

UNDERGRADUATE CATALOG 2017–18

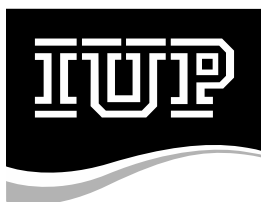
DEPARTMENT OF BIOLOGY

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

www.iup.edu/biology

This document is a direct extract from the full 2017–18 *Undergraduate Catalog*. As a result, the original page numbering will appear.

For information on other colleges at IUP, or about specific courses, please consult the full 2017–18 catalog, available at www.iup.edu/registrar/catalog. Earlier catalogs are also available at this web address.



Indiana University of Pennsylvania

Molecular Biology; Ecology, Conservation, and Environmental Biology; Environmental Health; Honors Biology; Pre-medical Biology; and Pre-veterinary Biology. Students who pursue the Pre-medical or Pre-veterinary Track must maintain a minimum cumulative GPA of 3.0 after their third semester in the program to continue in that track. All students, including transfer students, must have a cumulative GPA of 3.0 or higher to transfer into the Pre-medical or Pre-veterinary Track after their third semester.

The bachelor of science degree program in biology with no specialization is designed to provide maximum depth in the sciences and mathematics, combined with flexibility in the choice of ancillary science courses. This program allows the student (in consultation with the advisor) to select a suite of ancillary science and mathematics courses that is most appropriate to the student's specific interests within the field of biology. With proper selections from among ancillary science courses, a student could minor in any of the following: biochemistry, chemistry, geoscience, or applied statistics. Furthermore, with proper selection of free electives, a student could minor in either mathematics or physics.

BA—Biology

The bachelor of arts degree program in biology is designed for students who wish to combine a primary academic interest in biology with a secondary interest in a complementary field. Through the choice of complementary field and free electives, this curriculum allows the greatest overall flexibility in a student's program of study. The complementary field also allows pursuit of a minor or a double major in the secondary area of interest. The primary biology major combined with a double major or a minor in the complementary field can make an attractive educational package for the student and for potential employers. Examples of complementary fields that might enhance a student's competitiveness in the job market include anthropology, business administration, computer science, criminology (for forensic science), English (for technical writing), foreign language, geoscience, marketing, pre-law, or psychology.

BS—Biology/Cell and Molecular Biology Track

Students electing the bachelor of science degree with an emphasis in cell and molecular biology take the core biology courses and, in addition, a collection of upper-division courses that focus collectively on important aspects of modern cell and molecular biology. This track will prepare students for employment in technical positions or for graduate studies in cell biology, molecular biology, biotechnology, or related biomedical disciplines.

BS—Biology/Ecology, Conservation, and Environmental Biology Track

The Ecology, Conservation, and Environmental Biology (ECEB) Track includes all core biology courses and a selection of related courses that focus on ecological and environmental sciences. To achieve an environmental focus, the student must complete broad training in the sciences and mathematics. The track is designed to provide flexibility to allow pursuit of specialized interests within ECEB, including minors in other environmental disciplines (Applied Statistics, Geology, Geography, Regional Planning, and Sustainability). Course requirements for professional certification by the Ecological Society of America (Certified Associate Ecologist) and/or the Wildlife Society (Certified Wildlife Biologist) can be met within this track. This track prepares students for pursuing advanced degrees or employment in areas related to ecology and environmental sciences at universities, government, and private companies.

BS—Biology/Environmental Health Track

Students electing the bachelor of science degree with an emphasis in environmental health will take the core biology courses and a collection of upper-division courses that focus on environmental factors having an impact on human health. In addition, students will elect technical courses offered by other departments that provide analytical and problem-solving skills to identify, evaluate, and manage these factors. This track will prepare students for employment as environmental health specialists and practitioners in industry, government, and academia and for entry into graduate school programs in environmental and public health.

Department of Biology

Website: www.iup.edu/biology

Narayanaswamy Bharathan, Chairperson; S. Bharathan, Bi, Brenneman, Diep, Duchamp, Hinrichsen, Irani, Janetski, Knoch, Larkin, Luciano, Major, Morschhauser, Nealen, Pistole, Ruby, Simmons, Townsend, Travis, Tyree, Widzowski, Yerger; and professors emeriti Andrew, Butler, Gallati, Hulse, Humphreys, Kesner, Newell, Linzey, Lord, Moore, Schrock

Degree programs offered by the Department of Biology are the bachelor of science degree program in biology, the bachelor of arts degree program in biology, and the bachelor of science in education with a biology certification. The first two degree programs are under the College of Natural Sciences and Mathematics, and the third is under the College of Education and Communications. The department also offers minors in Biology and Biomedical Science.

BS—Biology

In addition to the bachelor of science degree with no specialization, the department also offers these specialized bachelor of science tracks: Cell and

BSEd—Secondary Biology

The Department of Biology, in conjunction with the College of Education and Communications, provides a program leading to the bachelor of science in education with certification to teach biology. The program is committed to preparing teachers who possess a strong foundation in biology, a broad background in associated sciences, and an extensive preparation in pedagogy.

Minors—Biology and Biomedical Science

These minors are intended for students in the Nursing and Allied Health or Natural Science programs. Not for biology majors.

Minor—Forensic Biosciences

The goal of this interdisciplinary minor is to provide students with a broad-based understanding of the field of forensic biosciences. The minor allows students to gain both a deep understanding of a traditional discipline through their major field of study while gaining experience with various aspects of forensic biology and criminal investigations. It is not designed to provide students necessarily with the methods and measures of forensics, which will come from student's undergraduate fields of study and/or future graduate study. The purpose is to give students an understanding of the basic issues and the applications of those methods within the context of forensic biology.

Biology Honors Program

The honors program is open by departmental permission to all majors in the Department of Biology. Students who, by the end of the first semester of their sophomore year, have a minimum 3.25 cumulative GPA will be invited to apply for the program. The application will include a transcript and a personal statement outlining the student's academic plan, career goals, and why she or he wants to be considered for the honors program. A department honors committee (makeup to be determined by the department) will select a maximum of 12 students per year for the program.

Students accepted into the program will take BIOL 484 during the first semester of their junior year, two semesters of BIOL 483, and one 500- or 600-level BIOL course. The honors thesis will be based on research performed under the supervision of a department professor who specializes in the student's area of interest and must be approved by a thesis committee made up of the faculty member directing the student and two others, one of whom may come from outside the Department of Biology.

Students interested in the Biology Honors Program should discuss this opportunity with their advisors as early as possible so that they have achieved the necessary GPA and are prepared to make application for the program in the spring of their sophomore year. This program, though designed for all qualified students within the Department of Biology, should be of particular value to students intending to seek admission to graduate or professional schools. Honors course work is designated on university transcripts. Students completing the departmental honors program are recognized at departmental commencement ceremonies.

Accelerated MS Track

The department offers an accelerated curriculum that provides an alternative pathway for progression through the requirements for the master of science degree with a major in biology. Although a graduate program, the Accelerated MS Track begins during and overlaps with the undergraduate program. By taking advantage of this track, a highly motivated undergraduate student can, with appropriate planning beginning in the junior year, tailor his or her curriculum to complete the requirements for both the BS—Biology and MS—Biology in a total of five calendar years. Upon completion of this accelerated program, students will be prepared for skilled technical positions in the industrial or academic workforce or for advanced study in outstanding graduate or professional schools. Undergraduate students should consult the *Graduate Catalog* or contact the Biology Department graduate coordinator for more information.

Certificate in Cell and Molecular Biology

For students who wish to obtain specialized training in cell and molecular biology without electing the major track, the department offers a 15-credit

certificate program that consists of four core courses and one elective course. Completion of the certificate will help to prepare students for positions in the modern biotechnology workforce. Applications are available at 114 Weyandt Hall. For more information, call 724-357-2352.

Foreign Language Requirement

Some biology majors must complete intermediate-level or two semesters of foreign language starting at the highest level recommended by the freshman Preregistration Placement Test in that language (may be included in Liberal Studies electives). This requirement can also be met by demonstrating proficiency in a foreign language equivalent to the intermediate level. See individual tracks and programs for specific requirements.

Cooperative Programs

The department cooperates in programs with Jefferson Medical College, Lake Erie College of Osteopathic Medicine, and Pymatuning Laboratory of Ecology.

Jefferson Medical College, Physician Shortage Area Program (PSAP): IUP is a participating affiliate of the PSAP, established by Jefferson Medical College of Thomas Jefferson University in Philadelphia for the purpose of increasing the distribution of physicians practicing in underserved areas of Pennsylvania. To be eligible for this special program, students must be from, or have spent a significant amount of time living in, a non-urban area. Students interested in this program should enroll as biology/pre-medical majors.

This program will admit approximately four graduates of IUP and 20 graduates of other colleges each year. Students from IUP will be admitted only if properly qualified according to the admission standards and policies of Jefferson Medical College. Applications are reviewed by the Joint IUP-Jefferson Subcommittee, and recommendations are made to the Jefferson Committee on Admissions. Preference will be given to Pennsylvania residents who are interested in this program, with highest priority given to those who actually live, at the time of application, in the underserved area in which they hope to practice.

Osteopathic Medicine: IUP has "Early Acceptance" agreements with both Philadelphia College of Osteopathic Medicine and Lake Erie College of Osteopathic Medicine. These programs allow qualifying students to gain provisional acceptance into the medical college as long as they maintain a GPA of 3.4 or better in the Biology/Pre-medical curriculum at IUP and score 25 or higher on the MCAT with no score lower than 7 on any section. These programs are also known as "3+4" programs, since students may elect to enter the medical school after just three years at IUP. Students are awarded a bachelor of science degree with a major in biology from IUP upon successful completion of their three years of undergraduate requirements at IUP and the first-year curriculum at LECOM or PCOM.

To be considered for either of the "Early Acceptance" programs, students must be in the top 25 percent of their graduating class, have a minimum SAT score (Math + Verbal) of 1170 or a minimum ACT score of 26, and have additional evidence of scholarly/professional potential, leadership, and community involvement.

Pymatuning Laboratory of Ecology: Biology majors can expand their selection of course offerings by participating in a cooperative program with the University of Pittsburgh's Field Station at the Pymatuning Laboratory of Ecology located in northwestern Pennsylvania. These elective courses center on ecological and environmental topics and vary annually. Application and registration for both summer sessions must be completed by April 1. Students usually register for credit and pay fees at IUP. Books, lab fee, and room and board are paid to the Pymatuning Laboratory of Ecology. The faculty advisor for this program assists students in program planning, application, and registration.

Degree Programs

In the programs of study that follow, no more than a total of 6 credits from internships, independent study, and special topics can be counted toward biology course requirements. Credits beyond 6 earned from these sources are counted as general electives. Note: Students changing into the majors of

biology or biology education are required to have a 2.5 cumulative GPA or permission of the chairperson.

Bachelor of Arts—Biology

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 44-45

Mathematics: MATH 121 or 217

Natural Science: CHEM 111-112 or CHEM 113-114

Liberal Studies Elective: 3cr, no courses with BIOL prefix

Major: 33

Required Core Courses:

BIOL 201 Principles of Ecology and Evolution 4cr

BIOL 202 Principles of Cell and Molecular Biology 4cr

BIOL 203 Principles of Genetics and Development 4cr

Controlled Electives:

Biology electives (major courses only) (1) 21cr

Other Requirements: 23-24

PHYS 111 Physics I Lecture 3cr

PHYS 121 Physics I Lab 1cr

Ancillary Science Courses:

An additional 4-5 cr from the following (2, 3): 4-5cr

BIOC 301, 302, 311, 312, 401, 480, 490

CHEM 231, 232, 325, 326, 351

GEOS 201, 202, 203, 303, 310, 311, 312, 313, 351, 352, 353, 354, 362, 370, 371

MATH 122, 417, 418

PHYS 112, 122, 151, 161

PSYC 290, 291, 315, 331, 341, 342 or 345, 350, 355, 356, 359, 372

Planned Program in Complementary Field (requires advisor approval) with at least 6cr in 300-/400-level courses (4) 15cr

Other Requirements: 0-6

Foreign Language Intermediate Level (5) 0-6cr

Exit survey for assessment purposes

Free Electives: 12-20

Total Degree Requirements: 120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) If MATH 121 (4cr) is elected as the Liberal Studies Mathematics course the additional requirement is 4cr; if MATH 217 (3cr) is elected, the additional requirement is 5cr. The mathematics course counted in Liberal Studies cannot also count in ancillary courses.
- (3) Other appropriate major courses at 200-level and above (excluding Liberal Studies courses) in the above departments may be substituted with permission of the advisor and the Biology Department chairperson in advance of taking the course.
- (4) Recommended complementary fields include anthropology, art, business, chemistry, communications media, computer science, criminology, dietetics, economics, English, foreign language, geography, geoscience, journalism and public relations, mathematics, philosophy, physics, political science, psychology, regional planning, or safety science. Some courses in complementary field may also fulfill Liberal Studies requirements (see Liberal Studies section). However, if complementary field selected is chemistry, geoscience, mathematics, physics, or psychology, courses used to fulfill other requirements above may not be applied to the complementary field requirement of 15cr. Students are encouraged to seek additional interdisciplinary connections not listed here.
- (5) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or geography/regional planning from the following: GEOG/RGPL 213, 314, 316, 415, 417.

Bachelor of Science—Biology

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 45

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Liberal Studies Elective: 3cr, no courses with BIOL prefix

Major: 36

Required Core Courses:

BIOL 201 Principles of Ecology and Evolution 4cr

BIOL 202 Principles of Cell and Molecular Biology 4cr

BIOL 203 Principles of Genetics and Development 4cr

Controlled Biology Electives:

Biology electives (major courses only) (1) 24cr

One course from each area: Cell and Molecular Area, Ecology Area, Organismal Area (A list of courses in each area is available on the Biology Department website or at the Biology office.) A minimum of 12cr must be in courses at the 400 level.

Other Science Requirements: 23

MATH 216 Probability and Statistics for Natural Sciences 3cr

or 217 Probability and Statistics

PHYS 111 Physics I Lecture 3cr

PHYS 121 Physics I Lab 1cr

Ancillary Science Electives: 16cr

An additional 16cr from the following (2): 16cr

BIOC 301, 302, 311, 312, 401, 480, 490

CHEM 231, 232, 321, 323, 351

GEOS 201, 202, 203, 303, 310, 311, 312, 313, 351, 352, 353, 354, 362, 370, 371

MATH 122, 417, 418

PHYS 112, 122, 151, 161

PSYC 290, 291, 315, 331, 341, 342 or 345, 350, 355, 356, 359, 372

Other Requirements: 0-6

Foreign Language Intermediate Level (3) 0-6 cr

Exit survey for assessment purposes

Free Electives: 10-16

Total Degree Requirements: 120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) Other appropriate major courses at 200 level and above (excluding Liberal Studies courses) in the above departments may be substituted with permission of the advisor and the Biology Department chairperson in advance of taking the course.
- (3) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of two courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or two courses in geography/regional planning (from the following: GEOG/RGPL 213, 314, 316, 415, 417).

Bachelor of Science—Biology/Cell and Molecular Biology Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 45

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Liberal Studies Elective: 3cr, no courses with BIOL prefix

Major: 37

Required Core Courses:

BIOL 201 Principles of Ecology and Evolution 4cr

BIOL 202 Principles of Cell and Molecular Biology 4cr

BIOL 203 Principles of Genetics and Development 4cr

Required Biology Courses:		
BIOL 123	Perspectives in Cell and Molecular Biology	1cr
BIOL 401	Laboratory Methods in Biology and Biotechnology	3cr
BIOL 405	Biology of the Cell	3cr
BIOL 410	Molecular Biology Topics	3cr
BIOL 466	Virology	3cr
BIOL 499	Research Biology/BIOL 493 Biology Internship/ BIOL 482 Independent Study/ BIOL 483 Honors Thesis Independent Study	3cr
Controlled Biology Electives: (1)		9cr
BIOL 240, 250, 262, 269, 271, 281 (2), 310, 323, 331, 352, 362, 363, 364, 453, 460, 477, 481 (2), 482 (2), 483, 484, 493 (2), or other biology major courses by permission of advisor and department chairperson		
Other Science Requirements:		23
Organic Chemistry Sequence:		
CHEM 231	Organic Chemistry I	4cr
CHEM 232	Organic Chemistry II	4cr
Biochemistry Sequence:		
BIOC 301	Foundations of Biochemistry	3cr
BIOC 302	Advanced Biochemistry	3cr
BIOC 311	Biochemistry Laboratory I	1cr
BIOC 312	Biochemistry Laboratory II	1cr
Other Science/Mathematics Requirements:		
PHYS 111	Physics I Lecture	3cr
PHYS 121	Physics I Lab	1cr
MATH 216	Probability and Statistics for Natural Sciences	3cr
or 217	Probability and Statistics	

Other Requirements:	0-6
Foreign Language Intermediate Level (3)	0-6 cr
Exit survey for assessment purposes	

Free Electives:	9-15
Total Degree Requirements:	120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) No more than 3cr may count toward Controlled Elective requirements.
- (3) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of two courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or two courses in geography/regional planning (from the following: GEOG/RGPL 213, 314, 316, 415, 417).

Bachelor of Science—Biology/Ecology, Conservation, and Environmental Biology Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications:	45	
Mathematics: MATH 121		
Natural Science: CHEM 111-112 or CHEM 113-114		
Liberal Studies Elective: 3cr, MATH 216 or 217		
Major:	39-40	
Required Core Courses:		
BIOL 201	Principles of Ecology and Evolution	4cr
BIOL 202	Principles of Cell and Molecular Biology	4cr
BIOL 203	Principles of Genetics and Development	4cr
Required Biology Courses:		
BIOL 205	Ecological Methods	3cr
BIOL 210	Botany	3cr
BIOL 220	General Zoology	3cr
BIOL 272	Conservation of Plant and Animal Resources	3cr
BIOL 362	Ecology	3cr
BIOL 451	Evolution	3cr

BIOL 490	Field Studies in Biology <i>or</i>	3-4cr
or 450	Field Biology at Pymatuning Laboratory	

Controlled Biology Electives:	6cr
Biology major courses only (1)	

Other Science Requirements:		20
GEOS 201	Foundations of Geology	4cr
PHYS 111	Physics I Lecture	3cr
PHYS 121	Physics I Lab	1cr
Controlled Electives: (2)		12cr

Select 12cr from the following (cannot include Liberal Studies Elective, or courses counting toward Other Requirements): ANTH 222, 250, 420; BIOC 301, 302, 311, 312; BIOL (majors courses only); CHEM 231, 232, 325, 326, 351; COSC 105, 110, 210, 310, 341; CRIM 374; ECON 122, 361; GEOG 331, 419, 425, 435; GEOG/RGPL 213, 231, 313, 314, 316, 341, 342, 343, 345, 415, 420, 440, 464; GEOS 202, 203, 302, 303, 310, 311, 312, 324, 352, 353, 370, 371; MATH 122, 171, 309, 341, 342, 363, 411, 412; PHIL 270, 330; PHYS 112, 122, 231; PSYC 330, 331; RGPL 350, 426; SAFE 310; SUST 201

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| Other Requirements: | 0-6 |
| Course sequence in one of the following areas (may not be counted toward Ancillary Courses): | |
| 1) Foreign Language: one course at Intermediate Level or two semesters beyond placement. | |
| 2) Computer Science: Select two from the following: COSC 105, 110, 210. | |
| 3) Geography/Regional Planning: Select two from the following: GEOG/RGPL 213, 314, 415, 420. | |

Free Electives:	9-16
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Total Degree Requirements:	120
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- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) Other appropriate BIOL courses at 200-level and above (excluding Liberal Studies courses) in the above departments may be substituted with permission of the advisor and the Biology Department chairperson in advance of taking the course.

Bachelor of Science—Biology/Environmental Health Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 45

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Social Science: ECON 101, PSYC 101 or SOC 151 or 161

Liberal Studies Elective: 3cr, BTED/COSC/IFMG 101, no courses with BIOL prefix

Major:	41
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Required Core Courses:		
BIOL 201	Principles of Ecology and Evolution	4cr
BIOL 202	Principles of Cell and Molecular Biology	4cr
BIOL 203	Principles of Genetics and Development	4cr

Required Biology Courses:		
BIOL 220	General Zoology	3cr
BIOL 221	Environmental Health and Protection	4cr
BIOL 240	Human Physiology	4cr
BIOL 250	Principles of Microbiology	4cr
BIOL 323	Introduction to Toxicology and Risk Assessment	3cr
BIOL 460	Fundamentals of Environmental Epidemiology	3cr
Controlled Biology Electives: (1)		8cr
BIOL 310, 466, 481, 482, 483, 484, 493, or other biology major courses by permission of advisor and department chairperson		

Other Science Requirements:		19
CHEM 231	Organic Chemistry I	4cr
CHEM 351	Biochemistry	4cr

MATH 216	Probability and Statistics for Natural Sciences	3cr
<i>or</i> 217	Probability and Statistics	
PHYS 111	Physics I Lecture	3cr
PHYS 121	Physics I Lab	1cr
Ancillary Science and Technical Electives: (2)		4cr
CHEM 232, 325		
GEOG/RGPL 415, 417, GEOG 419, 425		
GEOS 201, 202, 312, 313		
MATH 122		
PHYS 112, 122		
PSYC 290, 291, 315, 331, 341, 342 or 345, 350, 355, 356, 359, 372		
SAFE 330, 430		

Other Requirements: 0-6
Foreign Language Intermediate Level (3) 0-6cr
Exit survey for assessment purposes

Free Electives: (4) 9-15

Total Degree Requirements: 120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) Other appropriate major courses at 200 level and above (excluding Liberal Studies courses) in the above departments may be substituted with permission of the advisor and the Biology Department chairperson in advance of taking the course.
- (3) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of two courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or two courses in geography/regional planning (from the following: GEOG/RGPL 213, 314, 316, 415, 417).
- (4) Recommended free electives: MGMT 310; PLSC 250, 370; SAFE 101, 220.

Bachelor of Science—Biology/Pre-medical Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 45

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Social Science: 9cr, PSYC 101, SOC 151 or 161

Liberal Studies Elective: 3cr, no courses with BIOL prefix

Major: 37

Required Core Courses:

BIOL 201	Principles of Ecology and Evolution	4cr
BIOL 202	Principles of Cell and Molecular Biology	4cr
BIOL 203	Principles of Genetics and Development	4cr

Required Biology Courses:

BIOL 240	Human Physiology	4cr
BIOL 250	Principles of Microbiology	4cr
BIOL 331	Animal Developmental Biology	3cr
BIOL 402	Advanced Human Anatomy	4cr

Controlled Biology Electives: (1) 10cr

BIOL 200, 210, 221, 242, 271, 310, 323, 352, 364, 401, 405, 410, 460, 466, 475, 477, 481, 482, 483, 484, 491, 493, 499, or other biology major courses by permission of advisor and department chairperson

Ancillary Science Requirements: 23

CHEM 231	Organic Chemistry I	4cr
CHEM 232	Organic Chemistry II	4cr
CHEM 351	Biochemistry	4cr
MATH 216	Probability and Statistics for Natural Sciences	3cr
<i>or</i> 217	Probability and Statistics	
PHYS 111	Physics I Lecture	3cr
PHYS 121	Physics I Lab	1cr

PHYS 112	Physics II Lecture	3cr
PHYS 122	Physics II Lab	1cr

Other Requirements: (2) 0-6

Foreign Language Intermediate Level 0-6 cr
Exit survey for assessment purposes

Free Electives: 9-15

Total Degree Requirements: 120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of two courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or two courses in geography/regional planning (from the following: GEOG/RGPL 213, 314, 316, 415, 417).

Bachelor of Science—Biology/Pre-veterinary Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 45

Mathematics: MATH 121

Natural Science: CHEM 111-112 or CHEM 113-114

Liberal Studies Elective: 3cr, no courses with BIOL prefix

Major: 37

Required Core Courses:

BIOL 201	Principles of Ecology and Evolution	4cr
BIOL 202	Principles of Cell and Molecular Biology	4cr
BIOL 203	Principles of Genetics and Development	4cr

Required Biology Courses:

BIOL 220	General Zoology	3cr
BIOL 242	Comparative Vertebrate Anatomy	4cr
BIOL 250	Principles of Microbiology	3cr
BIOL 310	Applied Entomology and Zoonoses	3cr
BIOL 352	Comparative Animal Physiology	3cr

Controlled Biology Electives: (1) 9cr

BIOL 200, 210, 221, 242, 271, 323, 331, 352, 364, 401, 405, 410, 460, 466, 475, 477, 481, 482, 483, 484, 491, 493, 499, or other biology major courses by permission of advisor and department chairperson

Ancillary Science Requirements: 23

CHEM 231	Organic Chemistry I	4cr
CHEM 232	Organic Chemistry II	4cr
CHEM 351	Biochemistry	4cr
MATH 216	Probability and Statistics for Natural Sciences	3cr
<i>or</i> 217	Probability and Statistics	
PHYS 111	Physics I Lecture	3cr
PHYS 121	Physics I Lab	1cr
PHYS 112	Physics II Lecture	3cr
PHYS 122	Physics II Lab	1cr

Other Requirements: (2) 0-6

Foreign Language Intermediate Level 0-6 cr
Exit survey for assessment purposes

Free Electives: 9-15

Total Degree Requirements: 120

- (1) No more than 6cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.
- (2) (a) Two courses in one language, including the placement course; or (b) intermediate level. In lieu of a foreign language, students may elect to take a sequence of two courses in either computer science, exclusive of COSC 101 (COSC 110 and 210 recommended), or two courses in geography/regional planning (from the following: GEOG/RGPL 213, 314, 316, 415, 417).

Bachelor of Science in Education—Biology (*)

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 48

Mathematics: MATH 110 (1)

Natural Science: CHEM 111-112 or CHEM 113-114

Social Science: PSYC 101

Liberal Studies Electives: 7cr, MATH 217, GEOS 201, no courses with BIOL prefix

College of Education: 31**Preprofessional Education Sequence:**

ACE 103 Digital Instructional Technology 3cr

EDSP 102 Educational Psychology 3cr

Professional Education Sequence:

EDEX 301 Education of Students with Disabilities in Inclusive Secondary Settings 2cr

EDEX 323 Instruction of English Language Learners with Special Needs 2cr

EDSP 477 Assessment of Student Learning: Design and Interpretation of Educational Measures 3cr

EDUC 242 Pre-student Teaching Clinical Experience I 1cr

EDUC 342 Pre-student Teaching Clinical Experience II 1cr

EDUC 441 Student Teaching 12cr

EDUC 442 School Law 1cr

EDUC 451 Teaching Science in the Secondary School 3cr

Major: 28

Required Courses:

BIOL 201 Principles of Ecology and Evolution 4cr

BIOL 202 Principles of Cell and Molecular Biology 4cr

BIOL 203 Principles of Genetics and Development 4cr

Required Biology Course:

BIOL 480 Biology Seminar 1cr

Controlled Electives: 15cr

Biology electives: (major courses only) (2)

One course from each area: Cell and Molecular Area, Ecology Area, Organismal Area (A list of courses in each area is available on the Biology Department website or at the Biology office.) A minimum of 6cr must be in courses at the 488 level. At least one course must be a field biology course.

Other Science Requirements: 12

CHEM 231 Organic Chemistry I 4cr

CHEM 351 Biochemistry (3) 4cr

PHYS 151/161 Medical Physics Lecture and Lab 4cr

Other Science Requirements:

Exit survey for assessment purposes

Free Electives: 1

(#) **Total Degree Requirements:** 120

(*) See requirements leading to teacher certification, titled “3-Step Process for Teacher Education,” in the College of Education and Communications section of this catalog.

(1) MATH 121 may be substituted for MATH 110.

(2) No more than 3cr total from Independent Study, Special Topics, or Internship applies to major; excess applied as free electives.

(3) The two-semester (6cr) sequence of BIOC 301-302 can be substituted for CHEM 351 to meet the biochemistry requirement.

(#) See advisory paragraph “Timely Completion of Degree Requirements” in the section on Requirements for Graduation.

Biology Honors Track 9

BIOL 484 Honors Seminar (1) 2cr

BIOL 483 Honors Thesis/Independent Study (1, 2) 4cr

BIOL 5XX/6XX Graduate-level course (3) 3cr

(1) May be counted toward the BA, BS, and BSEd in Biology programs.

(2) Two semesters, 2cr each.

(3) Students must take one course at the 500/600 level during their junior or senior year. This will be in addition to the biology credits (currently 38 for all tracks) required for the major.

Minor—Biology 18

Required Courses: (1, 2) 8

BIOL 103 Life on Earth 4cr

BIOL 104 Human Biology: How the Human Body Works 4cr

BIOL 106 Human Genetics and Health 4cr

Additional BIOL courses (3, 4) 10

Other Requirements:

Student must have at least a 2.0 GPA in all BIOL courses for the minor.

Student must take at least 6cr of biology courses at IUP.

Must have permission of Biology Department chairperson.

(1) Student must take two of the three required courses.

(2) Two of the following courses may be substituted for the required courses: BIOL 201, 202, or 203.

(3) With approval of department chairperson.

(4) At least six of the 10 required additional BIOL cr must come from 300-level or higher courses.

Minor—Biomedical Science 18

Required Courses: 12

BIOL 150 Human Anatomy 4cr

BIOL 240 Human Physiology 4cr

BIOL 241 Introductory Medical Microbiology 4cr

Controlled Electives: (1) 6

6 credits from the following:

BIOL 310, 323, 364, 405, 410, 460, 466, or 477

(1) Other BIOL content courses with the approval of the minor advisor.

Minor—Forensic Biosciences (1) 19-20

Foundation Courses: (all majors) 12

BIOL 107 Introduction to Forensic Biology 3cr

BIOL 211 Investigative Biological Forensics 3cr

BIOL 313 Forensic Analysis of DNA 3cr

CHEM 105 The Forensic Chemistry of CSI 3cr

Required Course: 4

BIOL 411 Forensic Biology Laboratory Operations 4cr

Controlled Elective: 3-4

One course from the following: ANTH 488, 491, BIOL 103, 104, 105, 106, 115, 323, 364, 493, PSYC 388

(1) Must have formal Biology Department approval to be admitted to the minor in Forensic Biosciences.

Certificate—Cell and Molecular Biology 15

Core Courses: 12

BIOL 401 Laboratory Methods in Biology/Biotechnology 3cr

BIOL 405 Biology of the Cell 3cr

BIOL 410 Molecular Biology Topics 3cr

BIOL 466 Principles of Virology 3cr

Elective Course: 3

One course from the following: BIOL 323, 364, 460, 481