BIOLOGY

Majors:

- Bachelor of Science, Biology (p. 1)
- Bachelor of Science, Environmental Biology (p. 3)

Minor:

- Biology (p. 5)
- Neuroscience (p. 5)

The Bachelor of Science program in biology is designed to prepare a student for a career in the life sciences. Graduates of the program are competitive for entry into graduate programs in the biological sciences as well as professional schools, such as medical, dental, osteopathic, and veterinary science, as well as physician assistant (PA) and advanced nursing programs.

The department has two primary areas of focus:

1. Basic biomedical science
2. Environmental/ecological science

Biomedical science course offerings includes:

- Cell biology
- Comparative and human anatomy
- General and medical microbiology
- Genetics
- Genetics of human disease
- Immunology
- Mammalian physiology
- Neurobiology

Environmental/ecological science course offerings include:

- Community and restoration ecology
- Ecology
- Entomology
- Analysis of biological data
- Environmental ecology
- Applied microbiology
- Evolutionary biology
- Invertebrate and Vertebrate Zoology

In addition, advanced undergraduates may enroll in graduate courses for undergraduate credit with the consent of the department chairperson. In line with the two areas of research interests, the department encourages students (in consultation with their advisors) to declare one of the two as an area of concentration of study no later than the end of their sophomore year. For the student more interested in a broad approach to biology, the department recommends a third option, the general biology option (any combination of upper-level biology courses that fulfills the program requirements).

The department offers a research mentorship program for upper-level students majoring in biology. The program allows a student to work closely with both faculty and graduate students in laboratory and/or field research. Participation in the program is based on the recommendation of a member of the faculty. The mentorship program is designed to provide a significant advantage for those students who intend to enter a graduate program.

The department also offers an accelerated Bachelor and Master of Science (BPM) program in Biology. This accelerated program offers the opportunity for students to complete the B.S. and M.S. degrees in five years and is designed for students who display strong potential for research in biology. It provides a liberal arts education, a broad background in biology, the development of expertise in a biological subfield, and a thorough introduction to research instrumentation and techniques. Graduates from the program are prepared for either direct entry into the job market or continuation toward the Ph.D.

A minor in biology consists of 20 semester hours.

A minor in neuroscience consists of 16 semester hours.

Faculty
Karolyn Hansen, Chairperson
Distinguished Service Professor: Noland
Professors Emeriti: Burky, Kearns, Robinson, P. Williams
Professors: Kango-Singh, Krane, McEwan, Nielsen, Singh, S. Wright
Associate Professors: Hansen, Pitychoutis, Prather, Sun, T. Williams, D. Wright
Assistant Professors: Bui, Gantchoff, Hantak, Rajput, Sathyanesan
Principal Lecturers: Dillon, Kavanaugh
Senior Lecturers: Rhoads
Lecturers: Muratore, Pope, Regula, Reinhart, Schnell, Thakur, Tsouma, M. Williams, Wolters, Yingling

Bachelor of Science, Biology (BIO) minimum 120 hours

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.

Common Academic Program (CAP) [1]		
First-Year Humanities Commons [2]		12 cr. hrs.
HST 103	Introduction to Global Historical Studies	
REL 103	Introduction to Religious and Theological Studies	
PHL 103	Introduction to Philosophy	
ENG 100	Writing Seminar I [3]	
Second-Year Writing Seminar [4]		0-3 cr. hrs.
ENG 200	Writing Seminar II	

Oral Communication		3 cr. hrs.
CMM 100	Principles of Oral Communication	
Mathematics		3 cr. hrs.
Social Science		3 cr. hrs.
SSC 200	Social Science Integrated	
Arts		3 cr. hrs.
Natural Sciences [5]		7 cr. hrs.
Crossing Boundaries		up to 12 cr. hrs.
Faith Traditions		
Practical Ethical Action		
Inquiry [6]		
Integrative		
Advanced Study		
Philosophy and/or Religious Studies (6 cr. hrs.)		
Historical Studies (3 cr. hrs.) [7]		
Diversity and Social Justice [8]		3 cr. hrs.
Major Capstone [9]		0-6 cr. hrs.

1 The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

2 May be completed with ASI 110 and ASI 120 through the Core Program.

3 May be completed with ENG 100A and ENG 100B, by placement.

4 May be completed with ENG 114 or ENG 198 or ASI 120.

5 Must include two different disciplines and at least one accompanying lab.

6 U.S. History AP and CLEP credit will not satisfy this requirement.

7 May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.

8 May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

9 The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

(Satisfies CAP Mathematics and CAP Natural Science)		
CHM 123 & 123L	General Chemistry and General Chemistry Laboratory	4
CHM 124 & 124L	General Chemistry and General Chemistry Laboratory	4
CHM 313 & 313L	Organic Chemistry and Organic Chemistry Laboratory	4
CHM 314 & 314L	Organic Chemistry and Organic Chemistry Laboratory	4
PHY 201 & 201L	College Physics I and College Physics Laboratory I	4
PHY 202 & 202L	College Physics II and General Physics Laboratory	4
Select one mathematics sequence from:		6-8
MTH 116 & MTH 148	Precalculus Math and Introductory Calculus I	
MTH 148 & MTH 149	Introductory Calculus I and Introductory Calculus II	
MTH 168 & MTH 169	Analytic Geometry & Calculus I and Analytic Geometry & Calculus II	

Major Requirements [1, 6] 44

BIO 151 & 151L	Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology	4
BIO 152 & 152L	Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	4
BIO 299	Biology Seminar	1
BIO 310	Ecology	3
BIO 312	General Genetics	3
BIO 420	Biology Capstone Seminar (Satisfies Cap Major Capstone)	1
Select two environmental/ecological courses from: [2, 6]		7
BIO 207L	Trees of Ohio	
BIO 301 & 301L	Evolution and Evolution Laboratory	
BIO 309 & 309L	Comparative Anatomy of the Vertebrates and Comparative Anatomy Laboratory	
BIO 310L	Ecology Laboratory	
BIO 311	Introductory Entomology	
BIO 312L	Genetics Laboratory	
BIO 314 & 314L	Plant Biology and Plant Biology Laboratory	
BIO 320 & 320L	Marine Biology and Marine Biology Laboratory	
BIO 350	Applied and Environmental Microbiology	
BIO 359	Sustainability & the Biosphere	
BIO 370	Conservation Biology	
BIO 402 & 402L	Vertebrate Zoology and Vertebrate Zoology Laboratory	
BIO 407 & 407L	Plant Diversity & Ecology and Plant Diversity & Ecology Laboratory	
BIO 409 & 409L	Ecological Restoration and Ecological Restoration Laboratory	

BIO 411 & 411L	General Microbiology and General Microbiology Laboratory	
BIO 421	Biological Problems [4]	
BIO 435 & 435L	Microbial Ecology and Microbial Ecology Laboratory	
BIO 439	Analysis & Interpretation of Biological Data	
BIO 445	Evolution & Development	
BIO 450 & 450L	Comparative Animal Physiology and Comparative Animal Physiology Laboratory	
BIO 452 & 452L	Biology of Rivers & Lakes and Biology of Rivers & Lakes Laboratory	
BIO 459 & 459L	Environmental Ecology and Environmental Ecology Laboratory	
BIO 461 & 461L	Invertebrate Zoology and Invertebrate Zoology Laboratory	
BIO 480 & 480L	Principles of Microscopy and Principles of Microscopy Laboratory	
BIO 489	Mycology	
BIO 496L	Special Topics Laboratory in Biology	
Select two basic biomedical courses from: [3, 6]		7
BIO 301 & 301L	Evolution and Evolution Laboratory	
BIO 309 & 309L	Comparative Anatomy of the Vertebrates and Comparative Anatomy Laboratory	
BIO 311	Introductory Entomology	
BIO 312L	Genetics Laboratory	
BIO 350	Applied and Environmental Microbiology	
BIO 403 & 403L	Physiology I and Physiology Laboratory I	
BIO 404	Physiology II	
BIO 411 & 411L	General Microbiology and General Microbiology Laboratory	
BIO 412	Genetics Human Diseases	
BIO 415 & 415L	Neurobiology and Neurobiology Laboratory	
BIO 421	Biological Problems [4]	
BIO 427	Immunology	
BIO 439	Analysis & Interpretation of Biological Data	
BIO 440 & 440L	Cell Biology and Cell Biology Laboratory	
BIO 442 & 442L	Developmental Biology and Developmental Biology Laboratory	
BIO 445	Evolution & Development	
BIO 460	Introduction to Bioinformatics	
BIO 461 & 461L	Invertebrate Zoology and Invertebrate Zoology Laboratory	
BIO 462	Molecular Biology	
BIO 465	Disease Ecology	
BIO 466	Biology of Infectious Disease	
BIO 470	Cancer Biology	
BIO 475 & 475L	Human Anatomy and Human Anatomy Laboratory	
BIO 480 & 480L	Principles of Microscopy and Principles of Microscopy Laboratory	
BIO 489	Mycology	
BIO 496L	Special Topics Laboratory in Biology	
CHM 420	Biochemistry	
Select four electives, two with accompanying labs, from the group above. [5, 6]		14

Breadth [7]

ASI 150	Introduction to the University Experience	1
Social & Behavioral Sciences (includes CAP Social Science)		6
Total Hours to total at least		120

1. The Department of Biology supports national standards established by the National Institutes of Health for the responsible, humane treatment and housing of animals. The biology curriculum contains some laboratory courses in which dissection and vivisection are necessary and required in order to convey an understanding of certain biological concepts. All students are expected to participate in such laboratory exercises in the introductory biology sequence, BIO 151L and BIO 152L which involve dissection and/or vivisection. In other elective formal laboratory courses in which dissection and vivisection occur, it is expected that students will participate in all aspects of the laboratory. No alternatives to dissection or vivisection will be offered in these courses. It is ultimately the responsibility of students to make certain that they enroll in courses in which they are able to participate in all required exercises, and to obtain information from each instructor as to the specific laboratory course content and requirements. The Department of Biology maintains an updated list of laboratory courses in which dissection and/or vivisection is required in order to assist students in the selection of course work.
2. One with accompanying laboratory.
3. One with accompanying laboratory. BIO 462 strongly recommended as one of two courses.
4. By permission only. Qualifies as a laboratory elective for any category.
5. One of the following Non-BIO science courses may include: CHM 201,CHM 302,CHM 303,CHM 420,MTH 367,CPS 107,CPS 111,CPS 132,GEO 2 Non-BIO science courses may be included with the approval of the chairperson.
6. A minimum grade of C- is required.
7. HST 340, HST 341 or HST 342 are highly recommended.

Bachelor of Science, Environmental Biology (EVB) minimum 120 hours

Environmental biology is a science specialization based upon the fundamentals of biology and ecology, applying interdisciplinary skills, knowledge, and principles to the environmental problems facing society today. Students entering this dynamic field could become directly involved in addressing some of the significant global problems related to human impact on the environment. In addition to the standard base of courses required of most biology majors, the curriculum also requires a challenging core of environmentally related science courses and course work drawn from a multidisciplinary elective pool that includes offerings in the humanities and social sciences.

Internship Program: Majors will participate in the EVB internship program (BIO 499, see course prerequisites), where they will have the unique opportunity to obtain valuable training and experience under the mentorship of established scientists and other environmental professionals.

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.

Common Academic Program (CAP) [1]

First-Year Humanities Commons [2]		12 cr. hrs.
HST 103	Introduction to Global Historical Studies	
REL 103	Introduction to Religious and Theological Studies	
PHL 103	Introduction to Philosophy	
ENG 100	Writing Seminar I [3]	
Second-Year Writing Seminar [4]		0-3 cr. hrs.
ENG 200	Writing Seminar II	
Oral Communication		3 cr. hrs.
CMM 100	Principles of Oral Communication	
Mathematics		3 cr. hrs.
Social Science		3 cr. hrs.
SSC 200	Social Science Integrated	
Arts		3 cr. hrs.
Natural Sciences [5]		7 cr. hrs.
Crossing Boundaries		up to 12 cr. hrs.
Faith Traditions		
Practical Ethical Action		
Inquiry [6]		
Integrative		
Advanced Study		
Philosophy and/or Religious Studies (6 cr. hrs.)		
Historical Studies (3 cr. hrs.) [7]		
Diversity and Social Justice [8]		3 cr. hrs.
Major Capstone [9]		0-6 cr. hrs.

1 The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

2 May be completed with ASI 110 and ASI 120 through the Core Program.

3 May be completed with ENG 100A and ENG 100B, by placement.

4 May be completed with ENG 114 or ENG 198 or ASI 120.

5 Must include two different disciplines and at least one accompanying lab.

6 U.S. History AP and CLEP credit will not satisfy this requirement.

7 May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.

8 May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

9 The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

(Satisfies CAP Mathematics and CAP Natural Science)		
CHM 123 & 123L	General Chemistry and General Chemistry Laboratory	4
CHM 124 & 124L	General Chemistry and General Chemistry Laboratory	4
CHM 313 & 313L	Organic Chemistry and Organic Chemistry Laboratory	4
GEO 115	Physical Geology	3
GEO 116	Geological History of the Earth	3
GEO 450	Applied Geographic Information Systems	4
PHY 201 & 201L	College Physics I and College Physics Laboratory I	4
Select one sequence from:		6-7
MTH 116 & MTH 148	Precalculus Math and Introductory Calculus I	
MTH 148 & MTH 149	Introductory Calculus I and Introductory Calculus II	
MTH 148 & MTH 207	Introductory Calculus I and Introduction to Statistics [1]	

Major Requirements [2] **43-48**

BIO 151 & 151L	Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology	4
BIO 152 & 152L	Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	4
BIO 299	Biology Seminar	1
BIO 310 & 310L	Ecology and Ecology Laboratory	4
BIO 312	General Genetics	3
BIO 420	Biology Capstone Seminar (Satisfies CAP Major Capstone)	1
BIO 479L	Environmental Instrumentation Laboratory	2

BIO 499	Environmental Biology Internship [3]	3
Environmental and Ecological Courses: Select 5 lectures and 4 labs:[2, 4]		18-22
BIO 207L	Trees of Ohio	
BIO 301 & 301L	Evolution and Evolution Laboratory	
BIO 311	Introductory Entomology	
BIO 312L	Genetics Laboratory	
BIO 314 & 314L	Plant Biology and Plant Biology Laboratory	
BIO 320 & 320L	Marine Biology and Marine Biology Laboratory	
BIO 350	Applied and Environmental Microbiology	
BIO 359	Sustainability & the Biosphere	
BIO 370	Conservation Biology	
BIO 402 & 402L	Vertebrate Zoology and Vertebrate Zoology Laboratory	
BIO 407 & 407L	Plant Diversity & Ecology and Plant Diversity & Ecology Laboratory	
BIO 409 & 409L	Ecological Restoration and Ecological Restoration Laboratory	
BIO 421	Biological Problems [5]	
BIO 439	Analysis & Interpretation of Biological Data	
BIO 450 & 450L	Comparative Animal Physiology and Comparative Animal Physiology Laboratory	
BIO 452 & 452L	Biology of Rivers & Lakes and Biology of Rivers & Lakes Laboratory	
BIO 459 & 459L	Environmental Ecology and Environmental Ecology Laboratory	
BIO 478	Honors Thesis Project	
BIO 489	Mycology	
BIO 496L	Special Topics Laboratory in Biology	
Biology Elective: Select one course from: [2, 3, 5, 6]		3-4
BIO 309 & 309L	Comparative Anatomy of the Vertebrates and Comparative Anatomy Laboratory	
BIO 403 & 403L	Physiology I and Physiology Laboratory I	
BIO 404	Physiology II	
BIO 411 & 411L	General Microbiology and General Microbiology Laboratory	
BIO 412	Genetics Human Diseases	
BIO 415	Neurobiology	
BIO 427	Immunology	
BIO 435 & 435L	Microbial Ecology and Microbial Ecology Laboratory	
BIO 440 & 440L	Cell Biology and Cell Biology Laboratory	
BIO 442 & 442L	Developmental Biology and Developmental Biology Laboratory	
BIO 445	Evolution & Development	
BIO 462	Molecular Biology	
BIO 466	Biology of Infectious Disease	
BIO 475 & 475L	Human Anatomy and Human Anatomy Laboratory	
BIO 480 & 480L	Principles of Microscopy and Principles of Microscopy Laboratory	
Breadth		
ASI 150	Introduction to the University Experience	1
Social and Behavioral Sciences		6
Total Hours to total at least		120

1. Other appropriate statistics courses may be substituted with the approval of the EVB Program Director or Department Chairperson.
2. A minimum grade of C- is required for all BIO courses.
3. BIO 499 requires the permission of the EVB Program Director.
4. One Laboratory from the Biology Electives can count toward Environmental & Ecological requirements.
5. BIO 421 is permission only. Qualifies as a laboratory elective.
6. One of the following non-BIO science courses may be substituted as a Biology Elective Course: SEE 301, CHM 314, MTH 367. GEO 208.

Minor in Biology (BIO)

Biology		
BIO 151 & 151L	Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology	4
BIO 152 & 152L	Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	4
BIO 310	Ecology	3
BIO 312	General Genetics	3
Select two BIO courses (300/400 level)		6
Total Hours		**20**

Minor in Neuroscience (NSC)

The Neuroscience minor is designed for students with academic and/or professional interests in the field of Neuroscience. Upon completion of the Neuroscience minor students will: i) gain strong foundational knowledge of the biological functions of the nervous system and its relationship to behavior and brain disorders; ii) demonstrate knowledge of the grand challenges and questions facing modern experimental neuroscience; and iii) develop an appreciation of the interdisciplinary nature of this fascinating scientific field. The Neuroscience minor is housed in the Biology Department. Students can earn this minor by completing two core Neuroscience courses, introductory Psychology, two upper-level Biomedical elective courses and two upper-level Psychology elective courses from the course list below for a total of 19 credit hours. Students who wish to minor in Neuroscience should contact the Neuroscience Minor Coordinator.

Required Courses [1,2]		
BIO 415	Neurobiology	3
BIO 415L	Neurobiology Laboratory	1
or BIO 416	Neuroscience Seminar	
PSY 101	Introductory Psychology	3
Select two Biomedical courses from the following: [1,2,3]		6
BIO 403	Physiology I	
or HSS 307	Human Physiology	
BIO 404	Physiology II	

BIO 411	General Microbiology	
BIO 412	Genetics Human Diseases	
BIO 427	Immunology	
BIO 439	Analysis & Interpretation of Biological Data	
BIO 440	Cell Biology	
BIO 445	Evolution & Development	
BIO 442	Developmental Biology	
BIO 462	Molecular Biology	
BIO 475	Human Anatomy	
or HSS 305	Human Anatomy	
CHM 420	Biochemistry	
or CHM 451	General Biochemistry I	
or CHM 452	General Biochemistry II	
Select two Psychology courses from the following: [1,3]		6
PSY 321	Cognition	
PSY 322	Learning	
PSY 323	Psychology of Perception	
PSY 355	Developmental Psychopathology	
PSY 363	Abnormal Psychology	
PSY 422	Biopsychology	
Total Hours		**19**

1 Students who wish to minor in Neuroscience should contact the Neuroscience Minor Coordinator.

2 A minimum grade of a C- is required for all Biology (BIO) courses in the minor.

3 Additional courses may be approved by the Neuroscience Minor Coordinator.

- Bachelor of Science, Biology (p. 1)
- Bachelor of Science, Environmental Biology (p. 3)

Biology

First Year

Fall	Hours	Spring	Hours
ASI 150	1	BIO 152 & 152L	4
BIO 151 & 151L (CAP Natural Science w/lab)	4	CHM 124 & 124L	4
CHM 123 & 123L (CAP Natural Science)	4	MTH 149	3
MTH 148 (Satisfies CAP Mathematics)	3	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
ENG 100 (CAP Humanities Commons)	3	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3		
	18		**17**

Second Year

Fall	Hours	Spring	Hours
BIO 299	1	BIO 310	3
BIO 312	3	CHM 314 & 314L	4
CHM 313 & 313L	4	PHY 202 & 202L	4
PHY 201 & 201L	4	CMM 100 (CAP Communication)	3
ENG 200 (CAP Writing Seminar)	3	SSC 200 (CAP Social Science)	3
	15		**17**

Third Year

Fall	Hours	Spring	Hours
BIO Elective Biomed	3	BIO 420 (Satisfies CAP Major Capstone)	1
BIO Elective Env/Eco w/lab	4	BIO Elective Env/Eco	3
CAP Arts	3	BIO Elective Biomed w/lab	4
CAP Faith Traditions	3	CAP Inquiry	3
CAP Advanced Historical Studies	3	CAP Integrative	3
		Social Science - elective	3
	16		**17**

Fourth Year

Fall	Hours	Spring	Hours
BIO Elective w/lab	4	BIO Elective w/lab	4
BIO Elective	3	BIO Elective	3
CAP Adv. Philosophy/Religious Studies (Practical Ethical Action)	3	CAP Advanced Philosophy/ Religious Studies	3
CAP Diversity and Social Justice	3	General Elective (optional)	3
General Elective (optional)	3	General Elective (optional)	3
	16		**16**

Total credit hours: 132

Environmental Biology

First Year

Fall	Hours	Spring	Hours
ASI 150	1	BIO 152 & 152L	4
BIO 151 & 151L (CAP Natural Science w/lab)	4	CHM 124 & 124L	4
CHM 123 & 123L	4	MTH 149	3
MTH 148 (Satisfies CAP Mathematics)	3	HST 103, PHL 103, or REL 103 (CAP Humanities Commons)	3
ENG 100 (CAP Humanities Commons)	3	HST 103, PHL 103, or REL 103 (CAP Humanities Commons)	3
	15		**17**

Second Year

Fall	Hours	Spring	Hours
BIO 310 & 310L	4	BIO 299	1
CHM 313 & 313L	4	BIO 312	3
ANT 150 (Satisfies CAP Inquiry, Diversity and Social Justice, Social Science elective)	3	Environmental & Ecological Lecture	3
Environmental & Ecological Lecture	3	Environmental & Ecological Lab	1
ENG 200 (CAP Writing Seminar)	3	General Elective	3
		CMM 100 (CAP Communication)	3
		SSC 200 (CAP Social Science)	3
	17		**17**

Third Year

Fall	Hours	Spring	Hours
GEO 115	3	BIO 420 (Satisfies CAP Major Capstone)	1
PHY 201 & 201L	4	Environmental & Ecological Lecture	3
Enviornmental & Ecological Lecture	3	Environmental & Ecological Lab	1
Enviornmental & Ecological Lab	1	GEO 116	3
HST 103, PHL 103, or REL 103 (CAP Humanities Commons)	3	CAP Faith Traditions	3
CAP Arts	3	CAP Advanced Historical Studies	3
	17		**14**

Fourth Year

Fall	Hours	Spring	Hours
BIO 479L	2	BIO 499	3
CAP Adv. Philosophy/Religious Studies (Practical Ethical Action)	3	CAP Integrative	3
GEO 450	4	Environmental & Ecological Lecture	3
General Elective	3	General Elective	3
Biology Elective	3	CAP Advanced Philosophy/ Religious Studies	3
	15		**15**

Total credit hours: 127

Courses

BIO 101. Life, Environment, and Society. 3 Hours
An introductory course covering the study of life in all its forms, understanding how life interacts with the environment and the role of biological inquiry in society. Emphasis will be placed on discussing topical issues relevant to evaluating the critical role of the life sciences in society today. Supporting laboratory strongly recommended, but optional. No prerequisite. For non-science majors only.

BIO 101L. Life, Environment, and Society Laboratory. 1 Hour
A hands-on approach to the study of life, understanding how life interacts with the environment, and the role of biological inquiry in society. Lab activities will stress an experiential, inquiry-based approach to topics relevant in today's society in an effort to increase student's abilities to critically evaluate modern science media. Laboratory topics are designed to run parallel to lecture topics. Recommended that the laboratory be taken concurrently with BIO 101 lecture. One two-hour laboratory per week. For non-science majors. Corequisite(s): BIO 101.

BIO 151. Concepts of Biology I: Cellular & Molecular Biology. 3 Hours
Introduction to the biological concepts surrounding cell and molecular biology. Topics include scientific practice, molecular basis of life, cellular composition and energy processes, genetics, and biotechnology. Intended for science majors. Core biology course.

BIO 151L. Concepts of Biology Laboratory I: Cellular & Molecular Biology. 1 Hour
Laboratory-based introduction to the biological concepts surrounding cell and molecular biology. Utilizing a hands-on approach to the study of life, students will take part in experiential, inquiry-based activities as they observe the properties of cellular, micro-scale biology while concurrently defining proper laboratory procedures, operating modern scientific instrumentation, and practicing effective documentation of experiments. Topics include scientific practice, biological instrumentation, cellular composition and processes, genetics, and biotechnology. One three-hour lab per week. Intended for science majors. Core biology course. Corequisite(s): BIO 151.

BIO 152. Concepts of Biology II: Evolution & Ecology. 3 Hours
Introduction to the biological concepts surrounding evolution and ecology. Topics include scientific practice, evolutionary basis of life, phylogeny and systematics, biodiversity, ecology and biosphere sustainability. Intended for science majors. Core biology course.

BIO 152L. Concepts of Biology Laboratory II: Evolution & Ecology. 1 Hour
Laboratory-based introduction to the biological concepts surrounding evolution, diversity and ecology. Utilizing a hands-on approach, students will take part in experiential, inquiry-based activities as they explore the concepts of evolution and macro-scale biology while concurrently developing proper laboratory procedures, operating modern scientific instrumentation, and practicing effective scientific presentation of research through the two most widely accepted formats: the scientific journal article and the research poster presentation. Topics include evolution and phylogeny, the diversity of life, ecology, and human impact on ecosystems. One three-hour laboratory per week. Intended for science majors. Core biology course. Corequisite(s): BIO 152.

BIO 207L. Trees of Ohio. 1 Hour
A practical laboratory of dendrology. Taxonomy and ecology of woody plants of Ohio with an emphasis on identification skills. Field trips to encounter various species and habitats, taxonomic and botanical terminology, working with a dichotomous key and laboratory exercises will be blended together. Prerequisites: BIO 152; BIO152L.

BIO 299. Biology Seminar. 1 Hour
Introduction to biological journals and abstracting materials. Practice in reviewing, abstracting, and presenting biological information, and career development. Core biology course. Biology and environmental biology majors only. Prerequisite(s): BIO 152.

BIO 300. Research Experience in Biology. 0-1 Hours
In this course, students will engage in faculty mentored experiential learning in Biology. These experiences may be related to biology research activity in a field or laboratory setting and course outcomes will be assessed through a reflection following the experience.

BIO 301. Evolution. 3 Hours
Theory and evidence of organic evolution, with emphasis on microevolutionary change and population genetics. Prerequisite(s): BIO 152.

BIO 301L. Evolution Laboratory. 1 Hour
A laboratory research experience in evolution with emphasis on phylogenetic reconstruction and natural selection. Prerequisites: BIO 152. Corequisites: BIO 301.

BIO 309. Comparative Anatomy of the Vertebrates. 3 Hours
Study of changes that have occurred in the vertebrate body with the passage of time, and analysis of their significance. Prerequisite(s): BIO 152.

BIO 309L. Comparative Anatomy Laboratory. 1 Hour
Dissection and study of the anatomical structure of representative vertebrate animals. One three-hour laboratory per week. Corequisite(s): BIO 309.

BIO 310. Ecology. 3 Hours
Interrelationship of plants, animals, and micro-organisms with the physical-chemical environment: nutrient cycles, energy flow, ecosystems, and factors affecting distribution and abundance of organisms. Core biology course. Prerequisite(s): BIO 152.

BIO 310L. Ecology Laboratory. 1 Hour
Measurement of population, community, and environmental variables in terrestrial and aquatic systems. The lab is field-based using local ecological resources. One three-hour laboratory per week and weekend field trips. Corequisite(s): BIO 310.

BIO 311. Introductory Entomology. 3 Hours
Classification, physiology, ecology, and impact of insects on society. Prerequisite(s): BIO 152.

BIO 312. General Genetics. 3 Hours
Study of the principles of variation and heredity covering both Mendelian and molecular genetics. Core biology course. Prerequisite(s): BIO 152.

BIO 312L. Genetics Laboratory. 1 Hour
Exploration of heredity using molecular genetic methods. One three-hour laboratory per week. Corequisite(s): BIO 312.

BIO 314. Plant Biology. 3 Hours
Consideration of structure, function, reproduction, and inheritance as applicable in the plant patterns of life. Emphasis on the vascular plants. Prerequisite(s): BIO 152.

BIO 314L. Plant Biology Laboratory. 1 Hour
Emphasis on generalized structure and function of plants. One three-hour laboratory per week. Corequisite(s): BIO 314.

BIO 320. Marine Biology. 2 Hours
Introduction to the diversity of marine life including the physical-chemical environment. Prerequisite(s): Permission of instructor. . Corequisite(s): BIO 320L.

BIO 320L. Marine Biology Laboratory. 2 Hours
Examination of marine organisms and processes. Laboratory work conducted on UD campus and at off-campus field sites in the southern United States or Hawaii. Prerequisite(s): Permission of instructor. Corequisite(s): BIO 320.

BIO 330. Animal Behavior. 3 Hours
An evolutionary approach to the study of animal behavior, emphasizing both proximate mechanisms and functional explanations of the survival value of behavior. Prerequisite(s): BIO 152.

BIO 330L. Animal Behavior Laboratory. 1 Hour
Analysis of animal behavior using various animal models. One three-hour laboratory per week and occasional Saturday field trips. Corequisite(s): BIO 330.

BIO 350. Applied and Environmental Microbiology. 3 Hours
This course covers the fundamentals of applied and environmental microbiology, such as the production of fine and commodity chemicals, agriculture and food manufacturing, bioremediation of wastes and toxic chemicals, as well as other relevant topics in the applications of microbes for human and societal benefits. Prerequisites: BIO 151; BIO 152; CHM 124.

BIO 359. Sustainability & the Biosphere. 3 Hours
Study of the principles of sustainability. All areas of sustainability will be covered with emphasis on ecological facets of sustainability. Discussion of loss of habitat and biodiversity in the context of sustaining natural resources for future generations. Prerequisite(s): BIO 152 or SCI 230.

BIO 362. Bioessentialism and Constructions of Bodies. 3 Hours
Study of bodies from an essentialist and bio-psychosocial models, as well as culturally informed and historical perspectives. Examines the historical and cultural impact on biological processes and identity formation. Through an intersectional lens, examines power dynamics impacting inclusion and exclusion in dominant structures. Prerequisites: Sophomore standing or higher.

BIO 370. Conservation Biology. 3 Hours
An ecosystem approach to the study of and threat to local, regional, and global biodiversity. Application of ecological principles of conservation of species and habitats. Prerequisite(s): BIO 152.

BIO 395. Global Environmental Biology. 3 Hours
Presentation of the biological and ecological principles needed for the critical discussion and evaluation of current global issues related to human impact on the environment. Ecological data on the current extinction crisis and sustainable solutions will be addressed. No credit toward a biology major or minor. Prerequisite(s): BIO 101, BIO 151 or SCI 230.

BIO 402. Vertebrate Zoology. 3 Hours
The morphology, physiology, ecology, and distribution of representative vertebrate groups. Prerequisite(s): BIO 310 or BIO 312.

BIO 402L. Vertebrate Zoology Laboratory. 1 Hour
Laboratory focused on the diversity, systematics and ecology of vertebrates. One three-hour laboratory per week. Corequisite(s): BIO 402.

BIO 403. Physiology I. 3 Hours
Physical-chemical examination of the physiological events occurring in a living system with emphasis on physiology of the cell, excretion, nerves, muscles, bone, blood, heart, circulation, and respiration. Prerequisite(s): BIO 152; CHM 314.

BIO 403L. Physiology Laboratory I. 1 Hour
Systematic approach to the acquisition and interpretation of information about the physiology of living systems. One three-hour laboratory per week. Corequisite(s): BIO 403 or HSS 307.

BIO 404. Physiology II. 3 Hours
Integrated systems based examination of physiological processes in humans with a special emphasis on molecular mechanisms of pathophysiological conditions in humans and experimental animal systems. Prerequisite(s): BIO 403.

BIO 407. Plant Diversity & Ecology. 3 Hours
Lecture course addressing plant diversity and ecology. Course includes an overview of plant systematics and aspects of plant anatomy, population ecology, community ecology, ecosystem ecology, and global ecology. Prerequisite(s): BIO 310.

BIO 407L. Plant Diversity & Ecology Laboratory. 1 Hour
Field laboratory course addressing plant diversity and ecology. Includes a series of field labs focused on plant identification, followed by labs focused on quantitatively assessing plants, plant communities, and ecosystems. Labs will take place in a variety of natural areas. Corequisite(s): BIO 407.

BIO 409. Ecological Restoration. 3 Hours
Principles and practices of ecological restoration. The course presents the rationale and knowledge needed to understand, appreciate, plan and perform ecological restoration. Prerequisite(s): BIO 310.

BIO 409L. Ecological Restoration Laboratory. 1 Hour
Practical applications of the principles of ecological restoration to a variety of ecosystems. One three-hour laboratory per week. Corequisite(s): BIO 409.

BIO 411. General Microbiology. 3 Hours
Introductory course stressing the physiology, cultivation, and classification of microbial organisms; their role in medicine, agriculture, and industry. Prerequisite(s): BIO 152; CHM 313.

BIO 411L. General Microbiology Laboratory. 1 Hour
Lab exercises focusing on the basic techniques involved in the isolation and identification of bacteria, including assessment of biochemical activities, growth characteristics of bacteria, and the impact of the environment on microbial growth. One three-hour laboratory per week. Corequisite(s): BIO 411.

BIO 412. Genetics Human Diseases. 3 Hours
Study of the molecular genetics of inherited human diseases using a systems approach. Survey of inherited diseases linked to major organs and organ systems. Prerequisite(s): BIO 312; CHM 313.

BIO 415. Neurobiology. 3 Hours
Structure and function of the brain and nervous system. Emphasis on understanding cellular and molecular events within the nervous system using model organisms. Prerequisite(s): BIO 152; CHM 124.

BIO 415L. Neurobiology Laboratory. 1 Hour
Laboratory research experience in neuroscience with emphasis on cellular, molecular and behavioral neurobiology and neurochemistry. Prerequisite(s): BIO 152, BIO 415 (may be taken as a co-req), CHM 124.

BIO 416. Neuroscience Seminar. 1 Hour
Advanced seminar focusing on major topics in the field of Neuroscience and emphasizing the critical analysis of experimental approaches and research findings. Prerequisite(s): BIO 415 (may be taken as a co-req).

BIO 420. Biology Capstone Seminar. 1 Hour
Seminar course designed to further develop students' ability to communicate and synthesize within their discipline and prepare them for their chosen career paths in the Biological and Environmental professions. All class activities, including presentations, relate to key issues facing society today in addition to continued career development skills. Biology core and capstone course. Prerequisite(s): BIO 299, BIO 310, BIO 312.

BIO 421. Biological Problems. 1-2 Hours
Laboratory research problems. Topics arranged with faculty advisors. Prerequisite(s): (BIO 310 or BIO 312); Permission of department chairperson.

BIO 422. Biological Problems. 1-2 Hours
Library research problems. Topics arranged with faculty advisors. Prerequisite(s): (BIO 310 or BIO 312); Permission of department chairperson.

BIO 427. Immunology. 3 Hours
Discussions of antigens, antibodies, antigenicity, immunogenicity, and antigen-antibody reactions including hypersensitivity, immune tolerance, and transplants. Prerequisite(s): (BIO 403 or BIO 411 or BIO 440 or BIO 442) or CHM 420.

BIO 435. Microbial Ecology. 3 Hours
Study of the diversity and activity of microorganisms and the interrelationships between microorganisms and their environments with emphasis on aquatic ecosystems. Prerequisite(s): BIO 411; CHM 314.

BIO 435L. Microbial Ecology Laboratory. 1 Hour
Examination of the methods of isolation and enumeration of microorganisms and techniques for determining their activities in the field and laboratory. One three-hour laboratory per week. Corequisite(s): BIO 435.

BIO 439. Analysis & Interpretation of Biological Data. 3 Hours
Introducing the nature of some of the important types of data that are generated in biological research, the databases that warehouse such data, the principles involved in the analysis of such data, the use of appropriate software to analyze such data, and the biological interpretation of the results of analysis. Prerequisite(s): BIO 152.

BIO 440. Cell Biology. 3 Hours
Study of the function, structure, composition, heredity, and growth of cells. Analysis of cell concepts in biochemical terms. Prerequisite(s): BIO 152; CHM 314.

BIO 440L. Cell Biology Laboratory. 1 Hour
Experimental approaches to explore modern concepts in cell structure, function, and biology. One three-hour laboratory per week. Corequisite(s): BIO 440.

BIO 442. Developmental Biology. 3 Hours
Study of animal development, including morphological patterns of development, mechanisms of cellular differentiation, cell-cell interactions during development, and mechanisms of differential gene expression. Emphasis on understanding development at the cellular and molecular levels. Prerequisite(s): BIO 152; CHM 314.

BIO 442L. Developmental Biology Laboratory. 1 Hour
Exploration of the development of key model organisms from the morphological and molecular perspectives with an emphasis on basic developmental laboratory techniques. One three-hour laboratory per week. Corequisite(s): BIO 442.

BIO 445. Evolution & Development. 3 Hours
Molecular and population genetic examination of the evolution of animal form. Topics include comparative developmental biology, population genetics, and molecular evolution. Prerequisite(s): BIO 312.

BIO 450. Comparative Animal Physiology. 3 Hours
Organized on a function-system basis, course dealing with environment-organism interaction and with integrative systems of the principle phyla of animals. Prerequisite(s): (BIO 310 or BIO 312); CHM 124.

BIO 450L. Comparative Animal Physiology Laboratory. 1 Hour
Examination of physiological responses to the physical environment. Variations of the physical environment are examined in the field. Study of animals under controlled laboratory conditions with experimental design, data collection and analysis to assess physiological adaptations. One three-hour laboratory or field trip per week. Corequisite(s): BIO 450.

BIO 452. Biology of Rivers & Lakes. 3 Hours
The biological interrelationships of organisms in rivers, streams, lakes and ponds including biodiversity, ecological/evolutionary adaptations and structure of aquatic ecosystems. Prerequisite(s): BIO 310.

BIO 452L. Biology of Rivers & Lakes Laboratory. 1 Hour
Laboratory and field exercises emphasizing the biological, chemical and physical attributes of freshwater ecological systems. One three-hour laboratory or field trip per week. Corequisite(s): BIO 452.

BIO 459. Environmental Ecology. 3 Hours
The application of current ecological knowledge and principles toward the study of human impact on the environment. Emphasis on ecosystem dynamics, applied ecology, disturbance ecology, and approaches to solving global environmental problems. Prerequisite(s): BIO 310.

BIO 459L. Environmental Ecology Laboratory. 1 Hour
Analytical approach to studying applied ecology and human impact on the environment. Emphasis on laboratory and field approaches to solving environmental problems through the use of ecological principles. One three-hour laboratory per week. Corequisite(s): BIO 459.

BIO 461. Invertebrate Zoology. 3 Hours
Survey of the structure, activities, life histories, and relationships of the invertebrate animals, with some emphasis on their origin and development. Prerequisite(s): BIO 310 or BIO 312.

BIO 461L. Invertebrate Zoology Laboratory. 1 Hour
Examination of the structure and function of the major invertebrate phyla. Survey of representative animals with an emphasis on observational skills for analysis of the structural adaptations of live animals. One three-hour laboratory per week. Corequisite(s): BIO 461.

BIO 462. Molecular Biology. 3 Hours
Analysis of the nature of the gene and gene action. Particular attention to genetic regulation and to recent advances in molecular genetics. Prerequisite(s): BIO 312; CHM 314.

BIO 466. Biology of Infectious Disease. 3 Hours
The nature of infectious diseases, host-parasite relationships in resistance and infection, defense mechanism (antigen-antibody response); survey of the bacteria causing disease in humans. Prerequisite(s): BIO 411.

BIO 470. Cancer Biology. 3 Hours
Study of growth patterns and causes of cancer at the cellular and molecular levels. Discussion of the hereditary and environmental factors that contribute to the development of the disease in cancer patients. Description of the research being conducted to understand and cure the disease. Prerequisites: BIO 312, CHM 313. Corequisites: BIO 403 or BIO 415 or BIO 440 or BIO 442.

BIO 475. Human Anatomy. 3 Hours
Study of the fundamental principles of human gross anatomy with emphasis on all organ systems. Prerequisite(s): BIO 152; CHM 314.

BIO 475L. Human Anatomy Laboratory. 1 Hour
Study of human gross anatomy emphasizing all organs systems using computer-assisted dissection, anatomical human models and occasional dissection of nonhuman cadaver organs. One three-hour laboratory per week. Corequisite(s): BIO 475.

BIO 477. Honors Thesis Project. 3 Hours
First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

BIO 478. Honors Thesis Project. 3 Hours
Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

BIO 479L. Environmental Instrumentation Laboratory. 2 Hours
The understanding and use of field- and laboratory-based equipment to study current environmental issues. Emphasis on team-centered approaches to investigating environmental problems. Same as GEO 479L. One five-hour laboratory or field trip per week. Prerequisite(s): BIO 310; GEO 116.

BIO 480. Principles of Microscopy. 3 Hours
Focus on basic principles and theory of light and electron microscopy, and how these techniques address fundamental questions in science. Prerequisite(s): BIO 152.

BIO 480L. Principles of Microscopy Laboratory. 1 Hour
Application and practice of light and electron microscopy. One three-hour laboratory per week. Corequisite(s): BIO 480.

BIO 489. Mycology. 3 Hours
Introductory course stressing the interrelationship between fungi and the rest of the biological world. Emphasis on the basic biology and ecology of fungi, decomposition, species interactions, plant pathology and medical mycology. Prerequisite(s): BIO 152.

BIO 496. Special Topics in Biology. 1-3 Hours
Lecture course addressing advanced topics in biology. Topics are variable depending on faculty teaching the course and the course aims. Students should consult the class schedule. May be repeated. Prerequisite(s): BIO 151, BIO 152.

BIO 496L. Special Topics Laboratory in Biology. 1 Hour
Laboratory course addressing advanced topics in biology. Topics are variable depending on faculty teaching the course and the course aims. Students should consult the class schedule. May be repeated. Prerequisites: BIO 151L, BIO 152L.

BIO 499. Environmental Biology Internship. 3 Hours
Majors will have the opportunity to obtain valuable training and experience under the mentorship of established scientists and professionals. Emphasis on approaches to solving environmental problems including such research areas as bioremediation, risk assessment, and ecological restoration. May be repeated up to six semester hours. No science credit for biology majors. Prerequisite(s): Permission of Environmental Biology Program Coordinator.