

DEPARTMENT OF BIOLOGICAL SCIENCES

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The Department of Biological Sciences offers programs of study leading to Bachelor of Arts, Bachelor of Science, Master of Science and Master of Arts degrees in biology, and a Doctor of Philosophy degree in the biomedical sciences with a specialization in biological communication. The undergraduate programs prepare students for graduate study in the life sciences; laboratory work and research in industries concerned with biological materials; professional careers in medicine, dentistry, optometry or veterinary medicine; nursing or other allied health areas; or teaching science in high school. This liberal arts program in biology is particularly suited to the needs of pre-medical students. For information on graduate study within the department, see the *Oakland University Graduate Catalog*.

The department offers a diversified selection of courses and research programs in biochemistry, botany, cell and molecular biology, developmental biology, ecology, evolutionary biology, genetics, microbiology, morphology, physiology, immunology and zoology. Students select courses that suit their goals and interests. With permission, they may elect to participate in the research laboratories of individual faculty members for which they may receive course credit (BIO 490). In the past, many such students have appeared as co-authors on scientific publications as a result of the work in which they participated. Such opportunities are of particular value to students preparing for graduate study or research positions. High school students intending to major in biological sciences should refer to the Admissions section of the catalog for specific preparation requirements.

Admission to major standing

To be eligible for a degree in biology, students must be admitted to major standing by the Department of Biological Sciences at least three semesters before graduation. This procedure ensures that an appropriate program of study is completed by graduation. Students may be admitted to major

standing after filing a satisfactory curriculum plan and completion of one year of introductory biology plus two other BIO courses, one year of general chemistry and mathematics through MTH 141.

Requirements for the liberal arts major in biology, B.A. program

This curriculum is designed for students intending to incorporate a biology major into a broader liberal arts program in pursuit of careers in technical fields or business or postgraduate study. Students in the B.A. curriculum who wish to apply to medical or dental schools are advised to complete the pre-medical studies concentration in pre-medical studies: medicine, dentistry, optometry and veterinary medicine.

A minimum of 42 credits in biology (BIO 111 and above) required, including at least nine lecture courses and a minimum of four BIO laboratory courses (one of these may be BIO 490). Students must complete:

1. BIO 111, 113, 116, 315, 341, 387, and 495
2. One course each from two of the following areas:
Physiology: BIO 207, 309 or 321
Morphology: BIO 205, 305 or 323
Ecology: BIO 301
3. One of the following organismic biology courses selected in consultation with a biology adviser: (Note: BIO 307 does not satisfy this requirement).
Botany: BIO 311, 327 or 373
Zoology: BIO 303, 317 or 353
Microbiology: BIO 319
4. One 3- or 4-credit 400-level lecture course (BIO 405, 490, 495 and 497 do not satisfy this requirement).
5. 14 credits of chemistry: CHM 157-158, 234.
6. 10 credits of physics: PHY 101-102 or 151-152, depending on MTH option, and 158.
7. MTH 141 and STA 225.
8. BIO 495 (*Satisfies the university general education requirement for the capstone experience*).

Corresponding lecture and lab courses should normally be taken simultaneously. Note that some courses have incorporated labs into lecture credit while other labs are given separate credit.

Requirements for the major in biology, B.S. program

This curriculum is designed for students who wish to pursue a career in the sciences, including medicine and health-related fields.

A minimum of 48 credits in biology (BIO 111 and above) is required, including at least 10 lecture courses and a minimum of five BIO laboratory courses (one of these may be BIO 490). Students must complete:

1. BIO 111, 113, 116, 325, 341, 387, 425, 495
2. One course each from two of the following areas:
Physiology: BIO 207, 309 or 321
Morphology: BIO 205, 305 or 323
Ecology: BIO 301
3. One of the following organismic biology courses selected in consultation with a biology adviser: (Note: BIO 307 does not satisfy this requirement).
Botany: BIO 311, 327 or 373
Zoology: BIO 303, 317 or 353
Microbiology: BIO 319

4. One 3- or 4-credit 400-level lecture course in addition to BIO 425 (BIO 405, 490, 495 and 497 do not satisfy this requirement).
5. 20 credits of chemistry: CHM 157-158, 234 and either CHM 235 and 237 or CHM 220 and 325.
6. 10 credits of physics: PHY 101-102 or 151-152, depending on MTH option, and PHY 158.
7. 12 credits of mathematics and statistics: MTH 141, 122 or 154, and STA 225 or 226.
8. BIO 495 (*Satisfies the university general education requirement for the capstone experience*).

Corresponding lecture and lab courses should normally be taken simultaneously. Note that some courses have incorporated labs into lecture credit while other labs are given separate credit.

Requirements for a modified major in biology (B.S.) with a specialization in anatomy

Adviser: *Feona M. Hansen*

Students may elect this specialization in their sophomore year. Biology courses required for the anatomy specialization are: BIO 205, 206, 305, 306, 317, 323, 324, 381 and 460. The selection of all courses should be planned by consultation with the adviser.

Requirements for a modified major in biology (B.S.) with a specialization in cell-molecular biology

Adviser: *Anne L. Hitt*

Students considering a career in cell biology, biotechnology or molecular biology may elect this specialization in their sophomore year. Biology courses required are: BIO 309, 310, 319, 320, 326, 342, 417, 418, 441, and 425 or 437. The selection of all courses should be planned in consultation with the adviser.

Requirements for a modified major in biology (B.S.) with a specialization in microbiology

Adviser: *Satish K. Walia*

Students may elect this specialization in their sophomore or junior year. Biology courses required for the microbiology specialization are: BIO 319, 320, 421, 437, and either 432 or 441; and one of the following electives: BIO 417, 423, 441, 443. The selection of all courses should be planned in consultation with the adviser.

Requirements for the modified major in biology (B.S.) with a concentration in applied statistics

Adviser: *Keith A. Berven*

This concentration is open to students pursuing either a Bachelor of Arts or a Bachelor of Science degree in biology. Students should elect this concentration in their sophomore year. Required courses are STA 226 and either 323 or 324, as well as BIO 490 (4 credits).

Secondary Teacher Education Program (STEP): Biological Sciences

The Secondary Teacher Education Program (STEP) at Oakland University is an extended program of study leading to certification. Generally, eligibility for admission to the STEP requires a GPA of 3.00 in both the major and minor, and an overall GPA of 2.80. No single major or minor course grade may be below 2.0. Second-undergraduate degree candidates completing major and/or minors may be required to complete additional coursework at Oakland University beyond the stated minimums. Students in this program must complete the requirements for a B.A. or B.S. degree in the College of Arts and Sciences and concurrently fulfill the major requirements listed below:

1. BIO 111, 113, 116, 315, 341, 387
2. One course each from two of the following areas:
 - Physiology:** BIO 207, 309 or 321
 - Morphology:** BIO 205, 305 or 323
 - Ecology:** BIO 301
3. Significant work in the following eight biological areas, as defined by the department, and chosen in consultation with the biology adviser. Note that a single course may satisfy more than one area:
 - Cell biology/biochemistry:** BIO 111, 309, 315, 323 or 325
 - Physiology:** BIO 207 or 321
 - Zoology:** BIO 205, 303, 305, 317, 323, 353 or 465
 - Botany:** BIO 311, 327 or 373
 - Ecology:** BIO 301, 303 or 387
 - Genetics:** BIO 341
 - Microbiology:** BIO 307, 319, 421 or 465
 - Evolution:** BIO 113 or 387
4. A minimum of four biology laboratory courses.
5. One course in earth science such as ENV 308, 373; PHY 106
6. One course in science, technology and society, chosen from AN 300; CHM 300; ENV 308, 312, 373; PHL 318.
7. BIO 495. (*Satisfies the university general education requirement for the capstone experience*).
8. 14 credits of chemistry: CHM 157-158, 234 for the B.A.; for the B.S., CHM 157-158, 234; and CHM 220 and 325.
9. 10 credits of physics: PHY 101-102 or 151-152, depending on MTH option, and 158.
10. MTH 141 and STA 225 BA only; MTH 141, 122 or 154, and STA 225 or 226 BS only.

A program in STEP must include either a 20-28 credit secondary teaching minor or an integrated science endorsement. Furthermore, STEP Biology majors must also complete a sequence of undergraduate course-work in education to include SED 300, FE 345, RDG 538 and SED 427. Extended study including SED 428, 455 and SE 501 is also required. Further details on program and admission requirements and procedures can be found in the School of Education and Human Services portion of the catalog and by consulting advisers in the Department of Biological Sciences and the School of Education and Human Services advising office, 363 Pawley Hall, (248) 370-4182.

Secondary Teacher Education Program (STEP): Endorsement in Integrated Science

Students pursuing the STEP Biology major are eligible to pursue an Integrated Science endorsement. Students who complete both the STEP Biology major and the STEP Integrated Science program will be recommended for certification by Oakland University to teach the following subjects at the secondary level: Biology, Chemistry, Earth Science, Life Science, Physical Science and Physics. This

program may be substituted for a secondary teaching minor. Students must complete the STEP Biology major and also have taken the following courses:

BIO 111, BIO 113, CHM 157, CHM 158, CHM 234, ENV 308, PHY 101/151, PHY 102/152, PHY 104, PHY 106/GEO 106.

STEP Biology majors should note that many of the courses listed above may have already been taken in the process of completing the STEP Biology major.

A cumulative grade point average of 3.00 is required in courses in the program, with no single course grade below 2.0. Second undergraduate degree candidates completing the program may be required to take additional courses at Oakland University beyond the stated minimums. Students must consult with the STEP Biology adviser.

Requirements for the major in engineering biology, B.S. program

Coordinator: *Fatma Mili (Engineering)*

Advisers: *Shailesh K. Lal (Biology), Mohammad Siadat (Engineering)*

The engineering biology major degree program is offered jointly by the Department of Biological Sciences in the College of Arts and Sciences, and by the School of Engineering and Computer Sciences. This program requires a minimum of 130 credits including general education requirements. Students should consult with advisers for the majors to be certain they are on track for all requirements.

Core courses (86 credits)

MTH 154, 155	Calculus I and II*
MTH 254	Multivariable Calculus
APM 255	Intro to Differential Equations and Matrix Algebra
STA 226	Applied Probability and Statistics
PHY 151, 152	Introductory Physics I and II*
CHM 157, 158	General Chemistry I and II (included labs)
CHM 201	Intro to Organic and Biological Chemistry
BIO 111, 113, 116	Biology I and II and lab*
BIO 321	Physiology, <i>or</i> BIO 309 Biology of the Cell <i>or</i> BIO 319 Microbiology
BIO 325	Biochemistry I
BIO 341	Genetics
EGR 120	Computer Graphics and CAD
EGR 141	Computer Problem Solving/Engineering/Computer Science
EGR 240	Introduction to Electrical and Computer Engineering
EGR 250	Introduction to Thermal Engineering
EGR 280	Design/Analysis/Electromechanical Systems
EGB 390	Introduction to Engineering Biology
EGB 490	Research Project/Capstone Design

**These course sequences satisfy the general education requirements for the formal reasoning, natural science/technology and knowledge applications categories.*

Professional track (*students must choose one of five tracks listed below*)

Track I: Bioinformatics (16 credits)

BIO 443 and CSE 461 and two courses selected from: CSE 230, 345 or 361

Track 2: Biomedical/biophysical engineering (16 credits)

PHY 325; ME 456 or PHY 421; ME 361, ME 461

Track 3: Computational Biology (15 credits)

MTH 275, APM 450, BIO 482 or BIO 483, and one course selected from: APM 357, 433, 434 or 455

Track 4: Electronic Devices/Signal Analysis/Bio-sensors (16 credits)

ECE 276, ECE 327, CSE 465, CHM 428

Track 5: Molecular Engineering Biology (16 credits)

BIO 319, BIO 423, BIO 441, and one course selected from: PHY 325, BIO 309, BIO 323

Students in this program are not required to complete the College of Arts and Sciences distribution requirements, but must complete the general education requirements including capstone and writing intensive courses. In addition, this program requires an average grade of 2.00 in courses taken to satisfy the biology, chemistry, mathematical sciences and engineering requirements.

Requirements for departmental honors in biology

Departmental honors may be granted to students who have been nominated by a faculty member on the basis of high academic achievement and excellence in either independent research or teaching assistance.

The specific requirements are:

1. 3.20 grade point average (GPA) minimum overall and 3.50 GPA minimum in BIO courses,
2. at least one 400-level BIO lecture course (BIO 405, 490, 495 and 497 do not qualify),
3. excellence in one of the following two service roles:
 - a. assisting in teaching a laboratory course(s) either for pay or credit
 - b. performing independent laboratory study or serving as a laboratory research assistant.

Concentration in pre-medical studies: medicine, dentistry, optometry and veterinary medicine

Adviser: *Keith A. Berven*

Committee: *Andrew F.X. Goldberg (Eye Research Institute), Kathy H. Moore (Chemistry), John R. Reddan (Biological Sciences)*

The concentration in pre-medical studies is intended for students who wish to pursue careers in medicine, dentistry, optometry or veterinary medicine. The Bachelor of Science degree with a major in biology provides students with all the requirements for a concentration in pre-medical studies. Students in the Bachelor of Arts degree program will need to complete two semesters of organic chemistry and laboratory in addition to their other science requirements.

Students are expected to complete a concentration consisting of the following:

1. At least 24-25 credits of biology, including some laboratories and the required introductory biology sequence (BIO 111, 113, 116) and at least three of the following:

Cell Biology:	BIO 309, 310
Genetics:	BIO 341, 342
Physiology:	BIO 207 or 321 and 322
Biochemistry:	BIO 325, 326, 425, or CHM 453, 457, 458
Developmental biology:	BIO 323, 324

- Microbiology:** BIO 319, 320
- 20 credits of chemistry: CHM 157, 158, 234, 235, 237.
 - 10 credits of physics: PHY 101-102 or 151-152 and PHY 158.
 - 8 credits of mathematics: MTH 141 plus one of MTH 122, 154, STA 225, 226. Note: preoptometry concentration students must take 12 credits of mathematics including one statistics course (STA 225 or 226).

The concentration provides the minimum requirements for admission to various medical, osteopathic, dental, optometry and veterinary schools, and provides the necessary background for the science portion of the standardized aptitude tests: medical (MCAT), dental (DAT), optometry (OAT) and veterinary (VCAT or GRE). The committee strongly recommends WRT 142 or 144 for better preparation for the non-science portions of the standardized tests. This concentration does not constitute a major. Students must elect a major from those offered by the university. Interested students should consult with Keith Berven, pre-medical concentration coordinator, for counseling and assistance in planning their academic programs.

Biochemistry program

In cooperation with the Department of Chemistry, the Department of Biological Sciences offers a Bachelor of Science degree program with a major in biochemistry.

Requirements for the liberal arts minor in biology

Students in other departments who wish to minor in biology must take a minimum of 20 credits in biology, including BIO 111, 113 and 116. At least 8 credits must be taken in courses numbered 301 or above. Students majoring in other life science areas should read the restrictions on dual use of courses to satisfy both major and minor requirements.

Requirements for the secondary teaching minor in biology

A minimum of 20 credits in biology is required for the secondary teaching minor in biology. BIO 101, 104, 110, 121 and 300 may not be counted toward this requirement. Course-work shall include:

- BIO 111, 113, 116 or equivalent.
- The remaining credits shall include one course each from the following categories:
 - Molecular/cellular biology: BIO 309, 315, 321, 323, 325, 341, 351;
 - Organismic biology: BIO 205, 207, 311, 319, 327, 353, 373;
 - Evolutionary/ecological biology: BIO 301, 303, 317, 387.
- SED 427, Methods of Teaching Secondary Students.

Non-science majors must complete an additional 4 credits in chemistry for a total of 24 credits for this minor. Students are also expected to have pre-calculus mathematics.

Generally, a cumulative grade point average of 3.00 is required in courses included in the minor, with no single course grade below 2.0. Post-baccalaureate candidates completing the minor may be required to take additional courses at Oakland University beyond the stated minimums. Students must consult with the departmental adviser.

Course Offerings

The department offers selected courses from this catalog as warranted by student needs and availability of faculty. Specific offerings for each term may be found in the Schedule of Classes.

The following courses are designed particularly for non-biology majors and are not counted toward major or minor requirements.

BIO 101 Foundations of Modern Biology (4)

Principles of biochemistry, energy transformations, metabolism, cell division and heredity. Emphasizing problem-solving skills and the background necessary for success in more advanced biology courses. Especially suited for students majoring in science or allied health programs needing additional preparation prior to BIO 111. Not for major or minor credit in biology.

BIO 104 Human Biology (4)

Introduction to human biology with emphasis on human anatomy and physiology. Topics include cell biology, skeletal, muscular, digestive, cardiovascular, neural, hormonal and reproductive systems. Offered fall and winter semesters. *Satisfies the university general education requirement in the natural science and technology knowledge exploration area.*

BIO 110 Life on Earth (4)

A survey course on the history of nature. The evolutionary emergence of plant and animal life from unicellular to multi-cellular organisms and eventually to humans is presented through lectures, text readings and films. Offered fall and winter semesters. *Satisfies the university general education requirement in the natural science and technology knowledge exploration area.*

BIO 121 Clinical Anatomy and Physiology (5)

Basic human anatomy and physiology with clinical emphasis, *specifically for pre-nursing students*. Lectures are closely tied to laboratory activities. Computer simulations of cadaver dissections are used to teach and test anatomy.

Prerequisite: BIO 111.

BIO 300 Biology and Society (4)

The major concepts of modern biology that would serve as a foundation for the well-educated nonscientist, including evolutionary biology, molecular and cellular biology, genetic and medical interventions, the biological bases of behavior and social organization, and the effects of biological and chemical pollutants. *Satisfies the university general education requirement in the natural science and technology knowledge exploration area. Satisfies the university general education requirement for a writing intensive course in general education or the major, not both. Prerequisite for writing intensive: completion of the university writing foundation requirement.*

The following courses are designed particularly for the biology major and minor and for other majors in the sciences.

BIO 111 Biology (4)

Cell ultrastructure, enzymology, metabolism, genetics, cell division. A year of high school chemistry and/or CHM 090 is strongly recommended. Offered fall and winter semesters. *Satisfies the university general education requirement in the natural science and technology knowledge exploration area.*

BIO 113 Biology (4)

Introduction to the structure and function of plants and animals; nutrient acquisition, gas exchange, internal transport, excretion, chemical and nervous control, reproduction, behavior, ecology, evolution, and a synopsis of the major phyla. Offered fall and winter semesters. *Satisfies the university general education requirement in the natural science and technology knowledge exploration area.*

Prerequisite: BIO 111 recommended.

BIO 116 Biology Laboratory (1)

Laboratory and field experience emphasizing scientific method, scientific writing, Mendelian genetics, vertebrate anatomy and animal and plant diversity. Offered fall and winter semesters.

Prerequisite or corequisite: BIO 111 or BIO 113.

BIO 205 Human Anatomy (4)

The integration of organs into systems and systems into the organism. Selected aspects of developmental, comparative and microanatomy also will be discussed. Relevant to students in health sciences, biological science and liberal arts studies. Offered fall and winter semesters.

Prerequisite: BIO 111.

BIO 206 Human Anatomy Laboratory (1)

Dissection and identification of the musculoskeletal system as well as other major organ systems using human cadavers.

Prerequisite or corequisite: BIO 205.

BIO 207 Human Physiology (4)

A detailed study of general physiological principles and mechanisms with emphasis on systemic physiology. Normal physiology of individual organ systems will be explored, with stress on the role each plays in the human homeostatic balance. Offered fall and winter semesters.

Prerequisite: BIO 111.

BIO 301 Ecology (5)

Basic ecological concepts, energy and materials flow, growth and regulation of populations, community interactions, chemical ecology and environmental biology. Includes laboratory experience.

Offered fall semester.

Prerequisite: BIO 111, 113.

BIO 303 Field Biology (4)

An ecological and taxonomic study of the fauna of southeastern Michigan. Aims include competence in use of illustrated handbooks and keys, and skills in collecting, preserving and identifying. Offered summer semester both first and second sessions.

Prerequisite: BIO 111, 113, 116.

BIO 305 Histology (4)

Structural organization of vertebrate tissues and organs in relation to cell and tissue functions. Offered fall semester.

Prerequisite: BIO 111, 113.

BIO 306 Histology Laboratory (1)

Microscopic examination and identification of vertebrate tissues and organs. Preparation of histological slides.

Prerequisite or corequisite: BIO 305.

BIO 307 Introduction to Human Microbiology (4)

Introduction to the biology of microorganisms emphasizing the infectious diseases they cause and their control. Bacterial, mycotic, protozoan and viral infections; immunology; epidemiology; pathogenic mechanisms; chemotherapy; microbial genetics; microbial growth; and microbial physiology. Required of students in the nursing program. Not open to students who have taken BIO 319.

Prerequisite: BIO 111.

BIO 309 Biology of the Cell (4)

Introduction to the biology of the cell. Includes structure and function of cell organelles and physiological processes at the cellular and molecular levels.

Prerequisite: BIO 111, 113; CHM 157.

BIO 310 Biology of the Cell Laboratory (1)

Laboratory experience in cellular biology.

Prerequisite or corequisite: BIO 309.

BIO 311 Botany (5)

A course in plant biology including topics on gross and microscopic structure, physiological processes, reproduction and development. Diversity within the plant kingdom and evolutionary history are also discussed. Includes laboratory experience.

Prerequisite: BIO 111, 113, 116.

BIO 315 Fundamentals of Biochemistry (4)

Structure, assembly, and function of biomolecules and subcellular components; enzyme catalysis and regulation; generation of metabolic energy; electron transport and photosynthesis, metabolism of carbohydrates, amino acids and proteins, lipids, and nucleic acids; nutrition and health implications.

Prerequisite: BIO 111, CHM 158.

BIO 317 Vertebrate Zoology (5)

A comparative study: gross and histological anatomy, taxonomy, unique physiological adaptations to habitats, evolution and paleontology. Includes laboratory experience. Offered winter semester.

Prerequisite: BIO 111, 113, 116.

BIO 319 General Microbiology (4)

Concepts include microbial metabolism and physiology, genetics and genomics, diversity and evolution, growth control and aseptic techniques, host-parasite relationships, and survey of human bacterial and viral pathogens. Emerging techniques and applications in molecular biology and genetic engineering will also be considered as they relate to microbiology. Not open to students who have taken BIO 307. Offered fall and winter semesters.

Prerequisite: BIO 325 or CHM 453.

BIO 320 General Microbiology Laboratory (1)

Introduction to techniques used for growing, isolating, and handling microbes, as well as a survey of traditional and molecular approaches to microbe identification and analysis.

Prerequisite or corequisite: BIO 319.

BIO 321 Physiology (4)

A detailed study of physiological principles: the internal environment, bioenergetics, transport, osmoregulation, respiration, conduction, contraction and circulation.

Prerequisite: BIO 315 or 325.

BIO 322 Anatomy and Physiology Laboratory (1)

Laboratory exercises in anatomical organization from cellular to organ systems with integrated physiological experiments.

Prerequisite or corequisite: BIO 207 or 321.

BIO 323 Developmental Biology (4)

An examination of mechanisms regulating the development of various organisms. Emphasis on the cellular and molecular controls that govern gametogenesis, fertilization, tissue formation, cellular interactions and gene activity. Offered alternate winter semesters.

Prerequisite: BIO 309 or 341.

BIO 324 Developmental Biology Laboratory (1)

A series of observations and experimental exercises on a variety of organisms designed to expose the student to basic patterns of development, embryonic structures and techniques to analyze developmental processes.

Prerequisite or corequisite: BIO 323.

BIO 325 Biochemistry I (4)

Science-intensive study of the structure, function and isolation of biomolecules and subcellular components; enzyme catalysis and regulation; principles of metabolism, generation of metabolic energy by glycolysis, Krebs' cycle and oxidative phosphorylation; and molecular approaches in biological research.

Prerequisite: BIO 111. Prerequisite or corequisite: CHM 234.

BIO 326 Biochemistry I Laboratory (1)

Cellular extraction and purification of enzymes and enzymes kinetics. Analytical and quantitative methods for characterization of protein structure and activity.

Prerequisite: BIO 116. Prerequisite or corequisite: BIO 325.

BIO 327 Dendrology (4)

The study of trees and shrubs; their identification, biology and ecology and the importance of woody plants to people. Includes laboratory experience. Offered in alternate fall semesters.

Prerequisite: BIO 111, 113, 116.

BIO 341 Genetics (4)

Fundamentals of classical and molecular genetics. Selected topics in human genetics, microbial genetics, biochemical genetics, molecular biology, cytogenetics and genomics. Offered fall and winter semesters.

Prerequisite: BIO 111.

BIO 342 Genetics Laboratory (1)

Laboratory experience in genetics, including elementary experiments in Mendelian genetics and molecular genetics. Principles of hypothesis testing and data analysis.

Prerequisite: BIO 111, 116. Prerequisite or corequisite: BIO 341.

BIO 351 Neurobiology (4)

Properties of individual nerve cells and small groups of nerve cells involved in information processing. Emphasis is placed on the cellular and molecular basis of excitability and synaptic transmission, membrane receptor systems and signaling, neuronal plasticity, and sensory and motor functions in relation to neurological disorders. Offered winter semester.

Prerequisite: BIO 111, 113; CHM 158.

BIO 353 Animal Behavior (4)

The genetics, physiology, ecology and evolution of animal behavior. Emphasis is on social behavior, especially the behavior of social insects. Offered fall semester.

Prerequisite: Sophomore standing.

BIO 354 Animal Behavior Laboratory (1)

An introduction to the study of animal behavior in the field and in the laboratory. Topics will include experimental design, data analysis and writing in the scientific format.

Prerequisite: BIO 116 (with a grade of 2.0 or higher).

BIO 355 Neuropharmacology (4)

Examination of drugs that affect nervous tissue. Include basic principles and fundamentals of pharmacological actions on neurons and their synapses in relation to autonomic function, control of

movement, mood and emotion, addictive disorders, higher cognitive function and psychosis, sleep arousal, pain, memory, dementias, and seizures and stroke.

Prerequisite: CHM 234 and BIO 207 or 321.

BIO 373 Field Botany (4)

A local flora course in identifying vascular plants occurring naturally in Michigan. Emphasis is on flowering plants, although ferns and coniferous species are also treated. Includes field trips to representative natural areas in southeast Michigan. Offered summer semester, first session.

Prerequisite: BIO 111, 113.

BIO 377 Marine Biology (3)

Overview of the ocean environment with emphasis on marine organisms. Marine communities and adaptations from the intertidal zone to the abyssal plains will be presented.

Prerequisite: BIO 111, 113.

BIO 381 Gross Human Anatomy (4)

Combined lectures and laboratories primarily for upper-level health science majors. Study of human body systems with emphasis on the musculoskeletal system; morphological correlate of human physiological functions; and dissection of cadaver.

Prerequisite: BIO 321 and permission of instructor.

BIO 387 Evolutionary Biology (4)

Exploration of the processes of evolution and their past and current influence on organisms of today. Topics include origin of variability, natural selection, differentiation of populations, speciation, phylogenetic concepts, evolutionary ecology and sociobiology. BIO 341 recommended.

Prerequisite: BIO 111, 113.

BIO 399 Occupational Experience in Biology (4)

Occupational experience in biology with faculty supervision that incorporates student performance in a professional setting. May not be repeated for credit.

Prerequisite: junior/senior standing; 16 credits in biology of which 8 must be at the 300-400 level.

Permission of instructor.

BIO 401 Advanced Human Physiology (4)

Lectures and discussion emphasizing the human organism and the experimental basis for current concepts and techniques. Topics include reproduction, circulation, respiration, electrophysiology and cellular mechanisms in physiological processes. Offered fall semester.

Prerequisite: BIO 207 or 321.

BIO 405 Directed Readings in Biology (1-4)

Term paper based on library research of a current research-oriented biological topic. May be taken more than once. *Satisfies the university general education requirement for a writing intensive course in the major when taken for 3 or 4 credits. Prerequisite for writing requirement: completion of the university writing foundation requirement.*

Prerequisite: Written agreement with a biology faculty supervisor.

BIO 407 Cellular Biochemistry (4)

Advanced discussion of cellular control mechanisms emphasizing recent developments in the biochemistry of proteins and nucleic acids. Offered fall semester.

Prerequisite: BIO 325.

BIO 409 Endocrinology (4)

Endocrine systems, mechanisms of hormone action, interactions among hormones, the roles of hormones in growth, differentiation, and reproduction; tumor suppressor genes and oncogenes.

Emphasis will be placed on human endocrine disorders and their clinical significance.

Prerequisite: BIO 207 or 321.

BIO 413 Advanced Topics in Cell Physiology (4)

Discussion and lecture course offered by faculty members with research interests in cell physiology. Topics will be announced.

BIO 417 Molecular Biology (4)

Basic molecular biology of viruses, prokaryotes, and eukaryotes with emphasis on cloning, expression and regulation of genes, applications of recombinant DNA, cancer and genetic diseases/disorders.

Prerequisite: BIO 325 or 341.

BIO 418 Molecular Biology Laboratory (2)

Basic techniques in molecular biology: isolation and characterization of DNA and RNA, cloning, restriction analysis, nucleic acid hybridization and recombinant DNA techniques.

Prerequisite or corequisite: BIO 417.

BIO 419 Advanced Genetics (4)

A continuation of BIO 341. Topics include methods of gene discovery through analysis of genetic variation, genetics of complex traits (in which multiple genes and environment interact), non-classical modes of inheritance, and applied topics such as the use of genetics in medicine and forensics.

Prerequisite: BIO 341 and either STA 225 or 226.

BIO 421 Medical Microbiology (4)

Bacterial and viral human pathogens, emphasizing their etiology, physiology, pathogenesis, epidemiology, control and diagnosis.

Prerequisite: BIO 325.

BIO 423 Immunology (4)

Human immune response. Emphasis on components of the immune system, antibody structure and function, antigen processing and presentation, T cell responses, immune response to infectious diseases, and disorders of the immune system.

Prerequisite: BIO 341 or 325.

BIO 425 Biochemistry II (4)

A continuation of BIO 325 and using the same textbook. Topics include photosynthesis, metabolism of lipids and nitrogen-containing compounds, biochemical mechanisms of hormone action, integration and control of cell metabolism, biochemistry of nucleic acids, and mechanisms of gene transcription and protein synthesis.

Prerequisite: BIO 325.

BIO 427 Cell Biology of Cancer (4)

Introduction to cancer from signal transduction pathways that regulate cell proliferation, apoptosis, adhesion and migration. Offered winter semester.

Prerequisite: BIO 309.

BIO 430 Research Associate Program I (4)

Structured research learning experience for pre-medical students: basic concepts, topics of clinical research, and structure of clinical research, clinical epidemiology, evidence-based medicine, data analysis, relevant medical pathophysiology, diagnostics and therapeutics.

Prerequisite: junior standing.

BIO 432 Research Associate Program II (4)

Structured research learning experience for pre-medical students,/ advanced concepts, topics of clinical research, and structure of clinical research, clinical epidemiology, evidence-based medicine, data analysis, relevant medical pathophysiology, diagnostics and therapeutics.

Prerequisite: BIO 430.

BIO 437 Virology (4)

Fundamentals of virology including classification of bacteriophages, plant and animal viruses, viral multiplication, and pathogenesis. Laboratory exercises to be included.

Prerequisite: BIO 309, 315, 319 or 325.

BIO 441 Microbial Biotechnology (4)

Microbial genetics, emphasizing the basic aspects of bacteriophage and plasmid genetics applied to biotechnology.

Prerequisite: BIO 341 or 319.

BIO 443 Functional Genomics and Bioinformatics (4)

Use and implementation of computer software for sequence analysis of nucleic acids and proteins. Emphasis on gene discovery, annotation, building phylogenetic histories, and state-of-the-art strategies used for gene expression analysis of an organism from a genome-wide perspective.

Prerequisite: BIO 341.

BIO 444 Functional Genomics and Bioinformatics Laboratory (1)

Explores molecular biology, genomics and bioinformatics techniques useful in study of genomes and proteomes.

Prerequisite or corequisite: BIO 443.

BIO 451 Research Forum (1)

A forum for students to present their research in a seminar environment and to discuss problems and potential solutions with other students and department faculty. May be repeated for up to 4 credits. Graded S/U.

Prerequisite: permission of faculty supervisor.

BIO 460 Neuroanatomy (4)

The brain, brain stem, spinal cord and associated structures with respect to their morphology, development, function and the integration of these functions in motor activity. Certain lesions and their clinical significance will be discussed.

Prerequisite: BIO 205 or 381.

BIO 461 Neuroanatomy Laboratory (1)

Laboratory experience in neuroanatomy. Identification of basic neuroanatomical structures of the human.

Corequisite: BIO 460.

BIO 465 Medical Parasitology and Mycology (4)

Integrated lecture-lab. Study of medically important protozoan, helminth, arthropod and mycotic organisms; their morphology, biology, pathogenesis, clinical manifestations, immunology, epidemiology and control. Laboratory methods for identification of medically important parasites.

Prerequisite: BIO 111, 113, 116.

BIO 481 Topics in Physiological Ecology (3)

Physiological responses of organisms to their environment, including plant/herbivore interactions,

adaptations of desert animals, allelopathy, energy cost of animal activities, and communication on an organismal level. Offered alternate winter semesters.

Prerequisite: BIO 207, 301 or 321.

BIO 482 Topics in Evolutionary Biology (3)

Advanced topics in evolutionary biology, including evolutionary patterns, the nature of selection, adaptation, macroevolution, the application of molecular biology to evolution and philosophical issues of evolution. Offered alternate fall semesters.

Prerequisite: one course in either ecology, behavior or evolution or permission of instructor.

BIO 483 Topics in Community and Population Biology (3)

Analytic and synthetic approaches to the biology of populations and communities utilizing both plant and animal studies. Topics will include population growth and regulation, competition, predator-prey interactions, community structure and species diversity. Offered alternate fall semesters.

Prerequisite: BIO 301 or 387.

BIO 484 Topics in Behavioral Biology (3)

The ecology, evolution, genetics and physiology of behavior, especially social behavior. Topics will include kin recognition, mate choice, dominance hierarchies and the mechanisms by which societies are organized. Offered alternate winter semesters.

Prerequisite: BIO 353.

BIO 487 Science of Vision (3)

In-depth study of the tissues of the eye. Topics include visual transduction, light and dark adaptation, color vision, lens physiology and cataract, cornea, glaucoma, inherited retinal diseases, diabetic retinopathy, physiological optics, and regulation of gene expression in ocular development.

Prerequisite: BIO 207 or 321 or 351.

BIO 490 Independent Research (1-4)

Directed undergraduate research in laboratory, field or theoretical biology. Should be initiated before or during the junior year. May be taken for a numeric grade (research paper required) by written arrangement with a biology faculty supervisor for a maximum of 4 credits. May be taken for a S/U grade (no paper required) by written arrangement with a biology supervisor for a maximum of 8 credits. BIO 490 counts as one laboratory course for the major.

Prerequisite: written agreement with a biology faculty supervisor.

BIO 491 Selected Topics in Biology (1-5)

Advanced topics in a specialized area of biological sciences. The topics and prerequisites may vary. May be repeated for additional credit.

BIO 495 Scientific Inquiry and Communication (3)

Synthesis of several sub disciplines in biological sciences using technical reports, articles in the popular press and on the Internet. Integration of life sciences with history, fine arts, other cultures, social and ethical issues addressed through a variety of methods of inquiry with emphasis on communication skills and critical thinking. *Satisfies the university general education requirement for a writing intensive course in the major.*

Prerequisite for writing intensive: completion of the university writing foundation requirement. Satisfies the university general education requirement for the capstone experience.

Prerequisite: junior standing.

BIO 497 Apprentice College Teaching (2)

Assisting in presenting a course, usually a laboratory course, to undergraduates. May be taken more than once. Cannot be counted as a biology laboratory course.

Prerequisite: written agreement with a biology faculty supervisor.