anatomy observation laboratory. Concurrent or prior enrollment in BIOL 240 is required. LAB

**BIOL 242 Human Anatomy Dissection Laboratory (3).** N One of the two laboratories in gross anatomy designed to complement BIOL 240. Provides an opportunity to develop a comprehensive three-dimensional understanding of anatomical structures and spatial relationships while gaining substantial dissecting experience. Student perform supervised dissection of human cadavers. Limited to students enrolled in, or seeking admission to, programs that require a human anatomy laboratory. Concurrent or prior enrollment in BIOL 240 is required. LAB

**BIOL 246 Principles of Human Physiology (3).** N An introduction to the physiological and biochemical processes and general physiological principles necessary to sustain life. Organ and organ system processes are emphasized. Intended for students majoring in allied health or sports related curricula who require a course in human physiology. Not intended for biology majors. Prerequisite: BIOL 100 or equivalent. LEC

**BIOL 247 Principles of Human Physiology Laboratory (2).** U Designed to complement BIOL 246. Uses experiments and simulations to demonstrate laboratory techniques and representative processes in areas of human physiology. Concurrent or prior enrollment in BIOL 246 required. LAB

**BIOL 307 Special Problems in Microbiology (1-10).** N Students may elect a problem from the following fields: (a) general microbiology; (b) immunology, (c) virology, (d) pathogenic microbiology, (e) microbial biochemistry, (f) microbial genetics, (g) microbial ultrastructure. Prerequisite: Five or more hours of microbiology and at the discretion of the department. IND

**BIOL 308 Special Problems in Microbiology, Honors (1-10).** N Honors section of BIOL 307. Prerequisite: Five or more hours of microbiology and at the discretion of the department. IND

**BIOL 311 Undergraduate Research Seminar in Microbiology (1).** U For juniors and seniors majoring in microbiology who are enrolled in special problems in microbiology. Students will present their on-going research for discussion and critique. Technique of date presentation including graph constructions, statistical analysis, preparation of slides, and data discussion. Required of students enrolled in the microbiology departmental Honors Program. One meeting per week. Prerequisite: BIOL 307 or BIOL 308 or may be taken concurrently, or consent of instructor. LEC

**BIOL 350 Principles of Genetics (3).** N Why are related individuals more similar than unrelated individuals and what is the basis for heritable traits? From Mendel's discoveries of the patterns of genetic inheritance, to the study of transmissible hereditary factors, genetics is central to understanding the biological sciences. Topics include molecular genetics and genetic engineering; Mendelian genetics and mapping; control of gene expression; cytogenetics; epigenetics and non-Mendelian genetics; and population and

quantitative genetics. Examples are taken from a wide variety of organisms, including viruses, bacteria, plants, fungi, insects, and humans. Prerequisite: Two semesters of college-level chemistry and BIOL 150 or BIOL 152; or consent of the instructor. LEC

**BIOL 352 Heredity and Society (3).** N A general course dealing in genetics and its social and political implications with special reference to human genetics; Mendelian genetics, population genetics, medical genetics, chemical basis of heredity. Not open to students who have credit for BIOL 404. Does not meet requirements for a major in biology. Prerequisite: BIOL 100, BIOL 101, BIOL 150, or BIOL 151. LEC

**BIOL 400 Fundamentals of Microbiology (3).** NB N Fundamental principles of microbiology with emphasis on physical and chemical properties of the bacterial cell; microbial metabolism, cultivation, growth and death of bacteria; microbial genetics, pathogenesis and immunity, industrially important microorganisms. Prerequisite: BIOL 150 or BIOL 151 and two semesters of college chemistry, or consent of the instructor. LEC

**BIOL 401 Fundamentals of Microbiology, Honors (3).** N Honors section of BIOL 400 and BIOL 612, by application and invitation. Prerequisite: BIOL 151, two semesters of college chemistry, and membership in the University Honors Program, or consent of the instructor. LEC

**BIOL 402 Fundamentals of Microbiology Laboratory (2).** N Laboratory exercises designed to complement BIOL 400 or BIOL 700. Prerequisite: BIOL 400 or BIOL 612, or BIOL 400 or BIOL 612 concurrently. LAB

**BIOL 405 Laboratory in Genetics (2).** U A laboratory program which includes written reports on fruit fly crosses, exercises on meiosis, probability and statistics, human genetics and computer simulations of genetics problems. Prerequisite: Concurrent or prior (preferred) enrollment in BIOL 350 or its equivalent. LAB

**BIOL 408 Physiology of Organisms (3).** N A comprehensive and integrative approach to the study of organisms with an emphasis on physiological, ecological, structural, and behavioral adaptations to differing environments. Prerequisite: BIOL 152, or BIOL 153, and CHEM 184, or consent of the instructor. LEC

**BIOL 409 Physiology of Organisms, Laboratory (2).** U The laboratory exposes the students to the structure and function of the major groups of animals and plants. Students use basic techniques of biological observation, such as microscopy and dissection, and experimental techniques to analyze plant and animal function. Prerequisite: Concurrent or prior enrollment in BIOL 408, or consent of the instructor. LAB

**BIOL 410 Human Biogeography, Honors (3).** N Principles of evolution and earth change are used to examine distributions of human populations, wealth, and resources. Readings from the current literature will be included. Lecture and discussion. (Same as GEOG 410.) Prerequisite: BIOL 152 or BIOL 153 or GEOG 107 and membership in the University Honors Program or consent of instructor. LEC

**BIOL 412 Evolutionary Biology (3).** N Introduction to the patterns and processes of organic evolution. Considered are the history of evolutionary thought, molecular evolution, genetics and microevolution, selection and adaptation, and speciation and macroevolution. Emphasis will be placed on how scientists study and document change over time in natural populations, methods for testing hypotheses about events in evolutionary history, and how discovering evolutionary mechanisms at one level of organization can help to explicate general processes in the natural world. Prerequisite: BIOL 152 and BIOL 350, or consent of the instructor. LEC

**BIOL 413 History and Diversity of Organisms (3).** N An integrated lecture and laboratory course presenting an overview of the variety and ancestry of life on earth. Using representatives from prokaryotes, protists, plants, fungi, and animals, principles of phylogenetic reconstruction are illustrated and evolutionary trends in the life history features, functional morphology, and structural complexity of extant and extinct organisms are presented. Two hours of lecture and three hours of laboratory per week. Prerequisite: BIOL 152 or BIOL 153, or consent of the instructor. LEC

**BIOL 414 Principles of Ecology (3).** N Study of the principles underlying species population density changes, community structure and dynamics, biogeochemical cycles, and energy flow and nutrient cycling in ecosystems. Prerequisite: BIOL 152 or BIOL 153, or consent of the instructor. LEC

**BIOL 415 Field and Laboratory Methods in Ecology (2).** N This course complements BIOL 414 with field trips and laboratory exercises that illustrate the basic concepts of ecology. Topics covered include methodologies for quantitative sampling of terrestrial and aquatic systems, design of field studies, computer simulation and digital data analysis techniques, and scientific writing. Prerequisite: Concurrent or prior enrollment in BIOL 414. A statistics course is recommended. FLD

**BIOL 416 Cell Structure and Function (3).** N Lecture survey of cell biology, with emphasis on correlating cell architecture with cell function; topics considered include general cell types, cell evolution, macromolecules, membranes, ultra-structure and function of organelles, motility, transport phenomena, and the cell life cycle. Prerequisite: BIOL 150 or consent of instructor. BIOL 350 and CHEM 624 are highly recommended. LEC

**BIOL 417 Biology of Development (3).** N A general course designed to introduce students to the developmental biology of plants and animals. Emphasis is placed on understanding the concepts of morphogenesis, growth, cell differentiation and aging. Lectures

**Field facilities available for research include the 560-acre John H. Nelson Environmental Study Area.**

**CLAS departments are online at [www.clas.ku.edu/departments](http://www.clas.ku.edu/departments).**

will stress experimental approaches to investigating how single cells develop into complex, multicellular organisms. Prerequisite: BIOL 350 or consent of the instructor. LEC

**BIOL 418 Laboratory in:** \_\_\_\_\_ (1-3). N A varied program of laboratory and field-work designed to introduce students to investigative approaches in the study of the basic concepts of biological science. Students may enroll in more than one section. Prerequisite: BIOL 100, BIOL 101, BIOL 150, BIOL 151, or exemption. Each section may have additional prerequisites to be determined by instructor. LAB

**BIOL 419 Topics in:** \_\_\_\_\_ (1-3). N Courses on special topics in biology, given as need arises. May be lectures, discussions, readings, laboratory, or fieldwork. Students may select sections according to their special needs. IND

**BIOL 420 Seminar:** \_\_\_\_\_ (1-3). N The preparation and presentation of oral reports on selected topics from the recent research literature. Students may choose one interest group each semester, but may enroll in a given interest group only once. Enrollment in each interest group limited to twenty students. Prerequisite: Course work varying with the topic of the seminar, or consent of instructor. LEC

**BIOL 423 Nonlaboratory Independent Study** (1-9). N Original study in discussion or preparation of review papers on selected topics of current interest. May be undertaken only with the consent of the major adviser and of the faculty member who will guide the research. Prerequisite: Consent of instructor. IND

**BIOL 424 Independent Study** (1-9). N Original study in laboratory or field in selected topics of current research interest. May be undertaken only with the consent of the major adviser and of the faculty member who will guide the research. Prerequisite: Consent of instructor. IND

**BIOL 425 Teaching Apprenticeship in Biology** (1-9). N Involvement as teaching assistant for a course in Biology. Credit hours shall not exceed the credits offered for the course being taught. May be undertaken only with the consent of the Director of Undergraduate Biology and of the faculty member who will teach the course. Prerequisite: Consent of instructor and Director of Undergraduate Biology. FLD

**BIOL 426 Laboratory in Cell Biology** (3). N Laboratory exercises will examine the function, organization, and composition of eukaryotic cells. Prerequisite: BIOL 150 and CHEM 184, concurrent or prior enrollment in BIOL 416, or consent of the instructor. BIOL 350 is highly recommended. LAB

**BIOL 427 Developmental Biology Laboratory** (2). N Laboratory exercises examine processes of early development in animal model organisms. Students study the normal development of live embryos and prepared slides of sea anemones, sea urchins, frogs and chicks. Study of regeneration and axial patterning through experimental manipulation of invertebrates is also explored. Prerequisite: Concurrent or prior enrollment in BIOL 417. LAB

**BIOL 430 Laboratory in Molecular Biology** (3). N Practical experience in recombinant DNA technology and molecular cloning. Prerequisite: BIOL 416 or a course in biochemistry or microbiology. LAB

**BIOL 432 Human Behavioral Genetics** (3). S A survey of human behavioral genetics for upper division undergraduates. Emphasis is on how the methods and theories of quantitative, population, medical, and molecular genetics can be applied to individual and group differences in humans. Both normal and abnormal behaviors are covered, including intelligence, mental retardation, language and language disorders, communication, learning, personality, and psychopathology. (Same as ANTH 447, PSYC 432, SPLH 432.) Prerequisite: Introductory courses in biology/genetics or biological anthropology and psychology are recommended. LEC

**BIOL 435 Introduction to Neurobiology** (3). N Basic principles of neurobiology. The focus will be on the nature of communication among nerve cells and their targets. Topics will include the development, structure and function of nerve cells, chemistry of neurotransmission, processing and integration including the cellular and molecular basis of higher functions and neurological disorders. Prerequisite: BIOL 150 or BIOL 151. LEC

**BIOL 440 Advanced Human Anatomy** (6). N Integrated lecture and laboratory course designed to provide students with a detailed understanding of the structure of the human body. Cadaver dissection will reinforce three-dimensional relationships discussed in lecture and each of the main organ systems will be considered using a regional approach to the body. Not open to students who have taken BIOL 240. Prerequisite: BIOL 152. LEC

**BIOL 448 Kansas Plants** (3). N A study of common and important non-cultivated Kansas plants, with special emphasis on the ecology of the state; paleoclimatic and paleobotanical background of the central prairies and plains; present climate, physiography and vegetation; poisonous, edible, and medicinal plants; identification by means of simplified keys. Prerequisite: BIOL 100, BIOL 101, BIOL 150, or BIOL 151 and BIOL 152 or BIOL 153. LEC

**BIOL 449 Laboratory/Field Work in Human Biology** (1-3). N Faculty supervised laboratory or field research for Human Biology majors. Students design and complete a research project in collaboration with a Human Biology faculty member. (Same as ANTH 449, PSYC 449, and SPLH 449.) Prerequisite: Consent of instructor and Human Biology major. FLD

**BIOL 450 Cancer Biology** (3). N This course is an overview of cancer biology; distribution of cancer in human populations; origins of the physiological changes caused by the disease; cellular biology of neoplastic cells; experimental causation of cancer; molecular changes in neoplastic transformation of cells; genetic aspects of cancer; introduction to cancer epidemiology and cancer causation in human beings; examples of studies of causation of cancer in human beings (by radiation, chemicals, viruses, heredity, occupation, and lifestyle factors which include aspects of diet and food preparation, smoking tobacco, reproductive and sexual behavior, etc.) and the relative significance of environmental versus intrinsic factors in causation. Prerequisite: A course in general biology and a course in general chemistry. LEC

**BIOL 454 Brain Diseases and Neurological Disorders** (3). N Major brain diseases and neurological disorders such as stroke, Alzheimer's Disease, Parkinson's Disease, Huntington's Disease, Multiple Sclerosis, Epilepsy, Schizophrenia, etc., will be discussed in terms of the etiology, molecular, and cellular basis of potential thera-

peutic interventions. Graduate students are required to present original research paper assigned by the instructor to the class in addition to other assignments for all the students enrolled. Prerequisite: BIOL 150, or consent of instructor. LEC

**BIOL 460 Plants and Humans** (3). N A study of the interrelationships between plants and humans and their significance to the origin of cultivated plants, plant improvement, and utilization. Lecture and laboratory. Not open to students with credit in BIOL 456. Prerequisite: BIOL 100, BIOL 101, BIOL 152, BIOL 153, or ANTH 104. LEC

**BIOL 461 Biodiversity of the Rainforest** (3). N An introduction to birds, bats, and plants of the rainforest, with emphasis on general characteristics of each of the taxa and their relationship to the tropical ecosystem, as well as their particular anatomy, ecology, behavior, and diversity. Field work focuses on identification of birds and bats (at species level), plants (at family level), and on capturing and preservation techniques. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 462 Introduction to the Natural History of Costa Rica** (4). N A field study of structures and dynamics of relationships in aquatic and terrestrial communities in Costa Rica. It covers geography, geology, and biology. Biological interactions like mutualism, parasitism, and epiphytism between organisms, and the habitat concept and its relation with the environment will be studied. Weekly field trips. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 463 Introduction to Ornithology of the Tropics** (4). N A theory and practice course on birds. Course covers morphology, reproduction, evolution, ecology, and behavior, as well as systematics of Costa Rican birds. Course includes field work on bird identification. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 464 Mammals of the Neotropics** (4). N Course covers mammal morphology, systematics, reproduction, and evolution, with emphasis on the mammals of the Neotropics. Course includes field work on observation and capture techniques of day and night mammals, and identification and preservation of mammal tracks. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 465 Marine Biology** (4). N A theory and practice course on biotic relations, the role of organisms and marine biodiversity. It covers basic marine principles and physico-chemical processes (temperature, salinity, dissolved oxygen, nutrients, and pH in the water) and their effect on the abundance, and horizontal and vertical distribution of marine organisms. Course includes field work on data collection. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 466 Marine Ecology** (4). N A theory and practice course about coastal, benthonic, and plankton communities. It covers faunal and floral group dynamics as well as morphological and physiological adaptations of coastal communities. Distribution, biomass, density, and community structures of benthonic communities. Composition, distribution, and ecological relationships between zooplankton (animals) and phytoplankton (plants) organisms. Course includes field work on data collection. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 467 Marine Resources Management** (3). N A theory and practice course which focuses on the techniques used for monitoring the growth of fish, shrimp, and mollusks, with the purpose of understanding the variables that could produce the best yields. The course covers ecology (population growth, competition, predators, ecosystem dynamics), and fishery biology (growth, fish yield, capture efficiency) applicable in the field experiments. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 468 Fresh Water Ecology** (4). N A theory and practice class on the study of rivers and lagoons. It includes systematics of rivers, lagoons, and reservoirs. Course includes theory and field work to monitor physical (stream topography, flow, edge vegetation), chemical (nutrients, temperature, pH levels, dissolved oxygen), and biological (collecting and identification of aquatic insects) conditions in rivers. Taught in Golfito, Costa Rica. Contact Undergraduate Biology, or the Office of Study Abroad. Prerequisite: BIOL 150 or BIOL 151 and BIOL 152 or BIOL 153, or equivalent. Fall and spring semester courses are taught in Spanish; therefore, four semesters of Spanish are required. Summer courses are taught in English. LEC

**BIOL 477 Ecology and Global Change** (3). N Humans influence both natural and managed ecosystems. This course studies the effects of climate change, land-use change, and reductions in biodiversity on ecosystems. Emphasis is placed on how biological and physical processes may be perturbed by human influences. Topics include the greenhouse effect, species extinctions, human disease expansion, and the effects of global change on agricultural productivity. A combination of lectures and discussion address issues from a scientific basis and link these ecological issues to our everyday lives and society as a whole. Prerequisite: BIOL 152, BIOL 153, or equivalent, or permission of instructor. LEC

**BIOL 493 Introduction to Ornithology** (3). N A lecture course on the biology, evolution, and diversity of birds. Prerequisite: BIOL 152, or BIOL 153, or permission of instructor. LEC

**BIOL 494 Introduction to Mammalogy** (3). A study of mammals, with emphasis on evolution, biogeography, systematics, and natural history. Lectures, laboratory, and field study. Prerequisite: BIOL 152 or 153 or permission of instructor. LEC

**BIOL 500 Biology of Insects** (3). N Lectures and demonstrations providing an introduction to the study of insects, including general classification, structure, phylogeny, identification, development, physiology, behavior, ecology, and relations to human affairs. Prerequisite: BIOL 152, 153, or equivalent, or permission of instructor. LEC

**BIOL 502 Laboratory in Insect Biology and Diversity** (2). U Laboratory and field studies of insects, emphasizing their diversity, classification, ecological relationships, morphology, and behavior. Course provides practical application of principles covered in BIOL 500. Prerequisite: Concurrent or prior enrollment in BIOL 500 or the equivalent. LAB

**BIOL 503 Immunology** (3). N Lectures on the nature and mechanisms of natural and acquired resistance including humoral and cellular immunity. Characteristics of antigens and antibodies and of their interaction; ontogeny and cellular basis of immune responsiveness, hypersensitivity; specific immunologic tolerance. Not open to those with credit in BIOL 524. Prerequisite: BIOL 400 or BIOL 401, or consent of instructor. LEC

**BIOL 504 Immunology Laboratory** (2). U Laboratory designed to complement BIOL 503. Prerequisite: BIOL 503, or BIOL 503 concurrently. LAB

**BIOL 505 Social Insects** (3). N Lectures and laboratory demonstrations on presocial and social insects, specifically termites, ants, wasps, and bees. Emphasis will be placed on evolution of social behavior and the place of social insects in sociobiology. Prerequisite: BIOL 152, BIOL 153, or equivalent. LEC

**BIOL 506 Pathogenic Microbiology** (3). N Lectures. Characteristics and mechanisms of pathogenic microorganisms and disease processes. Elements of host-parasite interactions. Not open to freshmen or sophomores. Prerequisite: BIOL 503, or consent of instructor. LEC

**BIOL 507 Pathogenic Microbiology Laboratory** (2). U Laboratory to complement BIOL 506. Cultivation of pathogenic microorganisms, diagnostic procedures, and experiments to demonstrate various aspects of microbial pathogenicity and host responses. Prerequisite: BIOL 402 and BIOL 506 (or concurrent enrollment) or consent of instructor. LAB

**BIOL 509 Biology of Spiders** (3). N An introduction to the evolution, anatomy, physiology, behavior, and ecology of spiders and other arachnids. Special topics include the action of spider venoms; the composition and uses of silk; courtship and mating; predation; social behavior; and the role of spiders in natural and agricultural ecosystems. Concurrent enrollment in BIOL 511 is encouraged. Prerequisite: BIOL 152, BIOL 153 or permission of instructor. LEC

**BIOL 510 Comparative Anatomy** (5). N Structure, function, and evolution of the vertebrates. Lectures and laboratory study. A course designed for zoologists. Prerequisite: BIOL 100, BIOL 101, BIOL 150, or BIOL 151 and BIOL 152 or BIOL 153. LEC

**BIOL 511 Biology of Spiders Laboratory** (1). N Topics will include comparative biology of arachnid orders (spiders, scorpions, harvestmen, mites, and others), external and internal anatomy of spiders, identification of common spider families and genera, and spider behavior. Students will be required to make a small collection (collect, preserve, and identify specimens). Prerequisite: BIOL 509; concurrent enrollment is preferred. LAB

**BIOL 512 General Virology** (3). N Lectures and discussions covering the basic nature and characteristics of viruses from a general biological point of view: viruses of bacteria, animals and plants, physical-chemical properties; host cell-viral interactions; mode of replication of DNA and RNA viruses, tumor viruses. Prerequisite: BIOL 400, BIOL 401 or consent of instructor. LEC

**BIOL 513 Virology Laboratory** (2). U Experiments involving cultivation, quantitation, and identification of animal viruses, continuous cell culture and primary chicken embryo culture techniques. Molecular biology techniques are used to demonstrate the steps in virus replication. The value of viruses as tools to understand normal cellular processes is emphasized in experiments which demonstrate the relative simplicity of viruses and the relative complexity of eukaryotic cells. Demonstrations include transformation of cells by tumor viruses and electron microscopy of virus particles. Prerequisite: BIOL 402 and BIOL 512, or consent of instructor. LAB

**BIOL 514 Principles of Ecology, Honors** (3). N Honors section of BIOL 414 for students with superior academic records. Course covers core concepts on the ecology of individuals, populations, communities, and ecosystems. Relative to BIOL 414, topics are presented in greater depth with increased student participation and stronger emphasis on the primary scientific literature. Prerequisite: BIOL 100, BIOL 101, BIOL 150, or BIOL 151 and BIOL 152 or BIOL 153. Open only to students admitted to the University Honors Program or by consent of instructor. LEC

**BIOL 516 Microbial Physiology** (3). N Elements of microbial physiology. Carbohydrate metabolism; enzymes and coenzymes; microbial nutrition; quantitative problems in microbial physiology; a survey of microbial metabolic types. Prerequisite: BIOL 400 or BIOL 612 and BIOL 402, and five hours of organic chemistry. LEC

**BIOL 517 Microbial Physiology Laboratory** (2). U Laboratory designed to complement BIOL 516. Prerequisite: BIOL 516, or BIOL 516 concurrently. LAB

**BIOL 518 Microbial Genetics** (3). N Bacteria and viruses as models of genetic systems. Mutagenesis and repair. Transformation, transductions, and recombination. Molecular biology of gene expression. Prerequisite: An introductory microbiology course. LEC

**BIOL 519 Microbial Genetics Laboratory** (2). U Laboratory designed to complement BIOL 518. Prerequisite: BIOL 402, BIOL 518, or BIOL 518 concurrently. LAB

**BIOL 525 Aquatic Entomology** (5). N Designed to enable the student to develop skill in the area of identification of aquatic insects and to gain a detailed comprehension of their community structure and dynamics. The external morphology of all aquatic orders will be covered, followed by consideration of specific physiological and behavioral adaptations that facilitate an aquatic existence. Four hours of lecture and three hours of laboratory per week. Prerequisite: BIOL 414 or BIOL 500. LEC

**BIOL 533 Biology of Fungi** (4). N A study of the major groups of fungi from slime molds to mushrooms. Emphasis on their activities in natural substrates, isolation techniques, parasitic and mutualistic relationships with other organisms, uses in research, industrial applications, production of mycotoxins and poisons, and physiological, genetic and reproductive behavior. Lectures, laboratory, and field trips. Prerequisite: BIOL 100, BIOL 101, BIOL 150, or BIOL 151 and BIOL 152 or BIOL 153. LEC

**BIOL 536 Cell Structure and Function (Honors)** (3). N BIOL 536 is the honors version of BIOL 416. Completion of this class will satisfy the BIOL 416 requirement. Open to students in the Honors program or by permission of instructor. Prerequisite: BIOL 350 or consent of instructor. LEC

**BIOL 540 General Invertebrate Zoology** (4). N Phylogeny, physiology, and embryology; evolutionary processes; characteristics of major ecological groupings. Laboratory will consider major taxonomic categories with emphasis on functional morphology and its evolutionary modifications. Prerequisite: BIOL 152 or BIOL 153. LEC

**BIOL 545 Evolution of Development** (3). N An advanced course designed to expose students to evolutionary change in the developmental patterning of plant and animal form. This course integrates multiple biological disciplines including phylogenetics, comparative morphology, molecular evolution and developmental genetics to explore biodiversity at a mechanistic level. Topics range from issues surrounding homology assessment to empirical examples of how changes in gene expression or function may have shaped morphological diversity. Prerequisite: BIOL 350 or equivalent. LEC

**BIOL 550 Introduction to Systematics** (3). N Basic elements of systematic theory and practice; discussion of the needs and aims of taxonomy; species and speciation; principles of nomenclature and classification; phylogenetic reconstruction; evolutionary processes and patterns of species diversity; analysis of systematic evidence; construction of keys, synopses, monographs, and revisions. Prerequisite: BIOL 152 or BIOL 153. Not intended for graduate students planning to specialize in systematics. LEC

**BIOL 555 General Plant Physiology** (3). N The principal physiological processes of higher plants including photosynthesis, respiration, water relations, mineral nutrition, and factors associated with morphogenesis. Prerequisite: BIOL 408 or consent of instructor. LEC

**BIOL 560 Histology** (3). N Study of detailed microscopic anatomy of cells, tissues, and organs of mammals. Examples are drawn from normal and abnormal tissue, histochemistry, and electron microscopy. Lecture and demonstrations. A course in anatomy and physiology is highly recommended. Prerequisite: BIOL 152 or BIOL 153. LEC

**BIOL 561 Histological Technique** (2). N Training in the preparation of tissues for study with the light microscope. Both paraffin and plastic embeddings will be used. Prerequisite: Concurrent or prior enrollment in BIOL 560. LAB

**BIOL 570 Introduction to Biostatistics** (3). N Statistical concepts related to biological problems. Topics include the scientific method, data representation, descriptive statistics, elementary probability distributions, estimation and hypothesis testing, emphasizing the analysis of variation. Prerequisite: College algebra and ten hours of natural science. LEC

**BIOL 571 Introduction to Biostatistics Laboratory** (1). U Introductory statistical analyses on microcomputers. Introduction to the operating system; data entry and export; simple graphs and exploratory data analysis; descriptive statistics; sampling; point and interval estimation; one and two sample t-tests; Chi-square; regression and correlation; analysis of variance; and nonparametric methods. Prerequisite: BIOL 570 or equivalent. LAB

**BIOL 583 Herpetology** (3). N A study of amphibians and reptiles. This lecture course will explore the taxonomic diversity of amphibians and reptiles, and current areas of active research in herpetology. Topics will be considered within a phylogenetic framework, and include discussion on systematics, biogeography, tetrapod origins, skeletal systems, growth, circulatory system, locomotion, thermal and water regulation, hibernation, ecology, sexual behavior, parental care, and mimicry. LEC

**BIOL 590 Principles of Embryology** (3). N An introduction to the general principles underlying invertebrate and vertebrate development plus a consideration of the major features of vertebrate organogenesis. Lecture and laboratory. Prerequisite: BIOL 408. LEC

**BIOL 592 Ichthyology** (4). N A study of fishes. Lecture topics include the structure and adaptations of fishes to the aquatic environment and a survey of major fish groups with emphasis on their evolution and biogeography. Laboratory topics in-

---

**KU was one of the 77 undergraduate institutions in the nation named to the Princeton Review's America's Best Value College list. KU also was one of the 150 schools profiled in the Princeton Review's first edition of The Best Midwestern Colleges.**

**A listing of Biology Courses by Topics appears on pages 87-89.**

clude a survey of fish diversity using specimens and the use of keys to identify fishes, with emphasis on the Kansas fish fauna. This course meets with BIOL 792. Students taking this course at the 700 level will have additional work required of them. Prerequisite: BIOL 152 and/or BIOL 413. LEC

**BIOL 594 Forest Ecosystems** (3). Students learn basic concepts of forest productivity, forest water relations, forest hydrology, nutrient cycling, through soils and vegetation, nutrient uptake, carbon cycling, decomposition, linkages to aquatic ecosystems, and agents of disturbance to these cycles. The class spends a significant part of the semester exploring forest soil profiles and the challenges they present to different forest ecosystems. We discuss the function of forested ecosystems in a global context and identify and understand smaller-scale processes that drive forest function. Prerequisite: CHEM 188 and BIOL 414. LEC

**BIOL 595 Human Genetics** (3). N A lecture course providing balanced coverage of Mendelian and molecular genetics of humans; includes discussions and presentations on current issues in human and medical genetics. Prerequisite: BIOL 350. LEC

**BIOL 599 Senior Seminar:** \_\_\_\_ (1). N A synthesis and discussion of current trends in a discipline or disciplines related to one of the degrees offered in the biological sciences. Emphasis is placed on providing seniors with an appreciation of the discipline's state-of-the-art and on developing skills for success in the next stage of a career in the biological sciences. Topics depend on the associated degree program. Prerequisite: Must be taken in the final year of a degree and students must have completed most of the course work required for one of the degrees in the biological sciences. LEC

**BIOL 600 Introductory Biochemistry, Lectures** (4). N Designed to offer the essentials of the chemistry of the constituents of living organisms and the changes these constituents undergo (during life processes) in the human body and other living forms. Prerequisite: BIOL 150 or BIOL 151 and one semester of organic chemistry. LEC

**BIOL 602 Plant Ecology** (3). N Introduction to basic concepts, focused at community and species level. Architectural ecomorphology of plants and their physiological responses to physical factors: solar radiation, climate, and soils. Plant succession as an interaction among species differing in ecomorphology and life style. Classification and ordination of plant communities: practice and theory. Other topics include: species diversity and lognormal distribution as to abundance classes; species/area relations and theory of island biogeography; allelochemical defenses; genecology; paleoecology. Prerequisite: BIOL 414 or consent of instructor. Concurrent enrollment in parallel laboratory, BIOL 607, recommended. LEC

**BIOL 603 Systematic Botany** (3). N A lecture/laboratory course providing hands-on experience with plant identification, a history of plant classification, the principles of nomenclature and character analysis, the basics of systematics theory, and a phylogenetically-oriented introduction to vascular plant diversity. Prerequisite: BIOL 413 or equivalent. LEC

**BIOL 606 Ecological Plant Physiology** (3). N Physiological responses of higher plants to environmental factors are discussed. Major topics are: water relations, heat transfer, resistance to water and temperature stress, dormancy, photoperiodism, photosynthesis and respiration under natural conditions, and effects of environmental pollution. Prerequisite: BIOL 408 or consent of instructor. LEC

**BIOL 607 Field and Laboratory Exercises in Plant Ecology** (2). U Introduction to quantitative analysis of plant communities and correlated environmental parameters; field and/or laboratory measurements of ecophysiological traits and comparative ecomorphology of principal species. Prerequisite: BIOL 414. Concurrent enrollment in parallel lecture, BIOL 602, recommended, but not required. LAB

**BIOL 608 Developmental Plant Anatomy** (4). N A study of the anatomy of the vascular plants, using both traditional and modern techniques. The origin and structure of cell types and tissues of the various plant organs along with their ecological, phylogenetic, taxonomic and functional significance. Two one-hour lectures and 2 three-hour laboratory sessions each week. Prerequisite: BIOL 152 or BIOL 153; BIOL 413; or consent of instructor. LEC

**BIOL 609 Current Progress in Microbiology** (1). U A seminar course which will focus on current research in microbiology. A term paper will be required of each student. May be repeated for credit. Required of all majors in the senior year. Prerequisite: Two courses in microbiology. LEC

**BIOL 610 Plant Kingdom** (4). N A comparative morphological survey of the structural diversity, life cycles, origins, and patterns of evolution in the two basic groups of the plant kingdom, the bryophytes (mosses and liverworts) and the tracheophytes (ferns, gymnosperms, and flowering plants). Three one-hour lectures and one three-hour laboratory each week. Prerequisite: BIOL 152 or BIOL 153 and BIOL 413 or consent of instructor. LEC

**BIOL 611 Molecular Systematics and Evolution** (4). N An introduction to the use of molecular data in systematics and population biology. Topics include: evolution of genes and proteins; properties of mitochondrial DNA, chloroplast DNA, ribosomal RNA genes, protein-coding genes, and repetitive DNAs; laboratory methods for data collection; and data analysis. Prerequisite: BIOL 350. BIOL 550 or equivalent is recommended. LEC

**BIOL 612 Fundamentals of Microbiology** (3). NB N Lectures. Fundamental principles of microbiology with emphasis in physical and chemical properties of the bacterial cell; microbial metabolism, cultivation, growth and death of bacteria; microbial genetics; pathogenesis and immunity, industrially important microorganisms. Meets with BIOL 400, but students will be given additional and more advanced assignments, and will carry higher expectations. Prerequisite: BIOL 150 or BIOL 151 and two semesters of college chemistry, or consent of instructor. LEC

**BIOL 613 Biology of Honeybees** (3). N Social organization, evolution, behavior, morphology, communication, pollination biology, and ecology of honeybees. Experience will be gained with colony dynamics and behavior while working with bees in the field. Prerequisite: BIOL 152, BIOL 153, or consent of instructor. LEC

**BIOL 616 Medical Entomology** (3). N A study of the major human diseases transmitted by arthropods with emphasis on the biology and ecology of vectors, vector feeding

mechanisms as related to disease transmission, epidemiology of arthropod-borne diseases, and the impact of arthropod-borne diseases on humans. Laboratory work on recognition of vector species, information sources, and use of taxonomic keys. Prerequisite: BIOL 152 or BIOL 153 and a course in microbiology or consent of instructor. LEC

**BIOL 620 Physiological Ecology** (3). N Ecological consequences of physiological characteristics of animals. Topics include water balance, temperature regulation, energy utilization, physiological variation, life histories, historical factors, and body size. Prerequisite: BIOL 408 or equivalent. LEC

**BIOL 622 Paleontology** (3). N A study of the structure and evolution of ancient life; the nature and diversity of life through time; the interactions of ancient organisms with their environments and the information that the study of fossils provides about ancient environments; the use of fossils to determine the ages of rocks and the timing of past events in earth history; and the patterns of extinction through time. (Same as GEOL 521.) Prerequisite: BIOL 100, BIOL 101, BIOL 152, BIOL 153, GEOL 105, or GEOL 304. LEC

**BIOL 623 Paleontology Laboratory** (1). U Laboratory course in the study of fossils with emphasis on the practice of paleontology and the morphology of ancient organisms. (Same as GEOL 523.) LAB

**BIOL 625 Behavioral Ecology and Sociobiology** (3). N The role of natural selection in animal behavior, and the influence of behavior on population biology and social dynamics of animal species. Topics include: game theory and optimization as applied to animal behavior; altruism, cooperation and competition; kin recognition and interactions; group formation and dynamics, dominance, aggression, and territoriality; feeding strategies; reproductive behavior including mate choice, parental care, and mating systems. Prerequisite: BIOL 152; either BIOL 350, BIOL 412 or BIOL 414 recommended; or consent of instructor. LEC

**BIOL 630 Conservation and Wildlife Biology** (3). N Examination of the concepts and processes involved in conservation of plant and animal populations and communities. Topics to be covered include conservation of endangered species, problems with invasions of exotic species and habitat fragmentation, wildlife management, and design of nature reserves. Prerequisite: BIOL 414, BIOL 412 strongly recommended. LEC

**BIOL 636 Biochemistry I** (3). N First semester of a two-semester lecture course in introductory biochemistry. Emphasis upon the physical structure of macromolecules and membranes, enzyme structure/function, and enzyme kinetics. Prerequisite: CHEM 626 or consent of instructor. LEC

**BIOL 637 Introductory Biochemistry Laboratory** (2). U The laboratory portion of BIOL 600 or 636. Experiments have been selected to introduce the student to cell constituents and biochemical reactions. One four-hour laboratory and one-hour lecture each week. Prerequisite: BIOL 600 or BIOL 636, or concurrent enrollment. LAB

**BIOL 638 Biochemistry II** (3). N Second semester of a two-semester lecture course in introductory biochemistry. Emphasis upon the metabolism of carbohydrates, lipids, amino acids, proteins, and nucleic acids. Prerequisite: BIOL 636. LEC

**BIOL 639 Advanced Biochemistry Laboratory** (2). U The laboratory portion of BIOL 638. One four-hour laboratory and a one-hour lecture each week. Experiments have been selected to familiarize students with experimental biochemical techniques using state-of-the-art methodology. Prerequisite: BIOL 637 and 638 (BIOL 638 may be taken concurrently). LAB

**BIOL 640 The Biology and Evolution of Fossil Plants** (3). N A lecture course in which fossil plants, protists and fungi are examined throughout geologic time. Emphasis will be directed at paleoecology, biogeography and the stratigraphic distribution and composition of ancient floras. (Same as GEOL 528.) Prerequisite: BIOL 413 or permission of instructor. LEC

**BIOL 641 Laboratory in Paleobotany** (1). U An examination of selected fossil plants throughout geological time and the techniques used to study them; laboratory will include identification and the use of plant fossils in biostratigraphy. (Same as GEOL 529.) Prerequisite: BIOL 413 or permission of instructor. Must be taken concurrently with BIOL 640. LAB

**BIOL 644 Comparative Animal Physiology** (3). N Lecture and discussion of the basic mechanism of organic maintenance and integration; a comparative treatment of the uniformities and diversity of animal function; emphasis on environmental adaptations and evolutionary relationships. Prerequisite: BIOL 408, five hours of organic chemistry, and one year of college physics, or consent of instructor. LEC

**BIOL 646 Mammalian Physiology** (4). N Lectures and demonstrations. An intermediate course in the functions, mechanisms and interactions of mammalian organ systems. Discussions span topics from molecular to whole animal functions. Required for pharmacy students and strongly recommended for students planning advanced work in any area of physiology. The student is assumed to have the knowledge and ability to utilize their math and science background. Prerequisite: Five hours of organic chemistry, a course of college physics. LEC

**BIOL 647 Mammalian Physiology Laboratory** (2). U Laboratory experiments in representative areas of mammalian physiology designed to complement BIOL 646. Not open to students with credit in BIOL 306. Prerequisite: BIOL 646 or BIOL 726 or concurrent enrollment LAB

**BIOL 650 Advanced Neurobiology** (3). N The course builds an in depth knowledge about basic mechanisms of synaptic communication among nerve cells and their targets, and the structure and function of nervous systems. Topics include nervous system development and synapse formation, structure and function of neurons, physiological and molecular basis of synaptic communication between neurons, mechanisms of synaptic plasticity involved in learning and memory, sensory systems (vision, auditory, vestibular, motor reflexes and pain), processing of neural information at cellular and system levels, synapse regeneration and diseases of the nervous system. Prerequisite: BIOL 435 (Introduction to Neurobiology), or consent of instructor. LEC

**BIOL 652 Comparative Animal Behavior** (3). N A comparative analysis of behavior as an adaptive mechanism; emphasis on ontogenetic and evolutionary aspects of behavior. Prerequisite: BIOL 152 or BIOL 153, and PSYC 104, or consent of instructor. LEC

**BIOL 654 Comparative Animal Behavior, Laboratory** (1). U Laboratory and field phase of BIOL 652. Students may elect sections according to their special interests. Prerequisite: Prior or concurrent enrollment in BIOL 652. LAB

**BIOL 656 Ecosystem Ecology** (3). N An introduction to the patterns and processes that affect terrestrial ecosystems. Emphasis is placed on understanding nutrient cycles (e.g., carbon nitrogen phosphorous), hydrologic cycles, and patterns of net primary productivity. The role of both natural and anthropogenic disturbances in structuring terrestrial ecosystems is examined in the context of global land-use patterns. Discussion of current research literature will be expected. (Same as EVRN 656.) Prerequisite: BIOL 414 and CHEM 184. LEC

**BIOL 660 Lake Ecology** (3). N An introduction to the biological, chemical, and physics processes that characterize ponds, lakes, and reservoirs. Discussion of current research papers. Prerequisite: General ecology (BIOL 414 or equivalent) or permission of instructor. LEC

**BIOL 661 Stream Ecology** (3). N Population, community, and ecosystem ecology of flowing water habitats from ephemeral creeks to great rivers. The course emphasizes biological phenomena, but physical and chemical processes are discussed. Prerequisite: BIOL 414 or equivalent, or consent of instructor. Concurrent enrollment in Stream Ecology Laboratory. BIOL 668 is recommended. LEC

**BIOL 662 Aquatic Ecology Laboratory** (2). U A field and laboratory course introducing biological, physical, and chemical characteristics of lentic (ponds and lakes) and lotic (creeks and rivers) habitats. Students learn sampling and monitoring techniques and how to classify aquatic biota at higher taxonomic levels. Co- or prerequisite: CHEM 184 and either BIOL 660 or 661. LAB

**BIOL 664 Vertebrate Biology** (3). N A laboratory course emphasizing principles of systematics and identification and the behavioral ecology of local vertebrate animals. Prerequisite: BIOL 152, BIOL 153 or consent of instructor. LAB

**BIOL 667 Chemical Communication in Sex, Feeding, and Fighting** (3). N The course focuses on the role of chemical information molecules in the interrelationships among organisms, with particular attention to interactions (a) within and between animal species, (b) within and between plant species, (c) between animals and plants, (d) between predators and prey, and (e) between parasites and hosts. Prerequisite: BIOL 100 or BIOL 101 or BIOL 152 or BIOL 153 or consent of instructor. LEC

**BIOL 668 Evolutionary Ecology** (3). N Emphasis will be on the themes that interface ecology and evolutionary studies. Topics will include selection theory; reproductive, foraging, and sex allocation problems; coevolution; patterns or morphological and behavioral adaptations; competition, predation, and population regulation. Special attention will be given to the philosophy and practice of resolving unanswered questions in evolutionary ecology. Prerequisite: BIOL 412 or permission of instructor. LEC

**BIOL 669 Biology of Freshwater Invertebrates** (3). N A lecture, field, and laboratory course examining the classification, biological characteristics, and ecology of invertebrates in lotic and lentic habitats. Major groups of benthic and planktonic invertebrates will be studied, including aquatic insects, crustaceans, molluscs, and others. Prerequisite: BIOL 540, BIOL 660, BIOL 661, or BIOL 663, or permission of instructor. LEC

**BIOL 670 Natural History Museum Techniques** (2-5). N A maximum of fifteen hours credit. Construction of museum exhibits; preparation of plants, animals, and fossils for research, including accessioning, cataloging, and filing. Prerequisite: Permission of director of museum. FLD

**BIOL 672 Gene Expression** (3). N A study of the structure and expression of genes in prokaryotes and eukaryotes. Emphasis on the mechanisms of DNA, RNA, and protein biosynthesis. Prerequisite: A course in biochemistry or consent of instructor. LEC

**BIOL 673 Cellular and Molecular Neurobiology** (3). Mechanisms of neural function and development will be considered at the cellular and molecular levels. Synaptic mechanisms of learning and memory, modulation of transmitter release, and the molecular basis of neurodegenerative disorders will also be discussed. Prerequisite: BIOL 435, BIOL 646, or permission of instructor. LEC

**BIOL 676 Mammalian Neuroanatomy** (3). N Lectures, video tape demonstrations, and laboratory dissection of mammalian nervous system with some attention to human material. Major emphasis on nervous system structure as it relates to function. For neurobiology and pre-health science majors. Prerequisite or Corequisite: A course in neurobiology (BIOL 435, BIOL 650), or permission of the instructor. LAB

**BIOL 688 The Molecular Biology of Cancer** (3). N The basic concepts of molecular biology are examined and used to probe the process by which a normal cell becomes a cancer cell. The course investigates DNA damage and repair, chemical carcinogenesis, gene cloning and manipulation, the control of gene expression in eukaryotes, tumor viruses, the roles of oncogenes and tumor suppressor genes in carcinogenesis, and cancer therapy. Prerequisite: BIOL 350 and BIOL 600, or consent of instructor. LEC

**BIOL 692 Developmental Genetics** (3). N The genetic control of basic developmental processes such as cell differentiation, morphogenesis and pattern formation in developing organisms will be analyzed using model systems ranging from yeast to fruit fly *Drosophila* to higher plants. Prerequisite: A course in genetics and in cell developmental biology. LEC

**BIOL 694 The Art of Becoming a Professional Scientist** (3). N Discusses aspects of graduate education that are directed at students entering graduate school and that focus on how to be successful in the post Ph.D. phases of a career, but that must be initiated early in the graduate student program of study. One three hour discussion per week. Senior standing and planning on entering graduate school. LEC

**BIOL 695 Animal Communication and Sensory Ecology** (3). N Lectures and discussion sessions. A study of the propagation and perception of olfactory, acoustic, and visual signals produced by animals in the context of communication. Both physiological and evolutionary perspectives will be treated. Prerequisite: A course in behavior or consent of instructor. LEC

**BIOL 699 Divisional Honors Research Colloquium** (1). U Students pursuing Honors in Biology will meet weekly to discuss, both formally and informally, their honors research. Background information and experimental approaches of the research will be examined and critiqued. Prerequisite: Enrollment in Division of Biological Sciences Honors Program and consent of instructor. LEC

**BIOL 700 Conservation Principles and Practices** (3).

**BIOL 701 Topics in:** \_\_\_\_\_ (1-3).

**BIOL 702 Laboratory Practice: Radiation Safety Procedures** (0.75).

**BIOL 703 Radioisotopes and Radiation Safety in Research** (1.25).

**BIOL 704 Research Animal Methods** (3).

**BIOL 706 Current Trends in Curation and Collection Management** (2).

**BIOL 708 External Morphology of Insects** (4).

**BIOL 709 Immature Insects** (2).

**BIOL 710 Insect Development** (3).

**BIOL 711 Insect Systematics** (4).

**BIOL 712 Evolutionary Biology—Graduate** (3).

**BIOL 714 Community and Ecosystem Ecology** (3).

**BIOL 716 Insect Physiology and Internal Morphology** (3).

**BIOL 717 Insect Ecology and Behavior** (3).

**BIOL 718 Laboratory in Molecular Biology** (3).

**BIOL 719 Light and Electron Microscopy** (3).

**BIOL 720 Scientific Illustration** (3).

**BIOL 721 Microbial Genetics** (3).

**BIOL 742 Plant Population Biology** (3).

**BIOL 743 Population Genetics** (3).

**BIOL 745 Laboratory in Experimental Ecology** (3).

**BIOL 746 Principles of Systematics** (4).

**BIOL 747 Quantitative Genetics** (3).

**BIOL 749 Topics in Stable Isotopes in the Natural Sciences:** \_\_\_\_\_ (2-3).

**BIOL 750 Advanced Biochemistry** (3).

**BIOL 751 Plant Communities of North America** (3).

**BIOL 752 Cell Biology** (3).

**BIOL 753 Advanced Genetics** (3).

**BIOL 754 Brain Diseases and Neurological Disorders** (3).

**BIOL 755 Mechanisms of Development** (3).

**BIOL 756 Cell and Tissue Culture Laboratory** (3).

**BIOL 767 The Vegetation of the Earth** (3).

**BIOL 768 Plant Molecular Biology** (3).

**BIOL 770 Plant Biochemistry** (3).

**BIOL 772 Gene Expression** (3).

**BIOL 775 Chemistry of the Nervous System** (3).

**BIOL 777 Integrative and Developmental Neurobiology** (3).

**BIOL 780 Fisheries** (2).

**BIOL 781 Fisheries, Laboratory** (2).

**BIOL 782 Principles of Biogeography** (3).

**BIOL 783 Herpetology** (3).

**BIOL 784 Introduction to Museum Public Education** (3).

**BIOL 785 Museum Management** (3).

**BIOL 786 Fundamentals of Tropical Biology** (1-8).

**BIOL 787 Introduction to Museum Exhibits** (3).

**BIOL 788 The Nature of Museums** (3).

**BIOL 789 Field Course in Entomology** (1-6).

---

**Higuchi Biosciences Center includes the Centers for Biomedical Research, BioAnalytical Research, Drug Delivery Research, and Neurobiology and Immunology Research.**

**KU's Mid-America Poison Control Center offers help and advice 24 hours a day through a toll-free telephone service. Call (800) 222-1222, or in Kansas City, Kan., 588-6633, or visit [www.kumed.com/poison](http://www.kumed.com/poison).**

- BIOL 790 Paleontology of Lower Vertebrates** (3).  
**BIOL 791 Paleontology of Higher Vertebrates** (3).  
**BIOL 792 Ichthyology** (4).  
**BIOL 793 Ornithology** (3).  
**BIOL 794 Mammalogy** (3).  
**BIOL 795 Biology of Amphibians** (3).  
**BIOL 796 Biology of Reptiles** (3).  
**BIOL 797 Field Course in Vertebrate Paleontology** (3-6).  
**BIOL 798 Principles and Practices of Museum Collection Management** (3).  
**BIOL 799 Natural History Museum Apprenticeship** (1-6).

## Bosnian/Croatian/Serbian

See Slavic Languages and Literatures in this chapter of the catalog.

## Botany

A bachelor's degree with a major in botany is not offered, but the student may obtain a degree in biology with emphasis in botany. Any course in the plant sciences numbered 699 or below is appropriate for the undergraduate emphasis. See Biology Undergraduate Program in this chapter of the catalog. For those planning to go on for advanced degrees, the following courses are recommended:

- BIOL 533 Biology of Fungi
- BIOL 555 General Plant Physiology
- BIOL 602 Plant Ecology
- BIOL 603 Systematic Botany

## Brazilian Studies

See Spanish and Portuguese in this chapter of the catalog.

## Caribbean Studies

See African and African-American Studies in this chapter of the catalog.

## Cell Biology

Students may concentrate in cell biology by seeking a B.S. in biology. See Biology Undergraduate Program in this chapter of the catalog.

## Chemistry

Chair: Joseph A. Heppert  
 Malott Hall, 1251 Wescoe Hall Dr., Room 2010  
 Lawrence, KS 66045-7582, [www.chem.ku.edu](http://www.chem.ku.edu), (785) 864-4673  
 Degrees offered: B.A., B.S., M.S., Ph.D.

**Why study chemistry?** Because understanding the atomic and molecular nature of matter informs us about ourselves and our universe, and creating and finding applications for new and modified forms of matter helps to conserve and enhance our world.

Chemistry course work educates students to become professional chemists or to do graduate work in chemistry. It also provides the basic chemistry background for students entering such fields as biochemistry, biological sciences, dentistry, engineering, environmental science, geology, medicine, pharmacy, physics, and secondary-level science education. Courses in chemistry provide general knowledge and appreciation of chemistry and its impact on society.

### Courses for Nonmajors

Students taking chemistry as preparatory study for another field should consult the courses listed for that field in this catalog. CHEM 124 and CHEM 125 are introductory courses for the non-science major who wants to study the general principles, methods, role, and significance of chemistry in the modern world, for prenursing students, and for students who plan to take no additional courses in chemistry. Premedical students and chemistry or other science majors should not take CHEM 124 or CHEM

125. CHEM 124 is lecture only. CHEM 125 includes a laboratory. Engineering students who need only one semester of chemistry should take CHEM 184. CHEM 184 is an introductory course for students who plan to take more than one year of college chemistry, including chemical engineering, premedical, prepharmacy, and pre dental students and students in biological sciences who must take organic chemistry. Students should continue with CHEM 188 in the same academic year that they take CHEM 184.

### Advanced Placement

Students who have taken the Advanced Placement Examination in chemistry should have the results forwarded to the Office of Admissions and Scholarships. Students who earn a score of 5 need not take CHEM 184 and CHEM 188 and receive 10 hours of credit. With departmental permission, those who earn a score of 3 or 4 receive credit for CHEM 184. Credit for CHEM 188 also may be given to those who pass a special examination. Students who receive a score of at least 50 on the College Level Examination Program general chemistry examination receive 5 hours of credit in CHEM 125.

### Majors

The B.S. prepares students for graduate school and professional careers. The B.A. is for the student who wants to understand the fundamental principles of chemistry and to study a number of other fields. Both are based on a high school background that includes at least one and one half years of algebra and one year of geometry. High school courses in chemistry and physics are desirable but are not required.

Many chemistry majors are preparing for medical school or for graduate study in chemistry and related fields. For graduate school, the common body of knowledge in the B.A. program is the minimum prerequisite. For premedical students, much of the knowledge will be important in their careers. Even more important, however, is the training in logical thinking, drawing conclusions from experimental observations, and digesting and understanding scientific information.

**First- and Second-year Preparation.** Because study in chemistry requires preparation in mathematics and physics as well as a structured series of courses in chemistry, students should begin meeting major requirements in the first year. Students planning to major in chemistry should consult a chemistry department major adviser during their first semester to develop a four-year plan for degree completion. It is particularly important to take CHEM 184 (or CHEM 185) and CHEM 188 (or CHEM 189) in the first year and CHEM 624 (or CHEM 628) and CHEM 625 in the second year. For those seeking a B.S. degree it is also important to complete CHEM 626 (or CHEM 630) and CHEM 627 in the second year as well as their mathematics preparation (MATH 121, MATH 122, MATH 223, and MATH 290) and physics preparation (PHSX 211 and PHSX 212) in the first two years.

**Requirements for the B.A. Major.** In addition to the common College requirements for the B.A., a minimum of 29 to 30 hours in chemistry (including 5 hours each of analytical, organic, and physical chemistry lecture and laboratory) and one year each of calculus and physics (prerequisites for physical chemistry) are required. These courses fulfill the requirements:

| <b>Chemistry Courses</b> (29 hours)                      |   |
|----------------------------------------------------------|---|
| CHEM 184 (or CHEM 185) Foundations of Chemistry I .....  | 5 |
| CHEM 188 (or CHEM 189) Foundations of Chemistry II ..... | 5 |
| CHEM 622 Fundamentals of Organic Chemistry (3) <b>or</b> |   |
| CHEM 624 (or CHEM 628) Organic Chemistry I (3) .....     | 3 |
| CHEM 625 Organic Chemistry I Laboratory .....            | 2 |
| CHEM 516 Analytical Chemistry .....                      | 3 |
| CHEM 517 Analytical Chemistry Laboratory .....           | 2 |
| CHEM 640 Biological Physical Chemistry (3) and           |   |
| CHEM 641 Biological Physical Chemistry Lab (2) <b>or</b> |   |
| CHEM 646 Physical Chemistry I (3) and                    |   |
| CHEM 647 Physical Chemistry I Laboratory (2) .....       | 5 |
| CHEM 696 Junior/Senior Seminar .....                     | 1 |
| Additional chemistry course .....                        | 3 |