

College of Natural, Applied and Health Sciences

The mission of the College of Natural, Applied and Health Sciences is consistent with the overall mission of the University. The College of NAHS has strong, quality program offerings in the sciences and health professions. The faculty and staff are committed to providing relevant education and services to a diverse student population. The goal is to prepare students to think critically and creatively so that they can adapt to changing social, economic and technological conditions. Building external collaborations with major technological corporations and the health care industry is an integral part of the colleges outreach mission, which enables it to provide valuable services to the community as well as increased opportunities for students.

We are proud to have been designated the Flagship State University for the Health Professions. Our graduates can be found practicing in hospitals and other health care agencies across New Jersey. Also, our programs in the Sciences have a long distinguished record of service to this region. So, whether you are looking to study in the Natural and Physical Sciences, Health Care, Mathematics, Technology, or Computer Science, you will gain a strong foundation at the College of Natural, Applied and Health Sciences.

Interim Dean, Pablo Zafra

Assistant to the Dean, Lourdes F. Prieto

B-104, (908) 737-3600

ACADEMIC DEGREES, PROGRAMS

B.A. in Biology

- General Option
- Honors Option
- Teacher Certification Option
- Teacher of Students with Disabilities Option

B.S. in Biology

- General Option
- Biotechnology Option

B.A. in Chemistry

- General Option
- Preprofessional Option
- Teacher Certification Option

B.S. in Chemistry, Expanded Option

B.S. in Computer Science

- Information Systems Option

B.A. in Earth Science

- General Option
- Teacher Certification Option
- Teacher of Students with Disabilities Option

B. S. in Earth Science

- Earth System Science Option
- Geology Option
- Meteorology Option

B.A. in Mathematical Sciences

- Teacher Certification Option
- Teacher of Students with Disabilities Option

B.S. in Computer Integrated Design and Manufacturing Technology

B.S. in Electronics Technology

B.S. in Telecommunications and Information Technology

HEALTH PROFESSIONS

B.S. in Health Information Management

- General Option
- Occupational Therapy Track

B.S. in Medical Technology

- General Option
- Cytotechnology Option
- Histotechnology Option

B.S.N. in Nursing

Post Baccalaureate School Nurse Program

JOINT (OR COMBINED) DUAL DEGREE PROGRAMS

B.S. in Health Information Management/ M.S. Management Information Systems

B.S. in Health Information Management/ M.A. Communication Studies

B.A. / M.S. in Occupational Therapy

B.A. / DPT Physical Therapy (with UMDNJ)

COLLABORATIVE PROGRAM

BA in Elementary Education Liberal Studies in Mathematics, Science, and Technology:

- Biology Specialization
- Earth Science Specialization
- Mathematics Specialization
- Technology Specialization

DEPARTMENTS, FACULTY

Biological Sciences

Faculty: Codella, Field, Glazer, Hayat, James, Mancarella (Chairperson), Osborne, Porta, Pu, Rosenthal, Vassiliou, Yu, Zhang

Chemistry-Physics

Faculty: Castiglione, Criasia (Chairperson), Gao, Getzin, Hicks, Kampa, Kubow, Lees, Shin, Stokes-Huby, Vitale, Zarrilli

Geology and Meteorology

Faculty: Croft, Dobosiewicz, Krall, Kroll, Manfrino, Metz (Chairperson), Murphy, Ngoy, Yoh, Zois

Mathematics and Computer Science

Faculty: Abeles, Affouf, Alsina, Arnow, Avirappattu, Beaugris, Chang, Deavours, Emanouilidis, Hahn (Chairperson), Halper, Krantz, Lehmann, Lipson, Mathur, Narasimhan, Ryder, Santomauro, Stewart-Gardiner, Tse, Viglione, Wang, Wittenberg, Woubneh, Zafra

Technology

Faculty: Behi, Cokewood, Shahrabi (Chairperson)

Health Information Management

Faculty: Davis, Manger (Chairperson)

Medical Technology

Coordinator: Osborne

Nursing

Faculty: Campbell (Chairperson), Fitzgerald, Fitzsimons, Hascup, Krause-Parello, Neville, Pisani

Occupational Therapy

Faculty: Knis-Matthews, Richard, Stern (Chairperson)

Biology

Chairperson: Dr. Denise A. Mancarella
C123, (908) 737-3650

The Department offers a B.A. degree with three options, a B.S. degree with two options, and a Minor Program.

The different options in the B.A. program prepare the student for graduate study in various fields of biology for teaching in elementary or secondary schools, and for positions in industry or government related to the biological sciences. The B.S. degree is designed to provide students with the necessary skills and opportunities for both intensive study and research in biotechnology, and in the broad scope of biological and medical areas of medicine, dentistry, veterinary medicine, molecular biology, environmental biology, biomedical research, ecology and behavior, and microbiology.

The student should consult with his/her departmental advisor to select appropriate major electives for the respective area of interest.

B.A. DEGREE BIOLOGY

OPTION: GENERAL

GENERAL EDUCATION 53-54

FOUNDATIONS REQUIREMENTS 13

GE 1000	Transition to Kean	1
ENG 1030	College Composition	3
MATH 1000	College Algebra	3
COMM 1402	Speech Communication as Critical Citizenship	3
GE 2024	Research and Technology	3

DISCIPLINARY/ INTERDISCIPLINARY

DISTRIBUTION REQUIREMENTS 40-41

<i>Humanities</i>		9
*ENG 2403	World Literature	3
Select two courses from different areas:		
Fine Arts or Art History		3
Philosophy or Religion		3
Foreign Languages		3
Music or Theatre		3
Interdisciplinary		3
<i>Social Sciences</i>		9
*HIST 1000	History of Civil Society in America	3
Select two courses from different areas:		
Economics or Geography		3
Political Science		3
Psychology		3
Sociology or Anthropology		3
Interdisciplinary		3

<i>Science & Mathematics</i>		11
*MATH 1054	Precalculus	3
CHEM 1083	Chemistry I	4
CHEM 1084	Chemistry II	4

Health / Physical Education 2-3

ID 1225	Issues Contemp. Health	
OR		
ID 1010	Leisure & Rec Multicult Soc	3
OR		
Physical Education		2

Concentration 6

CHEM 3181	Organic Chemistry Lecture I	3
CHEM 3182	Organic Chemistry Lecture II	3

Major/GE Capstone

BIO 4970	Seminar in Integrative Biology	3
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*Required Distribution Course

ADDITIONAL REQUIREMENTS 15

CHEM 3183	Organic Chemistry Lab I	2
CHEM 3184	Organic Chemistry Lab II	2
MATH 2411	Calculus I	3
PHYS 2091	General Physics I	4
PHYS 2092	General Physics II	4

MAJOR REQUIREMENTS 31

REQUIRED COURSES IN BIOLOGY 23

BIO 2200	Cell Biology	4
BIO 2400	Genes, Organisms, Populations	4
BIO 2500	Principles of Botany	4
BIO 3400	Zoology: Form and Function	4
BIO 3614	Principles of Ecology	4
BIO 3704	Principles of Genetics	3

MAJOR ELECTIVES 8

Selected with departmental advisement at the 3000-4000 level.

FREE ELECTIVES 24-25

At least 50% must be at 3000-4000 level.

TOTAL 124

B.A. DEGREE BIOLOGY

OPTION: HONORS

GENERAL EDUCATION 53-54

FOUNDATIONS REQUIREMENTS 13

GE 1000	Transition to Kean	1
ENG 1030	College Composition	3
MATH 1000	College Algebra	3

COMM 1402	Speech Communication as Critical Citizenship	3
GE 2024	Research and Technology	3

DISCIPLINARY/INTERDISCIPLINARY

DISTRIBUTION REQUIREMENTS 40-41

<i>Humanities</i>		9
*ENG 2403	World Literature	3
Select two courses from two different areas:		
Fine Arts or Art History		3
Philosophy or Religion		3
Foreign Languages		3
Music or Theatre		3
Interdisciplinary		3
<i>Social and Behavioral Sciences</i>		9
*HIST 1000	History of Civil Society in America	3

Select two courses from different areas:		
Economics or Geography		3
Political Science		3
Psychology		3
Sociology or Anthropology		3
Interdisciplinary		3

<i>Science & Mathematics</i>		11
*MATH 1054	Precalculus	3
CHEM 1083	Chemistry I	4
CHEM 1084	Chemistry II	4

Health/Physical Education 2-3

ID 1225	Issues Contemp. Health	
OR		
ID 1010	Leisure & Rec Multicult Soc	3
OR		
Physical Education		2

<i>Concentration</i>		6
CHEM 3181	Organic Chemistry Lecture I	3
CHEM 3182	Organic Chemistry Lecture II	3

<i>Major /GE Capstone</i>		3
BIO 4971	Honors Seminar in Integrative Biology	3

*Required Distribution Course

ADDITIONAL REQUIREMENTS 15

CHEM 3183	Organic Chemistry Lab I	2
CHEM 3184	Organic Chemistry Lab II	2
MATH 2411	Calculus I	3
PHYS 2091	General Physics I	4
PHYS 2092	General Physics II	4

MAJOR REQUIREMENTS	40
<i>Required Courses in Biology</i>	29
BIO 2200 Cell Biology	4
BIO 2400 Genes, Organisms, Populations	4
BIO 2500 Principles of Botany	4
BIO 3400 Zoology: Form and Function	4
BIO 3614 Principles of Ecology	4
BIO 3704 Principles of Genetics	3
BIO 4955 Intro to Biological Research	3
BIO 4963 Independent Research in Biology	3
<i>Major Electives</i>	11
Selected with departmental advisement at the 3000-4000 level may include Honors courses such as BIO 4913 Special Topics in Biology Honors)	
FREE ELECTIVES	15-16
(At least 50% must be at the 3000-4000 level).	
TOTAL	124

B.A. DEGREE BIOLOGY

OPTION: TEACHER CERTIFICATION

Students choosing this (K-12) option must make a formal application for admission to the Elementary, Middle and Secondary Education (EMSE) Department. Prior to taking education courses, all prerequisites must be met. See the description under the College of Education.

GENERAL EDUCATION AND ADDITIONAL LIBERAL ARTS REQUIREMENTS

GENERAL EDUCATION 48

FOUNDATIONS REQUIREMENTS 13

GE 1000 Transition to Kean	1
ENG 1030 College Composition	3
MATH 1000 College Algebra	3
COMM 1402 Speech Communication as Critical Citizenship	3
GE 2024 Research and Technology	3

DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS 35

<i>Humanities</i>	9
*ENG 2403 World Literature	3
Select two courses from different areas:	
Fine Arts or Art History	3
Philosophy or Religion	3
Foreign Languages	3
Music or Theatre	3
Interdisciplinary	3
<i>Social Sciences</i>	9
*HIST 1000 History of Civil Society in America	3
PSY 1000 General Psychology	3

SOC 1000 Introduction to Sociology	3
OR	
ANTH 1800 Cultural Anthropology	3
<i>Science & Mathematics</i>	11
*MATH 1054 Precalculus	3
CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4
<i>Health/Physical Education</i>	3
ID 1225 Issues Contemp. Health	3
<i>Capstone</i>	3
BIO 4970 Seminar in Integrative Biology	3
*Required Distribution Course	

ADDITIONAL REQUIREMENTS 21

MATH 2411 Calculus I	3
PHYS 2091 General Physics I	4
PHYS 2092 General Physics II	4
CHEM 2180 Prin. Organic Chemistry	4
PSY 2110 Psych. Adolescence	3
ES 1000 Observing the Earth	3

MAJOR REQUIREMENTS 31

REQUIRED COURSES IN BIOLOGY 23

BIO 2200 Cell Biology	4
BIO 2400 Genes, Organisms, Populations	4
BIO 2500 Principles of Botany	4
BIO 3400 Zoology: Form and Function	4
BIO 3614 Principles of Ecology	4
BIO 3704 Principles of Genetics	3

MAJOR ELECTIVES 8

Selected with departmental advisement at the 3000-4000 level

PROFESSIONAL EDUCATION 30

<i>Sophomore Level</i>	
EMSE 2801 Intro Field Experience K-12	3
<i>Junior Level</i>	
EDUC 3000 Curriculum, Evaluation and Learner	3
EDUC 3401 Language Arts/ Reading K-12	3
EMSE 3122 Computers in Education	3
EMSE 3230 Science Education K-12	3
EMSE 3801 Junior Field Experience K-12	2
EMSE 3903 Eng Language Learning in America	1
<i>Senior Level</i>	
EMSE 4801 Professional Internship: Subject Areas K-12	9

PROFESSIONAL /GE CAPSTONE

EDUC 4000 Teacher and Classroom	3
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TOTAL 130

B.A. BIOLOGY / TEACHER OF STUDENTS WITH DISABILITIES (70198)

Students who wish to be certified in both Biology K-12 and Educator of Students with Disabilities should consult the Catalogue under Special Education programs for a complete description of this dual certification program.

B.S. DEGREE BIOLOGY

OPTION: GENERAL

GENERAL EDUCATION 53-54

FOUNDATIONS REQUIREMENTS 13

GE 1000 Transition to Kean	1
ENG 1030 College Composition	3
MATH 1000 College Algebra	3
COMM 1402 Speech Communication as Critical Citizenship	3
GE 2024 Research and Technology	3

DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS 40-41

<i>Humanities</i>	9
*ENG 2403 World Literature	3
Select two courses from different areas:	
Fine Arts or Art History	3
Philosophy or Religion	3
Foreign Languages	3
Music or Theatre	3
Interdisciplinary	3
<i>Social Sciences</i>	9
*HIST 1000 Hist of Civil Society in America	3

Select two courses from different areas:

Economics or Geography	3
Political Science	3
Psychology	3
Sociology or Anthropology	3
Interdisciplinary	3

Science & Mathematics 11

*MATH 1054 Precalculus	3
CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4

Health/Physical Education 2-3

ID 1225 Issues Contemp. Health	3
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OR

ID 1010 Leisure & Rec Multicult Soc	3
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OR

Physical Education	2
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Concentration 6

CHEM 3181 Organic Chemistry Lecture I	3
CHEM 3182 Organic Chemistry Lecture II	3

Major/GE Capstone 3
 BIO 4970 Seminar in Integrative Biology 3

*Required Distribution Course

ADDITIONAL REQUIREMENTS 15

CHEM 3183 Organic Chemistry Lab I 2
 CHEM 3184 Organic Chemistry Lab II 2
 MATH 2411 Calculus I 3
 PHYS 2091 General Physics I 4
 PHYS 2092 General Physics II 4

MAJOR REQUIREMENTS 49-50

Required Courses In Biology 35

BIO 2200 Cell Biology 4
 BIO 2400 Genes, Organisms, Populations 4
 BIO 2500 Principles of Botany 4
 BIO 2900 Computer Applications Biology 3
 BIO 3400 Zoology: Form and Function 4
 BIO 3614 Principles of Ecology 4
 BIO 3704 Principles of Genetics 3
 BIO 3705 Principles of Genetics Lab 2
 BIO 4105 Essentials of Biochemistry 4
 BIO 4835 Biostatistics 3

Major Electives 14-15

Selected with departmental advisement from a list at the 3000-4000 level.

FREE ELECTIVES 5-7

(At least 50% must be at the 3000-4000 level.)

TOTAL 124

B.S. DEGREE BIOLOGY

OPTION: BIOTECHNOLOGY

GENERAL EDUCATION 53-54

FOUNDATIONS REQUIREMENTS 13

GE 1000 Transition to Kean 1
 ENG 1030 College Composition 3
 MATH 1000 College Algebra 3
 COMM 1402 Speech Communication as Critical Citizenship 3
 GE 2024 Research and Technology 3

DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS 40-41

Humanities 9
 *ENG 2403 World Literature 3
 Select two courses from different areas:
 Fine Arts or Art History 3
 Philosophy or Religion 3
 Foreign Languages 3
 Music or Theatre 3
 Interdisciplinary 3

Social Sciences 9
 *HIST 1000 History of Civil Society in America 3

Select two courses from different areas:

Economics or Geography 3
 Political Science 3
 Psychology 3
 Sociology or Anthropology 3
 Interdisciplinary 3

Science & Mathematics 11

*MATH 1054 Precalculus 3
 CHEM 1083 Chemistry I 4
 CHEM 1084 Chemistry II 4

Health/Physical Education 2-3

ID 1225 Issues Contemp. Health

OR

ID 1010 Leisure & Rec Multiyear Soc 3

OR

Physical Education 2

Concentration 6

CHEM 3181 Organic Chemistry Lecture I 3

CHEM 3182 Organic Chemistry Lecture II 3

Major/GE Capstone 3

BIO 4970 Seminar in Integrative Biology 3

*Required Distribution Course

ADDITIONAL REQUIREMENTS 15

CHEM 3183 Organic Chemistry Lab I 2
 CHEM 3184 Organic Chemistry Lab II 2
 MATH 2411 Calculus I 3
 PHYS 2091 General Physics I 4
 PHYS 2092 General Physics II 4

MAJOR REQUIREMENTS 40

Required Courses in Biology 29

BIO 2200 Cell Biology 4
 BIO 2400 Genes, Organisms, Populations 4
 BIO 3305 Principles of Microbiology 4
 BIO 3704 Principles of Genetics 3
 BIO 3705 Principles of Genetics Lab 2
 BIO 3820 Basic Tissue Culture 4
 BIO 4105 Essentials of Biochemistry 4
 BIO 4700 Molecular Genetics 4

Program Related Electives 11

Selected with departmental advisement from a list at the 3000-4000 level.

FREE ELECTIVES 15-16

(At least 50% must be at the 3000-4000 level.)

B.A. DEGREE IN ELEMENTARY EDUCATION

OPTION: LIBERAL STUDIES IN MATHEMATICS, SCIENCE, AND TECHNOLOGY

Biology Specialization K-5 and 5-8

This is a joint program with the College of Education designed to provide elementary education students the opportunity to pursue a specialization in science, mathematics, or technology. Students selecting this option must make formal application for admission to the Elementary, Middle and Secondary Education Department. Prior to taking education courses, all prerequisites must be met. Please refer to the Elementary Education program description under the College of Education.

GENERAL EDUCATION AND LIBERAL ARTS REQUIREMENTS 64

GENERAL EDUCATION REQUIREMENTS 46

FOUNDATIONS REQUIREMENTS 13

GE 1000 Transition to Kean 1
 ENG 1030 College Composition 3
 MATH 1000 College Algebra 3
 COMM 1402 Speech Communication as Critical Citizenship 3
 GE 2022 Research and Technology 3

DISCIPLINARY/INTERDISCIPLINARY

DISTRIBUTION REQUIREMENTS

Humanities 9
 *ENG 2403 World Literature 3
 AH 1700 Art History 3
 MUS 1050 Music Fundamentals (Rec.) 3

Social Sciences 9

* HIST 1000 History of Civil Society in America 3
 PSY 1000 General Psychology 3
 GEOG 2010 Geography of Man 3

Science & Mathematics 11

*MATH 1010 Found of Math (Recommended) 3
 BIO 1000 Principles of Biology 4

Select one course:

PHYS 2091 General Physics I

OR

CHEM 1010 Preparatory Chemistry 4

Health/Physical Education 4

ID 1225 Issues in Contemporary Health 3

PED 1101 Beginning Modern Dance I 1

OR

PED 1103 Beginning Jazz Dance I 1

OR

PED 1105	Beginning Ballet I	1	EMSE 4900	Senior Seminar (CAPSTONE)	3
ADDITIONAL REQUIREMENTS		18	MINOR IN BIOLOGY		
PSY 2100	Child Psychology	3	One semester of general chemistry and the following:		
HIST 2303	U.S. History to 1877	3	REQUIRED COURSES 8 S.H.		
HIST 2304	U.S. History 1877 to Present	3	BIO 2200	Cell Biology	4
PSY 2110	Psychology of Adolescence	3	BIO 2400	Genes, Organisms, Populations	4
ID 2950	The Child and Technology	3	ELECTIVES 10 S.H.		
ID 2955	Disabled Person in American Society	3	Ten credits in biology, including at least 7 credits at the 3000-4000 level, selected with approval of departmental advisor		
*Required Distribution Course			BIOLOGY COURSES		
MAJOR REQUIREMENTS		43-44	GENERAL		
Math/Science/Technology Basic Requirements		23-24	BIO 1000 Principles of Biology (4)		
Mathematics		6	An introduction to the structure and function of living cells and organisms and their interdependencies and adaptations to the environment. This course is not required for Biology majors. (3 hr. lec./3 hr. lab.)		
Select two of the following:			<i>Prerequisites: Completion of all GELAP foundations courses in Math, English and Communication Sciences.</i>		
MATH 1016	Statistics	3	<i>Approved General Education Distribution Course.</i>		
MATH 1030	Problem Solving in Mathematics	3	BIO 1001 Principles of Biology (Honors) (4)		
OR			Introduction to the nature of life. Fundamentals of structure and function are examined through processes such as photosynthesis, digestion, respiration, circulation, coordination, adaptation, reproduction, heredity, interactions with the environment and variation through time. Observation and experimentation and societal consequences are emphasized. (3 hr. lec./3 hr. lab.)		
MATH 1054	Precalculus	3	<i>Prerequisite: Open to any student who qualifies for the Biology Major Honors Program.</i>		
OR			BIO 1200 Biology & Society (3)		
MATH 2411	Calculus I	3	Explores the impact of biological discoveries and their applications on individuals and society. Includes ethical and practical ramifications. May not be used for major credits toward graduation by biology majors. Satisfies the general education disciplinary/interdisciplinary science requirement.		
Biology		4	<i>Prerequisite: COMM 1402 and (GE2020 or GE2021 or GE 2022 or GE 2023 or GE 2024)</i>		
BIO 2200	Cell Biology	4	BIO 2900 Computer Applications in Biology (3)		
Earth Science		3-4	Introduction to biological applications of information technology. Students apply biology software, computer programs, and electronic communication techniques to selected topics in the biology core curriculum.		
Intro course in Astronomy, Geology, Meteorology			<i>Prerequisite: Completion of 6 credits in Biology core.</i>		
OR			BIO 3000 Marine Biology (4)		
ES 1000	Observing the Earth	3-4	The interrelations of marine plants and animals with their environment. Topics include:		
Technology		9	primary production, symbiosis, predation, energy flow, and zonation. Effects of salinity, temperature, light, dissolved oxygen, tides and wave action studied. One weekend field trip required. (3 hr. lec./3 hr. lab.) Equivalent given summers at N.J. Marine Sciences Consortium field stations.		
CPS 1031	Intro to Computers	3	<i>Prerequisites: CHEM 1084 or equivalent; eight credits in biology or permission of instructor.</i>		
CPS 1032	Microcomputer Applications	3	BIOCHEMISTRY		
OR			BIO 4105 Essentials of Biochemistry (4)		
TECH 1100	Technology Systems	3	An introduction to the chemistry of biologically important compounds and their relationship to the metabolic activity of living cells. Laboratory activities will utilize the methods and techniques currently used in biochemical research. (3 hr. lec./3hr. lab.)		
Biology Specialization		20	<i>Prerequisite: One semester of Organic Chemistry, BIO 2400, or permission of instructor.</i>		
Biology Core		8	CELLULAR		
BIO 2500	Principles of Botany	4	BIO 2200 Cell Biology (4)		
BIO 3400	Principles of Zoology	4	An introduction to the fundamental concepts of biological organization, with emphasis on the molecular and cellular levels. Emphasis is placed on scientific methods, the integration of structure and function at the cellular level, and on the underlying biochemistry. This course, in combination with BIO 2400, forms the foundation for the biology major. (3 hr. lec./3 hr. lab.)		
Biology Electives		12	<i>Corequisite: CHEM 1083</i>		
12 credits at the 2000 level or higher, with advisement			BIO 3260 Introduction to Histology (4)		
PROFESSIONAL EDUCATION		33	A laboratory oriented course dealing with the microscopic and ultrastructural anatomy of mammalian tissues and organs, with emphasis on relating structure to function. (3 hr. lec./3 hr. lab.)		
EMSE 2802	Exp. Tchg/Lab Exp	3	<i>Prerequisites: 12 credits in biology including BIO 2200 and BIO 2400, or permission of instructor.</i>		
EDUC 3000	Curr, Eval and Learner	3	BIO 4200 Preparatory Techniques for Electron Microscopy (4)		
EDUC 3400	Lang Arts/Read Pre-School and Elem Curriculum	3	Biochemical concepts governing the preparation of biological specimens for electron microscopy. Details of the chemistry of the interaction between various reagents and cellular substances. The laboratory covers the preparation of a wide variety of biological specimens and the study of ultrastructure and enzymatic activity.		
EMSE 3123	Math and Science in Education	3	<i>Prerequisites: Eight hours in Biology, CHEM 2180, and permission of instructor.</i>		
EMSE 3140	Soc Studies and Contemp Issue in Educ	3	BIO 4225 Cell Physiology (4)		
EMSE 3300	Middle School Curr.& Phil	3	Biochemical and electron micrographic studies of mammalian tissue subcellular organization by separation and analysis of cell molecules and organelles, and determination of their structure and function. (3 hr. lec./3 hr. lab.)		
EMSE 3802	Field Exp. in Middle School	2	<i>Prerequisites: BIO 2400 and CHEM 2180 or CHEM 3181 or permission of instructor.</i>		
EMSE 3903	Teaching ELL	1	BIO 4245 Radiation Biology (4)		
EMSE 4800	Prof Intern Elem Teaching and Curr	9	A study of the fundamentals of radiation biology and the effects of ionizing radiations on macromolecules, the cell, the systems and		

the organism.

Prerequisites: BIO 3403-3404 and BIO 4105 or permission of instructor.

MICROBIOLOGY

BIO 3305 Principles of Microbiology (4)

A study of microorganisms with emphasis on bacteria. Morphology, physiology and metabolism, ecology, taxonomy and methods of culture and identification of some common microorganisms. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2400 or permission of instructor.

BIO 4310 Virology (4)

Study of the isolation, propagation, and characteristics of viruses, and the techniques for achieving those goals. Consideration also given to the interaction of viruses with prokaryotic and eukaryotic cells, the origin and evolution of viruses, and the emergence of new viruses.

Prerequisites: BIO 2400, BIO 3305 and CHEM 2180, and permission of instructor.

BIO 4315 Immunology (4)

A fundamental study of the innate and adaptive immune systems of animals. Consideration also given to immunologic responses of plants. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 2400 and BIO 3305, one semester of Organic Chemistry or Biochemistry, and permission of the instructor.

BIO 4325 Applied Microbiology (4)

A study of the importance of microorganisms in food production and preservation, industry, pathogenesis and disease prevention, and public health. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 3305 or permission of instructor.

ORGANISMS-ANIMALS

BIO 2400 Genes, Organisms, Populations (4)

An introduction to fundamental concepts of biological organization, with emphasis on genetic, organismal and population levels. Emphasis is placed on hierarchical organization, the integration of structure and function, and evolution as unifying principles of biology. This course builds on BIO 2200 to form a foundation for the biology major. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 2200, CHEM 1083, Math 1054, and GE 202X or permission of instructor.

BIO 2402 Human Physiology and Anatomy (4)

A study of the physiology of body processes and related anatomical and histological studies. Topics include biochemical, cellular and histological units and the structures and functions of the body's integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, digestive, urinary and reproductive systems. Provides background for students in special education, health information management, recreation therapy and physical education. (3 hr. lec./3 hr. lab.)

Credit not given for both BIO 2402 and BIO

2409.

Prerequisite: BIO 1000 or permission of instructor. Approved General Education Distribution Course

BIO 2409 Essentials of Human Physiology and Anatomy (4)

Integrated study of human physiology and related anatomy. Skeletal, muscular, nervous, cardiovascular and respiratory systems emphasized to provide basic background for physical therapy and occupational therapy programs.

Credit will not be granted for both BIO 2409 and 2402.

Prerequisites: BIO 1000 and CHEM 1032 or permission of instructor.

BIO 3400 Zoology: Form and Function (4)

The evolution of invertebrates and vertebrates using principles of comparative anatomy and physiology. Morphological and functional changes will be correlated with varied environments and adaptations that gave rise to a diversity of life forms. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2400 and CHEM 1084, or permission of instructor.

BIO 3403-3404 Anatomy and Physiology I and II (4,4)

An integrated understanding of the structures (both gross and microscopic) and the functions of various body systems. Laboratories are synchronized with lecture materials and include exercises using prosected models and other specimens.

BIO 3403 is the study of the organization of the human body, introductory chemistry, cells, tissues, the integumentary system, skeletal systems and articulations, muscular system and the nervous system. (3 hr. lec./3 hr. lab.)

BIO 3404 is a continuation of BIO 3403 and includes the study of the endocrine system, cardiovascular system, the lymphatic system, the respiratory system, the digestive system, the urinary system and the reproductive system. (3 hr. lec./3 hr. lab.)

Credit not given for both BIO 2402/ BIO 2409 and BIO 3403-3404.

Prerequisites: BIO 2400 and CHEM 2180 or CHEM 3181 or permission of instructor.

BIO 3403 prerequisite for BIO 3404.

BIO 3405 Basic Gross Anatomy (4)

An in-depth study of gross and functional anatomy utilizing skeletons and models that depict the skeletal, muscular, vascular and nervous systems. A general overview and regional study of the viscera. Open to Occupational Therapy majors and students in the Athletic Training Option Programs. Not open to Biology majors, except by permission of the instructor. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2402 or BIO 2409 or permission of instructor. Credit will not be given for both BIO 3405 and BIO 3403-3404.

BIO 3406 Neuroscience (4)

Morphology and physiology of the nervous systems specifying function and related clinical conditions. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 3404 or BIO 3405 or equivalent, or permission of instructor.

BIO 3414 The Invertebrates-Form and Function (4)

Study of structure and function in the major invertebrate groups. The course stresses principles of morphology, physiology and embryology with special reference to the invertebrate phyla. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2200 or permission of instructor.

BIO 3420 Parasitology (4)

Introduction to animal parasites and parasitism; emphasis on morphology, distribution, life cycles and effects on host of protozoan, helminth and arthropod parasites. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2200 or permission of instructor.

BIO 3425 The Vertebrates-Form and Function (4)

A study of the evolution of the vertebrates using the principles of comparative morphology, physiology and embryology. Autotutorial instruction. (two 3 hour periods.)

Prerequisite: BIO 2200 or permission of instructor.

Writing Emphasis Course

BIO 3433-3434 Anatomy and Physiology I and II (Honors) (4,4)

Designed for preprofessional students in biology and medical technology. These Honors courses integrate gross and microscopic structure of the human body systems with their function at a more intensive level than BIO 3403-3404. Laboratories are synchronized with lecture-discussion materials and include studies with microscopic and macroscopic materials, prosected models, animal specimens and computer simulations. BIO 3433 starts with introductory topics on biochemical, cellular and histological units and covers the integumentary, skeletal, muscular and nervous systems.

BIO 3434 starts with a review of the autonomic nervous system and covers the endocrine system, the cardiovascular system, the lymphatic system, the respiratory system, the digestive system, the urinary system and the reproductive system.

Students can take BIO 3433-3434 or BIO 3403-3404 or a mixture of the two to satisfy a one-year Anatomy and Physiology course requirement. Credit not given to both 3403 and 3433, or both 3404 and 3434, or both BIO 2402/2409 and BIO 3433-3434.

Prerequisites: BIO 2400 and CHEM 1084 or CHEM 3181 or permission of the instructor. BIO 3433 or BIO 3403 prerequisite for BIO 3434. Open to all biology majors; students should consult their advisors and consider their performance in prerequisite and related courses before registering.

BIO 3435 Animal Behavior (4)

An introduction to the concepts, techniques, and history of animal behavior with emphasis

on the ecological and evolutionary levels of organization. Lectures stress the methods by which biologists test evolutionary hypotheses. Laboratory involves individual and group research projects. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 1000 or permission of instructor.

BIO 3450 Biological Aspects of Aging (3)

A study of the biology of aging from biochemical, cellular, and physiological viewpoints. Emphasis on age-associated functional and structural changes of the organ systems.

Prerequisite: BIO 2200 or permission of instructor.

BIO 3465 Biology and Ecology of Birds (3)

Emphasis on the biological uniqueness of birds and the behavioral, physiological and ecological relationships of birds to their environment. Laboratory work, with several field trips, includes identification of New Jersey birds. (2 hr. lec./3 hr. lab.)

Prerequisite: BIO 3400 or permission of instructor.

BIO 4455 Developmental Biology (4)

A study of developmental processes in animals combining descriptive, theoretical and experimental approaches. Includes study of cell determination and pattern formation. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 3704 or BIO 4105 or permission of instructor.

ORGANISMS-PLANT

BIO 2500 Principles of Botany (4)

Structure, function, development, reproduction, and evolution of plants. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 1000 or equivalent or permission of instructor.

Corequisite: BIO 2200 or equivalent or permission of instructor.

BIO 3513 Morphology and Evolution of the Plant Kingdom (4)

A study of the structural, reproductive, and evolutionary aspects of the plant kingdom. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2500 or permission of instructor.

BIO 3535 Field Botany (3)

Principles of field identification of local flora with emphasis on use and construction of keys. Two all day Saturday field trips.

Prerequisite: BIO 2500 or BIO 2601 or permission of instructor.

BIO 4575 Plant Physiology (4)

A study of physiological mechanisms involved in the germination, growth, development and reproduction of green plants, including water relations, carbohydrate metabolism, translocation, photosynthesis, mineral nutrition, growth regulators, and growth and development. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 2400 and BIO 2500.

COMMUNITY-ECOLOGY

BIO 2601, 2602 Environment, Ecology and Humanity (4/3)

A course for non-science majors briefly describing basic global ecological principles. Emphasis on disruptive effects on the envi-

BIO 3614 Principles of Ecology (4)

Factors affecting the distribution and abundance of organisms. Basic ecology is examined at the organismal, population and ecosystem levels. Human impact on the environment. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 2200 or BIO 1001, or permission of instructor.

WRITING EMPHASIS COURSE

BIO 4615 Applied Ecology (4)

Examination of environmental problems, solutions and management dealt with by biologists in government and industry. Wildlife management, conservation biology and industrial ecology. Student must provide own transportation for some labs. (3 hr. lec./3 hr. lab.)

Prerequisite: BIO 3614 or equivalent.

GENETICS

BIO 3704 Principles of Genetics (3)

The nature and functioning of hereditary material in living organisms including its biochemistry, mode of expression, and physical basis of inheritance. Emphasis on recent developments in the field. (3 hr. lec.)

Prerequisite: BIO 2400, CHEM 1084, or permission of instructor.

BIO 3705 Principles of Genetics Laboratory (2)

Examination of major principles of classical and contemporary genetics by means of laboratory exercises. (2 hr. lab.)

Prerequisite: BIO 3704.

BIO 4700 Molecular Genetics (4)

Molecular biology of the gene with an emphasis on current topics related to recombinant DNA and genetic engineering. Laboratory activities include methods and instrumentation used in recombinant DNA studies. (3 hr. lec./3 hr. lab.)

Prerequisites: BIO 3704 and BIO 4105 or permission of the instructor.

BIO 4704 Molecular Biology of Genes (3)

Molecular biology of genetic inheritance and molecular evolutionary genetics, with an emphasis on recent advances. Topics include DNA and chromatin structure and function, regulation of gene expression and related processes, mutation, gene duplication, patterns of generic divergence and genealogical reconstruction. (3 hr. lec.)

Prerequisites: BIO 3704 and one semester of Organic Chemistry, or permission of the instructor.

TECHNIQUES

BIO 3815 Microtechniques (4)

Experience in the preparation of biological material for microscopic examination; fixing, embedding, sectioning, mounting, staining; preparation of whole mounts of small specimens. (Two 3 hr. lec./lab. periods: many procedures require the student's presence at times in addition to scheduled class hours.)

Prerequisites: One of the following: BIO 2400, 2402, 2409, 3403 or 3433, CHEM 1032 or 1084; or permission of instructor.

BIO 3820 Basic Tissue Culture (4)

Fundamentals of animal and plant tissue culture. Laboratory exercises include methods of establishing and maintaining primary tissue cultures and the culture of established cell lines. (3 hr. lec./3 hr. lab.)

Prerequisites: 16 credits of Biology including BIO 2400 or permission of the instructor.

BIO 4835 Biostatistics (3)

Basic statistical techniques useful in biological research including frequency distributions, statistical inference, and application of chi square, analysis of variance and regression.

Prerequisite: 16 credits in Biology including BIO 2200 and BIO 2400, and MATH 1054, or permission of instructor.

RESEARCH, SEMINAR AND COOP EDUCATION

BIO 4395,6,7,8 Cooperative Education in Biology (1-4)

Off-campus laboratory experience in a biological field. Students may work full or part-time by arrangement with employer. May be repeated for credit, up to a total of four credits.

Prerequisites: Completion of 16 credits in Biology Core and Junior Status, and permission of department chairperson.

BIO 4905 Senior Seminar in Biology (1)

Critical study of current topics in biology utilizing the original literature. Students present papers and lead discussion. May be repeated for credit.

Prerequisite: Completion of 20 credits in Biology Core and Senior Status (completion of 16 credits and Junior status for honor students).

BIO 4911,2,3,4 Special Topics in Biology (1-4)

Class work designed to provide an opportunity to study special topics in biology which are not studied in regular courses. Topics to be announced by the department. One semester hour of credit given for each 15 hours of class work.

Prerequisite: 16 semester hours of biology.

BIO 4955 Introduction to Biological Research (3)

The philosophy, aims and methods of biological research are developed through lectures, discussions and the execution of a research project.

Prerequisite: Permission of instructor.

BIO 4961,2,3 Independent Research in Biology (1-3)

A laboratory or field investigation of a biology research problem, performed independently by student, under the supervision of a faculty member. May be repeated for credit, up to a total of six credits; however, only four credits may be used to fulfill major elective requirement.

Prerequisite: Open to seniors with a minimum of 20 credits in Biology, or Juniors who are on Dean's List at the time of enrollment with a minimum of 16 credits in Biology, and permission of department chairperson.

BIO 4970 Seminar in Integrative Biology (3)

Critical analysis of current topics in biology utilizing the primary literature and integrating concepts taught in the Biology Core curriculum. Consideration given to social, ethical, philosophical and/or historical aspects of the life sciences. Format includes student presentations, reading-based class discussions, and library papers.

Prerequisites: 20 credits in Biology Core and Senior status.

BIO 4971 Honors Seminar in Integrative Biology (3)

Critical analysis of current topics in biology utilizing the primary literature and integrating concepts taught in the Biology Core curriculum. Consideration given to social, ethical, philosophical and/or historical aspects of the life sciences. Format includes student presentations, reading-based class discussions, library papers and presentation of research completed in BIO 4963 (Honors section).

Prerequisites: 20 credits in Biology Core including BIO 4955 and BIO 4963 (Honors section) and Senior status in the Honors Program.

MARINE SCIENCES CONSORTIUM

BIO 2650 Introduction to Marine Biology (4)

Offered summers at N.J. Marine Sciences Consortium field stations. A field and laboratory oriented course covering the characteristics of marine plants and animals; instruction and experience in collecting and identifying examples of local marine flora and fauna. May not be applied toward credit for major requirements in biology.

Prerequisite: BIO 1000 or equivalent.

BIO 4365 Marine Prokaryotes (2)

Offered summers at N.J., Marine Sciences Consortium field stations. Morphology, cytology, ecology and taxonomy of marine bacteria and blue-green algae. Emphasis will be placed on organisms found in New Jersey waters.

Prerequisites: BIO 2500, BIO 3000, BIO 3305, or permission of instructor.

BIO 4366 Marine Diatoms and Dinoflagellates (2)

Offered summers at N.J. Marine Sciences Consortium field stations. Morphology, cytology and taxonomy of marine diatoms and dinoflagellates. Emphasis will be placed on organisms found in New Jersey waters.

Prerequisites: BIO 2500, BIO 3000, or permission of instructor.

BIO 4415 Ichthyology (4)

Offered summers at N.J. Marine Sciences Consortium field stations. The biology of the major groups of fishes, including fish systematics, anatomy, physiology, reproduction, evolution, adaptations, genetics, ecology and zoogeography.

Prerequisite: BIO 3400.

BIO 4420 Seashore Entomology (2)

Offered summers at N.J. Marine Sciences Consortium field stations. Ecological studies of the insect fauna of the intertidal zone, coastal sand dunes, and salt marsh.

Prerequisite: BIO 3400 or permission of instructor.

BIO 4430 Birds of the Seashore (2)

Offered summers at N.J. Marine Sciences Consortium field stations. Field identification of birds of the ocean, salt marsh, sand dunes and adjacent land areas. Discussion of behavior and ecology.

Prerequisite: BIO 3465 or permission of instructor.

BIO 4460 Marine Invertebrate Zoology - Protozoa - Amoeboid and Sporozoan (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of amoeboid and sporozoan protozoa. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4461 Marine Invertebrate Zoology: Protozoa-Ciliated (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of ciliated protozoa. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4462 Marine Invertebrate Zoology: Flagellated Protozoa and Porifera (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of flagellated protozoa and porifera. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4463 Marine Invertebrate Zoology: Coelenterata and Ctenophora (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of coelenterata and ctenophora. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4464 Marine Invertebrate Zoology: The Worm Phyla (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of Platyhelminthes, Nemertinea, pseudocoelomates and Annelida. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4465 Marine Invertebrate Zoology: Mollusca (1)

Offered At N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of Mollusca. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4466 Marine Invertebrate Zoology: Arthropoda (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of Arthropoda. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4467 Marine Invertebrate Zoology: Bryozoa, Echinodermata and Protochordata (1)

Offered at N.J. Marine Sciences Consortium field stations. Systematics, ecology, range, morphology, development, physiology and importance of Bryozoa, Echinodermata and Protochordata. Emphasis on the systematics and ecology of fauna native to New Jersey.

Prerequisite: BIO 3400 or permission of department chairperson.

BIO 4470 Invertebrate Physiology (4)

Offered summers at N.J. Marine Sciences Consortium field stations. A study of the diversity of patterns of physiological adaptation displayed by the different invertebrate groups. A comparative study using a wide and representative variety of organisms with emphasis on marine and estuarine forms. Students taking this course may not receive credit for BIO 4475.

Prerequisites: BIO 3400, CHEM 1084 and PHYS 2092; or equivalent, or permission of instructor.

BIO 4565 Marine Botany Euglenophyta, Chlorophyta and Phaeophyta (2)

Offered at N.J. Marine Sciences Consortium field stations. Detailed consideration of the functional morphology and evolution of marine algae. Analysis of ecological and physiological adaptations of Euglenoids, Green and Brown Algae. Laboratory and field work designed to encourage individual investigations.

Prerequisites: Eight hours of biology including BIO 2500 or permission of the instructor. BIO 2650 or BIO 3000 recommended.

BIO 4566 Marine Botany II-Rhodophyta and Marine Fungi (2)

Offered at the N.J. Marine Sciences Consortium field stations. Detailed consideration of the functional morphology and evolution of marine algae and fungi. Analysis of physiological and ecological adaptations of red algae and marine fungi. Laboratory and field work designed to encourage individual investigations.

Prerequisites: Eight hours of biology including BIO 2500 or permission of instructor. BIO 2650 or BIO 3000 recommended.

BIO 4570 Plants of the Dunes and Marshes (2)

Offered summers at N.J. Marine Sciences Consortium field stations. Field and laboratory study of the diversity, adaptations and the ecological role of plants inhabiting sand dunes and marshes of the coastal zone.

Prerequisites: Eight hours of biology including one semester of botany, or permission of the instructor. A course in ecology is recommended.