

Biochemistry*Coordinator: Associate Professor Wright**Professor: Gooch**Associate Professor: Matera*

Biochemistry focuses on those processes that occur at the molecular level in living organisms. The goal of the biochemistry major is to provide an in-depth, interdisciplinary foundation in the chemistry and biology needed to understand these processes. Students completing this major will be prepared for careers in the biotechnology industry or graduate studies in biochemistry, pharmaceutical chemistry, molecular biology or medically-related fields.

Administered by the Department of Chemistry, a Bachelor of Science degree in Biochemistry (61-65 semester hours) is offered in a three-tiered structure. Foundational courses are taken from biology, chemistry, mathematics and physics. Intermediate courses in biochemistry, genetics and organic chemistry provide in-depth knowledge. Advanced electives in biochemistry, biology and chemistry allow students flexibility in tailoring a curriculum to fit their post baccalaureate goals. The major concludes with a capstone experience focusing on an advanced topics in biochemistry coupled with the creation of a scientific research proposal.

Students who major in biochemistry will gain access to state-of-the-art technology and be able to put their knowledge into practice through internships and/or undergraduate research. Biochemical research may be offered by appropriate faculty in either the Department of Biology or the Department of Chemistry. Undergraduate researchers are encouraged to present their results at local, regional and national scientific meetings.

A Bachelor of Science degree in Biochemistry requires the following courses:

BIO	111	Introductory Cell Biology	3 sh
BIO	112	Population Biology	3 sh
BIO	113	Cell Biology Lab	1 sh
BIO	114	Population Biology Lab	1 sh
CHM	111	General Chemistry I	3 sh
CHM	112	General Chemistry II	3 sh
CHM	113	General Chemistry I Lab	1 sh
CHM	114	General Chemistry II Lab or (in lieu of CHM 111, 113, 112, 114)	1 sh
CHM	115	Advanced General Chemistry	3 sh
CHM	116	Advanced General Chemistry Lab	1 sh
PHY	111	General Physics I	4 sh
PHY	112	General Physics II	4 sh
		or	
PHY	113	General Physics I with Calculus	4 sh
PHY	114	General Physics II with Calculus	4 sh
MTH	121	Calculus I	4 sh
BIO	245	Principles of Genetics	4 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

CHM	311	Quantitative Analysis	4 sh
CHM	351	Biochemistry	3 sh
CHM	352	Biochemistry Lab	1 sh
CHM	353	Advanced Biochemistry	3 sh
CHM	354	Advanced Biochemistry Lab	1 sh
CHM	495	Senior Seminar in Biochemistry	3 sh

Students must take a minimum of 10 hours with at least 4 hours from CHM and 4 hours from BIO¹:

BIO	321	Microbiology
BIO	422	Molecular and Cellular Biology
BIO	445	Advanced Genetics
BIO	499 ^{2,3}	Research
CHM	321	Instrumental Analysis
CHM	332	Physical Chemistry I
CHM	334 ⁴	Physical Chemistry II
CHM	472 ³	Special Topics: NMR
CHM	473 ³	Special Topics: Medicinal Chemistry
CHM	499 ^{2,3}	Research

TOTAL			61-65 sh
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¹ Other elective can be substituted with approval of the department.

² BIO/CHM 499 must be approved by the coordinator as having biochemical content.

³ Special topics courses (2 sh each) and BIO/CHM 499 can count up to 4 sh toward the major.

⁴ MTH 221 is a prerequisite for this optional course.

Students majoring in Biochemistry may not also declare a minor in either Biology or Chemistry.

CHM 495. SENIOR SEMINAR IN BIOCHEMISTRY 3 sh

This capstone course for senior biochemistry majors includes (1) analyzing and understanding advanced biochemical topics using current literature as the major source of information, (2) developing and writing a novel scientific research proposal, and (3) presenting information through both informal in-class discussions of journal articles and a more formal oral seminar presentation. Prerequisites: CHM 351, 351 (required); CHM 353, 354 (recommended). Offered spring.

69

Biology

Chair, Department of Biology: Associate Professor Niedziela

Associate Chair, Department of Biology: Associate Professor Vick

Professors: H. House, S. House

Associate Professors: M. Clark, Haenel, N. Harris, Kingston, MacFall, Touchette

Assistant Professors: Coker, Gallucci, Gammon, Izzo, Miyamoto, Vandermast

Adjuncts: DeVries, Mackin, Train

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, antibiotic resistance, emerging diseases, pollution and rising cancer rates.

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 pre-professional 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.

Molecular/Cellular Bio.	Organismal Bio.	Supraorganismal Bio.	Diversity
BIO 325	BIO 316	BIO 335	BIO 321
BIO 348	BIO 318	BIO 342	BIO 335
BIO 351/352	BIO 321	BIO 344	BIO 341
BIO 353/354	BIO 331	BIO 350	BIO 342
BIO 422	BIO 332		BIO 442
BIO 445	BIO 341		
	BIO 343		
	BIO 442		

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	231	Biodiversity	4 sh
BIO	245	Principles of Genetics	4 sh

BIO	261	Introductory Seminar	2 sh
Upper level biology electives (300-400 level)			
		One course - Molecular/Cellular Biology category	4 sh
		One course - Organismal Biology category	4 sh
		One course - Supraorganismal Biology category	4 sh
Eight additional semester hours chosen from			8 sh
		Molecular/Cellular Biology category	
		Organismal Biology category	
		Supraorganismal Biology category	
		Special topics seminars (non-lab courses)	
		Undergraduate Research (BIO 499) up to 4 sh	
Additional Requirement:			
		At least one elective must have Diversity designation	
BIO	462	Senior Seminar	2 sh
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TOTAL			40 sh

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
or (in lieu of CHM 111, 113, 112, 114)			
CHM	115	Advanced General Chemistry (3 sh)	
CHM	116	Advanced General Chemistry Lab (1 sh)	
Choose one course			4 sh
	MTH 112	General Statistics	
	MTH 212	Statistics in Application	
In addition, a required experiential component selected from the following:			
(a) internship			
(b) research			
(c) a specialized approved laboratory assistantship			
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TOTAL			48-52 sh

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
or (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

BIOLOGY

PHY	111	General Physics I	4 sh
PHY	112	General Physics II	4 sh
		or	
PHY	113	General Physics I with Calculus	4 sh
PHY	114	General Physics II with Calculus	4 sh
MTH	112	General Statistics	4 sh or
MTH	212	Statistics in Application	4 sh

In addition, a required experiential component selected from:

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

TOTAL			64-68 sh
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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	245	Principles of Genetics	4 sh
BIO	321	Microbiology	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
		or (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			
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
<p>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.</p>		
BIO 102.	GENERAL BIOLOGY LABORATORY	1 sh
<p>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.</p>		
BIO 103.	REINVENTING LIFE	4 sh
<p>Can humans responsibly direct evolution? Reinventing Life explores how human activities are rapidly changing life and what this means for the future. Basic concepts are linked with the cutting-edge science of environmental manipulations, stem cells, genetic engineering, synthetic biology and bioethics. Laboratory included. No credit toward biology major or minor. Satisfies General Studies laboratory science requirement. Offered fall and spring.</p>		
BIO 105.	CURRENT ISSUES IN BIOLOGY	4 sh
<p>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.</p>		
BIO 111.	INTRODUCTORY CELL BIOLOGY	3 sh
<p>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.</p>		
BIO 112.	INTRODUCTORY POPULATION BIOLOGY	3 sh
<p>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.</p>		
BIO 113.	CELL BIOLOGY LABORATORY	1 sh
<p>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.</p>		
BIO 114.	POPULATION BIOLOGY LABORATORY	1 sh
<p>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.</p>		

- 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, one laboratory per week. No credit toward biology 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. DIVERSITY OF LIFE** 4 sh
 This course examines the basic concepts of biological form and function, based on evolutionary relationships and diversity. Students investigate the natural history of local species and their role in community dynamics. Laboratory experiences emphasize field investigations, including sampling techniques, species identification and data analysis. Satisfies the General Studies lab science requirement. This course can be used for the major in Environmental Studies and the Elementary Education concentration in Society and Environment, as well as a minor in Biology. No credit toward the Biology major. Prerequisites: ENS 111/113 or BIO 112/114. (BIO 215 is cross-listed with ENS 215). Offered spring.
- BIO 231. BIODIVERSITY** 4 sh
 This course is an integrated lab/lecture which will teach students lab and field techniques to measure and understand the diversity of the living world. Concepts include the measurement of biodiversity, the evolutionary relationships among organisms and the construction of phylogenies. Three two-hour lab/lectures per week. Required for biology majors. Prerequisites: BIO 111, 112, 113, 114. Corequisite: BIO 261. Offered fall and spring.
- BIO 245. PRINCIPLES OF GENETICS** 4 sh
 Students learn basic concepts and laboratory techniques used in classic and modern genetics. Topics covered include transmission, molecular and population genetic principles and their implications in the modern world. Three class hours, one laboratory per week. Required for biology majors. 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. Corequisite: BIO 231. Offered fall and spring.
- 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 231; 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, 231. 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.
- 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. Prerequisite: BIO 231. Offered fall of odd-numbered years.
- BIO 331. THE BIOLOGY OF ANIMAL BEHAVIOR** 4 sh
 This course examines why animals behave the way they do. Specific topics include the causation, development, function and evolution of behavior in wild and captive animals. Three class hours and one laboratory per week. Prerequisites: BIO 112, 114 and 231 or consent of instructor.
- BIO 332. 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. Prerequisite: BIO 231.
- 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 341. 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. Prerequisite: BIO 231. Offered fall.
- BIO 342. 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 231; 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 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 231 and 245. Offered fall.

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, 114 and 245. Offered spring 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, two class hours per week. Prerequisite: BIO 245. Offered spring of odd-numbered years.

BIO 350. 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 231. Prerequisites for environmental studies major: BIO 112, 114, 215. Offered fall.

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 353. ADVANCED BIOCHEMISTRY 3 sh

Topics chosen to complement BIO 351 include a detailed study of primary and intermediary metabolism: syntheses and degradation of lipids, amino acids and nucleotides; metabolic coordination; signal transduction; molecular motors; and the role of cytochrome c. The use of selected case studies from medical schools will be integrated into the study of metabolism. The course will also include a student-led discussion of selected articles from the primary literature in biochemistry. Prerequisites: BIO 351-2. (BIO 353 is cross-listed with CHM 353.) Offered spring of even years.

BIO 354. ADVANCED BIOCHEMISTRY LABORATORY 1 sh

This laboratory investigates the analysis of selected proteins and other biomolecules by NMR as well as the methods used in BIO 352. Experiments involving the study of dynamic processes inside living cells (metabolism) will be included. Prerequisites: BIO 351-2.

Corequisite: BIO 354. (BIO 354 is cross-listed with CHM 354.) Offered spring of even 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 422. 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 biology. Four class hours. Prerequisites: BIO 245; CHM 211, 212, 213, 214. Offered spring of even-numbered years.
- BIO 442. 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 231; CHM 211, 212, 213, 214 or permission. Offered spring of odd-numbered years.
- BIO 445. ADVANCED GENETICS** 4 sh
Advanced problem solving in prokaryotic and eukaryotic genetics. The focus is on the applications of advanced concepts in transmission, molecular and population genetics to problem solving in the modern world. Three class hours, one laboratory per week. Prerequisites: BIO 245; CHM 211, 212, 213, 214. Offered fall of even-numbered years.
- 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 non-laboratory 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 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.

77

Business Administration

Martha and Spencer Love School of Business mission statement:

To provide instruction and experiences for our students so they graduate with the knowledge, skills and character essential for responsible business leadership in the 21st century.

Chair, Department of Business Administration: Associate Professor Stevens

Professors: Burbridge, Gowan, Honeycutt, Noer, O'Mara, Valle

Associate Professors: Burpitt, Garber, Hodge, Manring, Nienhaus, Powell, Strempek, Yap

Assistant Professors: Buechler, Gunby

Lecturer: Rich, Riney

Senior Lecturer and Executive Director of the Doherty Center for Entrepreneurial Leadership: Palin

Instructor, Visiting Executive in Marketing: Miller
Executive-in-Residence: MacMahon

The study of Business Administration at Elon University begins with a solid grounding in the traditional liberal arts and sciences. This preparation is an integral part of becoming an informed, responsible and capable business leader. An Elon education emphasizes the development of the whole person — mind, body and spirit. Business Administration courses at Elon University advance that commitment by emphasizing business knowledge acquisition, skill development through hands-on learning and experiential activities and the development of discipline, integrity and an ethic of service.

Students majoring in Business Administration at Elon University take courses in a common core representing the functional business disciplines (e.g., accounting, finance, management, marketing, etc.). They also have the opportunity to develop specialized knowledge in one of five areas of concentration: Entrepreneurship, Finance, International Business, Management, and Marketing.

Our coursework emphasizes active learning and appreciative inquiry. Rather than dictate a set of principles to be memorized, our programs emphasize the integration of business knowledge and the application of that knowledge to organizational problems. We emphasize hands-on learning through internships, co-op experiences, service learning and classroom instruction which engages students in the study and practice of business. Students also develop skills in written and oral communications, team-building and problem solving, and decision-making in our increasingly global business environment.

The Bachelor of Science in Business Administration (BSBA) program at Elon University emphasizes academic challenge, mature intellectual development and a lifetime of learning. Our graduates go on to leadership positions in business and industry in for-profit and not-for-profit organizations. Our graduates are prepared for a variety of assignments because they possess an extensive array of knowledge, skills and abilities.

A major in Business Administration requires the following:

At least 50% of the business credit hours required for the degree (B.S. in Business Administration) must be earned at Elon University.

Select one course from:			4 sh
MTH	116	Applied Calculus	
MTH	121	Calculus and Analytic Geometry I	
ECO	111	Principles of Economics	4 sh
ECO	203	Statistics for Decision-Making	4 sh
ECO	301	Business Economics	4 sh
ACC	201	Principles of Financial Accounting	4 sh
ACC	212	Principles of Managerial Accounting	4 sh
CIS	211	Management Information Systems	4 sh
BUS	202	Business Communications	4 sh
BUS	221	Legal Environment of Business	2 sh
BUS	311	Principles of Marketing	4 sh
BUS	323	Principles of Management and Organizational Behavior	4 sh
BUS	326	Operations Management	4 sh
BUS	465	Business Policy	4 sh

FIN	343	Principles of Finance	4 sh
Select one course from:			0-4 sh
LSB	382	Professional Work Experience (0 credit)	
LSB	381	Internship in Business (1-4 sh)	
BUS	481	Internship in Business Administration (1-4 sh)	
Sixteen to twenty semester hours of a concentration			16-20 sh
TOTAL			70-78 sh

Concentrations

Finance 16 sh

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student's program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student's concentration.

The following courses are required:

FIN	413	Advanced Managerial Finance
FIN	421	Investment Principles
FIN	419	Financial Services or
FIN	471	Seminar: Special Topics

Marketing 16 sh

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student's program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student's concentration.

The following course is required:

BUS	414	Marketing Research
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Two courses from the following:

BUS	413	Integrated Marketing Communications
BUS	415	Consumer Behavior
BUS	416	Global Marketing
BUS	417	Business-to-Business Marketing
BUS	419	Sales Management
BUS	473	Special Topics in Marketing

Management 16 sh

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts

and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student's program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student's concentration.

Three courses from the following:

- BUS 424 Responsible Leadership
- BUS 425 Human Resource Management
- BUS 427 Organizational Improvement
- BUS 428 Advanced Organizational Behavior
- BUS 429 Entrepreneurship/Intrapreneurship
- BUS 430 International Business Management
- BUS 471 Seminar: Special Topics in Management

Entrepreneurship

16 sh

One course from the following:

One 300/400 level course from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society or Science). The 300/400 level Studies in Arts and Sciences course selected must be taken in addition to the upper-level GST and Advanced Study courses already required, and it may not also count for any other course in the student's program of study. Advisors may assist students in selection of an appropriate course which should enhance the subject matter of the student's concentration.

The following three courses are to be taken in sequence as indicated:

- BUS 341 EEA1 – New Business Concepts and Market Justifications
To be taken first term junior year.
- BUS 342 EEA2 – Writing and Defending the Business Plan
To be taken second term junior year.
- BUS 441 EEA3 - New Enterprise Start-Up and Operations
To be taken first term senior year.

International Business

16 sh

The following two classes are required:

- BUS 416 Global Marketing
- BUS 430 International Business

Two 300/400 level courses should be selected from outside Business Administration. At least one of these must be from the Studies in Arts and Sciences course offerings (Expression, Civilization, Society, or Science). These courses must be taken in addition to the upper level GST and Advanced Study courses already required, and may not also count for any other courses in the student's program of study. Advisors may assist students in the selection of appropriate courses which should enhance the subject matter of the IB Concentration. Courses selected are subject to approval by the IB coordinator.

Intermediate proficiency in a modern foreign language is a concurrent requirement of the concentration. Proficiency can be demonstrated either by achieving an intermediate-mid level rating on an Oral Proficiency Interview (OPI) or a Simulated Oral Proficiency Interview (SOPI), by passing a modern foreign language course at the 221 level, or by placement in the language at or above the 222 level.

A minor in Business Administration requires the following courses:

Select one course from:			4 sh
BUS	304	Introduction to Marketing	
BUS	311	Principles of Marketing (prerequisite BUS 202)	
Select one course from:			4 sh
BUS	303	Introduction to Managing	
BUS	323	Principles of Management and Organizational Behavior (prerequisite BUS 202)	
ACC	201	Principles of Financial Accounting	4 sh
FIN	303	Introduction to Finance	4 sh
ECO	111	Principles of Economics	4 sh
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TOTAL			20 sh

BUS 202. BUSINESS COMMUNICATIONS 4 sh

In addition to studying the theory and principles of good oral and written communications, students practice making oral presentations and writing business reports, letters and memoranda. Prerequisites: ENG 110 and sophomore standing. Offered fall and spring.

BUS 221. LEGAL ENVIRONMENT OF BUSINESS 2 sh

A number of laws influence business decisions and activities. Matters relating to competitive conduct, consumer protection, accounting and financial reporting, public communications and the natural environment are regulated by widely known federal agencies. Most states also have counterpart commissions that set additional standards and rules for business regulation. U.S. businesses enjoy a remarkably free legal environment compared to many other developed markets, and certainly more free than centrally controlled economic systems. This course explores these aspects of the U.S. business scene, with comparisons across states and other nations where appropriate. Its focus is on the legal environment, not on the legal processes, torts or case law. Its appropriate audience is the business student who needs a broad, general understanding of how we govern ourselves in the marketplace. Offered fall and spring.

81

BUS 303. INTRODUCTION TO MANAGING 4 sh

For non majors and business administration minors, this introductory course examines universal business processes such as goal-setting, planning, decision-making, motivation, human resource management and control which are utilized by both not-for-profit and government organizations. Sophomore standing required. Credit not given in the major for BUS 303 and BUS 323. Offered fall, winter and spring.

BUS 304. INTRODUCTION TO MARKETING 4 sh

For non majors and business administration minors, this introductory course examines marketing principles which are applied by all organizations. Sophomore standing required. Credit not given in the major for BUS 304 and BUS 311. Offered fall, winter and spring.

BUS 311. PRINCIPLES OF MARKETING 4 sh

This study of the marketing and distribution of goods and services includes buyer behavior, the marketing functions, commodity and industrial markets, merchandising considerations, price policies and governmental regulation of competition. Prerequisites: ECO 111 and BUS 202. Sophomore standing required. Credit not given in the major for BUS 304 and BUS 311. Offered fall and spring.

BUS 323. PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOR 4 sh

This course will prepare the student for the challenges of management and leadership in the dynamic new workplace of the 21st century. The course examines the central role of management in the efficient and effective production of goods and services. Students will learn how strategic and operational planning, job and organizational structure design and

human behavior affect operations in manufacturing and service industries. Organizational behavior topics include leadership and ethics, motivation and rewards, communication and teams, and teamwork. The global dimensions of management are also emphasized. Prerequisite: BUS 202. Sophomore standing required. Credit not given in the major for BUS 303 and BUS 323. Offered fall and spring.

- BUS 326. OPERATIONS MANAGEMENT** 4 sh
 As a primary business function, operations plays a vital role in achieving a company's strategic plans. Since the operations function produces the goods and services, it typically involves the greatest portion of the company's people and capital assets. Customer service, product/service delivery, product/service quality and overall organizational effectiveness depend on excellence in operations. This course covers manufacturing and service process design, planning and control. Operations strategy, demand forecasting, supply chain management, facility location and design, e-commerce, capacity planning, inventory systems, scheduling and quality control are topics included in the course. Prerequisites: ECO 203, CIS 211, BUS 323 or 303. Sophomore standing required. Offered fall and spring.
- BUS 341. EEA 1 – NEW BUSINESS CONCEPTS AND MARKET JUSTIFICATION** 4 sh
 In the first course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, students identify business ideas, develop them into detailed business concepts and models, undertake research to determine the feasibility of their concepts and structure a preliminary marketing plan. At the conclusion of this course, student groups will present their ideas for evaluation. The best ideas will move on to full business plan development in BUS 342 (Writing and Defending the Business Plan). Prerequisite or corequisite: BUS 311. To be taken first term of junior year.
- BUS 342. EEA 2 – WRITING AND DEFENDING THE BUSINESS PLAN** 4 sh
 In the second course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, students expand their business concepts developed in BUS 341 into full business plans including complete marketing plans, operations plans, schedules and financial projections. A Venture Capital Board of business professionals will critique and judge the plans. Successful student teams will receive funding to operate their ventures the following term in BUS 441 (New Enterprise Start-up and Operations). Prerequisite or corequisite: BUS 323; Prerequisite: BUS 341; or by permission. To be taken second term junior year.
- BUS 365. BUSINESS ADMINISTRATION APPLICATIONS** 4 sh
 Topics vary yearly in the study of applications of business administration principles and theories in various business situations. Sophomore standing required.
- BUS 366. FIELD EXPERIENCE IN BUSINESS** 4 sh
 This course revolves around visits to diverse local businesses and analyses of the businesses visited. Prerequisite: permission of instructor. Sophomore standing required.
- BUS 413. INTEGRATED MARKETING COMMUNICATIONS** 4 sh
 This course focuses on the management of the communication aspects of marketing strategy. Elements of advertising, personal selling, sales promotion, direct marketing and public relations are included. The study of marketing communications includes a review of concepts from economics, behavioral sciences and social sciences, which play a role in creating, executing and evaluating promotional programs. Topics include setting communications objectives and budgets, media planning and creative strategy, all in the context of an integrated communication program. Emphasis will be placed on appreciating the scope, strengths and weaknesses of these marketing communication tools, and particularly on how they can and should be used together. Prerequisite: BUS 311. Offered spring.
- BUS 414. MARKETING RESEARCH** 4 sh
 Students apply various research methods used in business to gather and analyze marketing data. Possible effects and implications of the analyses are discussed in terms of the market-

ing and decision-making processes of businesses. Prerequisites: BUS 311 and ECO 203. Offered spring.

BUS 415. CONSUMER BEHAVIOR 4 sh

This course for the marketing concentration focuses on the application of the behavioral sciences to understand consumer behavior. Emphasis is placed on developing an appreciation for the scope of the topic, understanding the essentials underlying consumer behavior and developing an ability to relate such understanding to important issues faced by marketing practitioners. Traditional research-oriented topics include perception, memory, affect, learning, persuasion, motivation, behavioral decision-theory and environmental (e.g., social and cultural) influences. All topic presentations will include a discussion of practitioner-oriented managerial implications. Prerequisite: BUS 311. Offered fall.

BUS 416. GLOBAL MARKETING 4 sh

This course for the marketing concentration is designed to explore the scope of global marketing. The course examines the impact the global environment has upon marketing decisions and strategy formulations. Through analyses of different types of markets, students will develop an understanding and appreciation of how the world is “shrinking” and the influence this has on U.S. businesses, individuals, households and institutions. Students will monitor the global environment and report their findings on specific regions of the world to the class. The intent is to make students more aware of the global environment and its impact on U.S. businesses. Prerequisite: BUS 311. Offered fall.

BUS 417. BUSINESS-TO-BUSINESS MARKETING 4 sh

This course for the marketing concentration focuses on exploring and understanding business-to-business (B2B) marketing. The study of business-to-business marketing provides an opportunity for students to synthesize their knowledge of B2B or industrial marketing with other, highly-related business disciplines (accounting, finance and management) in order to move products through the supply chain from producer to the ultimate consumer. Business-to-business relationships, interfaces, strategies, problems and performance are explored through the case method. Prerequisite: BUS 311. Offered spring.

BUS 419. SALES MANAGEMENT 4 sh

The sales management course is an analysis of professional selling practices with emphasis on the selling process and sales management, including the development of territories, determining potentials and forecasts and setting sales quotas. Prerequisite: BUS 311. Offered fall.

BUS 424. RESPONSIBLE LEADERSHIP 4 sh

This course addresses the characteristics, behaviors and responsibilities required of contemporary organizational leaders. While focusing on the traditional topics (individual differences and traits of leaders, behaviors of leaders, role of power, types and styles of leadership and theories of motivation), the student will also be introduced to some nontraditional approaches (nontraditional metaphors, leadership as an art and individual differences of followers and followership) to understanding leaders and leadership. The responsibilities of leadership will be specifically addressed in relationship to the concepts of organizational success and effectiveness, social responsibility and ethical decision-making. Prerequisite: BUS 323. Offered fall and spring.

BUS 425. HUMAN RESOURCE MANAGEMENT 4 sh

Effective human resource management is critical to the long-term value of an organization and ultimately to its success and survival. All aspects of human resource management — including how organizations interact with the environment; acquire, develop and compensate human resources; design and measure work — can help organizations meet their competitive challenges and create value. This course looks at the role of strategic human resource planning, recruitment and selection, performance management, developing and compensating human resources, the legal environment and employee relations, collective

bargaining and labor relations, using technology to increase HRM effectiveness and global issues in HRM. Prerequisite: BUS 323. Offered fall.

- BUS 427. ORGANIZATIONAL IMPROVEMENT** 4 sh
 This course will introduce the students to material which will cover basic productivity improvement techniques, application of these techniques in his/her work place, teaching coworkers these techniques, leading work teams in problem-solving activities and managing an organizational productivity improvement program. Prerequisite: BUS 323. Offered spring.
- BUS 428. ADVANCED ORGANIZATIONAL BEHAVIOR** 4 sh
 This course addresses the impact of individual, group and organizational influences in human behavior within organizations. Building on the organizational behavior topics introduced in BUS 323, the focus of this course is on acquiring in-depth knowledge and developing interpersonal skills through the study and application of theories and concepts related to understanding and predicting human behavior in organizations. Personality, perception, job design and goal-setting, appraisal, group dynamics, decision-making, cooperation and conflict, organizational structure and culture, power and organizational politics, organizational learning, innovation and change management, and organizational development are topics included in the course. Prerequisite: BUS 323. Offered fall and spring.
- BUS 429. ENTREPRENEURSHIP/INTRAPRENEURSHIP** 4 sh
 This course addresses how to go into business and several of the unique problems and circumstances encountered in establishing and operating a small business. Emphasis is also placed on the role of entrepreneurship in large firms through the study of "intrapreneurship." Special emphasis focuses on why small businesses fail and what entrepreneurs can do to minimize the influence of these forces. Family-owned business management is included as one type of small business covered. Prerequisite: BUS 323.
- BUS 430. INTERNATIONAL BUSINESS MANAGEMENT** 4 sh
 This course covers business management from the perspective of the current global business environment. Students examine the overall nature of international business, the foreign environments that international businesses face and the unique situations associated with doing business across international borders. Prerequisite: BUS 323. Offered fall and spring.
- BUS 441. EEA 3 – NEW ENTERPRISE START-UP AND OPERATIONS** 4 sh
 In the third course of the three-course entrepreneurship concentration (Elon Enterprise Academy) sequence, student ventures that succeed in receiving funding from the Venture Capital Board in BUS 342 (Writing and Defending the Business Plan) will implement those plans and begin operations. Periodic business reviews will be held to assess progress against projections, identify issues and identify necessary adjustments. Success will be partially determined based on venture performance and demonstrated ability to apply core business concepts. Prerequisite or corequisite: BUS 326; Prerequisite: BUS 342; or by permission. To be taken first term senior year.
- BUS 465. BUSINESS POLICY** 4 sh
 This capstone course integrates students' experiences and previous study through case studies and simulated business decision exercises. Prerequisites: BUS 202, 311, 323; BUS 326 for Business Administration majors or ACC 336 for Accounting majors; ECO 301 (Business Administration majors only); FIN 343; and senior status. Offered fall and spring.
- BUS 471. SEMINAR: SPECIAL TOPICS IN MANAGEMENT** 4 sh
 This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.

- BUS 472. SEMINAR: SPECIAL TOPICS IN INTERNATIONAL BUSINESS** 4 sh
This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.
- BUS 473. SEMINAR: SPECIAL TOPICS IN MARKETING** 4 sh
This advanced study consists of readings and discussion of special topics and involves participation by students, faculty and other resource persons.
- BUS 481. INTERNSHIP IN BUSINESS ADMINISTRATION** 1-4 sh
An internship experience offers the student valuable experience in business and management. Appropriate placement must be arranged by the student with the help and support of business administration faculty and other appropriate resources.
- BUS 491. INDEPENDENT STUDY** 1-4 sh
- BUS 499. UNDERGRADUATE RESEARCH IN BUSINESS ADMINISTRATION** 1-4 sh
Students may engage in an undergraduate research study in collaboration with a faculty sponsor.

Love School of Business Courses

- LSB 350. PERSONAL MASTERY I** 1 sh
The purpose of this course is to further prepare business students for the exciting and challenging world of business. The course will introduce students to some perspectives and themes that are not the primary focus of other courses in the Love School of Business. The course has two primary objectives: 1) internal development, focusing on integrity, ethics, and professional development 2) ability to demonstrate those qualities. Prerequisite: Junior standing in Business Fellows Program. Offered fall.
- LSB 351. PERSONAL MASTERY II** 1 sh
The purpose of this course is to further prepare business students for the exciting and challenging world of business. Building on the skills developed in LSB 350, this course will focus on further developing job-search skills, including company research, networking skills, interviewing skills, and the development of a personal portfolio. The primary output for Personal Mastery II is a professional portfolio for students to showcase their academic, extracurricular and internship experiences. Creation of the portfolio will not only enable students to have an impressive visual to present to future employer; the process of creating the portfolio will better prepare them for the interview. Prerequisite: Junior standing in the Business Fellows program. Offered spring.
- LSB 381. INTERNSHIP IN BUSINESS** 1-4 sh
This course is designed to provide majors in accounting and in business administration with hands-on experience. Students will work in off campus positions to confirm or clarify career goals, test what they have learned in their classes, gain a clearer sense of what they still need to learn and build their professional network. This program will be managed and monitored by the LSB internship coordinator. Students systematically evaluate themselves and the organization in which they work over the course of the term to determine: "If offered a career employment opportunity with this organization at the end of the term, would I accept? Why or why not?" The "why or why not" will focus on the potential fit between a student's individual strengths/interests and the organization's environment and culture.
- LSB 382. PROFESSIONAL WORK EXPERIENCE** 0 credits
The objective of the PWE is to provide students the opportunity to learn more about organizational life and about themselves and their responsibilities to an organization, while requiring academic or reflective work. This work requires a minimum of 40 hours of on-the-job work. Students arrange their own work experience, and the program will be managed and monitored by the LSB internship coordinator. This requirement will

be graded as either Satisfactory (S) or Unsatisfactory (U). Offered fall, winter, spring, summer. Special fee: \$331.00 if taken during the summer or more than 4 hours during winter term. If the course is taken by a student enrolled in less than 12 semester hours or 18 or more semester hours during fall and spring semesters, the fee is \$331.00.

Chemistry

Chair, Department of Chemistry: Associate Professor Wright

Professors: Danieleley, Gooch, Grimley

Associate Professors: Karty, Matera, Sienerth

Assistant Professor: Ponton

Adjuncts: Bernhardt, Bowling, Chandler, Schwartz

Science Lab Manager: Weller

The Department of Chemistry offers courses of study leading to either a Bachelor of Science degree (61-65 semester hours), Bachelor of Arts degree (44-48 semester hours) or a minor in Chemistry (20-24 semester hours). Students satisfying the requirements of the Bachelor of Science degree will be certified by the American Chemical Society.

Students who major in chemistry are qualified for many pursuits. They may choose to work in the chemical industry, continue advanced studies in chemistry, take professional training in medicine, dentistry or other health-related fields, prepare to teach at the secondary level or pursue opportunities in related fields (environmental science, forensics, business and industry).

Elon's chemistry program provides the opportunity for students to engage with faculty in undergraduate research and to gain direct experience with new instrumentation using today's state-of-the-art technology. The results of the research projects are presented at local, regional and national scientific meetings.

Another key feature of the program is the introduction and use of instrumentation in the first-year general chemistry sequence and its continued emphasis throughout the chemistry curriculum. Student participation in assisting in laboratory and recitation instruction is strongly advised and supported.

A Bachelor of Science (ACS certified) degree in Chemistry requires the following courses:

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
		or (in lieu of CHM 111, 113, 112, 114)	
CHM	115	Advanced General Chemistry (3 sh)	
CHM	116	Advanced General Chemistry Lab (1 sh)	
CHM	205	Inorganic Chemistry	4 sh
CHM	211	Organic Chemistry I	3 sh
CHM	213	Organic Chemistry I Lab	1 sh
CHM	212	Organic Chemistry II	3 sh
CHM	214	Organic Chemistry II Lab	1 sh
CHM	125	Chemical Literature	1 sh
CHM	311	Quantitative Analysis	4 sh
CHM	321	Instrumental Analysis	4 sh

CHM	332	Physical Chemistry I	4 sh
CHM	334	Physical Chemistry II	4 sh
CHM	351	Biochemistry	3 sh
CHM	431	Advanced Inorganic Chemistry	4 sh
CHM	432	Physical Organic Chemistry	2 sh
CHM	461	Seminar	1 sh
CHM	499	Chemistry Research	2 sh
MTH	121	Calculus & Analytic Geometry I	4 sh
MTH	221	Calculus & Analytic Geometry II	4 sh
PHY	113	General Physics I with Calculus	4 sh
PHY	114	General Physics II with Calculus	4 sh
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TOTAL			61-65 sh

A Bachelor of Arts degree in Chemistry requires the following courses:

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
		or (in lieu of CHM 111, 113, 112, 114)	
CHM	115	Advanced General Chemistry (3 sh)	
CHM	116	Advanced General Chemistry Lab (1 sh)	
CHM	205	Inorganic Chemistry	4 sh
CHM	211	Organic Chemistry I	3 sh
CHM	213	Organic Chemistry I Lab	1 sh
CHM	212	Organic Chemistry II	3 sh
CHM	214	Organic Chemistry II Lab	1 sh
CHM	125	Chemical Literature	1 sh
CHM	311	Quantitative Analysis	4 sh
CHM	332	Physical Chemistry I	4 sh
CHM	461	Seminar	1 sh
MTH	121	Calculus & Analytic Geometry I	4 sh
PHY	111	General Physics I	4 sh
PHY	112	General Physics II	4 sh
		(Physics 113 and 114 may be substituted for Physics 111 and 112.)	
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Six semester hours from chemistry (at least 4 sh at the 300-400 level)			6 sh
TOTAL			44-48 sh

A minor in Chemistry requires the following courses:

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
		or (in lieu of CHM 111, 113, 112, 114)	
CHM	115	Advanced General Chemistry (3 sh)	
CHM	116	Advanced General Chemistry II Lab (1 sh)	

CHEMISTRY

CHM	211	Organic Chemistry I	3 sh
CHM	213	Organic Chemistry I Lab	1 sh
CHM	212	Organic Chemistry II	3 sh
CHM	214	Organic Chemistry II Lab	1 sh
Eight additional hours selected from:			8 sh
	CHM 205	Inorganic Chemistry (4 sh)	
	CHM 305	Environmental Chemistry (4 sh)	
	CHM 311	Quantitative Analysis (4 sh)	
	CHM 321	Instrumental Analysis (4 sh)	
	CHM 351	Biochemistry (3 sh) and	
	CHM 352	Biochemistry Lab (1 sh)	
	CHM 353	Advanced Biochemistry (3 sh) and	
	CHM 354	Advanced Biochemistry Lab (1 sh)	
	CHM 471-79	Special Topics in Chemistry (2-4 sh)	
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TOTAL			20-24 sh

A Bachelor of Arts Degree in Chemistry/Chemical Engineering: See requirements listed in Engineering.

CHM 101. BASIC CONCEPTS IN CHEMISTRY 3 sh

The course is designed to meet the math/science general studies requirement for nonscience majors. The material covered includes atomic structure, chemical changes, descriptive chemistry of selected elements, introduction to organic chemistry and how chemistry applies to consumer products and the environment. No credit given to students with prior credit for CHM 111. No credit for major/minor. Corequisite: CHM 102. Offered fall and spring.

CHM 102. BASIC CONCEPTS IN CHEMISTRY LABORATORY 1 sh

Laboratory exercises are based upon selected foundational concepts covered in CHM 101. No credit for students with prior credit for CHM 113. No credit for major/minor. Corequisite: CHM 101. Offered fall and spring.

CHM 111. GENERAL CHEMISTRY I 3 sh

This course introduces fundamental principles of chemistry with special emphasis on developing skills in quantitative reasoning. Topics include stoichiometry, nomenclature, gases, atomic structure and periodicity, theories of chemical binding and thermochemistry. Prerequisite: High school chemistry. Corequisites: MTH 111 or higher and CHM 113. Offered fall and spring.

CHM 112. GENERAL CHEMISTRY II 3 sh

The study of fundamental chemical principles continues with chemical kinetics, liquid/solid states, chemical equilibrium (gas phase and acid/base), thermodynamics and electrochemistry. Prerequisite: CHM 111 and CHM 113. Corequisite: CHM 114. Offered spring.

CHM 113. GENERAL CHEMISTRY I LABORATORY 1 sh

The experiments offered familiarize students with basic laboratory techniques and complement topics discussed in CHM 111. Corequisite: CHM 111. Offered fall and spring.

CHM 114. GENERAL CHEMISTRY II LABORATORY 1 sh

This course involves laboratory applications of concepts and principles discussed in CHM 112. Prerequisites: CHM 111, 113. Corequisite: CHM 112. Offered spring.

CHM 115. ADVANCED GENERAL CHEMISTRY 3 sh

This course explores fundamental principles of chemistry with an emphasis on understanding chemical concepts and quantitative reasoning. It consists of a brief review

heavy metal pollutants sampling techniques and resistance of selected materials to certain pollutants. No credit toward B.S. degree. Prerequisites: CHM 211/213. Offered spring of alternate years.

- CHM 311. QUANTITATIVE ANALYSIS** 4 sh
 This course introduces chemical methods of quantitative analysis, including classical, volumetric and selected instrumental methods, a discussion of error and uncertainty in measurements, and elementary statistics. Discussion also covers the underlying physical and chemical theories and laws with emphasis on chemical equilibrium. Prerequisites: CHM 111-114 or CHM 115/116. Offered fall.
- CHM 321. INSTRUMENTAL ANALYSIS** 4 sh
 Instrumental Analysis offers theory and practice of instrumental methods, with emphasis placed on spectroscopic (UV/VIS, IR, NMR, AA) and mass spectrometric methods of analysis. Prerequisites: CHM 311, and CHM 211-214. Offered spring.
- CHM 332. PHYSICAL CHEMISTRY I** 4 sh
 The mathematical development of the physical principles in chemistry is explored. Topics include development and application of the laws of thermodynamics, equations of states, kinetic molecular theory, elementary electrochemistry and equilibria. Laboratory experiments are designed to complement lectures and include studies of phase relationships, calorimetry and gas laws. Three hours lecture and three hours lab per week. Prerequisites: CHM 111-114 or CHM 115/116; MTH 121; PHY 112 or 114. Offered fall.
- CHM 334. PHYSICAL CHEMISTRY II** 4 sh
 The principles of quantum mechanics are developed and illustrated by use of simple systems. Spectroscopic techniques are investigated as tools for probing structure and properties of molecules. Other topics include kinetics and group theory. Laboratory experiments are designed to complement lectures and include multiple techniques to investigate reaction kinetics, laser spectroscopy, UV-VIS spectroscopy and computational techniques. Three hours lecture, three laboratory hours per week. Prerequisites: CHM 332, MTH 221, PHY 114. Offered spring.
- 90 **CHM 351. BIOCHEMISTRY** 3 sh
 This is a survey of biochemistry as it relates to the physiology of organisms. Topics include biochemical methodology, buffers, proteins (structure, function and synthesis), enzymes, bioenergetics, anabolism and catabolism of carbohydrates and lipids and metabolic regulation. Prerequisites: CHM 211-214. (CHM 351 is cross-listed with BIO 351.) Offered fall.
- CHM 352. BIOCHEMISTRY LABORATORY** 1 sh
 This laboratory investigates the rates of enzyme-catalyzed reactions, including the effect of enzyme inhibitors; the isolation/purification/analysis of proteins, lipids and carbohydrates; and some analytical techniques used in clinical chemistry laboratories. Techniques employed include affinity chromatography, electrophoresis, gas chromatography, UV-visible spectrometry and polarimetry. Prerequisites: CHM 211-214. Corequisite: CHM 351. (CHM 352 is cross-listed with BIO 352.) Offered fall.
- CHM 353. ADVANCED BIOCHEMISTRY** 3 sh
 Topics chosen to complement CHM 351 include a detailed study of primary and intermediary metabolism: syntheses and degradation of lipids, amino acids and nucleotides; metabolic coordination; signal transduction; molecular motors; and the role of cytochrome c. The use of selected case studies from medical schools will be integrated into the study of metabolism. The course will also include a student-led discussion of selected articles from the primary literature in biochemistry. Prerequisites: CHM 351-2. (CHM 353 is cross-listed with BIO 353.) Offered spring.
- CHM 354. ADVANCED BIOCHEMISTRY LABORATORY** 1 sh
 This laboratory investigates the analysis of selected proteins and other biomolecules by NMR as well as the methods used in CHM 352. Experiments involving the study of

dynamic processes inside living cells (metabolism) will be included. Prerequisites: CHM 351-2. Corequisite: CHM 354. (CHM 354 is cross-listed with BIO 354.) Offered spring.

- CHM 431. ADVANCED INORGANIC CHEMISTRY** 4 sh
 This course will begin with an accelerated review of the history of inorganic chemistry, atomic structure and simple bond theory. It will then provide an in-depth introduction into symmetry and group theory with applications to the description of chemical bonding in molecular orbital theory. Acid-Base and Donor-Acceptor Chemistry and the descriptive chemistry of the main group elements will be followed by an in-depth survey of organometallic chemistry. The continued application of physical methods of structure determination of inorganic compounds by magnetic and spectral techniques including magnetic susceptibility, UV/VIS and IR spectroscopies and NMR spectrometry will be presented throughout the course. Prerequisites: CHM 205, 211-214 and CHM 334. Offered fall.
- CHM 432. PHYSICAL ORGANIC CHEMISTRY** 2 sh
 The study and applications of Hückel molecular orbital theory toward the understanding of the mechanisms of selected chemical reactions. The focus will be on empirical methods to derive mechanisms including linear free energy relationships and reaction kinetics. Techniques to be covered include photoelectron spectroscopy (PES) and computational chemistry (CC). Prerequisite: CHM 334. Offered spring.
- CHM 461. SEMINAR** 1 sh
 Students make presentations after they do individual library research. Student seminars are supplemented with seminars by practicing scientists. All chemistry-oriented students are encouraged to attend. Credit for junior and senior majors only or by permission of the instructor. Completion of this course satisfies the oral competency requirement for the B.S. and B.A. major in Chemistry. Course is two semesters in length with 0.5 sh each semester. Students must take both semesters. Offered fall and spring.
- CHM 471-479. SPECIAL TOPICS IN CHEMISTRY** 2-4 sh
 Advanced topics offered to meet the needs and interests of students include methods in forensic and medicinal chemistry, nuclear chemistry, nuclear magnetic resonance spectrometry, advanced organic or polymer chemistry. Prerequisites: CHM 212/214.
- CHM 481. INTERNSHIP** 1-4 sh
 Students gain advanced-level work experience in a chemical field. Internships are offered on an individual basis when suitable opportunities can be arranged. Prerequisite: permission of department.
- CHM 491. INDEPENDENT STUDIES** 1-4 sh
- CHM 499. RESEARCH** 1-3 sh
 In collaboration with a chemistry faculty member, students undertake experimental or theoretical investigations. Prerequisite: Approval of department chair. Offered fall, winter, spring.

Classical Studies

Coordinator: Professor Gill

Classical Studies is an interdisciplinary program of studies in the languages, history, culture and heritage of the ancient and early modern world. This program gives students an opportunity for concentrated study of "Classical" ideas and practices, which form an important part of Western civilization. In addition, the program examines the ways that these ideas and practices have influenced, and been modified by, later generations. A minor in Classical Studies can serve as a valuable complement to many fields, providing depth and context for a student's other courses, encouraging analytical study of primary sources and allowing the pleasure of reading some of Western civilization's greatest works.