

supporting materials such as an artist statement and electronic presentation of work.  
Materials fee: \$100.

**ART 485. PHOTOGRAPHY IV**

**4 sh**

Photography IV is a self-directed involvement in a long-range photographic project proposed, researched and executed in consultation with the instructor/mentor. The project should reflect the student's knowledge and experience in the medium and culminate in a coherent portfolio for exhibition or publication. Materials fee: \$150.

**ART 491. INDEPENDENT STUDY**

**1-8 sh**

Art majors and minors may pursue a program of advanced study and individual exploration in studio art or art history. Proposals for independent study should be prepared and submitted in the semester prior to enrollment. The instructor may require class attendance. Maximum 8 semester hours of credit, by permission of art faculty only.

**ART 499. RESEARCH IN ART**

**1-8 sh**

Students engage in an undergraduate research project under the guidance of an Art Department mentor. A special research proposal form must be prepared and submitted in consultation with the mentor. Maximum of 8 semester hours of credit.

***Asian/Pacific Studies***

Coordinator: Professor Digre

The vast area of the Pacific Rim is of major importance in political, economic and cultural terms. This program aids students to shift from an Atlantic to a Pacific perspective, to focus on some particular Asian/Pacific cultures, and to take first steps not only in seeing Asia with Western eyes but also in seeing the West through Asian eyes.

Asian/Pacific Studies takes an interdisciplinary approach to study the peoples and cultures of Asia and the Pacific Rim. The program allows students to select from a current group of courses approved by an advisory group.

The minor consists of a minimum of 20 credit hours. The Asian/Pacific Studies program may be expanded into an international studies major with Asian/Pacific Studies as a regional concentration. See note.

Foreign language study (e.g., Japanese or Chinese) is strongly recommended as is a study abroad experience in the region.

**A minor in Asian/Pacific Studies** requires 20 semester hours selected from the following list. Courses must be chosen from at least two disciplines.

***General Asian/Pacific Studies courses***

ENG 337	Asian Literature of Social Change	4 sh
ENS 310	Environmental Issues of Southeast Asia	4 sh
HST 320	China, Japan and the Pacific Century: Era of War and Revolution	4 sh
POL 363	Politics of Asia	4 sh
PHL 352	Eastern Philosophy	4 sh
REL 353	Buddhism	4 sh
REL 356	Hinduism	4 sh
APS 361-369	Seminars in Asian/Pacific Studies	2-4 sh
APS 481	Internship in Asian/Pacific Studies	1-4 sh

**Asian/Pacific Foreign Language Courses**

While not required for the minor, up to 8 semester hours of the courses below may count toward the minor.

CHN 121	Elementary Chinese I	4 sh
CHN 122	Elementary Chinese II	4 sh
CHN 221	Intermediate Chinese I	4 sh
JPN 121	Elementary Japanese I	4 sh
JPN 122	Elementary Japanese II	4 sh
JPN 221	Intermediate Japanese I	4 sh

**Study Abroad in the Region**

While not required for the minor, up to 4 semester hours of such study abroad may count for the minor.

Approved course lists for study abroad in Asia and the Pacific Rim may be obtained from the program coordinator.

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<b>TOTAL</b>		<b>20 sh</b>
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Note: If they choose, students can extend the minor into an international studies major, with a regional concentration in Asia and the Pacific Rim. In this way, the minor supports the international studies major by providing focus for a regional concentration and opportunity to acquire language skills. For details and other requirements, see International Studies.

**Athletic Training**

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Chair, Department of Health and Human Performance: Associate Professor J. Davis  
 Professors: Beedle, Calhoun  
 Associate Professor: Miller  
 Assistant Professors: Allen, Baker, Hall, Smith  
 Instructors: Calone, Myers

The Athletic Training Education Program (ATEP) major located within the Health and Human Performance (HHP) Department includes clinical education and internship experiences within a CAAHEP approved curriculum. Admission into the ATEP requires a separate application process that is outlined in the ATEP application packet which can be obtained through the HHP Department.

Students with disabilities or for more information about the technical standards of Elon's ATEP, please visit the program's Web site at: [www.elon.edu/athletictraining](http://www.elon.edu/athletictraining). Students wishing to transfer into the program from another institution should also access the program's Web site.

Upon completion of the curriculum, students are eligible to sit for the BOC certification exam. Graduates of this program may pursue careers in athletic training or graduate degrees in other allied health professions after satisfying the appropriate prerequisites.

**A major in Athletic Training Education** requires the following courses:

ATP 112*	Athletic Training I	4 sh
ATP 212	Athletic Training II	4 sh

ATP	301	Clinical Education I	2 sh
ATP	302	Clinical Education II	2 sh
PED	305	Legal Aspects	2 sh
ATP	311	Introduction to Pharmacology	2 sh
ESS	315	Advanced Strength Training Conditioning	4 sh
ATP	329	Assessment of Athletic Injuries	4 sh
ATP	330	Therapeutic Exercise/Rehabilitation	4 sh
ATP	401	Clinical Education III	2 sh
ATP	402	Clinical Education IV	2 sh
ESS	422	Physiology of Exercise	4 sh
ATP	430	Therapeutic Modalities	4 sh
ATP	481	Internship in Athletic Training	2 sh
ATP	495	Senior Seminar	2 sh
PED	321	Biomechanics	4 sh
PED	410	Organization and Administration	4 sh
HED	220	First Aid	1 sh
HED	324	Nutrition	4 sh
HED	421	Chronic and Acute Diseases	4 sh
BIO	161*	Human Anatomy	4 sh
BIO	162	Human Physiology	4 sh
PSY	111	General Psychology	4 sh
<b>TOTAL</b>			<b>73 sh</b>

\*Courses required for ATEP application.

**ATP 112. ATHLETIC TRAINING I 4 sh**

This course introduces the student to the profession and principles of athletic training, including topics such as sports medicine organizations, emergency care of specific injuries, emergency procedures, tissue repair and healing, transportation and transfer of catastrophic injuries, methods of bandaging and dressing wounds and adhesive taping. Offered fall and spring.

**ATP 212. ATHLETIC TRAINING II 4 sh**

Students will gain practical knowledge and hands-on experience of advanced skills and techniques of athletic training. Topics include but are not limited to protective sports devices and equipment, drugs and sports, skin disorders, specific sports conditions and injuries, and advanced taping skills. Prerequisites: ATP 112, BIO 161, admission to the athletic training education program or permission of instructor. Offered fall.

**ATP 301. CLINICAL EDUCATION I 2 sh**

This course is the first in a progressive series of four clinical education courses and is intended to apply theories learned in ATP 212 assessment and previous athletic training classes in a clinical setting. Outcome-based assessments of clinical skills will be performed to determine duties and responsibilities in each setting. Athletic training students are exposed to the practice of athletic training and are supervised by practicing certified athletic trainers. Rotations with medical doctors and other allied medical professionals will also be completed as a learning opportunity and to obtain a sense of where certified athletic trainers fit into the sports medicine team. Prerequisite: ATP 212. Offered spring.

**ATP 302. CLINICAL EDUCATION II** **2 sh**

This course is the second in a series of four clinical education courses. The athletic training student continues to practice and improve clinical decision-making skills by building upon Clinical Education I. Outcome-based assessments of clinical skills will be performed to determine duties and responsibilities in each setting. These students are further exposed to the practice of athletic training and are supervised by practicing certified athletic trainers. Prerequisite: ATP 301. Offered fall.

**ATP 311. INTRODUCTION TO PHARMACOLOGY** **2 sh**

This course is designed as an introduction to pharmacology. Pharmacodynamics, pharmacokinetics, and drug interactions and reactions will be discussed. Extra attention will be given to drugs commonly used in sports medicine including but not limited to: PNS- and CNS-acting, anti-inflammatory, antibiotics, gastrointestinal-acting, respiratory-acting and ergogenic aids. An understanding of the practical implication of using these drugs will be emphasized. Prerequisite: BIO 162 or permission of instructor. Offered fall of odd years.

**ATP 329. ASSESSMENT OF ATHLETIC INJURIES** **4 sh**

This course familiarizes students with the principles of assessing sport injuries, including injury history, inspection, palpation, range of motion tests, muscle function tests, joint stability, neurological tests and specific anatomical features. This course is designed with a lecture and laboratory component. Prerequisites: ATP 212, admission to the athletic training education program or permission of instructor. Offered fall.

**ATP 330. THERAPEUTIC EXERCISE AND REHABILITATION** **4 sh**

Students study the process and components of therapeutic rehabilitation. Emphasis is placed on deconditioning and reconditioning following injury, as well as the contribution of various forms of exercise and therapeutic techniques on recovery. Prerequisites: ATP 329, admission to the athletic training education program or permission of instructor. Offered spring.

**ATP 401. CLINICAL EDUCATION III** **2 sh**

This course is the third in a series of four clinical education courses. The athletic training student continues to practice and improve clinical decision-making skills by building upon ATP 302 and ATP 329. Students are given more responsibility and required to problem solve and improve their decision-making abilities in a practical setting while under the supervision of a practicing certified athletic trainer. Outcome-based assessments are performed to determine duties and responsibilities in each setting. Prerequisite: ATP 302. Offered spring.

**ATP 402. CLINICAL EDUCATION IV** **2 sh**

This course is the fourth in a series of clinical education courses. It is intended to be a capstone course to bring together all of the theories and skills learned in the classroom and clinical education courses and apply them in a practical setting under the supervision of a working professional. This course is intended to provide the student the opportunity to show mastery of the skills needed to function as a successful certified athletic trainer through outcome-based assessments. Successful completion of this course is required to sit for the BOC certification exam. Prerequisite: ATP 401. Offered fall.

**ATP 430. THERAPEUTIC MODALITIES** **4 sh**

This course is designed to cover topics in therapeutic modalities as they relate to athletic training. It is directed toward students who plan on pursuing careers in athletic training and/or physical therapy. The main topics discussed in this class will be the theory workings, application and use of therapeutic modalities in the rehabilitation of sports injuries, and the effect of therapeutic modalities on both the stages of healing and pain process. Prerequisites: ATP 330, admission to the athletic training education program or permission of instructor. Offered fall.

**ATP 481. INTERNSHIP IN ATHLETIC TRAINING****2-4 sh**

In this course, upper-level majors have opportunities to apply classroom knowledge and skills to real world problems under the supervision of a faculty member and a certified athletic trainer. Settings may include a sports medicine clinic, professional sports team, corporate setting, etc. Students must keep a daily journal of their experiences, which are discussed in conferences with the faculty supervisor. The student must also complete a project benefiting the internship facility, but which would not have been possible without the student. Student evaluations are based on these assignments. Students should make arrangements with their professors the semester prior to taking the internship. Prerequisites: ATP 329, 330; junior/senior majors only; permission of department; 2.0 GPA overall, 2.0 GPA in major. Offered fall, winter, spring and summer.

**ATP 491. INDEPENDENT STUDY****1-4 sh****ATP 495. SENIOR SEMINAR IN ATHLETIC TRAINING****2 sh**

This course is designated to be the capstone class for the athletic training major. The course will review acquired knowledge and experiences of the athletic training curriculum. Students will be prepared to sit for the BOC certification exam. Students will discuss moral and ethical responsibility, state licensure, continuing education, decision-making accountability and conflict management. The NATA professional code of practice and standards of practice will be reviewed. Resume and interview skills will be discussed. Prerequisite: senior majors only. Offered spring.

**ATP 499. RESEARCH IN ATHLETIC TRAINING****1-4 sh**

Independent research project supervised by faculty mentor.

**Biology**

Chair, Department of Biology and Allied Health: Associate Professor Kingston

Professors: H. House, S. House

Associate Professors: M. Clark, Haenel, N. Harris, MacFall, Seidel, Vick

Assistant Professors: Coker, Gallucci, Miyamoto, Niedziela, Stemke, Touchette

Adjuncts: DeVries, Vandermast

Biology is the study of life in all its diverse forms. As a species, we have always been deeply fascinated by other living creatures. Early human's dependence on other animals and plants for food, medicine and shelter fostered an appreciation for life's interconnectedness. Modern society has rediscovered these relationships in the face of such challenges as global warming, rain forest destruction, AIDS, rising cancer rates and industrial pollution.

Our approach to biology at Elon University stresses hands-on experiences in the classroom, laboratory and field. The course of study includes off-campus experiential opportunities and research seminars that encourage creative approaches to biological problems. The focus is on science as a process, not merely a collection of established facts.

The faculty strives to provide students with a high quality program that enables them to (1) develop critical thinking and problem-solving skills to better understand and meet present and future biological challenges; (2) develop competency in information retrieval, use and analysis; (3) develop an understanding of the latest technologies utilized in biological investigation; (4) acquire broad-based knowledge of biological concepts from molecules to ecosystems; and (5) acquire an experiential learning opportunity through either research, internship or laboratory assistantship.

The Bachelor of Science in Medical Technology (MT) consists of three years of preprofessional training at Elon followed by application to the 12-month clinical program at our

affiliated hospital. Admission to the affiliated program is competitive and based on overall GPA, evaluation by faculty and personal interviews. Students may also apply to a variety of Medical Technology programs once a bachelor's degree is completed with the appropriate prerequisites.

In all of Elon's biology offerings, students receive a strong foundation in biology that prepares them for graduate studies, medical and other allied health-related professional schools, teaching and industry.

The Department of Biology and Allied Health offers programs leading to the Bachelor of Arts or Bachelor of Science degree with a major in Biology, the Bachelor of Science degree with a major in Medical Technology and a minor concentration in biology for students majoring in another discipline.

The Department of Biology has divided its laboratory course offerings that serve as electives into three functional categories to assist students in the development of a broad-based major with the necessary fundamental biological concepts while at the same time providing the student with the flexibility to build a program that meets their individual interests and needs.

<b>Molecular/Cellular Biology</b>	<b>Organismal Biology</b>	<b>Supraorganismal Biology</b>
BIO 322	BIO 316 BIO 343	BIO 335
BIO 345	BIO 318	BIO 344
BIO 348	BIO 321	BIO 442
BIO 351	BIO 325	BIO 452
BIO 352	BIO 342	

**Both the Bachelor of Arts and the Bachelor of Science degrees in Biology** require the following **Core Courses**:

BIO 111	Introductory Cell Biology	3 sh
BIO 112	Introductory Population Biology	3 sh
BIO 113	Cell Biology Lab	1 sh
BIO 114	Population Biology Lab	1 sh
BIO 221	General Zoology	4 sh
BIO 222	General Botany	4 sh
BIO 261	Introductory Seminar	2 sh
BIO 322	Molecular and Cellular Biology	4 sh
One course selected from the Organismal Biology category:		4 sh
BIO 316	Developmental Biology	
BIO 318	Comparative Vertebrate Structure & Function	
BIO 321	Microbiology	
BIO 325	Human Histology	
BIO 342	Plant Physiology	
BIO 343	Clinical Anatomy	
One course selected from the Supraorganismal Biology category:		4 sh
BIO 335	Field Biology	
BIO 344	Evolution	
BIO 442	Aquatic Biology	
BIO 452	General Ecology	

Eight semester hours of electives selected from the following:	8 sh
Organismal Biology category	
Supraorganismal Biology category	
Molecular/Cellular Biology category	
This may include a maximum of two 2-semester hour special topics seminars.	
BIO 462      Senior Seminar	2 sh
<b>TOTAL</b>	<b>40 sh</b>

**A Bachelor of Arts degree in Biology** requires the following courses:

Core Courses in Biology	40 sh
CHM 111      General Chemistry I	3 sh
CHM 113      General Chemistry I Lab	1 sh
CHM 112      General Chemistry II	3 sh
CHM 114      General Chemistry II Lab	1 sh
<b>or</b> (in lieu of CHM 111, 113, 112, 114)	
CHM 115      Advanced General Chemistry (3 sh)	
CHM 116      Advanced General Chemistry Lab (1 sh)	
MTH 112      General Statistics	4 sh

In addition, a required experiential component selected from the following:

- (a) internship
- (b) research
- (c) a specialized approved laboratory assistantship.

<b>TOTAL</b>	<b>48-52 sh</b>
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**A Bachelor of Science degree in Biology** requires the following courses:

Core Courses in Biology	40 sh
CHM 111      General Chemistry I	3 sh
CHM 113      General Chemistry I Lab	1 sh
CHM 112      General Chemistry II	3 sh
CHM 114      General Chemistry II Lab	1 sh
<b>or</b> (in lieu of CHM 111, 113, 112, 114)	
CHM 115      Advanced General Chemistry (3 sh)	
CHM 116      Advanced General Chemistry Lab (1 sh)	
CHM 211      Organic Chemistry I	3 sh
CHM 212      Organic Chemistry II	3 sh
CHM 213      Organic Chemistry I Lab	1 sh
CHM 214      Organic Chemistry II Lab	1 sh
PHY 111      General Physics I	4 sh
PHY 112      General Physics II	4 sh
<b>or</b>	
PHY 113      General Physics I with Calculus	4 sh
PHY 114      General Physics II with Calculus	4 sh
MTH 112      General Statistics	4 sh

In addition, a required experiential component selected from:

- (a) internship
- (b) research
- (c) a specialized approved laboratory assistantship.

<b>TOTAL</b>	<b>64-68 sh</b>
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**A Bachelor of Science degree in Medical Technology** requires 40–47 semester hours of coursework at Elon University and completion of the clinical curriculum.

BIO 111	Introductory Cell Biology	3 sh
BIO 112	Introductory Population Biology	3 sh
BIO 113	Cell Biology Lab	1 sh
BIO 114	Population Biology Lab	1 sh
BIO 321	Microbiology	4 sh
BIO 345	Genetics	4 sh
CHM 111	General Chemistry I	3 sh
CHM 113	General Chemistry I Lab	1 sh
CHM 112	General Chemistry II	3 sh
CHM 114	General Chemistry II Lab	1 sh
	<b>or</b> (in lieu of CHM 111, 113, 112, 114)	
CHM 115	Advanced General Chemistry (3 sh)	
CHM 116	Advanced General Chemistry Lab (1 sh)	
CHM 211	Organic Chemistry I	3 sh
CHM 212	Organic Chemistry II	3 sh
CHM 213	Organic Chemistry I Lab	1 sh
CHM 214	Organic Chemistry II Lab	1 sh
PHY 111	General Physics I	4 sh
PHY 112	General Physics II	4 sh
MTH 112	General Statistics (or higher)	4 sh
	A course in immunology: Immunology as a separate course or as part of a microbiology course	0–3 sh

Recommended additional courses:

- CHM 311 Quantitative Analysis
- CIS 112 Problem Solving with Spreadsheet Applications
- CIS 114 Introduction to Web Site Development
- BIO 162 Human Physiology
- BUS 303 Introduction to Managing

A mathematics course higher than MTH 112

Completion of the clinical curriculum

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**TOTAL** **40-47 sh**

**A minor in Biology** requires the following courses:

BIO 111	Introductory Cell Biology	3 sh
BIO 113	Cell Biology Lab	1 sh
	Sixteen semester hours chosen from the following:	16 sh
	BIO 112 Introductory Population Biology	
	BIO 114 Population Biology Lab	
	Biology courses at the 200-400 level	

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**TOTAL** **20 sh**



- BIO 101. TOPICS IN GENERAL BIOLOGY** **3 sh**  
 This topical approach to the foundational concepts of biology examines theories and issues in biology as they relate to varying special topics selected by the instructor. To satisfy the general studies laboratory science requirement, BIO 102 should be taken concurrently. No credit to students with prior credit for BIO 111. No credit toward biology major or minor. Offered fall and spring.
- BIO 102. GENERAL BIOLOGY LABORATORY** **1 sh**  
 This two-hour laboratory provides experiences to complement selected foundational concepts from BIO 101. To satisfy the general studies laboratory science requirement, BIO 101 and 102 should be taken concurrently. No credit to students with prior credit for BIO 113. No credit toward biology major or minor. Offered fall and spring.
- BIO 105. CURRENT ISSUES IN BIOLOGY** **4 sh**  
 Designed for nonscience majors, this course focuses on reading, interpreting and evaluating facts behind biological issues and exploring the implications for science and human society. Students conduct library research, present oral reports, discuss and write papers on these issues. No credit toward biology major or minor. Satisfies General Studies nonlaboratory science requirement. Offered winter.
- BIO 111. INTRODUCTORY CELL BIOLOGY** **3 sh**  
 In this introduction to organization and function at the cellular level, topics of study include basic cell chemistry and structure, transport, energetics and reproduction. Required for biology majors/minors. Corequisite: BIO 113. Offered fall and spring.
- BIO 112. INTRODUCTORY POPULATION BIOLOGY** **3 sh**  
 Topics of study in this introduction to organization and function at the population level include reproduction and transmission genetics, patterns and mechanics of evolutionary change and basic concepts of ecology. Required for biology majors/minors. Corequisite: BIO 114. Offered fall and spring.
- BIO 113. CELL BIOLOGY LABORATORY** **1 sh**  
 Students have three hours of laboratory experience per week with topics complementing concurrent study in BIO 111. Required for biology majors/minors. Corequisite: BIO 111. Offered fall and spring.
- BIO 114. POPULATION BIOLOGY LABORATORY** **1 sh**  
 Students have three hours of laboratory experience per week with topics complementing concurrent study in BIO 112. Required for biology majors/minors. Corequisite: BIO 112. Offered fall and spring.
- BIO 161. HUMAN ANATOMY** **4 sh**  
 This course builds a basic foundation in regional human anatomy. Lectures emphasize macroscopic and some microscopic studies of the human body. Special emphasis will be placed on musculoskeletal and neuromuscular anatomy. Laboratory involves progressive anatomical dissections of human cadavers, use of human anatomy instructional software and examination of osteological models. Three class hours, 1 laboratory per week. No credit toward BIO major/minor. Offered fall and spring.
- BIO 162. HUMAN PHYSIOLOGY** **4 sh**  
 This study of human physiology emphasizes skeletal, muscular, nervous, endocrine, heart, blood, respiratory, digestive and urinary aspects. Three class hours, one laboratory per week. No credit toward biology major or minor. Offered fall and spring.
- BIO 181. BIOLOGY LABORATORY TECHNIQUES** **2 sh**  
 Skills taught in this training course for prospective laboratory assistants include laboratory procedures, materials preparation and grading procedures. Offered spring.

- BIO 215. ORGANISMAL BIOLOGY AND FIELD TECHNIQUES** 4 sh  
 This course examines the basic concepts of biological form and function and the fundamentals of organismal systematics with a focus on herbaceous and woody plants, invertebrates and microbial ecology. Students investigate the natural history of local species and their role in community dynamics. Laboratory experiences emphasize keying and identification, field methodologies of specimen collection and preservation, sampling techniques and population estimation procedures for terrestrial and aquatic ecosystems. Satisfies the General Studies lab science requirement. No credit toward the major. Prerequisites: ENS 111/113 or BIO 112/114. (BIO 215 is cross-listed with ENS 215.) Offered spring.
- BIO 221. GENERAL ZOOLOGY** 4 sh  
 Students survey the animal kingdom (emphasizing selected vertebrates and invertebrates) investigating basic concepts of morphology, anatomy, physiology and taxonomy as they affect the ecology of the animal. Three class hours, one laboratory per week. Prerequisites: BIO 111, 112, 113, 114. Offered fall and spring.
- BIO 222. GENERAL BOTANY** 4 sh  
 This survey of the plant kingdom (emphasizing vascular plants) includes general morphology, anatomy, physiology of metabolism and growth, economic importance and identification. Three class hours, one laboratory per week. Prerequisites: BIO 111, 112, 113, 114. Offered fall and spring.
- BIO 261. INTRODUCTORY SEMINAR** 2 sh  
 Students learn to use primary information sources and gain practice in manual and computer information retrieval, read and interpret research and review papers, write abstracts and present scientific information orally. Recommended for sophomore year. Offered fall.
- BIO 271. SPECIAL TOPICS SEMINAR** 2-4 sh  
 Study focuses on one biological topic per seminar in this nonlaboratory discussion course for biology majors. Topics are determined by student and faculty interest. Must have instructor's consent. Offered winter.
- BIO 316. DEVELOPMENTAL BIOLOGY** 4 sh  
 This course examines the changes that occur at the cellular and subcellular level as a single-cell zygote develops into a multi-cellular organism. Topics include fertilization, blastula formation, gastrulation and organogenesis. Three class hours, one laboratory per week. Prerequisites: BIO 221; CHM 111, 112, 113, 114 or CHM 115/116. Offered spring of even-numbered years.
- BIO 318. COMPARATIVE VERTEBRATE STRUCTURE AND FUNCTION** 4 sh  
 This course is an evolutionary approach to the form and function of vertebrates. Students will investigate a diversity of traits and follow the evolutionary changes of these traits from the earliest vertebrates to mammals. The primary focus is on the move from aquatic to terrestrial habitats, the evolution of flight and the evolution of endothermy. Students will compare changes in form and function of the major organ systems through laboratory dissection of the jawless fish, shark, amphibian and mammal. Prerequisites: BIO 112, 114, 221. Offered fall of even-numbered years.
- BIO 321. MICROBIOLOGY** 4 sh  
 In a general survey of microorganisms, study emphasizes bacteria, their cytophysiological characteristics and classification, viruses, microbial diseases and immunity, and the role of microorganisms in human affairs. Three class hours, one laboratory per week. Prerequisites: BIO 111, 113; CHM 111, 112, 113, 114 or CHM 115/116. Junior standing or consent of instructor. Offered spring of even-numbered years.
- BIO 322. MOLECULAR AND CELLULAR BIOLOGY** 4 sh  
 This course is a study of the structure and function of prokaryotic and eukaryotic cells

at the molecular level. It examines in depth specific biochemical pathways and processes essential to life. Topics include considerable coverage of the principles, techniques and applications of molecular genetics. Three class hours, one laboratory per week. Junior standing or consent of instructor. Prerequisites: BIO 111,112, 113, 114; CHM 111, 112, 113, 114 or CHM 115/116. Offered fall and spring.

**BIO 325. HUMAN HISTOLOGY** **4 sh**

Students survey human body tissues (especially of the cardiovascular, alimentary, respiratory, urinary and reproductive systems), stressing tissue identification and the relationship of microanatomy to physiology of the human body. Three class hours, one laboratory per week. Prerequisites: BIO 111, 113. Offered fall of odd-numbered years.

**BIO 335. FIELD BIOLOGY** **4 sh**

In this field-oriented course, restricted to selected natural taxa, environments or biological phenomena, in-depth field study may include identification, classification, life histories and relationships among organisms. Prerequisite: consent of instructor. Offered winter and/or summer.

**BIO 342. PLANT PHYSIOLOGY** **4 sh**

Topics in this study of the life processes of plants include photosynthesis, mineral nutrients, movement of materials, plant growth substances and senescence. Three class hours, one laboratory per week. Prerequisites: BIO 222; CHM 111, 112, 113, 114 or CHM 115/116. Offered spring of odd-numbered years.

**BIO 343. CLINICAL ANATOMY** **4 sh**

This course uses the regional approach to build a strong foundation in human anatomy. Lectures emphasize structure, basic clinical concepts and some functional and mechanical relationships at the gross anatomical level. Laboratory includes dissection of human cadavers, use of human anatomy instructional software, examination of osteological models and applications of basic radiology. Three class hours, one laboratory per week. Prerequisites: BIO 221; CHM 111, 112, 113, 114 or CHM 115/116. Offered fall of even-numbered years.

**BIO 344. EVOLUTION** **4 sh**

In this course, students investigate the causes, rates and implications of evolutionary change in biological systems. Evolution by natural selection is the unifying theory of biology linking phenomena that occur at many different levels of biological organization. Thus, natural selection is studied in depth. Other topics include speciation, rates of molecular change, causes of mass extinctions and sexual selection. Three lecture hours, one laboratory per week. Prerequisites: BIO 112 and BIO 114. Offered spring of odd-numbered years.

**BIO 345. GENETICS** **4 sh**

Students are introduced to Mendelian and molecular principles of genetics and the applications of these principles to the modern world. Three class hours, one laboratory per week. Prerequisites: BIO 111, 112, 113, 114; CHM 111, 112, 113, 114 or CHM 115/116. Offered fall of odd-numbered years.

**BIO 348. BIOTECHNOLOGY** **4 sh**

Students explore how biological systems are utilized in scientific research. In collaboration with their peers, students will apply the techniques of molecular biology (restriction digestion, transformation, DNA hybridization, PCR, etc.) to investigate a research question. Emphasis will be placed on protocol design, solution preparation and critical analysis of research data. Additionally, the social context of biotechnology will be investigated as students explore the risks and rewards in this expanding field. Two laboratory periods, one class hour per week. Prerequisite: BIO 345 or 322. Offered spring of odd-numbered years.

**BIO 351. BIOCHEMISTRY****3 sh**

In this survey of biochemistry as it relates to the physiology of organisms, study includes biochemical methodology, buffers, proteins (structure, function and synthesis), enzymes, bioenergetics, anabolism and catabolism of carbohydrates and lipids, and metabolic regulation. Three class hours, one laboratory per week. Prerequisites: CHM 211, 212, 213, 214. (BIO 351 is cross-listed with CHM 351.) Offered fall of odd-numbered years.

**BIO 352. BIOCHEMISTRY LABORATORY****1 sh**

Experiments in this study of laboratory techniques and principles of biochemistry as it relates to the physiology of organisms include biochemical methodology, buffers, proteins (structure, function and synthesis), enzymes, bioenergetics, anabolism and catabolism of carbohydrates and lipids, and metabolic regulation. Corequisite: BIO 351. (BIO 352 is cross-listed with CHM 352.) Offered fall of odd-numbered years.

**BIO 371. SPECIAL TOPICS SEMINAR****2-4 sh**

Each seminar — a nonlaboratory discussion course for biology majors — focuses on one biological topic determined by faculty interest. Offered winter.

**BIO 442. AQUATIC BIOLOGY: THE STUDY OF INLAND WATERS****4 sh**

Aquatic Biology considers the chemical, physical and biological properties of freshwater ecosystems including streams, rivers, ponds and lakes. Topics include the geomorphology of inland waters, thermal stratification, nutrient cycles, community metabolism, plankton community dynamics, seasonal succession and eutrophication resulting from human activities. Weekly laboratory meetings provide hands-on experience with the field techniques of freshwater scientists. Prerequisites for biology major: BIO 221, 222; CHM 111, 112, 113, 114 or CHM 115/116. Prerequisites for environmental studies major: BIO 112, 114, 215; CHM 111, 112, 113, 114 or CHM 115/116. Junior standing or consent of instructor. Offered spring of even-numbered years.

**BIO 452. GENERAL ECOLOGY****4 sh**

Students explore ecological principles at population, community and ecosystem levels in this study of the interrelationships of organisms with their biotic and abiotic environments. Three lecture hours, one laboratory per week. Prerequisites for biology major: BIO 221, 222. Prerequisites for environmental studies major: BIO 112, 114, 215. Junior standing or consent of instructor. Offered fall.

**BIO 462. SENIOR SEMINAR****2 sh**

This course provides students with the opportunity to conduct both individual and group literature research projects of their own choosing based on recently published scientific papers. Students participate in group discussions of the current literature, research and write a scientific review paper, and develop a formal oral presentation. Recommended for senior year. Offered fall.

**BIO 471. SPECIAL TOPICS SEMINAR****2-4 sh**

Each seminar — a nonlaboratory discussion course for biology majors — focuses on one biological topic determined by student and faculty interest. Must have instructor's consent.

**BIO 481. INTERNSHIP IN BIOLOGY****1-4 sh**

Advanced-level work experience in a biological field is offered on an individual basis when suitable opportunities can be arranged. Prerequisite: permission of department.

**BIO 499. RESEARCH****1-4 sh**

Students from all levels conduct laboratory and/or field research under the direction of the biology faculty. Maximum eight semester hours total credit. Prerequisite: permission of the biology faculty.