York College

City University of New York

Jamaica, New York 11451

Handbook for:

Biology (B.A. or B.S.) Majors
Biology/Secondary Education Majors
Biology Minors

Biology Department
Telephone: (718) 262-2700
Facsimile: (718) 262-2369

January 2008

Welcome to Biology

The Biology Program at York College provides academic experiences in the life sciences that meet a variety of student needs. The courses offered cover a broad range of subjects from General Biology, Biostatistics and Genetics, which all majors must take, to Organismic Biology, Molecular and Cell Biology, and Ecology. The program of study fulfills the academic requirements for admission to medical, dental and related professional schools and also prepares students for graduate studies (M.S. or Ph.D.) in all areas of Biology.

Advising

The Biology faculty in are always available for advisement. Advisors are assigned by student's last names. Please contact your advisor to schedule an appointment.

If your Last Name Begins with	Your Biology Advisor is	Phone No.	Office Room
A-D	Dr. C. Adams	262-2709	4E03d
E-I	Dr. I. Arsov	262-2713	4E03c/a
J -M	Dr. Beaton	262-5253	4E03b
N-R	Dr. L. Levinger	262-2704	4E03a
S- Z	Dr. G. McNeil	262-2192	4E03f

Biology Faculty

The faculty in Biology are dedicated teachers. In addition to teaching a broad range of biological disciplines in departmental courses, they are also active scholars in their respective fields of biology. Faculty are actively engaged in research and invite the participation of undergraduate students. For more information about courses or research opportunities, please contact any member of the Biology discipline.

Dr. Cheryl Adams, Associate Professor
Biostatistics and Ecology; Phylogenetic Relationships among Insects; Plants
(718) 262-2709
adams@york.cuny.edu

Dr. Ivica Arsov, Assistant Professor
Immunology; Cytotoxic T lymphocyte Biology; Immunological Memory
(718) 262-2713
iarsov@york.cuny.edu

Dr. Laura Beaton, Assistant Professor
Plant Physiology; Evolutionary Ecology; Biology of Disturbed Habitats and the Role of Invasive Species
(718) 262-5253
lbeaton@york.cuny.edu

Dr. Louis Levinger, Professor and Biotechnology Coordinator
Biochemistry and Molecular Biology; Biotechnology; Eukaryotic Transfer RNA Processing
(718) 262-2704
louie@york.cuny.edu

Dr. Margaret MacNeil, Associate Professor
Comparative Physiology; Histology; Neurobiology of the Retina
(718) 272-2711
macneil@york.cuny.edu

Dr. Gerard McNeil, Associate Professor
Department Chair
Developmental Biology; Cell and Molecular Biology; Early Development in *Drosophila melanogaster*
(718) 262-2192
mcneil@york.cuny.edu

Staff

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Room 4E03
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ramapon@york.cuny.edu

Graduation Requirements

To graduate as a Biology Major from York College, students must have completed at least 120 credits while maintaining at least a "C" average in all York College courses and an overall "C" average for the courses in their major disciplines. For students who transfer into York College with college credit, at least 40 credits in total must be taken at York College and at least 30 of these must count toward the Biology Major. In addition, students will also be required to pass the CUNY Proficiency Examination (CPE), fulfill requirements for General Education, Liberal Arts, and Writing. Specific requirements for Biology Majors are described below.

General Education Requirements

Every student who is a candidate for the degree of Bachelor of Arts or Bachelor of Science must satisfy the General Education Requirement (GER), except as listed below. No General Education course may be used to fulfill major requirements. Students with an A.A., A.S. or A.A.S. degree from a CUNY or SUNY community college, with the exception of students in the Nursing Program, will have fulfilled the General Education Requirements except for Writing 301, 302 or 303. Students may still have to take some courses included in the GER if they are required by their major, or they are prerequisites for other courses. Students who do not hold a two-year degree from a CUNY or SUNY community college, but have at least 45 credits in liberal arts and sciences from a regionally accredited college may apply for a full or partial waiver from the General Education Requirements, based on the evaluation of the credits transferred. Except for second degree students, all students admitted Fall 1996 or later and majoring in Biology must take Writing 301, 302 or 303.

General Education Program Requirements for Biology Majors: Credits

I. General Requirements: 18.0-26.0

English 125, 4.0
Writing 301, 302 or 303, 3.0
Cultural Diversity 101, 3.0
Cultural Diversity 201 or 202 or 203 or 210, 3.0
Physical Education 150, 2.0
Speech Communication 101, 3.0
Foreign Language 0-8.0 *(placement by Foreign Language Department)*

II. Humanities: 9.0

A) Literature – English 200
B) History and Philosophy - one course from the following:
History 100, 108, 113, 201, 202, 204, 257, 275, 276
Philosophy 102, 103, 121, 122 or 151
C) Fine and Performing Arts - one course from the following:
Fine Arts 104, 150, 152, 155, 264, 381
Music 101, 110, 225, 250, 253
Speech Communication 160
Theater Arts 110, 114, 211 or 215-219

III. Behavioral Science: 6.0

Six credits from 2 disciplines outside the major chosen from the following courses:
1. African-American Studies 101 or 172
2. Anthropology 101 or 103
3. Economics 101 or 102
4. Political Science 101 or 102 or 103
5. Psychology 102 or 110
6. Sociology 101

IV. Mathematics - : 4.0
Mathematics 121

V. Natural Science: 5.0-6.0
Chemistry 101

Total/General Education 42-51
Remainder of credits in Major Requirements and Free Electives**

Total Credits: Baccalaureate Degree 120 Credits

Biology Major Requirements

The Biology major is organized around a core of foundation courses in Natural Sciences (Physics, Chemistry, and Biology), Mathematics and two upper division areas of specialization. At least two courses are regularly offered among which students may choose to fulfill the requirements in Areas 2-3. Like all other major undergraduate majors at York College, Biology majors must complete the General Education Requirements as well as the major discipline requirements.

Major Discipline Requirements (56.5 - 60 Credits)

I. Required foundation courses:

Course Number	Course Title	Credits
Biology 201	Biological Principles I	4
Biology 202	Biological Principles II	4
Biology 307	Biostatistics	3
Biology 343	Laboratory Exercises in Genetics	2
Biology 344	Molecular and General Genetics	4
Chemistry 102*	Chemical Principles II	5
Chemistry 231	Organic Chemistry I	3
Chemistry 232	Techniques in Organic Chemistry I	2
Chemistry 233	Organic Chemistry II	3
Physics 151**	University Physics I	5
Physics 152**	University Physics II	5

II. Organismic and Environmental Biology
9 credits chosen from the following:

Course Number		
Biology 231	Biology of Plants	4.5
Biology 308	Invertebrate Biology	4.5
Biology 309	Biology of the Chordates	4.5
Biology 325	Histology	4.5
Biology 334	Comparative Physiology	4.5
Biology 403	Ecology	4.5

III. Cell and Molecular Biology
7.5 - 10 credits chosen from the following:

Course Number	Course Title	Credits
Biology 320	Cell Biology	4.5
Biology 412	Biochemistry	3
Biology 415	Biochemistry and Molecular Biology	2
Biology 452	Developmental Biology	4.5
Biology 465	Microbiology	4.5
Biology 466	Immunology	4.5
Biology 480	Theory and Experimentation in Biotechnology	5

* Majors in the Biology Program must take Mathematics 121 and Chemistry 101, which fulfill the General Education Requirements in Math and Natural Sciences, respectively.
** Physics 101 may be substituted for Physics 151, and Physics 102 may be substituted for Physics 152.

B.S. with Honors in Biology

Eligibility: Biology 202 and one 300 level Biology course; a 3.0 average in all Biology courses.
Approval by the Honors Committee of the Biology Discipline.
Requirements for Graduation with Honors:

1. Successful completion of the Biology Major Discipline Requirements with a 3.0 average in all Biology courses.
2. Successful completion of 6 credits of Biology 490-493, which will include independent research under the guidance of faculty members and the presentation and approval of a thesis by the Honors Committee of the Biology Discipline.
3. Certification by the Honors Committee of the Biology Discipline.

Minor Program in Biology- 13.5 to 15.5 credits

1. Required Courses (6 Credits)

Course Number	Course Title	Credits
Biology 343	Laboratory Exercise in Genetics	2
Biology 344	Molecular & General Genetics	4

2. Elective Courses (7.5-9.5 Credits):

Organismic and Environmental Biology (One course from the following)

Course Number	Course Title	Credits
Biology 231	Biology of Plants	4.5
Biology 308	Invertebrate Biology	4.5
Biology 309	Biology of the Chordates	4.5
Biology 325	Histology	4.5
Biology 334	Comparative Physiology	4.5
Biology 403	Ecology	4.5

Cell and Molecular Biology 3 - 5 Credits (One course from the following)

Course Number	Course Title	Credits
Biology 320	Cell Biology	4.5
Biology 412	Biochemistry	3
Biology 415	Biochemistry and Molecular Biology	2
Biology 452	Developmental Biology	4.5
Biology 465	Microbiology	4.5
Biology 466	Immunology	4.5
Biology 480	Theory and Experimentation in Biotechnology	5

Liberal Arts Requirement

The New York State Education Department requires 60 liberal arts credits in a Bachelor of Science program and 90 liberal arts credits in a Bachelor of Arts program. Completion of the Biology Major courses will satisfy the Liberal Arts Requirement.

Writing Intensive Course Requirement

Students who enter the College (or are readmitted) in Fall 2003 or later must meet the writing intensive course requirement passed by the York College Senate by taking three writing intensive (WI) courses. Students in Biology must complete:

- two WI courses in the lower division of the curriculum (at the 100or 200 level), and
- one WI course in the upper division of the curriculum (at the 300level or above) within the major discipline. Bio 343 maybe used to satisfy this requirement for Biology majors.

Transfer students who enter with the General Education Requirements fulfilled must take one WI course in the upper division within the major.

CUNY Proficiency Examination (CPE)

Effective Fall 2003, all CUNY undergraduate students, except those who hold a bachelor's degree from a CUNY-accredited college, are required to pass the CUNY Proficiency Examination (CPE). The University administers the CUNY Proficiency Exam at colleges several times each year, generally in March, June, October, and January. Students must be in good academic standing (grade point average 2.0 or higher) to take the exam. Students are first eligible to take the CPE during the semester in which the 45th credit hour is attempted, but the exam is optional at that time. Students are required to take the exam for the first time during the semester after they have completed 45 credits, or, for non-CUNY transfer students with 45 or more credits, during the semester they first enroll at CUNY. Please consult the York College Bulletin for more information.

Suggested Four-Year Course Plan for Biology Students

The Biology major includes foundation courses as well as elective courses in Biology, Chemistry, Physics and Mathematics. This suggested plan is meant to give Biology students a guide for completion of their requirements and be on track to graduate within four years.

Fall		Spring	
Semester 1		**Semester 2**	
CHEM 101*	5	CHEM 102	5
ENG 125	4	BIO 201	4
PHYS ED	2	ENG 200	3
GEN ED	3	MATH 121	4
	14		16
Semester 3		**Semester 4**	
BIO 202	4	PHYS 152	5
PHYS 151	5	WRITING 302	3
CHEM 231	3	BIO 300*	4.5
CHEM 232	2	GEN ED	3
ELECTIVE	2		
	16		15.5
Semester 5		**Semester 6**	
BIO 344	4	GEN ED	3
CHEM 233	3	BIO 300 OR 400 LEVEL**	4.5
BIO 307	3	GEN ED	3
BIO 343 (WI)	2	GEN ED	3
	12	GEN ED	3
			16.5
Semester 7		**Semester 8**	
BIO 300 OR 400 LEVEL	4.5	BIO 300 OR 400 LEVEL**	4.5
GEN ED	3	GEN ED	3
GEN ED	3	GEN ED	3
ELECTIVE	3	ELECTIVE	3
	13.5		13.5

* Students placed into MATH 119 and MATH 120 should take these courses with CHEM 101.

** Choose appropriate 300 and 400-level courses to fulfill Group 2 (Organismic and Environmental Biology) and Group 3 (Cell and Molecular Biology) requirements.

Course Availability

Biology faculty offer both day and evening classes. While most courses for non-majors and introductory courses for majors have both day and evening sections, most upper division classes for Biology majors are held during the day. Course availability is listed below:

BIO COURSE	DAY	EVENING	SEMESTER
110	X	X	Fall, Spring, Summer
120	X	X	Fall, Spring, Summer
130	X		Fall, Spring
201	X	X	Fall, Spring
202	X	X	Fall, Spring
231	X		Fall
234	X	X	Fall, Spring, Summer
235	X	X	Fall, Spring, Summer
265	X		As needed
281		X	Fall, Spring
283		X	Fall
307	X		Fall
308	X		
309	X		Alternate Spring semesters
320	X		Spring
325	X		Alternate Spring semesters
334	X		Fall
336	X		Fall
343	X		Fall
344	X		Fall
382	X	X	Fall, Summer
403	X		Spring
412	X		Fall
415	X		As needed
452	X		Fall
465		X	Spring
466		X	Spring
480	X		Spring
485-488	X		As needed
490-493	X		Fall, Spring

Science Education at York College

The Science Education program in the Natural Science Department is a multi-dimensional program. Its undergraduate and graduate courses function to complement the Education Certification Programs. It houses the Secondary Education Certification programs in Biology, Chemistry and Geology. The Science Education program provides and coordinates teacher training programs in the Sciences for primary, intermediate and high schools teachers and para-professionals.

Design for Biology Majors Planning to Apply for New York State Teaching Certification in Biology 7-12 (B.S.)

Students planning to seek New York State teaching certification in a natural science should file an application form in the Teacher Education Program during their sophomore year. Once accepted, it is the student's responsibility to seek advisement from the Science Education Office. Students intending to teach Biology at the secondary school level must successfully complete the requirements of a major in this discipline. Students selecting or considering this specialization are directed to meet with the Discipline Coordinator for advisement.

Education Course Requirements

I. Foundation Courses (10-13 credits)

Course Number	Course Title	Credits
Education 280	Childhood and Adolescent Development for Teachers	3
Education 281	Fieldwork in Educational Environments	1
Philosophy 202 or Sociology 202	Evolution of Major Ideas and Issues in Education	3
Education 283	Educational Psychology: Effective Teaching and Learning	3
Academic Computing 101	Introduction to Microcomputers	0-1
Academic Computing 230	Teaching with MultimediaTechnology	2

II. Methods Courses (6 credits)

Course Number	Course Title	Credits
Education 340	Literacy Instruction Inside Middle and Secondary Schools	3
Education 375	Teaching Biology in Secondary Schools	3

III. Student Teaching in a Junior/Senior High School (8 credits)

Course Number	Course Title	Credits
Education 442/443	Supervised Student Teaching in Secondary Biology	8

Pre-Medical and Pre-Dental Programs

Dr. Jack Schlein, Chair of the Advisory Committee
Room: 4E03e
Telephone: 262-2716.

The York College Pre-Med Advisory Committee provides academic advisement and counseling to students interested in pursuing a career in medicine and dentistry as well as veterinary, podiatry, optometry, chiropractic and osteopathy studies. Students are encouraged to attend bi-monthly meetings sponsored by the Committee that offers:

- information on academic requirements for medical school
- advice on some extracurricular activities recommended to enhance the medical school application
- study approaches to the MCAT and DAT
- assistance in selecting schools appropriate to the students strengths and interests
- information of procedures for applying to medical schools
- a composite letter of reference for the student drawn from individual faculty recommendations
- a practice interview, which is evaluated by the faculty with the student

Students interested in the health professions may choose any major to complete while at York. However a year of English and core of science courses covering the basic courses required by all medical schools is recommended. The core is composed of:

Course Number	**Course Title**	**Credits**
Biology 201	Biological Principles I	4
Biology 202	Biological Principles II	4
Chemistry 101	Chemical Principles	5
Chemistry 102	Chemical Principles II	5
Chemistry 231	Organic Chemistry I	3
Chemistry 232	Techniques in Organic Chemistry I	2
Chemistry 233	Organic Chemistry II	3
English	one year College level	6
Physics 151	University Physics	5
Physics 152	University Physics	5

Research and Internship Programs for Students

Faculty and students in Biology are actively engaged in research. These research projects range from short studies carried out for one semester to long-term projects that may result in publication in a professional journal. Research activities at York are funded by external grants from the National Institutes of Health, the National Science Foundation, NASA and the PSC-CUNY and students can apply for research funding through programs such as AMP or MARC. In addition, students can complete internships at the FDA for course credit. More information about these programs can be found below and at http://www.york.cuny.edu/natsci .

Louis Stokes Alliance for Minority Participation in Science, Mathematics, Engineering, and Technology (LSAMP)

The LSAMP program is funded by a grant from the National Science Foundation in collaboration with the City University of New York. The goal is to increase the number of underrepresented minority students with undergraduate degrees in a Scientific discipline, while fostering scientific inquiry, and interest in study at the graduate level. Since 1992, the Alliance has been uniting the SMET community of the City University of New York in a common purpose: dramatically increase the number of minority students who earn bachelor's degrees in SMET discipline.

Student Benefits:

- $1000-$5000 over 2 semesters
- $3500 stipend over the summer
- Paid travel/hotel for AMP affiliated conferences

Student Requirements:

- Overall GPA of 3.0 or higher with F/T status
- Major in a Science/Applied Science, Mathematics, Engineering and Technology disciplines
- Underrepresented minority: American Indian, Black, Filipino, Hawaiian, Latino, and Native-Alaskan
- US Citizen/Permanent Resident

Applications and information please contact Amarilis Bueno in the Math Department, Room 2C07b, 718-262-2542 or email ABuono@york.cuny.edu. For further information visit http://nyc-amp.cuny.edu.

MARC Program

The Minority Access to Research Careers (MARC) program at York College, funded by the National Institute of Health, is designed to provide research laboratory training, fellowship support, an enriched curriculum and career guidance to high achieving minority students interested in biomedical research at the PhD level. MARC trainees work under the direct supervision of preceptors who are York College faculty with active research programs. The faculty preceptor pool includes Drs. Arsov (T Cell Biology), Boudis (Nuclear magnetic resonance analysis of elastin hydration), Desamero (Protein Biochemistry), Fearnley (Bioactive Alkaloid Synthesis), Johnson (Dynamics of RNA-Peptide Complex Formation), Levinger (RNA Biochemistry and Molecular Biology), MacNeil (Shape and Circuitry of Neurons in the Retina), McNeil (Molecular Mechanisms Regulating Drosophila Development) and Profit (Combinatorial Chemistry). Please see Dr. Levinger in 4E03 for more information.

York College Honors Program

The York College Honors Program provides the opportunity to learn and grow within a small community of students who share a love of learning and strong academic skills. The program will prepare students for graduate study and exciting professional careers through research experience and individualized attention from faculty members. The interaction of students and faculty within the program will enrich the college experience and help guide students throughout their college career.

Honors students are eligible for a number of scholarships at York College, as well as generous fellowship programs funded by federal grants. Honors courses will be designated with an H on the students transcript. Successful completion of the Honors Program will be noted on the students diploma and final transcript, and Honors students will be recognized at a special awards ceremony and at commencement. Students in the program will receive other special benefits on campus, such as early registration so that they can choose courses that best fit their schedules. Most important, Honors students will receive the individualized attention of their faculty mentor, as well as the support of the other students within the Honors program community.

Each Honors student will work closely with a faculty mentor in his or her area of interest. This mentor will guide the student through college, developing an individualized academic program and helping the student prepare for graduate study and professional success. Honors students will participate in small interdisciplinary honors seminars on topics of timely interest and attend special programs with visiting scholars. Students will develop independent honors projects within their major subject. In the senior year, they will compete an independent study project and honors thesis under the guidance of their faculty mentor. Honors students will attend cultural and performing arts programs as a group each semester to make the most of our rich and culturally exciting city.

Students can apply to the Honors Program as incoming first year students, or prior to the Sophomore and Junior years. Students must spend at least 2 years in the program. Honors students must be attending college full time. To be considered for the program, students must meet the following criteria:

High School Students:

- 85% average or higher (official transcript required);
- academic course of study, including science and math courses;
- complete application with essay;
- two letters of recommendation.

Current York Students/Transfer Students (12-72 credits on entering the program):

- 3.25 GPA average or higher (official transcript required);
- complete application with essay;
- two letters of recommendation (must include college faculty)

For more information about the Honors Program, please contact Dr. William Ashton, Honors Program Director, York College, The City University of New York, 94-20 Guy R. Brewer Blvd., Room 4D-06, Jamaica, NY 11451, 718-262-2699. washton@york.cuny.edu.

Biology Courses

Biology 110. Environmental Biology. 3 hrs.; 3 cr. Prereq: None. Not credited toward fulfillment of Biology major requirements. Not open to students with credit in a 200 level Biology course. Introduction to basic principles of ecology and evolution; description of genetic variation in populations, the properties of ecosystems, and the interaction between them which leads to natural selection and evolutionary change. Current problems including the population explosion and biological effects of pesticides and other pollutants.

Biology 120. Principles of Inheritance and Human Reproduction. 3 hrs.; 3 cr. Prereq: None. Not credited toward fulfillment of Biology major requirements. Not open to students with credit in a 200 level Biology course. An introduction to the genetics and chemistry of biological macromolecules, including DNA, RNA, and enzymes, and an examination of their role in life processes. Genetics and biology of sexual reproduction; embryonic growth and development.

Biology 130. Biology of the Brain and Behavior. 3 credits, 3 hours lecture, Prereq: None Biology of the Brain and Behavior introduces students to the structure and function of the nervous system as well as the biological concepts that underlie human thought, physiology and behavior. The fundamentals of neuroanatomy and neurophysiology are presented to provide the basis for understanding human cognition, learning and emotion. The goal of this course is to provide students, who may have little or no background in biology, with an understanding of the biological basis of human behavior.

Biology 201. Biological Principles I. 2 hr. lecture; 1 hr. recitation/ prep.; 3 hrs. auto tutorial lab.; 4 cr. Coreq: Chemistry 101. Not open to students with credit in Biology 207 or 212. The biology of organisms; structure and function of plant and animal organ systems; plant and animal phylogeny; developmental biology. Experimental study of biological systems: fetal pig, frog, and representative invertebrates.

Biology 202. Biological Principles II. 2 hr. lecture; 1 hr. recitation/ prep. ; 3 hrs. auto tutorial lab.; 4 cr. Prereq: Biology 201 and Chemistry 101. Introduction to cell and molecular biology, genetics and the principles of evolution; correlation of cell structure, chemistry and function. Experimental study of biological systems, cell biology, cell chemistry, genetics.

Biology 231. Biology of Plants. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202. Phylogenetic relationships of plants based on comparative studies of structure, function, biochemistry, development, and life cycles; genetics and reproduction of algae, slime molds, fungi, non-vascular and vascular plants.

Biology 234. Anatomy and Physiology I. 2 hrs. lecture; 4 hrs. lab.; 4 crs. Coreq: Chemistry 105 or 102 or the equivalent or permission of the Instructor. Not credited toward fulfillment of Natural Science area requirements or Biology major requirements. Not open to students with credit in HPOT 315 and 316 or HPMT 330. A study of the structure and function of the human body. Topics include: basic anatomical terminology, general organization of the body, cells and tissues, integumentory system, skeletomuscular system, nervous and endocrine systems. Laboratory exercises will include dissection of a representative vertebrate as well as experiments illustrating physiological principles.

Biology 235. Anatomy and Physiology II. 2 hrs. lecture; 4 hrs. lab,; 4 crs. Prereq: Biology 234. Not credited toward fulfillment of Natural Science area requirements or Biology major requirements. Continuation of Biology 234. Topics include: circulatory system, respiratory system, digestive system, reproductive and excretory systems.

Biology 265. Clinical Microbiology. 2 hrs. lecture; 2 hrs. lab.; 3 cr. Prereq: Chemistry 105 or 102; Biology 202. Not credited towards fulfillment of Natural Science area requirements or Biology major

requirements. Not open to students with credit in10 Biology 465. Morphology, metabolism, growth, nutrition and genetics of microorganisms including bacteria, viruses, fungi, algae and protozoa, as a background for discussions of the role of microorganisms in disease. Topics include the disease process leading to infections of the respiratory, gastrointestinal and urogenital systems; blood, skin, wound, nosocomial and opportunistic infections. Natural and acquired immunity, physical and chemical methods of control; chemotherapy and antibiotic therapy in disease treatment. Laboratory exercises include the handling and cultivation of microorganisms, differential staining and the diagnostic bacteriology of clinically relevant gram positive and gram negative bacteria.

Biology 281. Human Structure and Function. 3 hrs. lecture; 2 hrs. lab. ; 4 cr. Prereq: Biology 120. Not credited toward fulfillment of Biology major requirements and Natural Science Area Requirements. Emphasis on muscular systems, nervous systems, cardiovascular system and respiratory gas exchange; fundamentals of bio-feedback are presented as exemplified by the central and autonomic nervous systems and the endocrine system. Designed for students in Physical Education and Health Education.

Biology 283. The Biology of Aging. 3 hrs.; 3 cr. Prereq: Gerontology 101. Not credited toward fulfillment of Biology majors and Natural Science Area Requirement. The Biology of Aging is designed for students of gerontology who wish to study in greater detail the biological basis of aging changes. Topics will include: Theories of biological aging; the comparative biology of aging in vertebrates and mammals; the influence of genetics, environment, nutrition and exercise on aging; the cellular basis of aging; anatomical and physiological changes in the musculoskeletal, nervous, cardiovascular, respiratory, cutaneous, gastrointestinal, urinary, endocrine, reproductive and immune systems. In studying the organ systems, all sections will be preceded by a review of the normal condition in young adults.

Biology 307. Biostatistics. 2 hrs. lecture; 2 hrs. lab.; 3 cr. Prereq: Completion of Instrumental Math Requirement. Coreq: Biology 201. The basic application of statistics to the analysis of biological and environmental data; concepts of sampling and population distributions. Laboratory session will consist of introduction to digital computers and application of statistical packages to data analysis.

Biology 308. Invertebrate Biology. 3 hrs. lecture; 3 hrs. lab. ; 4.5 cr. Prereq: Biology 202. Major invertebrate groups; emphasis on marine invertebrates and the biology of the oceans and on the relationship between man and significant invertebrate types such as parasites and insects.

Biology 309. Biology of the Chordates. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202. Survey of the anatomy, systematics, evolution, life histories, behavior and ecology of chordates with emphasis on the vertebrates. Laboratory includes dissection of representative vertebrates. Trips to museums, aquariums, and zoos.

Biology 320. Cell Biology. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202 Not open for students with credit in Bio 445 Examination of the cell as the unit of living matter using molecular and experimental approaches. Theory and laboratories in gene expression, protein activity, subcellular structure and function, cell regulation, and cell-to-cell communication.

Biology 325. Histology. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202. A study of the microscopic structure of animal tissues, including their cellular composition, origin, function and arrangement into organs. Laboratories will emphasize the preparation and study of prepared tissue and organ specimens.

Biology 334. Comparative Physiology. 3 hrs. lecture; 3 hrs. lab; 4.5 cr. Prereq: Biology 202. Excitable membranes and general properties of nerve function; receptors, reflex mechanisms, autonomic nervous system, pathways and integrative properties of the central nervous system; comparison of function in various organisms of muscular, respiratory, cardiovascular, excretory, digestive, salt-water regulatory, temperature regulatory and endocrine mechanisms.

Biology 336. Pathophysiology. 3 hrs.; 3 cr. Prereq: Biology 234, 235 and Chemistry 105. Not credited toward fulfillment of Biology major requirements. The study of mechanisms by which disease processes occur in the human body. Responses of the organ systems to the pathophysiologic condition and how these differ from the normal function. Emphasis will be placed on structural and functional disorders of the various biological systems. This course is designed for students in the B.S. Nursing Program but is open to interested students who meet the requirements.

Biology 343. Laboratory Exercises in Genetics. 4 hrs.; 2 cr. Prereq/Coreq: Biology 344. Modern experiments in genetics; Bacterial conjugation; gene expression and regulation; DNA cloning and amplification; Human DNA analysis.

Biology 344. Molecular and General Genetics. 4 hrs. ; 4 cr. Prereq: Biology 202, Chemistry 231. The chemical base of heredity DNA structure and replication, recombinant DNA technology, cloning strategies and clinical applications of restriction fragment polymorphisms. Mutation, gene structure and function in prokaryotic and eukaryotic systems. Gene regulation and the genetic code. Molecular basis of chromosome structure, mitosis and meiosis. Mendelian principles and their application to population genetics. Sex linkage and sex determination. Linkage recombination and transposition; extrachromosomal genetics and onco-genetics. Offered Fall semesters.

Biology 382. Nutrition. 2 hrs.; 2 cr. Prereq: Biology 234, 235. Not credited toward fulfillment of Biology major requirements. Principles and issues in nutrition in health and disease. Diets: facts and fads, deficiencies and disease states, drugs and additives. Nutrient absorption and malabsorption; metabolism for energy, development and growth. Special needs in nutrition from fetal development to the aged, and in various physiological states. Not offered on a regular basis. Availability to be determined by the department.

Biology 403. Ecology. 3hrs. lecture; 3 hrs. lab; 4.5 cr. Prereq: Biology 202. An examination of the factors comprising ecosystems with emphasis on the specific relationships between plants and animals in various types of habitats. Particular attention to the ecological role played by man. Laboratory and field work will consist of studying those physical, chemical and biological techniques which are useful in environmental analysis.

Biology 412. Biochemistry. 3 hrs.; 3 cr. Prereq: Biology 202; Chemistry 231 and 232 or 230. Not open to students with credit in Chemistry 412. Enzyme systems and their control, intermediary metabolism; transport mechanisms and role in cell function; structure of nucleic acids; protein synthesis. The interrelationship of these processes and effects of disease will be stressed.

Biology 415. Biochemistry and Molecular Biology. 4 hrs. lab; 2 cr. Prereq or Coreq: Biology 412, or Chemistry 412. Model building and wet lab experiments to introduce the fundamentals of nucleic acids and proteins: structure, measurements and manipulations; intermediary metabolism.

Biology 452. Developmental Biology. 3 hrs. lecture; 3 hrs. lab.; 4.5 crs. Prereq: Biology 344 and 343. The molecular, cellular, and genetic bases of developmental processes in non-embryonic and embryonic systems; experimental analysis of early embryogenesis in the sea urchin, chick, and frog and morphogenesis of cells, tissues, and organs.

Biology 465. Microbiology. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202; Chemistry 230 and 235 or 231 and 232. Ultrastructure, physiology, and metabolic and catabolic reactions in microorganisms as they relate to their industrial or medical usefulness; classification, with emphasis on disease-related organisms, aspects of water, food and dairy microbiology; immunological techniques applicable to medical microbiology. Offered Spring semesters.

Biology 466. Immunology. 3 hrs. lecture; 3 hrs. lab.; 4.5 cr. Prereq: Biology 202; Chemistry 230 and 235 or 231 and 232. Origin and mechanisms of the immune response; molecular structure of antigens and antibodies; cell-mediated immune responses; the genetic basis of antibody formation; neoplastic disease and immunity; immunosuppression; and transplantation.

Biology 480. Theory and Experimentation in Biotechnology. 7 hrs.; 5 cr. Prereq: Biology 343 and 412. Theory and methods of contemporary molecular biology and biotechnology. Topic and experiments will include the methodology in the forefront of genetic engineering such as tissue and cell cultures, separation processes, synthesis use of recombinant DNA carried out under P2 facilities. Analytical techniques such as ultracentrifugation, radiolabelling technique, scintillation counting, radio immuno-assays, immunological microtechniques, electrophoresis and isoelectric focusing in bio-chemical analysis and purification will be examined.

Biology 485-88. Special Topics in Biology. Lecture, lab. hrs. to be arranged; 3 cr. each. Prereq: Biology 202, Junior status in Biology. Intensive study of an advanced biological topic, the subject to be announced prior to registration. Field trips may be required. Not offered on a regular basis.

Biology 490-493. Independent Study. Minimum 6 hrs./wk.; 3 cr. each. Prereq: Permission of instructor prior to registration. Not open to students with a combined total of 12 credits in Independent Study in the Natural Sciences Department. PASS/FAIL after 6 credits of Independent Study in Natural Sciences have been completed. A student may register for only one independent study course in the Natural Sciences Department per semester, intersession or summer session. Independent research in an area of mutual interest to students and a faculty member. A formal report on topic is required.