

COOK COLLEGE



Information on the following subjects may be found in the General Information section at the back of this catalog: Student Life and Services, Admission, Tuition and Fees, Financial Aid, and University Policies and Procedures.

Web Site: <http://www.cook.rutgers.edu>

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History and Aims of the College

The Land-Grant College

Rutgers' Cook College is the land-grant college of Rutgers, The State University of New Jersey. Directly descended from the Rutgers Scientific School, the original land-grant unit at Rutgers, Cook College was created in 1973 and designated a professional school in 1982. It is named in honor of George Hammel Cook (1818–1889), a renowned geologist and teacher at the Rutgers Scientific School. Cook College is closely aligned with Rutgers' other land-grant component, the New Jersey Agricultural Experiment Station/Rutgers Cooperative Research and Extension (RCR&E), the state-mandated research and outreach arm of the university.

Undergraduate programs are designed to promote the study of challenges facing society in the areas of agriculture and food systems; environment and natural resources; food, nutrition, and health; and human and community development. Faculty members from Cook College and RCR&E pursue mission-based teaching, research, and outreach to solve problems faced by the people of New Jersey, and challenge students to adopt the same mission-based approach to their educational experience at Cook College.

Often, teaching, research, and outreach are done in collaboration with faculty members from various departments, centers, and institutes from throughout the university and beyond. Cook College students have not only access to quality classroom experiences, but also the opportunity to participate with faculty in world-class research projects funded by major funding agencies, including the National Institutes of Health and the United States Department of Agriculture. Through Rutgers Cooperative Research and Extension, Cook College students have the opportunity to work with faculty members throughout the state, who are applying Rutgers' research to address local needs.

Curricula and Professions in Agriculture and Food Systems

At Cook College, the scope of agriculture includes cutting-edge scientific research that is the basis for the new agriculture. Cook College students are learning how to breed new plant species that have pharmaceutical applications, how to use biotechnology to ensure that future generations will have enough to eat, and how to market agricultural products in the global economy. Graduates of agriculture-related majors work in many different fields, such as animal production and management, sales, research, or health care. Others pursue careers in research laboratories of major pharmaceutical and toxicology-related industries, many of which are located in New Jersey. The preveterinary medicine and research option within the animal science major prepares Cook College students to apply to veterinary colleges, enter medical and dental schools, or pursue graduate studies leading to advanced degrees.

Curricula and Professions in Environment and Natural Resources

Cook College students receive a solid foundation in science, one that will enable them to help develop the environmental solutions for tomorrow. Environmental sciences majors learn to apply biological, chemical, and physical sciences to problems in the environment. Marine sciences majors concentrate on the study of the marine environment and its interactions with the earth, the biosphere, and the atmosphere. Ecology and natural resources majors learn about natural living systems and how they can be managed to provide benefits to people. The environmental planning and design and the environmental policy, institutions, and behavior majors pay particular attention to the interaction between natural and social systems. Environmental and business economics majors learn to apply economic concepts to the analysis of policy issues. Graduates in these and other environment and natural resources-related programs enter graduate schools or embark on many successful professional career paths. Opportunities include careers in government, education, consulting, or employment with landscape architecture, architecture, engineering, and planning firms.

Curricula and Professions in Food, Nutrition, and Health

Students in the food science major, the only such major offered in New Jersey, study the chemical, biological, and engineering aspects of food and also learn about the latest innovations and ethical issues in foods and food processing. Options within the major prepare students for graduate study and for various careers in the food industry. The nutritional sciences major provides students with a strong background in the biological, biochemical, physiological, clinical, behavioral, sociological, and psychological dimensions of human nutrition. Options within the major can prepare students for the Registration Examination for Dietitians, an opportunity that is available at no other college in New Jersey. The nutritional sciences program also prepares students for work in the food industry, and after graduate study, positions in cooperative extension, nutrition education, nutrition counseling, or clinical research. Nutritional sciences majors can also prepare themselves for graduate study in the life sciences and medical, dental, and veterinary studies, as well as for immediate employment in the biomedical industry.

Integrated Curricula and Professions

Many programs of study at Cook College integrate discipline areas and can be applied to professions in several different fields. For example, the bioresource engineering major teaches students to use the physical and biological sciences in solving problems related to plants, animals, food, wastes, and our natural environment. This program enables graduates to take examinations leading to a professional engineering license.

The biotechnology major prepares students for the field of biotechnology, which is a key contributor to the advancement of agriculture, medicine, and environmental sciences. Students learn fundamental knowledge and laboratory skills, including molecular biology, and establish a firm

foundation in biology and the physical sciences. Cook College faculty members, who frequently form partnerships with pharmaceutical, biotechnology, food, environmental, and agricultural companies, are teaching their students the skills that are in demand in industry. Undergraduates have ample opportunities to work in industrial settings prior to graduation and, upon graduation, have the necessary skills to enter the biotechnology field. The program also prepares students for graduate and professional study in the life sciences.

The Rutgers Community

Students at Cook College have the experience of living and learning in a community where they are on a first-name basis with their professors and classmates. They have access to the 15 centers and institutes located on the Cook campus and to the 9 off-campus research and extension centers operated by the RCR&E. In addition, because of Cook College's partnerships with other units of Rutgers and beyond, students have access to faculty and facilities at many premier academic and research centers located throughout the state. These include Rutgers' Center for Advanced Biotechnology and Medicine, the Environmental and Occupational Health Sciences Institute, the W.M. Keck Center for Collaborative Neuroscience, and the University of Medicine and Dentistry of New Jersey. Students also have full access to services offered to all students at Rutgers.

Academic Policies and Procedures

Note: See also the University Policies and Procedures section for regulations that pertain to all the undergraduate colleges at Rutgers–New Brunswick/Piscataway.

STUDENT RESPONSIBILITY TO KEEP INFORMED

In addition to the contents of this catalog, important information about Cook College is contained in the *Undergraduate Schedule of Classes* (available from the Office of Academic and Student Programs), as well as the college web site (<http://www.cook.rutgers.edu>). Students are responsible for maintaining contact with their academic adviser and keeping themselves informed of policies, procedures, and changes announced in these publications, sent to their email accounts, printed in *Green Print* as official notices, and posted on bulletin boards in the Office of Academic and Student Programs and the offices of the various departments.

Students also are responsible for checking their email and Cook College Post Office (CPO) box, located in the PAL Building, on a regular basis. College and university correspondence is mailed to the CPO and/or sent to the student's campus email address.

ACADEMIC CREDIT

Advanced Placement

Students may receive advanced placement credit for course work taken at the secondary school level. All requests for advanced placement credit should be forwarded to the Office of University Undergraduate Admissions and are reviewed by the faculty members of the department concerned. Grades of 4 or 5 on the College Board Advanced Placement Examinations receive both credit and placement as determined by the respective department. Students who elect to take courses at or below the level for which they have received advanced placement credits will have the advanced placement credits deleted from the computation of their total degree credits. Credit earned for advanced placement is not included in the cumulative grade-point average.

During New Student Orientation, entering students are tested in mathematical and verbal skills. These examinations are used as guides in determining the proper mathematics and English courses for which a student should be registered.

Proficiency Examinations

With the approval of the dean of academic and student programs (or designee), the student's academic adviser, and the department concerned, a student may pay a fee and take a proficiency examination in certain courses offered by the university. Degree credit is given when the department evaluating the examination indicates proficiency at a level comparable to passing the course. Proficiency examinations ordinarily are not allowed after failure in a course or in courses where the principal content is laboratory or creative work, since the primary value of these courses lies in the student's continuing and supervised participation.

Transfer Credit

A student who has transferred from another accredited institution receives credit for all courses in which a grade of C (2.000) or better was received. The courses need not conform to courses offered at either Cook College or Rutgers provided they are not designated below the 100 (or remedial) level and are recognized as part of a student's graduation requirements at the college from which the student is transferring. Grades from such courses are not included in the student's cumulative grade-point average. This regulation applies both to transfer credit granted at the time of admission and to any summer or special courses taken outside of Rutgers while the student is a candidate for a degree at Cook College.

University regulations require that at least 30 of the last 42 credits must be completed at Rutgers.

Credit will not be granted for courses taken at another institution during a period of disciplinary suspension from the university.

Students may elect to remove courses taken at Rutgers as nonmatriculating students while enrolled in high school from the computation of their degree credits and cumulative grade-point average. Such courses and grades remain on the student's transcript with an "E-credit" designation and do not fulfill college or program requirements.

None of Cook College's programs of study awards credits on the basis of College Level Entrance Program subject tests administered by the College Entrance Examination Board. CLEP subject tests may be reviewed by other university departments for course equivalency credit.

An official transcript of all course work taken at other institutions of higher learning is required whether or not transfer credit is requested. Students should be aware that since some programs at Cook College include courses that may be unique to the college, some transfer credits may be accepted as excess unspecified electives, resulting in the transfer student needing more than the minimum of 128 credits required for graduation. Matriculated students wishing to take courses outside of Rutgers must have prior approval from the Office of Academic and Student Programs.

The credits and grades for approved courses taken at any division of Rutgers while matriculating at Cook College (including specific courses taken under the auspices of consortium agreements with other colleges and universities) are included in the cumulative grade-point average.

Distance Learning Course Credit

Cook College and Rutgers have entered into partnerships with other colleges and universities to provide courses not available in New Brunswick/Piscataway. In some cases, students participate in the course(s) on the campus of the college offering the course. Other courses are offered on the Internet.

Courses offered in partnership with Rutgers and approved by the appropriate faculty bodies are considered Rutgers courses, with university numbers, credits, and grades. The grades for these courses are included in the student's cumulative grade-point average.

Other distance learning courses taken by the student are considered for approval according to the procedures followed for transfer credits.

REGISTRATION AND COURSE INFORMATION

Academic Advising

Throughout their matriculation at Cook College, students select courses and develop their academic program in close consultation with an academic adviser. During the first year, students are assigned to an academic adviser. In all subsequent years, students are advised by a faculty member in the student's selected program(s) of study. Advising notwithstanding, students must assume full responsibility for meeting all curriculum and college requirements and for being sure they have the proper prerequisites for any course for which they register. **Students are encouraged to meet with their advisers throughout the academic year.**

Cook College uses a system of adviser codes to aid in the advising and registration process. Faculty advisers for upper-class students in each curriculum are indicated with the major requirements in the Programs of Study chapter. The following is a list of those now serving as academic advisers for first-year students.

Adviser	Code	Office	Phone (Ext.)
Ileana D. Almaguer	(28)	Martin 219	2-3000 (531)
Tamar Barkay	(41)	Lipman 333C	2-9763 (333)
Faith C. Belanger	(48)	Foran 304	2-8165 (346)
Dawn Brasaemle	(09)	Thompson 133	2-6524
Penny Carlson	(25)	Martin 202	2-3000 (512)
Theodore Chase, Jr.	(03)	Lipman 220	2-9763 (220)
George F. Clark	(62)	COB 209	2-9153 (311)
Donn A. Derr	(23)	COB 217	2-9155 (214)
Lee Ann Dmochowski	(33)	Martin 220	2-3000 (529)
Paul Fischbach	(05)	Loree Gym 110	2-8600
Fragar Foster	(22)	Martin 226	2-3000 (530)
Barbara M. Goff	(06)	Loree 038	2-9266
Al Gomez	(12)	Perry Hall	2-9363
Judith P. Grassle	(53)	IMCS 309C	2-6555 (351)
Edwin J. Green	(39)	ENR 158	2-9152
Robert Harnack	(49)	ENR 356	2-9841
Jean Marie Hartman	(54)	Blake 226	2-6785
Robert M. Hills	(08)	Martin 214	2-3000 (512)
Barry W. Jesse	(19)	Foran 108A	2-8165 (104)
Soo-Kyung Lee	(20)	Davison 212A	2-2766
Karl Matthews	(15)	Food Science 203	2-9611 (219)
Kenneth H. McKeever	(29)	Bartlett 003	2-9390
John Muth	(35)	Martin 222	2-3000 (515)
Sarah L. Ralston	(27)	Bartlett 209	2-9404
Shanice Richardson	(46)	Martin 204	2-3000 (512)
Carol M. Rutgers	(07)	Martin 211	2-3000 (523)
Lee D. Schneider	(17)	Cook Center	2-9429
Marie Siewierski	(18)	ENR 240	2-9804

Leslie E. Small	(59)	Martin 211	2-3000 (510)
Peter E. Smouse	(37)	Waller 001	2-1124
Mikhail Tchikindas	(38)	Food Science 203	2-9611 (218)
Theodoros van Es	(61)	Lipman 109	2-9763 (109)
Dana E. Veron	(14)	ENR 227	2-9081
James F. White	(50)	Foran 263	2-9711 (357)

Registration

Registration for matriculated students begins in October for the following spring term and in April for the following fall term. Matriculated students register through the Rutgers Touchtone Telephone Registration System (RTTRS) or the online web registration system (<http://webreg.rutgers.edu>). Registration is completed upon full payment of tuition and fees by the announced deadline prior to start of the term. The university reserves the right to restrict registration in all courses offered and, when necessary, to cancel courses previously announced. The university also will cancel a student's registration for late payment of term bills or for outstanding debts to the university. See the Tuition and Fees section for further information on registration.

Change of Courses. See the University Policies and Procedures chapter for drop/add procedures. Students are responsible for knowing the dates as well as procedures for changing their registration in a given term.

Course Load

Full-Time Status. A full-time matriculated student may elect to take from 12 to 19 credits of course work per term. No exceptions to this general rule are made without the approval of the student's academic adviser and the dean of academic and student programs (or designee).

Part-Time Status. A continuing student may matriculate on a part-time basis with the approval of the dean of academic and student programs (or designee) and the academic adviser. A student applying to matriculate at Cook College for the first time must apply as a full-time student.

Withdrawal and Readmission

Withdrawal. Students who wish to withdraw from the college should consult their faculty adviser and one of the deans in the Office of Academic and Student Programs. After the interviews, the student must fill out a withdrawal form stating the reasons for withdrawal and submit the withdrawal form to the Office of Academic and Student Programs. Withdrawal by mail is possible only when illness precludes the possibility of interviews. Students who leave the college without officially withdrawing receive a grade of *F* in each incomplete course. Official withdrawal from the college with grades of *W* in all courses is not granted after the 12th week of the term except in cases of extreme extenuating circumstances (such as serious illness) and with the approval of the Admissions and Scholastic Standing Committee. Students are responsible for knowing the procedures and deadlines for withdrawal from the college or from particular courses.

Readmission. Any matriculated student who withdraws or takes a leave of absence from college may apply for readmission to the Admissions and Scholastic Standing Committee at Cook College. Readmission customarily is approved for students who submit the application at least two weeks prior to the beginning of the term in which they

wish to return. Readmission applications are available in the Office of Academic and Student Programs, Martin Hall, second floor.

For the college's policy on readmission after dismissal for academic reasons, see Scholastic Standing later in this chapter.

Students who have graduated from Cook College may apply for readmission for one year to take additional undergraduate courses as nonmatriculated students in order to enhance employment opportunities, to complete requirements for academic certification, or to take courses that are required for application to a graduate program. Cook College students also may apply for readmission to complete a second Cook College bachelor's degree program.

Course Information

Graduate Courses. Undergraduates with senior standing and a cumulative grade-point average of at least 3.0 may take graduate courses with the approval of the graduate instructor or the director of the graduate program offering the course, the administrator of the school offering the course, and their faculty adviser. Forms for requesting permission are available in the Office of Academic and Student Programs.

Pass/No Credit Courses. Certain courses are offered on a *Pass/No Credit* basis. These courses are indicated by the credit prefix *P/NC* in this catalog and the *Schedule of Classes*. The credits earned on a *Pass/No Credit* basis count toward the credits required for graduation but are not included in the calculation of the cumulative grade-point average.

Students who have completed 60 degree credits also may register for two unspecified elective courses (no more than one per term) on a *Pass/No Credit* basis. A grade of *C* or better must be achieved in order to convert the instructor's grade to a *Pass*. Forms are available in the Office of Academic and Student Programs and must be submitted by the end of the second week of the term. Once elected officially, the *Pass/No Credit* designation may not be restored to a letter grade.

Seven-Week Courses. Some courses are offered for only the first or second half of a term. These courses may be added or dropped in the first week without a grade of *W* and for three additional weeks with a grade of *W*. It is the student's responsibility to be aware of these procedures and deadlines.

Auditing Courses. Upon obtaining the permission of the instructor of the course and subject to the availability of space, full-time students may audit a course without registration. No academic credit is earned in this manner, and audited courses do not appear on the student's transcript. Senior citizens also are encouraged to audit courses.

Duplication of Courses. If a student has taken courses that duplicate each other in subject matter, degree credit normally is granted for only one. Possible exceptions to this rule are left to the judgment of the Admissions and Scholastic Standing Committee.

Repeated Courses. If a student repeats the same Rutgers course in which he or she has received a grade of *D* or *F*, only the highest grade received is calculated in the cumulative grade-point average. Both grades remain on the

university transcript, but the initial credits (if any) and grade are omitted from the calculation of the degree credits and cumulative grade-point average.

It is the student's responsibility to complete a repeated course form, available in the Office of Academic and Student Programs, in order for this change to be made.

Internships. No more than one term's worth of credit, up to 16 credits, may be awarded for field experience (i.e., internships), except when additional field experience is a required part of a professional accrediting program or a cooperative education program is involved. The Admissions and Scholastic Standing Committee reviews special program needs in individual cases.

Examinations. Final examinations are held at the end of each term. All students enrolled for credit in a course in which a final examination is given must take the examination. During the term, unannounced and announced tests may be held at the discretion of the instructor. Students who miss an examination because of participation in university-sanctioned activities or because of required religious observance either do not have the examination included in the final grade calculation or are given an opportunity to make up the examination without penalty at the discretion of the instructor or department. Students must inform the instructor of the situation prior to the examination. Students missing examinations for medical reasons or other extenuating circumstances must provide written documentation to verify the absence.

Change of Curriculum

A change of curriculum should be discussed with the student's faculty adviser and the coordinator of the curriculum the student plans to enter. Such a change should then be properly recorded on a change of major form available in the Office of Academic and Student Programs.

SCHOLASTIC STANDING

Required Grade-Point Average

The cumulative grade-point average required for graduation from Cook College is 2.0. The cumulative grade-point average is based on all grades received in courses taken for graduation credit at Rutgers. See the University Policies and Procedures section for information on the computation of the cumulative grade-point average and other grading regulations.

Dean's List

Each term the college publishes the Dean's List, an honor list of students whose course work is outstanding. In order to qualify, a student must have taken 12 or more credits for letter grades and achieved a term grade-point average of 3.4 or better.

Poor Academic Performance

The Admissions and Scholastic Standing Committee, composed of elected faculty members, considers the scholastic performance of students who are deficient in term work and/or whose overall cumulative grade-point average is

less than 2.0. The committee may place students into one of the following three categories based on their current and/or previous scholastic record at the university.

Warning. The student is informed by letter to improve his or her scholastic performance. No restrictions are imposed.

Probation. The student is informed by letter early in the next term of the danger of being dismissed from Cook College unless marked scholastic improvement is demonstrated. Students in this category are required to consult regularly with their faculty advisers or a dean to discuss their course load and course selection and to attend all classes and laboratories in the courses for which they are enrolled. A stipulated cumulative grade-point average for the term must be achieved, and no temporary grades will be accepted. A maximum load of 13 credits also may be recommended.

Dismissal. A student whose scholastic performance has been consistently below the cumulative grade-point average required to graduate or whose current work indicates that a desired level of academic performance will not be achieved is informed by letter of dismissal from Cook College.

General Policies of the Committee. The following numerical guidelines are generally followed by the committee. They are not absolute, however, since many factors are considered before the committee places a student in one of the three performance categories listed above.

Term Grade-Point Averages

Warning: 1.800–1.999

Probation: 1.500–1.799

Dismissal: Below 1.500 after a term of probation or three consecutive terms of probation with a cumulative grade-point average below 2.0.

Ordinarily, students are not dismissed for academic reasons at the end of their first term. For any student, a minimum average may be stipulated as a condition of future enrollment. The average imposed is based on the average necessary to obtain the overall cumulative grade-point average of 2.0 required for graduation. Students remain on probation until a cumulative grade-point average of 2.0 is achieved, regardless of term average.

It is the student's responsibility to be aware of his or her academic standing. Questions regarding academic standing should be directed to the Office of Academic and Student Programs, Martin Hall, second floor.

Appeal. Students placed on **probationary** status may appeal, in writing only, prior to the conclusion of the term for which the probationary status is being imposed, to the Admissions and Scholastic Standing Committee. Grounds for appeal include technical error, changes in grades, and/or additional information not previously available to the committee. Letters of appeal must state the reasons for the appeal and must be accompanied by appropriate documentation. Letters of appeal must be written by the student, although advice from others may be sought in formulating the appeal, and submitted to the Office of Academic and Student Programs.

Students who have been **dismissed** from Cook College by the Admissions and Scholastic Standing Committee may submit a written appeal to the committee (in care of the

Office of Academic and Student Programs). Deadlines for appeal are indicated in the dismissal letter. Grounds for appeal include technical error, grade changes, extenuating circumstances, and/or additional information not previously available to the committee. Letters of appeal must state the reasons for the appeal and must be accompanied by appropriate documentation. Letters of appeal must be written by the student, although members of the committee and the staff of the Office of Academic and Student Programs are available to assist students in formulating appeals for committee action. **The decision of the committee is final.** Students are notified in writing within four weeks of the action taken.

Readmission. Cook College students who have been dismissed for academic reasons may make application for readmission after they have demonstrated an ability to complete a minimum of 6 credits of college-level work at a Rutgers' Summer Session with a grade-point average of 2.50 or better or if they have remained out of school for a period of one year. Students should contact the Office of Academic and Student Programs for specific instructions. Normally a student is not readmitted if he or she has been dismissed more than once.

DISCIPLINARY HEARING PROCEDURES

The Board of Governors of Rutgers, The State University of New Jersey, has established a list of offenses that may result in separation from the university. These offenses are handled through the University Code of Student Conduct. (See the University Policies and Procedures section.) In addition, each college has a hearing procedure for use in instances where charges against a student are not of sufficient gravity to lead to separation from the university. The Cook College hearing procedure is published on the Cook College web pages (<http://www.cook.rutgers.edu>). Lists of separation and nonseparation offenses and details on the hearing procedures also are available in the Office of Academic and Student Programs.

Degree Requirements

Cook College, the land-grant unit of Rutgers, is unique within the university system. As a professional college, Cook is engaged in the land-grant mission of educational scholarship designed to develop knowledge and skills that will enable students and the public to address challenges facing society in the areas of food, the environment, natural resources, and agriculture. Cook's undergraduate and graduate programs are designed to promote the study of these challenges by integrating the natural and physical sciences with the social sciences and humanities and by using conceptual frameworks that explore human interactions with the earth's system.

CREDITS AND RESIDENCY

To be awarded a degree, the Cook College student must complete a minimum of 128 credits* of course work with a cumulative grade-point average of 2.0 or better. The student must satisfactorily complete the requirements of a curriculum (major program of study) outlined in the next chapter. In addition, the student must complete 30 of the last 42 credits at Rutgers.

Double Majors

Students seeking to complete the requirements of a second program of study offered by Cook College and/or another Rutgers faculty must complete a double-major form at the Office of Academic and Student Programs in order to have the completion of these requirements verified by the curriculum or department offering the program. Satisfactory completion of these requirements is noted on the student's final transcript, but only one Cook College bachelor's degree, indicated by the student, is conferred upon graduation.

Second Bachelor's Degree

Students with a previously earned bachelor's degree from another institution who matriculate at Cook College for the purpose of earning a second degree must complete all major course and program requirements with a minimum of 30 credits from Rutgers. Course requirements for the second degree must comply with the requirements for experience-based education and competence in the field. These requirements may be modified by the undergraduate program director or curriculum coordinator, in consultation with the student, and must be approved by the Admissions and Scholastic Standing Committee.

* 159 credits for students in the five-year B.S./B.S. bioresource engineering curriculum.

MISSION AND GOALS OF THE UNDERGRADUATE PROGRAM

Human impacts on the earth's ecosystem are profound and far reaching. The faculty of Cook College is committed to educating students to understand and sustain the integrity of this ecosystem, as both specialists within their fields of concentration and well-informed citizens. The programs of study offered by Cook College apply the natural and social sciences to this dynamic system.

The curricula are designed to achieve the following goals for graduates of Cook College:

To understand and appreciate the interaction between the natural and social sciences as they relate to the earth's ecosystem, students master the basic knowledge and approaches of a field of concentration related to the environment, natural resources, food, or agriculture, and are introduced to multidisciplinary perspectives that locate their field and its contributions in this larger context.

To evaluate issues critically so they may become autonomous, versatile, and productive people who understand that they are inextricably related to the natural world and other people. Mastery of both quantitative and qualitative modes of inquiry develops each student's ability to deal with the complexity and dynamism of real-world issues.

To understand and appreciate human impacts on the earth's ecosystem, students develop a historical, global, and multicultural consciousness in order to expand their bases for decision making.

To sustain the integrity of the global ecosystem, students develop the ethical sensitivity and analytical skills necessary to address questions of social responsibility, environmental ethics, moral choice, and social equity.

Cook College offers bachelor's degree programs in 25 curricula, many with several areas of further concentration ("options"). All programs of study are designed to achieve the goals outlined above and specify course requirements that must be satisfactorily completed in each of eight areas: interdisciplinary critical analysis; introductory life and physical sciences; humanities and the arts; multicultural and international studies; human behavior; economic systems, and political processes; oral and written communication; experience-based education; and proficiency in a field/concentration.

Credits indicated in the text that follows are the minimum requirements established by the Cook College faculty for all bachelor's degree programs. While many courses simultaneously fulfill major program requirements (VIII Proficiency), the same course may not be used to fulfill more than one of the general degree requirements (I-VII). Many programs further specify and/or exceed the requirements in one or more of these areas. Students should consult the requirements for each program that they are considering before selecting courses. Lists of courses currently offered that fulfill the various requirements are sent to academic advisers and posted at the Office of Academic and Student Programs and on the Cook College web site: (<http://www.cookcollege.rutgers.edu/core>).

I. College Mission: Interdisciplinary Critical Analysis (5-6 credits)

The undergraduate program's goals are to help students develop the abilities to think critically; address problems with a variety of modes of inquiry; and recognize and assess ethical problems related to the environment, natural resources, food, and agriculture, in order to make decisions based upon an understanding of the long- and short-term implications of the various choices. As a means of meeting these goals, students are required to complete the following courses:

11:015:101 Perspectives on Agriculture and the Environment (2)

11:__:__ a junior/senior colloquium course (3)

Perspectives on Agriculture and the Environment is offered in the first 10 weeks of the fall term only and introduces students entering Cook College to the range of problems addressed by the programs of the college. The course provides opportunities to address selected problems both individually and in working groups, using a variety of modes of inquiry and emphasizing ethical, logical, historical, and factual analysis. The course requirement is waived for transfer students who enter with at least 24 earned degree credits.

The junior/senior colloquium course is a capstone, integrative educational experience for students concluding their undergraduate studies, enabling them to synthesize information and techniques gained in previous courses. Working cooperatively with peers who have different capabilities and interests and using the case study method, students in these courses devise creative, interdisciplinary solutions to multifaceted problems with ethical, social, political, and technical content in the college's mission areas.

Current lists of the sections of 11:015:101 and the junior/senior colloquium courses offered are posted in August on the Cook College web site: (<http://www.cookcollege.rutgers.edu/core>).

Students who are unable to register for, who withdraw from, or who fail the Perspectives course are required to substitute another course that meets the objectives of interdisciplinary critical analysis of problems in agriculture and/or the environment. Lists of appropriate college mission courses are posted during registration on the Cook College web site. The substituted course may not also be used to fulfill another major requirement.

II. Introductory Life and Physical Sciences

To provide a foundation for understanding and evaluating important questions related to the life and physical sciences, students are required to complete courses in both of these areas as follows:

A. Life Sciences (4-8 credits). Introductory courses in plant and animal biology, ecology, and evolution with a laboratory:

01:119:101-102 General Biology (4,4) * or

01:119:101 General Biology (4) and 11:067:142 Animal Science (3) or

01:119:101 General Biology (4) and 11:704:351 Principles of Ecology (4) or

01:119:103 Principles of Biology (4)

* This two-term General Biology sequence (01:119:101-102) is a prerequisite for most advanced life science courses.

B. Physical Sciences (3–5 credits). A basic chemistry or physics course or an introductory course that applies the physical sciences to earth systems, such as:

- 01:160:127 Impact of Chemistry (3)
- 01:160:161 General Chemistry (4)
- 11:375:101 Introduction to Environmental Sciences (3)
- 01:450:101 Earth Systems (3)
- 01:450:102 Transforming the Global Environment (3)
- 01:460:101 Introduction to Physical Geology (3)
- 01:460:102 Introduction to Historical Geology (3)
- 01:460:202 Environmental Geology (3)
- 01:460:204 The Water Planet (3)
- 01:460:209 Exploration of the Oceans (3)
- 11:628:120 Introduction to Oceanography (3)
- 11:670:201 Elements of Meteorology (3)
- 11:670:202 Elements of Climatology (3)
- 01:750:140 The Greenhouse Effect (3)
- 01:750:193 Physics for the Sciences (4)
- 01:750:201 Extended General Physics (5)
- 01:750:203 General Physics (3)

Many programs of study require specific courses and additional credits in the life and physical sciences. Students should consult the requirements of the specific program(s) of study they are considering before selecting courses from this list.

III. Humanities and the Arts (6 credits)

To develop an understanding and appreciation of the humanities, art forms, and modes of critical response and interpretation, students are required to complete a minimum of 6 credits in the following courses or subject areas. Upper-level literature and art courses in a foreign language may satisfy this requirement, but elementary and intermediate foreign language courses (i.e., conversation, grammar, and composition courses) do not satisfy this requirement. The two courses selected may be from the same or different disciplines.

Any of the following courses:

- 11:550:230 Environmental Design Analysis (3)
- 11:550:330 History of Landscape Architecture (3)
- 11:554:301 The Use of Animals (3)
- 11:554:305 Ideas of Nature (3)
- 11:554:346 Environmental Documentation in Photography, Film, and Video (3)
- 11:554:347 Environmental Photography (4)
- 01:590:201 Introduction to Latin American Civilization and Culture (3)

Any courses in the following subject areas:

- American studies (01:050)
- art (critical studies) (07:080)
- art (studio) (07:081)
- art (history) (01:082)
- classical humanities (01:190)
- comparative literature (01:195)
- dance (07:203 and 07:206)
- European history (01:510)
- American history (01:512)
- music theory/history/analysis (07:700)
- music performance (07:701)
- philosophy (01:730)
- theater arts (07:965 and 07:966)

Any courses in literature and the arts (but *not* language) from the following subject areas:

- African languages and literatures (01:013)
- Chinese (01:165)
- English literature (01:350)
- English literature and creative writing (01:351)
- English: literary theory (01:353)
- English: film studies (01:354)
- French (01:420)
- German (01:470)
- Modern Greek (01:489)
- Ancient Greek (01:490)
- Hungarian (01:535)
- Italian (01:560)
- Jewish studies (01:563)
- Japanese (01:565)
- Korean (01:574)
- Latin (01:580)
- Polish (01:787)
- Portuguese (01:810)
- Russian (01:860)
- Slavic and Eastern European (01:861)
- Spanish (01:940)

IV. Multicultural and International Studies (6 credits)

To encourage students to see the world through the eyes of people whose culture differs from their own, students are required to complete a minimum of 6 credits in multicultural and international studies. These courses are intended to expose students to international, cross-cultural, and historical perspectives; to acquire an appreciation for the diversity and variability of institutions, cultures, and individuals; and to consider the complex and changing interactions of cultural, situational, and institutional factors that affect human behavior.

Several programs of study require specific courses or additional credits in multicultural and international studies. Students should consult their advisers and/or the requirements of the specific majors they are considering before selecting courses from the list.

Any of the following courses:

- 11:300:327 Applications of Psychology in Education (3)
- 05:300:401 Individual and Cultural Diversity in the Classroom (3)
- 11:374:101 Introduction to Human Ecology (3)
- 11:374:269 Population, Resources, and Environment (3)
- 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:374:315 International Environmental Policy (3)
- 11:374:331 Culture and Environment (3)
- 11:374:341 Social and Ecological Aspects of Health and Disease (3)
- 10:832:414 Culture and Health (3)
- 10:832:417 Introduction to Population Tools and Policy (3)
- 09:910:352 Groups at Risk in Contemporary Society (3)
- 10:975:477 Immigration, Urban Policy, and Public Health (3)

Any courses from the following subject areas:

- Africana studies (01:014)
- Asian studies (01:098)
- general/comparative history (01:506)

African, Asian, and Latin American history (01:508)
 international studies (01:558)
 Middle Eastern studies (01:685)
 Puerto Rican and Hispanic Caribbean studies (01:836)
 women's and gender studies (01:988)

Selected courses as indicated from the following areas:

cultural anthropology (01:070:101, 210, 216–308, 312, 320–340, 356–380)
 cultural geography (01:450:103, 205, 222, 334, 335, 336, 338, 341, 342, or 361)
 psychology (01:830:362, 375, 376)
 religion (01:840:112, 211, 212, 320, 322, 323, 324, 326, 330, 332, 334, 346, 350, 351, 356)
 sociology (01:920:108, 111, 216, 270, 303, 304, 306)

Any course in a modern foreign language (excluding courses in literature and the arts)

Students who have studied outside the United States at an accredited institution for one term or more may waive 3 credits of this requirement.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

Civic engagement in our democratic society is enhanced by an understanding of human behavior and of the political processes and institutional frameworks within which public policies are developed, and by the ability to evaluate policy issues through the application of economic concepts and theory. To develop these understandings, students are required to complete courses in human behavior, in economic systems, and in political processes, as follows:

A. Human Behavior (3 credits)

One course from the following:

01:070:102 Introduction to Human Evolution (3)
 01:070:204 Introduction to Social Evolution (3)
 01:070:213 Environment and Human Evolution (3)
 01:070:310 Human Aggression (3)
 01:070:313 Culture, Language, and Cognition (3)
 01:070:350 Primatology and Human Evolution (3)
 11:374:322 Environmental Behavior (3)
 11:374:335 Social Responses to Environmental Problems (3)
 11:709:224 Individual, Marriage, and the Family (3)
 01:830:101 General Psychology (3)
 01:920:101 Introduction to Sociology (3)

Some majors require specific courses and additional credits in human behavior. Students should consult the requirements of the specific program(s) of study they are considering before selecting from the above list.

B. Economic Systems (3 credits)

One of the following introductory economics courses:

01:220:102 Introduction to Microeconomics (3)
 01:220:103 Introduction to Macroeconomics (3)
 01:220:200 Economic Principles and Problems (3)
 11:373:101 Economics, People, and the Environment (3)
 11:373:121 Principles and Applications of Microeconomics (3)

Some majors require specific courses and additional credits in economics. Students should consult the requirements of

the specific program(s) of study they are considering before selecting from the above list. Students should thus note that Economics, People, and the Environment (11:373:101) does not fulfill any of the prerequisites of more advanced economics courses.

C. Political Processes (3 credits)

One of the following introductory political science or policy courses focusing on the processes and institutions associated with the development of public policy:

11:374:102 Global Environmental Processes and Institutions (3)
 11:374:279 Politics of Environmental Issues (3)
 11:374:313 Environmental Policy and Institutions (3)
 01:790:105 American Politics: Public and Private (3)
 01:790:201 American Government (3)
 01:790:237 Political Economy and Society (3)
 01:790:305 Public Policy Formation (3)
 01:790:318 Comparative Public Policy (3)
 01:790:341 Public Administration: American Bureaucracy (3)
 01:790:342 Public Administration: Policy Making (3)
 01:790:350 Environmental Politics—U.S. and International (3)

Some majors require a specific course in political processes. Students should consult the requirements of the specific program(s) of study they are considering before selecting from the above list.

VI. Oral and Written Communication (6 credits)

To develop the speaking and writing skills essential for success in both the university and in the professions that students are preparing to enter, written and oral presentations are incorporated into all Cook College courses, where feasible. Students are further required to complete a minimum of 6 credits in the following courses:

01:355:101 Expository Writing I (3) *or*
 01:355:103 Exposition and Argument (3)

and

Intermediate-level courses designed to be taken in the first or second years:

04:192:220 Fundamentals of Speaking and Listening (3)
 01:355:201 Research in the Disciplines (3)
 01:355:202 Technical Writing Essentials (3)
 01:355:203 Business Writing Essentials (3)
 04:567:324 News Reporting and Writing (3)

or

Courses intended for advanced students:

11:015:380 Communication for Today's Leader (3)
 01:355:301 College Writing and Research (3)
 01:355:302 Scientific and Technical Writing (3)
 01:355:303 Writing for Business and the Professions (3)
 01:355:312 Writing for Biology and Natural Sciences (3)
 01:355:315 Writing Grant Proposals (3)
 01:355:342 Science Writing (3)
 01:355:352 Writing as a Naturalist (3)
 01:355:365 Technical Editing (3)
 01:355:425 Web Authoring (3)
 10:832:339 Public Health Literature (3)

Several programs of study require specific courses and additional credits in oral and written communication. Students should consult the requirements of the specific program(s) of study they are considering before selecting courses from this list.

VII. Experience-Based Education (0–3 credits)

To develop ability to apply curricular and extracurricular-based learning, including leadership development and personal as well as interpersonal management skills, within settings appropriate to their fields, each of the college's programs of study specifies a course or mechanism of study. Examples of currently available options are cooperative education, practica, internships, independent research, and the George H. Cook Scholars Program.

Students completing two major programs offered by Cook College must complete at least one experience-based education course, approved by both curricula.

VIII. Proficiency in a Field/Concentration

To develop proficiency in a field/concentration related to the environment, natural resources, food, or agriculture, each curriculum specifies required courses, elective courses, and, where applicable, option requirements. Every program of study also specifies minimum requirements in quantitative skills, computer and information technology competence, and professional ethics as they apply to the particular field/concentration for which it prepares its students.

Quantitative Skills. The quantitative skills objective develops mathematical literacy and skills for analytical reasoning, including an understanding of statistical methodologies appropriate to the field for which students are preparing.

All Rutgers graduates, regardless of college or degree program, are required to have attained the mathematical proficiency required for college-level mathematics, as indicated by a placement at the precalculus level or above.

Computer and Information Technology Competence. The objective of the computer and information technology requirement is to develop the ability to use computers and to understand their use in accessing, assimilating, analyzing, modeling, and interpreting information within the field. This requirement either is waived for students demonstrating an appropriate level of competence or is satisfied by a specific course designated by each program of study.

Professional Ethics. The professional ethics objective develops the ability to recognize, assess, and respond to ethical problems that could be encountered in the careers students are preparing to enter.

Additional Requirements. Each degree program stipulates additional required courses in the field and may require students also to fulfill requirements in more specialized options.

IX. Unspecified Electives

All students must complete a minimum of 128 credits for the bachelor's degree (or 159 credits for the five-year bioresource engineering curriculum). The minimum credit requirements to satisfy areas I–VIII sum to 125 credits or less for at least one option in every major available at the college (with the exception of the 5-year bioresource engineering major). The additional 3 or more credits required for graduation may be fulfilled by any courses for which the student has met prerequisites. Students who have completed at least 60 credits of course work may register for up to two of these unspecified elective courses (no more than one per term) on a *Pass/No Credit* basis.

GRADUATION

Degrees are conferred by Rutgers on the recommendation of the Cook College faculty only at the annual commencement in May. Students completing degree requirements in October or January may obtain a letter from the Office of Academic and Student Programs or ask the university registrar for a certificate attesting to their completion of degree requirements, provided they have filed a Diploma Information Card.

Degrees are conferred *in absentia* when the candidate has advised the Office of Academic and Student Programs in advance of his or her inability to attend the Cook College graduation ceremony.

Students who complete courses at other institutions or return to Rutgers to complete degree deficiencies must notify the Office of Academic and Student Programs of their intent to graduate and arrange to have an official transcript forwarded to Cook College, Office of Academic and Student Programs, Rutgers, The State University of New Jersey, 88 Lipman Drive, New Brunswick, NJ 08901-8525. Deadlines for this notification are February 1 for May graduation, August 1 for an October degree date, and November 1 for a January degree date.

Diplomas will be withheld from all students whose financial accounts are not clear.

Graduation with Honors

Academic excellence is recognized by the college faculty's recommendation that the bachelor's degree be conferred with "Highest Honors" to students whose cumulative grade-point average is 3.850 or higher; "High Honors" to those whose cumulative grade-point average is 3.700 to 3.849; and "Honors" to those whose cumulative grade-point average is 3.400 to 3.699.

Programs of Study

SUMMARY

The following curricula (major programs of study) are available to Cook College students.

Note: Faculty-approved revisions of the degree requirements outlined in the previous chapter will effect modifications in the major programs of study outlined in this chapter. Students matriculating in the fall of 2003 or after must fulfill the revised degree requirements and the requirements of the major programs as specified here or as modified to conform with the revised degree requirements.

Cook students may elect to enroll in courses offered by other faculties at the university; however, if they intend to major in a curriculum other than those listed here, they should apply directly to a college within Rutgers where the desired major is offered. College-to-college application forms are available in the various college dean's offices.

Cook College uses a system of adviser codes to aid in the advising and registration process. Adviser codes are indicated in the lists of faculty advisers for each curriculum.

The number preceding each title below indicates the curriculum code for the program.

- 017 Agricultural Science
 - with options in:*
 - Agricultural Science Teacher Education
 - Agroecology
 - Animal Science
 - Plant Science
- 067 Animal Science
 - with options in:*
 - Animal Industries (Animal Agribusiness, Livestock Production and Management, and Equine Science)
 - Laboratory Animal Science
 - Preveterinary Medicine/Research
- 115 Biochemistry
- 119 Biological Sciences
- 129 Bioresource (Bioenvironmental) Engineering (Five-Year B.S./B.S. Program)
- 126 Biotechnology
 - with options in:*
 - Animal Biotechnology
 - Bioinformatics
 - General Biotechnology
 - Microbial Biotechnology
 - Plant Biotechnology
- 160 Chemistry *
- 192 Communication *
- 704 Ecology and Natural Resources
 - with options in:*
 - Conservation and Applied Ecology
 - Ecology and Evolution
 - Professional Resource Management
- 373 Environmental and Business Economics
 - with options in:*

- Business Economics
- Environmental and Natural Resource Economics
- Food Industry Economics
- Food Science and Management Economics
- 573 Environmental Planning and Design
 - with options in:*
 - Environmental Geomatics
 - Environmental Planning
 - Landscape Architecture
 - Landscape Industry
- 374 Environmental Policy, Institutions, and Behavior
 - with options in:*
 - Health and Environmental Policy
 - Individual Option
 - International Environmental and Resource Policy
 - United States Environmental and Resource Policy
- 375 Environmental Sciences
 - with options in:*
 - Applied Environmental Science
 - Environmental Science
- 377 Exercise Science and Sport Studies *
 - with options in:*
 - Exercise Physiology
 - Exercise Science
 - General
 - Sport Management
- 400 Food Science
 - with options in:*
 - Food Biological Technologies
 - Food Chemistry
 - Food Operations/Management
 - Food Science and Management Economics
- 450 Geography *
- 460 Geological Sciences *
- 554 Independent Major
- 567 Journalism and Media Studies *
- 628 Marine Sciences
 - with options in:*
 - Marine Biology/Biological Oceanography
 - Marine Chemistry
 - Marine Geology
 - Physical Oceanography
- 670 Meteorology
- 680 Microbiology
- 709 Nutritional Sciences
 - with options in:*
 - Dietetics
 - Food Service Administration
 - Nutrition
- 776 Plant Science
 - with options in:*
 - Horticulture and Turf Industry
 - Professional Preparation
 - Research
- 832 Public Health

A bachelor of science degree is conferred for all programs of study except the following: chemistry, communication, geography, and journalism and media studies. A bachelor of arts degree is conferred for these programs.

* Cook College students electing to major in one of these programs of study, offered by other faculties in New Brunswick, are required also to complete a minor or certificate program offered by the faculty of Cook College. These minor and certificate programs are listed on the following page and outlined at the end of this chapter.

Premedical, Predental, and Prelaw Programs

Please note that there are no specific programs of study for students interested in medical, dental, or law school. Individuals can major in *any* of the above programs and complete the necessary admission requirements for these professional programs.

Minors

- Agroecology
- Animal Science
- Biochemistry
- Ecology and Evolution
- Entomology
- Environmental and Business Economics
- Environmental Policy, Institutions, and Behavior
- Environmental Sciences
- Equine Science
- Food Science
- Marine Sciences
- Meteorology
- Natural Resource Management
- Nutrition
- Plant Science
- Teacher Education

Certificate Programs Offered by Cook College

- Environmental Geomatics
- Environmental Planning
- Fisheries Science
- Food Systems Education and Administration
- Horticultural Therapy
- International Agriculture/Environment
- Medicinal and Economic Botany
- Social Strategies for Environmental Protection
- Urban/Community Forestry

Other Programs

- Cooperative Education
- Military Education
- Honors Programs
- Off-Campus Programs
- Special Programs (e.g., EOF)
- Preprofessional Programs
- Combined Degree Programs

AGRICULTURAL SCIENCE 017

Degree: B.S.

Coordinator: James F. White (jwhite@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Peter J. Bastardo	(BP)	Waller 209	2-9164
Richard H. Merritt	(MS)	Foran 272	2-9711 (247)
Peter Oudemans	(OE)		609/726-1590 (20)
James F. White	(WQ)	Foran 263	2-9711 (357)
James E. Wohlt	(WH)	Bartlett 306	2-9454

The agricultural science program is designed for students interested in production agriculture, farm management, nursery crop management, or agricultural science teacher education. Students may focus on animal or plant agriculture within one of the three options: agroecology, animal science, or plant science.

In addition to the three options, students working toward science teacher certification should complete the minor program in teacher education. The minor program is prerequisite to the application for a fifth year of studies, leading to a master's degree through the Graduate School of Education. See the Executive Director of Teacher Education (Waller Hall 209) for details.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

11:015:101 Perspectives on Agriculture and the Environment (2)
11:015:400 Junior/Senior Colloquium (BA)

II. Introductory Life and Physical Sciences

A. Life Sciences (12 credits)

01:119:101-102 General Biology (4,4)
11:704:351 Principles of Ecology (4)

B. Physical Sciences (12 credits)

01:160:161-162 General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:460:101 Introductory Geology (3)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems (6 credits)

11:373:121 Principles and Applications of Microeconomics (3) *or* equivalent
01:220:103 Introduction to Macroeconomics (3)

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (3 credits)

11:199:200 Cooperative Education I (3–6) *or*
11:015:483,484 Research Problems (BA,BA)
or 01:015:331,332,333 Agricultural Science Practicum (1–3,1–3,1–3) *or* equivalent

VIII. Proficiency in Agricultural Science (37–70 credits)

A. REQUIRED COURSES (19–20)

Quantitative Skills (3–4)

01:640:___ At least one term of mathematics (4) *or*
01:960:___ statistics (3)

Computer and Information Technology Competence (3)

01:198:110 Introduction to Computers and Their Application (3) *or* equivalent

Professional Ethics (3)

01:730:250 Environmental Ethics (3) *or* 01:730:251 Ethics and Business (3)

Additional Requirements (10)

11:372:381 Introduction to Systems Thinking and the Systems Approach (3)
11:375:266 Soils and Their Management (4) *or* 11:375:453 Soil Ecology (3) *or* 11:375:454 Soil Biological Processes (3)
11:776:200 Modern Crop Production (3) *or* equivalent

B. OPTIONS (21-47)

1. Agricultural Science Teacher Education (21)

Students seeking secondary agricultural science teacher certification must fulfill the requirements of the minor program in science and agriculture teacher education described at the end of this chapter.

2. Agroecology (46-50)

Required courses (18)

11:015:230 Fundamentals of Agroecology (3)
11:015:301 Topics in Agroecology (3)
11:015:350 Agroecology Practicum (3)
11:373:323 Public Policy toward the Food Industry (3) *or* 11:373:363 Environmental Economics (3)
11:776:221 Principles of Organic Crop Production (3)
11:776:242 Plant Science (3)

At least two courses concerning plant pests and pathogens (6-7):

11:370:350 Agricultural Entomology and Pest Management (3)
11:370:381 Insect Biology (4)
11:770:301 General Plant Pathology (3)
11:770:402 Mycology: Fungi in the Environment (3)
11:776:402 Principles of Weed Science (3)

At least four courses in agricultural production and management (10-13):

11:067:142 Animal Science (3)
11:067:330 Animal Nutrition (3) *and* 11:067:331 Animal Nutrition Laboratory (1)
11:067:335, 336 Livestock Production and Management I,II (3,3)
11:067:337, 338 Livestock Production and Management Laboratory I,II (2,2)
11:776:211 Introduction to Horticulture (3)
11:776:310 Plant Propagation (3)
11:776:321 Greenhouse Management and Crop Production (3)
11:776:341 Fruit Production (3)
11:776:439 Nursery Crop Production (3)

At least two additional courses in economics and business (6):

11:373:231 Agribusiness Marketing (3)
11:373:241 Agribusiness Management (3)
11:373:363 Environmental Economics (3)

At least two additional courses in ecology (6):

11:704:317 Conservation Ecology (3)
11:704:451 Ecosystems Ecology and Global Change (3)
11:704:488 Restoration Ecology (4)

3. Animal Science (35-37)

Required courses (11-13)

11:067:142 Animal Science (3)
11:067:335 Livestock Production and Management I (3)
11:067:337 Livestock Production and Management Laboratory I (2)
11:067:384 Horse Management (3) *or* 11:067:336 Livestock Production and Management II (3) *and* 11:067:338 Livestock Production and Management Laboratory II (2)

Electives (24)

Additional courses, chosen in consultation with the faculty adviser in a variety of areas relevant to agriculture.

4. Plant Science (33)

Required courses (9)

11:370:350 Agricultural Entomology and Pest Management (3)
11:770:301 General Plant Pathology (3) *or* equivalent
11:776:211 Introduction to Horticulture (3)

Electives (24)

Additional courses, chosen in consultation with the faculty adviser in a variety of areas relevant to agriculture.

IX. Unspecified Electives (0-32 credits)

ANIMAL SCIENCE 067

Degree: B.S.

Coordinator: James E. Wohl (wohl@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Juan P. Advis	(AJ)	Bartlett 213D	2-9240
Carol A. Bagnell	(BQ)	Bartlett 102	2-0535
Wendie S. Cohick	(CP)	Foran 108B	2-8165 (105)
Julie M. Fagan	(FP)	Bartlett 109B	2-8354
Barry W. Jesse	(JE)	Foran 108A	2-8165 (104)
Henry John-Alder	(JH)	Bartlett 213C	2-3229
Larry S. Katz	(KT)	Bartlett 106	2-7426
Karyn Malinowski	(MD)	Martin 309	2-5000 (591)
Kenneth H. McKeever	(MG)	Bartlett 003	2-9390
Sarah L. Ralston	(RM)	Bartlett 209	2-9404
Dipak K. Sarkar	(SF)	Foran 135	2-1529
Michael V.K. Sukhdeo	(SL)	ENR 152A	2-1064
Mehmet Uzumcu	(UM)	Bartlett 119	2-6912
Michael L. Westendorf	(WD)	Bartlett 213F	2-9408
Carey A. Williams	(WT)	Bartlett 213E	2-5529
James E. Wohl	(WH)	Bartlett 306	2-9454

The animal science curriculum provides training and career development for students having an interest in animal production and management or related fields (sales, research, health care). The biological sciences form a basis for the study and management of domesticated animals. Options are offered in animal industries, with specializations in animal agribusiness, livestock production and management, or equine science; laboratory animal science; and preveterinary medicine/research.

Animal Industries. Instruction and practical experience in animal science (selection, breeding/reproduction, nutrition, physiology, behavior) and appropriate courses in business provide students the basic knowledge and skills to manage commercial or research enterprises in the livestock (dairy/beef, poultry, sheep, swine) and horse industries or related fields (breed associations, feed/health care products). Students may specialize in animal agribusiness, livestock production and management, or equine science.

Laboratory Animal Science. Instruction and practical experience in this option emphasize the use and care of laboratory animals for research. Many graduates choose careers in animal care programs as well as research laboratories of major pharmaceutical and toxicology-related industries, many of which are located in New Jersey.

Preveterinary Medicine/Research. Rigorous instruction and experience are provided in the biological, molecular, and animal sciences in preparation for further education in medical or graduate studies. This option fulfills the academic course requirements of most U.S. veterinary colleges. Students completing this option also may enter medical and dental schools or pursue graduate studies leading to advanced degrees.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems

See VIII B below.

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

- 01:355:101 Expository Writing I (3)
- 01:355:302 Scientific and Technical Writing (3) *or* equivalent intermediate or advanced course in writing or speaking

VII. Experience-Based Education

A total of 9 credits of experienced-based education is stipulated for each option. Appropriate cooperative education placements, subject to approval by the curriculum coordinator, fulfills the requirement. Practica, livestock-related courses, 11:067:493,494 Research in Animal Science, or equivalent research projects approved by the faculty adviser also may fulfill this requirement.

VIII. Proficiency in Animal Science (62–81 credits)

A. REQUIRED COURSES (14–17)

Quantitative Skills

Specific courses to meet the quantitative skills requirements are listed under VIII B option/specialization requirements below. Completion of precalculus (or placement in calculus) is prerequisite for courses fulfilling this requirement.

Computer and Information Technology Competence (0–3)

- 01:198:110 Introduction to Computers and Their Application (3) *or* equivalent

This requirement also may be fulfilled by passing an approved departmental competency test.

Professional Ethics

Ethics in animal production, management, and research are addressed in several required courses.

Additional Requirements (14)

- 11:067:142 Animal Science (3)
- 11:067:327 Animal Reproduction (3)
- 11:067:330 Animal Nutrition (3)
- 11:067:331 Animal Nutrition Laboratory (1)
- 01:447:380 Genetics (4)

B. OPTIONS (48–64)

1. Animal Industries (48–58)

Required courses (24)

- 33:010:272 Introduction to Financial Accounting (3)
- 01:146:356 Systems Physiology (3) *or* equivalent
- 01:146:357 Systems Physiology Laboratory (1) *or* equivalent
- 01:160:209 Elementary Organic Chemistry (3) *or* equivalent
- 01:160:211 Elementary Organic Chemistry Laboratory (1) *or* equivalent
- 01:220:103 Introduction to Macroeconomics (3) *or* equivalent
- 11:373:121 Principles and Applications of Microeconomics (3) *or* equivalent
- 11:373:241 Agribusiness Management (3)
- 01:640:115 Precalculus College Mathematics (4) *or* equivalent

One of the following three specializations:

Specialization in Animal Agribusiness (34)

Required courses

- 11:067:335,336 Livestock Production and Management I,II (3,3)
- 11:067:337,338 Livestock Production and Management Laboratory I,II (2,2)
- 11:067:406 Farm Productivity Analysis in the Animal Sciences (3)

- 11:373:231 Agribusiness Marketing (3)
01:960:285 Introductory Statistics for Business (3)
or equivalent

At least two of the following courses (9):

- 11:067:200,204 Animal Practicum (*P/NC 2,2*)
11:067:493,494 Research in Animal Science (BA,BA)
11:199:___ Cooperative Education (3-6)

Electives (6)

At least 6 additional credits approved by the adviser, depending on the student's interests and career goals. See additional courses listed in the Animal Science (067) section of the following chapter.

Specialization in Livestock Production and Management (28)

Required courses (22)

- 11:067:335, 336 Livestock Production and Management I,II (3,3)
11:067:337, 338 Livestock Production and Management Laboratory I,II (2,2)
11:067:406 Farm Productivity Analysis in the Animal Sciences (3)

At least two of the following courses (9):

- 11:067:200,204 Animal Practicum (*P/NC 2,2*)
11:067:493,494 Research in Animal Science (BA,BA)
11:199:___ Cooperative Education (3-6)

Electives (6)

At least 6 additional credits approved by the adviser, depending on the student's interests and career goals. See additional courses listed in the Animal Science (067) section of the following chapter.

Specialization in Equine Science (24)

Required courses (18)

- 11:067:384 Horse Management (3)
11:067:390 Equine Nutrition (3)
11:067:402 Equine Exercise Physiology (3)

At least two of the following courses (9):

- 11:067:200,204 Animal Practicum: Section HO (*P/NC 2,2*)
11:067:493,494 Research in Animal Science (BA,BA),
with equine research faculty
11:199:___ Cooperative Education (3-6)

Electives (6)

At least 6 additional credits approved by the adviser, depending on the student's interests and career goals. See additional courses listed in the Animal Science (067) section of the following chapter.

2. Laboratory Animal Science (56)

- 11:067:200,204 Animal Practicum: Section LA (*P/NC 2,2*)
11:067:275 Laboratory Animal Science: Management and Techniques (3)
11:067:404 Animal Diseases (3)
11:067:430 Animal Microtechniques and Tissue Culture (4)
01:146:356 Systems Physiology (3) *or equivalent*
01:146:357 Systems Physiology Laboratory (1) *or equivalent*
01:160:307-308 Organic Chemistry (4,4)
01:160:311 Organic Chemistry Laboratory (2)
01:220:103 Introduction to Macroeconomics (3) *or equivalent*

- 11:373:121 Principles and Applications of Microeconomics (3) *or equivalent*
01:640:115 Precalculus College Mathematics (4) *or equivalent*
11:680:390 General Microbiology (4)
01:960:401 Basic Statistics for Research (3)

At least two of the following courses (7):

- 11:067:335, 336 Livestock Production and Management I,II (3,3)
11:067:337, 338 Livestock Production and Management Laboratory I,II (2,2)
11:067:493,494 Research in Animal Science (BA,BA)
11:199:___ Cooperative Education (3-6)

Electives (6)

At least 6 additional credits approved by the adviser, depending on the student's interests and career goals. See additional courses listed in the Animal Science (067) section of the following chapter.

3. Preveterinary Medicine and Research (61-64)

- 11:115:403,404 General Biochemistry (4,3) *or equivalent*
01:146:356 Systems Physiology (3) *or equivalent*
01:146:357 Systems Physiology Laboratory (1) *or equivalent*
01:160:307-308 Organic Chemistry (4,4)
01:160:311 Organic Chemistry Laboratory (2)
11:373:101 Economics, People, and Environment (3) *or equivalent*
01:640:135 Calculus I (4) *or equivalent*
11:680:390 General Microbiology (4)
01:750:193-194 Physics for the Sciences (4,4) *or equivalent*
01:960:401 Basic Statistics for Research (3)

Three of the following (9-12):

- 11:067:404 Animal Diseases (3)
11:067:430 Animal Microtechniques and Tissue Culture (4)
11:067:450 Endocrinology (3)
11:126:481 Molecular Genetics (3) *and* 11:126:482 Molecular Genetics Laboratory (3)
01:146:322 Animal Histology (4)
01:146:327 Parasitology (3)
01:146:474 Immunology (3)
01:377:213 Functional Human Anatomy (4)
01:377:424 Human Anatomy (4)
01:640:136 Calculus II (4) *or equivalent*
01:694:315 Introduction to Molecular Biology and Biochemistry Research (3) *or equivalent*
11:704:441 Animal Behavior (3) *or equivalent*

At least two of the following courses (9):

- 11:067:200,204 Animal Practicum (*P/NC 2,2*)
11:067:335, 336 Livestock Production and Management I,II (3,3)
11:067:337, 338 Livestock Production and Management Laboratory I,II (2,2)
11:067:493,494 Research in Animal Science (BA,BA)
11:199:___ Cooperative Education (3-6)

IX. Unspecified Electives (1-20 credits)

ATMOSPHERIC SCIENCES

(See Meteorology 670)

BIOCHEMISTRY 115

Degree: B.S.

Coordinator: Theodore Chase, Jr. (chase_c@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Theodore Chase, Jr.	(CH)	Lipman 220	2-9763 (220)
Keith R. Cooper	(CK)	Martin 104	2-1000 (500)
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Theodorus van Es	(VC)	Lipman 109	2-9763 (109)
William W. Ward	(WG)	Lipman 216	2-9763 (216)
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Biochemistry is a scientific discipline in which living systems, biological and related substances, reactions, and processes are studied at the molecular level. The curriculum emphasizes the integration of the foundations of chemistry, physics, and the biological sciences with the contemporary problems of biochemistry. Laboratory courses in biochemistry using modern instrumentation and procedures supplement the lecture instruction and expose students to a wide range of techniques used in biochemical research.

The curriculum prepares students for graduate study in biochemistry or related fields, including multidisciplinary research on problems in agriculture and the environment; professional school (medical or dental); immediate employment in research laboratories in industry or government; or other careers that may not entail continued laboratory work but make use of understanding of science and scientific research. By selecting appropriate electives, a student also can prepare for a career in areas such as genetic engineering and other aspects of biotechnology.

For Douglass, Livingston, Rutgers, and University College students, the requirements for a B.A. degree are listed below in VIII A, except that these students are not required to take the courses listed under *Professional Ethics*, nor are they required to take 11:115:406 Problem Solving in Biochemistry. However, candidates for a B.S. degree must take 11:115:406 and two additional science courses from VIII B.

Graduation Requirements for the Major

To enroll in 11:115:403,404 General Biochemistry (4,3), students must have completed 01:160:307-308 Organic Chemistry (4,4) with a grade of C or higher.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (9 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter. 01:355:302 Scientific and Technical Writing, 01:355:312 Writing for Biology and Natural Science (3) or 01:355:342 Science Writing (3) is strongly recommended.

VII. Experience-Based Education (3 credits)

- 11:115:493,494 Research Problems in Biochemistry (BA,BA) or equivalent independent research project or adviser-approved placement in cooperative education

VIII. Proficiency in Biochemistry (69–81.5 credits)

A. REQUIRED COURSES (63–78.5)

Quantitative Skills (12)

- 01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4) or other CALC1 (but not CALC2) course
- 01:640:251 Multivariable Calculus (4)

Computer and Information Technology Competence (1.5)

Computer applications in biochemistry are included in advanced courses required for the major.

Professional Ethics (3)

- 11:015:405 Ethics in Science (3) or 11:015:433 Critical Scientific Thinking (3) or 01:730:249 Medical Ethics (3)

Additional Requirements (48–58.5)

- 11:115:403,404 General Biochemistry (4,3)
- 11:115:406 Problem Solving in Biochemistry (1.5) (waived for students completing three terms of research)
- 11:115:413 Experimental Biochemistry (3)
- 11:115:414 Experimental Biochemistry (2.5) or equivalent
- 01:160:251 Analytical Chemistry (3) (preferred) or 11:115:493-494 Research Problems in Biochemistry (3–6) or adviser-approved equivalent laboratory experience
- 01:160:307-308 Organic Chemistry (4,4) or 01:160:315-316 Principles of Organic Chemistry (4,4)
- 01:160:309 Organic Chemistry Laboratory (2.5) or 311 Organic Chemistry Laboratory (2)
- 01:160:341-342 Physical Chemistry: Biochemical Systems (3,3) or 01:160:323-324 Physical Chemistry (3,3) or 01:160:327-328 Physical Chemistry (4,4)
- 01:447:380 Genetics (4) or 11:776:305 Plant Genetics (4)

01:750:193-194 Physics for the Sciences (4,4) *or*
01:750:201-202 Extended General Physics
(5,5) *or* 01:750:203-204 General Physics (3,3)*

Two of the following (2):

11:115:491,492 Seminar: Biochemistry Communication
(1,1)

11:115:495 Seminar: Biochemistry and Society (1)

One of the following (3-4):

11:115:412 Protein and Enzyme Chemistry (3)

11:115:421 Biochemistry of Cancer (3)

11:115:422 Biochemical Mechanisms of Toxicology (3)

11:115:428 Homology Modeling of Proteins (3)

11:115:435 Topics in Biochemistry (3)

11:115:452 Biochemical Separations (3)

11:126:427 Methods in Recombinant DNA Technology (4)

11:126:483 Nucleotide Sequence Analysis (3)

11:126:484 Biotechnology Robotics (3)

B. ELECTIVES (6-8)

Two additional science courses selected in consultation with the faculty adviser, normally at the 300 or 400 level. Students intending to apply to graduate school in biochemistry or a related field are advised to take a cell biology course, e.g., 01:146:270 Fundamentals of Cell and Development Biology (3) or 01:447:495 Cancer (3), and a molecular biology course, e.g., 11:126:413 Plant Molecular Biology (3) or 11:126:481 Molecular Genetics (3), as preparation for the GRE Subject Test in Biochemistry and Molecular and Cell Biology.

Students may complete a formal minor program in nutrition by taking 11:709:400, 401 Advanced Nutrition I,II (3,3) as their science electives in addition to 11:709:255 Nutrition and Health (3).

IX. Unspecified Electives (0-7 credits)

BIOLOGICAL SCIENCES 119

Degree: B.S.

Coordinator: Alan D. Antoine (antoine@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
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Tamar Barkay	(BD)	Lipman 333C	2-9763 (333)
Timothy M. Casey	(CD)	Martin 216	2-3000 (512)
Theodore Chase, Jr.	(CH)	Lipman 220	2-9763 (220)
Joan G. Ehrenfeld	(EF)	ENR 126	2-1081
Judith P. Grassle	(GE)	IMCS 309C	2-6555 (351)
Edwin J. Green	(GJ)	ENR 158	2-9152
Max M. Haggblom	(HQ)	Lipman 326	2-9763 (326)
Barry W. Jesse	(JE)	Foran 108A	2-8165 (104)
Larry S. Katz	(KT)	Bartlett 106	2-7426
Stanley E. Katz	(KJ)	Lipman 329	2-9763 (329)
Lee Kerkhof	(KC)	IMCS 305C	2-6555 (335)
Karl Kjer	(KQ)	Blake 121	2-9880
Michael V.K. Sukhdeo	(SL)	ENR 152A	2-1064
Robert L. Tate	(TF)	ENR 230	2-9810
Nilgun Tumer	(TD)	Foran 208	2-8165 (215)
Malcolm Watford	(WR)	Thompson 130	2-7418
Lori A. White	(WC)	Lipman 128	2-9763 (128)

* Students intending to apply to medical or dental school should be aware that many professional schools require a physics laboratory.

The biological sciences curriculum at Cook College is offered in cooperation with the Division of Life Sciences, Faculty of Arts and Sciences (FAS). The curriculum is designed to be in conformance with the current mission of Cook College while fulfilling the requirements for the FAS major, described in detail in the Life Sciences section of this catalog. Completion of the program prepares students for graduate study; for careers in government, industry, or secondary-school teaching; and also satisfies the entrance requirements for medical and dental schools.

Students interested in further concentrations within the biological sciences (animal science, biochemistry, biotechnology, cell biology, ecology and evolution, entomology, environmental biology, genetics, marine biology, microbiology, neurobiology, nutrition, physiology, plant biology, or plant pathology) should contact the curriculum coordinator for the appropriate adviser assignment.

Entry Requirements for the Major

To declare a major in biological sciences, students must have a minimum grade-point average of 2.0 and must have completed 01:119:101-102 General Biology (4,4) or equivalent courses, including laboratory, with grades of C or higher in both courses, or have the permission of the Director of Undergraduate Instruction, Division of Life Sciences.

Degree Requirements for the Major

To graduate with a degree in biological sciences, students must achieve a cumulative grade-point average of 2.0 in all biological sciences courses.

I. College Mission: Interdisciplinary Critical Analysis (5-6 credits)

11:015:101 Perspectives on Agriculture and the Environment (2)

11:015:400 Junior/Senior Colloquium (3) (11:015:405 Ethics in Science (3) satisfies both this requirement and the professional requirement below.)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

01:160:161-162 General Chemistry (4,4)

01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (0–3 credits)

This requirement may be fulfilled by an independent study, a research project, student teaching credits, or a cooperative education placement of at least 3 credits. Student-organized education placements presented to meet this requirement must be approved in advance by the curriculum coordinator.

VIII. Proficiency in the Biological Sciences (59–61 credits)

A. REQUIRED COURSES (35–37)

Quantitative Skills (7–8)

01:640:135 Calculus I (4) *and* 01:640:138 Calculus II for the Biological Sciences (4) *or* equivalent.
Note: 01:960:379 Basic Probability and Statistics (3) *or* 01:960:401 Basic Statistics for Research (3) may be substituted for the second term of calculus.

Computer and Information Technology Competence (3–4)

01:198:110 Introduction to Computers and Their Application (3) *or* 11:115:403 General Biochemistry (4) *or* equivalent

Professional Ethics (3)

One course in bioethics, such as:

11:015:405 Ethics in Science (3)
11:015:407 Issues in Animal Agriculture and Research (3)
11:015:433 Critical Scientific Thinking (3)
01:119:150 Biology, Society, and Biomedical Issues (3)
01:119:152 Biomedical Issues of AIDS (3)
01:119:154 Genetics, Law, and Social Policy (3)
01:119:160 Biology, Society, and Ecological Issues (3)
01:730:249 Medical Ethics (3)
01:730:250 Environmental Ethics (3)

Additional Requirements (22)

01:160:307-308 Organic Chemistry (4,4) *or* 01:160:315-316 Principles of Organic Chemistry (4,4)
01:160:311 Organic Chemistry Laboratory (2) *or* equivalent
01:447:380 Genetics (4) *or* 11:776:305 Plant Genetics (4)
01:750:193-194 Physics for the Sciences (4,4) *or* equivalent

B. ELECTIVES (24)

The elective courses must include at least one approved course of 3 credits from each of the following subject areas:

Cell Biology and Neuroscience 146
Ecology and Natural Resources 704
Genetics and Microbiology 447/680
Molecular Biology and Biochemistry 694
(11:115:301 Introductory Biochemistry (3) *or* 11:115:403 *or* 404 General Biochemistry (4,3) may be substituted)

A list of approved courses in these subject areas is published by the Office of Undergraduate Instruction, Division

of Life Sciences. Approved courses generally require 01:119:101-102 as a prerequisite; students are urged to consult the list of approved courses prior to registration. Cooperative education and nonbiological sciences research and independent study credits are not eligible as elective credits, without prior approval from the Office of Undergraduate Instruction.

Electives must include a minimum of three laboratory courses of at least 1 credit. Only one of these laboratory courses may be satisfied by Independent Study or Research in Biology credits. General biology and library research do not satisfy this requirement.

A minimum of six courses (18 credits) must be at the 300 or 400 level, including at least three laboratory courses. The latter may be separate laboratory courses, for example, 01:447:382 Genetics Laboratory (1); courses that include a laboratory component, for example, 11:680:390 General Microbiology (4). A maximum of 6 credits of independent research may be included in the 24 elective credits, but satisfies only *one* of the laboratory course requirements.

Courses at the 100 level or courses taken on a P/NC basis may not be used to satisfy elective requirements.

Students should refer to the Life Sciences section of this catalog for additional information concerning limits on biology credits transferred from other institutions, requirements and procedures for Independent Study or Research in Biology, and for information about a minor program in biological sciences.

IX. Unspecified Electives (15–20 credits)

BIORESOURCE (BIOENVIRONMENTAL) ENGINEERING 129 (Five-Year Program)

Degrees: B.S., School of Engineering; B.S., Cook College

Undergraduate Program Director: Christopher Uchrin
(uchrin@envsci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Donna E. Fennell	(FA)	ENR 231	2-8750
David H. Fleischer	(FB)	Biores Eng	2-9754
Weilin Huang	(HX)	ENR 258	2-7928
Uta Krogmann	(KE)	ENR 246	2-9060
Christopher C. Obropta	(OD)	ENR 232	2-4917
Barbara J. Turpin	(TC)	ENR 360	2-9540
Christopher Uchrin	(UA)	ENR 262	2-9444

Bioresource engineering utilizes the physical and biological sciences in solving problems related to plants, animals, food, wastes, and our natural environment. Graduates of this program have a unique engineering education enabling them to apply the rapid advances being made in the biological and environmental sciences for the benefit of humanity. This program prepares students for immediate employment as practicing engineers with industrial companies, government agencies, and private consulting firms, or for graduate study. The curriculum is accredited by the Accreditation Board for Engineering and Technology, thus enabling graduates to take examinations leading to a professional engineering license.

The curriculum focuses on maintaining the quality of the natural environment. It involves the application of physical and biological sciences to land use and waste management problems, air and water pollution, and the conservation of our natural resources. The goal of this program is to gain an understanding of the requirements and tolerances of natural, living ecosystems and the engineering expertise needed to solve serious environmental problems facing our society.

Bachelor of science degrees from the School of Engineering and Cook College are awarded upon completion of the five-year curriculum. A four-year program of study in bioresource engineering is offered by the School of Engineering and is described in that college's section of this catalog. See also the School of Engineering section for a year-by-year outline of the five-year program.

The five-year bioresource engineering curriculum requires a minimum of 159 credits for graduation.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

11:015:101 Perspectives on Agriculture and the Environment (2)

11:015:400 Junior/Senior Colloquium (3)

Interdisciplinary problem definition, analysis, synthesis, and evaluation also are taught in several of the required upper-level bioresource engineering courses.

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

01:119:101-102 General Biology (4,4)

B. Physical Sciences (11 credits)

01:160:159-160 General Chemistry for Engineers (3,3)

01:160:171 Introduction to Experimentation (1)

01:750:123-124 Analytical Physics I (2,2)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter. Students are advised to select courses that will simultaneously fulfill the School of Engineering humanities requirement.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter. Students are advised to select courses that will simultaneously fulfill the School of Engineering social sciences requirement.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter. Students are advised to select courses that will simultaneously fulfill the School of Engineering social sciences requirement.

B. Economic Systems (3 credits)

01:220:200 Economic Principles and Problems (3)

C. Political Processes (3 credits)

11:374:279 Politics of Environmental Issues (3)
or 01:790:201 American Government (3)
or an equivalent course focusing on the structure and function of American governmental institutions

VI. Oral and Written Communication (6 credits)

01:355:101 Expository Writing (3)
01:355:201 Research in the Disciplines (3) or 01:355:302 Scientific and Technical Writing (3)

VII. Experience-Based Education (4 credits)

11:127:488, 489 Bioresource Engineering Design I,II (2,2)

VIII. Proficiency in Bioresource Engineering (104–105 credits)

A. REQUIRED COURSES (92)

Quantitative Skills (16)

01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4)
01:640:244 Differential Equations for Engineering and Physics (4)
01:640:251 Multivariable Calculus (4)

Computer and Information Technology Competence (3)

14:440:127 Introduction to Computers for Engineers (3)

Professional Ethics

Ethical, social, and safety considerations important in engineering practice are included in several of the required upper-level design courses.

Additional Requirements (73)

11:127:100 Introduction to Bioresource Engineering (1)
11:127:290 Biosystems Engineering Measurements (3)
11:127:413, 414 Unit Processes in Bioenvironmental Engineering I,II (3,3)
11:127:424 Bioenvironmental Unit Processes Laboratory II (1)
11:127:462 Design of Solid Waste Treatment Systems (3)
11:127:468 Hazardous Waste Treatment Engineering (3)
11:127:474 Air Pollution Engineering (3)
01:160:209 Elementary Organic Chemistry (3)
01:160:211 Elementary Organic Chemistry Laboratory (1)
14:180:215 Engineering Graphics (1)
14:180:243 Mechanics of Solids (3)
14:180:387 Fluid Mechanics (3)
14:180:389 Fluid Mechanics Laboratory (1)
14:180:430 Water and Wastewater Engineering (3)
14:332:373 Elements of Electrical Engineering (3)
11:375:201 Biological Principles of Environmental Sciences (3)
11:375:202 Chemical Principles of Environmental Sciences (3)
11:375:203 Physical Principles of Environmental Sciences (3)
11:375:303 Numerical Methods in Environmental Science (3)
11:375:333 Environmental Law I (3)
11:375:423 Environmental Fate and Transport (3)

- 14:440:221-222 Engineering Mechanics (3,3)
- 14:650:351 Thermodynamics (3)
- 11:704:351 Principles of Ecology (4)
- 01:750:227 Analytical Physics IIA (3)
- 01:750:229 Analytical Physics IIA Laboratory (1)

B. Electives (12–13)

- 11:127:494 Land and Water Resources Engineering (3)
- 11:127:495 Environmental Systems Analysis for Engineers (3)
- 11:127:496 Planning and Design of Land Treatment Systems (3)
- 11:375:302 Elements of Water and Wastewater Treatment (3)
- 11:375:334 Environmental Law II (3)
- 11:375:408 Treatment Plant and Receiving Water Surveys (4)
- 11:375:409 Environmental Statement and Impact (3)
- 11:375:411 Environmental Microbiology (3)
- 11:375:422 Air Sampling and Analysis (3)
- 11:375:430 Hazardous Wastes (3)
- 11:375:444 Water Chemistry (3)
- 11:680:390 General Microbiology (4) *or equivalent*

IX. Unspecified Electives (2 credits)

BIOTECHNOLOGY 126

Degree: B.S.

Coordinator: Barbara A. Zilinskas (zilinskas@aesop.rutgers.edu)

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Dawn Brasaemle	(BG)	Thompson 133	2-6524
Theodore Chase, Jr.	(CH)	Lipman 220	2-9763 (220)
Wendie S. Cohick	(CP)	Foran 108B	2-8165 (105)
Thomas J. Gianfagna	(GN)	Foran 280	2-9711 (252)
Max M. Haggblom	(HQ)	Lipman 326	2-9763 (326)
Bradley I. Hillman	(HY)	Foran 339A	2-9711 (334)
Barry W. Jesse	(JE)	Foran 108A	2-8165 (104)
Donald Y. Kobayashi	(KN)	Foran 337A	2-8942 (328)
Thomas Leustek	(LG)	Foran 328A	2-8165 (326)
Malcolm Watford	(WR)	Thompson 130	2-7418
Barbara A. Zilinskas	(ZB)	Foran 296D	2-9711 (232)
Gerben J. Zylstra	(ZA)	Foran 322A	2-8165 (320)

The field of biotechnology has emerged as a major contributor to the advancement of agriculture, medicine, and environmental sciences. Recent developments in biotechnology, particularly molecular biology, promise major improvements in agricultural productivity, breakthroughs in human health care, and new solutions to environmental problems.

The biotechnology curriculum is designed to provide students with fundamental knowledge and laboratory skills in biotechnology, including molecular biology, and a firm foundation in biology and the physical sciences. The primary objectives of the program are to broadly educate students for positions in the rapidly developing biotechnology industry and to prepare students for graduate and graduate/professional study in the life sciences. The strong life and physical sciences foundation of the curriculum involves extensive laboratory and course work and research experience, as well as specializations in the following fields: animal biotechnology, microbial biotechnology, plant biotechnology, and bioinformatics.

Graduation Requirements for the Major

To enter biotechnology (11:126) courses, students must have completed 01:119:101 General Biology and 01:160:161 General Chemistry with grades of C or better and achieved a cumulative grade-point average of 2.0 or higher. Students whose cumulative grade-point average falls below 2.0 will be allowed one term to restore the average to 2.0 or higher.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (7 credits)

See suggested courses in the Degree Requirements chapter. 01:355:302 Scientific and Technical Writing (3) is strongly recommended.

- 11:126:401 Seminar in Biotechnology (1)

VII. Experience-Based Education (0–3 credits)

- 11:126:497,498 Research in Biotechnology (BA,BA) *or equivalent independent research project in biotechnology or appropriate cooperative education placement or appropriate non-credit bearing internship approved by the curriculum coordinator*

VIII. Proficiency in Biotechnology (71.5–78.5 credits)

A. REQUIRED COURSES (56.5–58.5)

Quantitative Skills (8)

- 01:640:1__-1__ CALC1 and CALC2 (4,4)

Computer and Information Technology Competence (3)

- 11:126:483 Nucleotide Sequence Analysis (3)

Professional Ethics (1.5)

- 11:126:110 Concepts and Issues in Biotechnology (1.5)

Additional Requirements (44–46)

- 11:115:403,404 General Biochemistry (4,3)
- 11:115:413 Experimental Biochemistry (3) *or* 11:115:313 Introductory Biochemistry Laboratory (1)
- 11:126:427 Methods in Recombinant DNA Technology (4)
- 11:126:481 Molecular Genetics (3)
- 11:126:482 Molecular Genetics Laboratory (3)
- 01:160:311 Organic Chemistry Laboratory (2) *or* 01:160:251 Analytical Chemistry Laboratory (3) *
- 01:160:307-308 Organic Chemistry (4,4)
- 01:447:380 Genetics (4) *or* 11:776:305 Plant Genetics (4) (Plant Biotechnology Option)
- 11:680:390 General Microbiology (4)
- 01:750:193-194 Physics for the Sciences (4,4) *or* equivalent*

B. OPTIONS (15–20)

1. Animal Biotechnology (18–19)

Required courses (9–10)

At least three of the following courses:

- 11:067:430 Animal Microtechniques and Tissue Culture (4)
- 01:146:474 Immunology (3)
- 11:709:400 Advanced Nutrition I (3)
- 11:709:401 Advanced Nutrition II (3)

Electives (9)

- 11:067:327 Animal Reproduction (3)
- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:452 Biochemical Separations (3)
- 11:126:407 Comparative Virology (3)
- 11:126:410 Process Biotechnology (3)
- 11:126:420 Trends in Biotechnology (3)
- 11:126:484 Biotechnology Robotics (3)
- 01:447:480 Topics in Molecular Genetics (3)
- 01:447:481 Topics in Human Genetics (3)
- 01:447:495 Cancer (3)
- 01:694:492 Molecular Biology of Gene Regulation and Development (3)
- 01:960:401 Basic Statistics for Research (3)

One to 3 additional credits of research in biotechnology may be substituted for an equal number of credits of elective course work.

2. Bioinformatics (18)

Required courses (11)

- 01:198:111 Introduction to Computer Science (4) *or* equivalent
- 01:198:112 Data Structures (4)
- 01:960:379 Basic Probability and Statistics (3)

One of the following:

- 11:115:428 Homology Modeling of Proteins (3)
- 11:126:410 Process Biotechnology (3)
- 01:160:410 Introduction to Molecular Modeling (3)
- 01:160:438 Introduction to Computational Chemistry (3)
- 01:447:486 Evolutionary Genetics (3)

At least one of the following:

- 01:198:205 Introduction to Discrete Structures (4)
- 01:198:211 Computer Architecture (4)
- 01:198:230 Introduction to Information Systems (4)
- 01:198:314 Principles of Programming Languages (4)
- 01:198:336 Principles of Database Management Systems (4)

3. General Biotechnology (15–20)

Required courses (6–8)

- 11:067:430 Animal Microtechniques and Tissue Culture (4) *or* 11:126:406 Plant Gene Transfer (4) *or* 11:776:452 Plant Tissue Culture (3)

One of the following courses:

- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:452 Biochemical Separations (3)
- 11:126:407 Comparative Virology (3)
- 11:126:410 Process Biotechnology (3)
- 11:126:420 Trends in Biotechnology (3)
- 11:126:484 Biotechnology Robotics (3)
- 11:126:486 Analytical Methods in Microbiology (4)
- 01:146:474 Immunology (3)

Electives (9–12)

Three additional courses from the required and elective courses listed in the other four biotechnology curriculum options.

One to 3 additional credits of research in biotechnology may be substituted for an equal number of credits of elective course work.

4. Microbial Biotechnology (16)

Required courses (7)

- 11:126:405 Microbial Technology (3)
- 11:680:394 Applied Microbiology (4)

Electives (9)

- 11:067:430 Animal Microtechniques and Tissue Culture (4) *or* 11:126:406 Plant Gene Transfer (4)
- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:452 Biochemical Separations (3)
- 11:126:407 Comparative Virology (3)
- 11:126:410 Process Biotechnology (3)
- 11:126:420 Trends in Biotechnology (3)
- 11:126:484 Biotechnology Robotics (3)
- 11:126:486 Analytical Methods in Microbiology (3)
- 01:146:474 Immunology (3)
- 01:146:475 Laboratory in Immunology (1)
- 11:375:411 Environmental Microbiology (3)
- 11:400:416 Food Biotechnology Topics (1)
- 11:400:419 Food Physical Systems (3)
- 11:400:423 Food Microbiology (3)
- 11:400:424 Food Microbiology Laboratory (1)
- 01:447:392 Pathogenic Microbiology (3)
- 01:447:480 Topics in Molecular Genetics (3)
- 01:447:495 Cancer (3)
- 01:447:498 Bacterial Physiology (3)
- 11:628:418 Marine Microbiology (4)
- 11:680:491 Microbial Ecology and Diversity (3)
- 01:694:492 Molecular Biology of Gene Regulation and Development (3)

One to 3 additional credits of research in biotechnology may be substituted for an equal number of credits of elective course work.

* Students intending to apply to medical or dental school should be aware that many professional schools require 01:160:311 Organic Chemistry Laboratory and a physics laboratory.

5. Plant Biotechnology (15–16)

Required courses (6–7)

- 11:126:406 Plant Gene Transfer (4) *or* 11:776:452 Plant Tissue Culture (3)
11:776:242 Plant Science (3)

Electives (9)

- 11:115:412 Protein and Enzyme Chemistry (3)
11:115:452 Biochemical Separations (3)
11:126:407 Comparative Virology (3)
11:126:410 Process Biotechnology (3)
11:126:413 Plant Molecular Biology (3)
11:126:484 Biotechnology Robotics (3)
11:126:486 Analytical Methods in Microbiology (4)
11:400:416 Food Biotechnology Topics (1)
11:400:419 Food Physical Systems (3)
01:447:480 Topics in Molecular Genetics (3)
01:694:492 Molecular Biology of Gene Regulation and Development (3)
11:704:351 Principles of Ecology (4) *or* 11:680:491 Microbial Ecology and Diversity (4) *or* 11:704:332 Plant Ecology (4)
11:770:301 General Plant Pathology (3)
11:776:210 Principles of Botany (4) *or* 11:704:411 Taxonomy of the Vascular Plants (4)
11:776:312 Medicinal Plants (3)
11:776:382 Plant Physiology (4)
11:776:406 Plant Breeding (3)
01:960:401 Basic Statistics for Research (3)

One to three additional credits of research in biotechnology may be substituted for an equal number of credits of elective course work.

IX. Unspecified Electives (0–6.5 credits)

BOTANY

(See Plant Science 776)

CHEMISTRY 160

Degree: B.A.

Undergraduate Executive Officer: John R. Krenos (krenos@rutchem.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
K.Y. Chen	(CM)	Wright Labs A108	5-3739
Martha Cotter	(CA)	Wright Labs 158	5-2259
Gene S. Hall	(HV)	Wright Labs 282	5-2590
Gregory F. Herzog	(HN)	Wright Labs 280	5-3955
John R. Krenos	(KF)	Wright Labs 221	5-3048
Karsten Krogh-Jespersen	(KM)	Wright Labs A206	5-4241
Joseph Potenza	(PG)	Wright Labs 182	5-2115
Laurence Romsted	(RA)	Wright Labs 388	5-3639
Heinz Roth	(RK)	Wright Labs 384	5-5664
Harvey Schugar	(SW)	Wright Labs 176	5-2602

The program of study in chemistry, offered in cooperation with the Departments of Chemistry and Chemical Biology, Faculty of Arts and Sciences, provides broad and comprehensive training in all areas of modern chemistry and leads to a bachelor of arts degree in chemistry. The curriculum is designed to permit the student a wide range of career choices, including, but not limited to, chemistry,

medicine, law, business, chemical physics, environmental science, and secondary-school teaching.

A core of courses is required for the completion of the major in chemistry, including course work in the four major subdisciplines of chemistry—inorganic, organic, physical, and analytical—as well as work in mathematics and physics. Within the program, several options permit students to select an area of concentration that reflects their particular interests and goals. (See VIII B below and the Chemistry 160 section of the Faculty of Arts and Sciences section.)

Entry Requirements for the Major

To declare a major in chemistry, students must achieve a grade of C or better in 01:160:161 General Chemistry.

Degree Requirements for the Major

Cook College students majoring in chemistry also must complete a minor or certificate program offered by the Cook College faculty.

Please see the Programs of Study Summary at the beginning of this chapter for information regarding changes in degree requirements.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4 credits)

- 01:119:103 Principles of Biology (4) *or* equivalent

B. Physical Sciences (8 credits)

- 01:750:203-204 General Physics (3,3)
01:750:205-206 General Physics Laboratory (1,1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

VI. Oral and Written Communication (8 credits)

See suggested courses in the Degree Requirements chapter. 01:355:302 Scientific and Technical Writing (3) is strongly recommended.

- 01:160:491-492 Seminar in Chemistry (1,1)

VII. Experience-Based Education (3 credits)

01:160:495-496 Senior Research Project (1-6,1-6), or
11:115:493,494 Research Problems in
Biochemistry (1-6,1-6) or 11:400:493,494
Research Problems in Food Science (1-4,1-4)
or equivalent independent laboratory
research project or appropriate, adviser-
approved placement in cooperative
education

VIII. Proficiency in Chemistry (75.5–95.5 credits)

A. REQUIRED COURSES (75.5–77.5)

Quantitative Skills (15)

01:640:151-152 Calculus for Mathematical and
Physical Sciences (4,4)
01:640:250 Introductory Linear Algebra (3)
01:640:251 Multivariable Calculus (4)

Computer and Information Technology Competence (2.5)

01:160:329 Experimental Physical Chemistry (2.5)

Professional Ethics

Issues in professional and scientific ethics are included in
01:160:491-492 Seminar in Chemistry (1,1).

Additional Requirements (56–58.5)

01:160:161-162 General Chemistry (4,4) or 01:160:163-164
Honors General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:160:251 Analytical Chemistry Laboratory (3)
01:160:309 Organic Chemistry Laboratory (2.5) or
311 Organic Chemistry Laboratory I (2) and
01:160:310 Organic Chemistry Laboratory
II (2.5)
01:160:315-316 Principles of Organic Chemistry (4,4)
or 01:160:307-308 Organic Chemistry (4,4)
01:160:323-324 Physical Chemistry (3,3) or
01:160:327-328 Physical Chemistry (4,4) or
01:160:341-342 Physical Chemistry:
Biochemical Systems (3,3)
01:160:348 Instrumental Analysis (3) or 01:160:344
Introduction to Molecular Biophysics
Research (3)
01:160:361 Chemical Bonding (1.5)
01:160:371 Inorganic Chemistry (3)
A minor or certificate program offered by Cook
College (18)

B. OPTIONS (0–18)

For currently available areas of further concentration, see
the Chemistry 160 section of the Programs of Study for
Liberal Arts Students section of this catalog. Options B, C,
and D lead to American Chemical Society-certified degrees
and must include at least one term of biochemistry at the
400 level. Students planning on acquiring secondary
teacher certification should consult the requirements for the
minor program in science and agriculture teacher education
at the end of this chapter.

IX. Unspecified Electives (0–3.5 credits)

COMMUNICATION 192

Degree: B.A.

Coordinator: Barbara Munson Goff (goff@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Barbara M. Goff	(GB)	Loree 038	2-9266
Mary Beth Hager	(CT)	SCILS 207	2-7500 (8951)
Ann Z. Li	(LA)	SCILS 206	2-7500 (8303)

Offered in cooperation with the Department of Communication (School of Communication, Information and Library Studies), the undergraduate program emphasizes the role of communication in human affairs. The program prepares students for communication careers in business, education, or government, or for the pursuit of graduate study in communication or other fields. As offered through Cook College, the program allows students to develop a strong background in environmental, scientific, or technical fields, areas in which communication specialists are in high demand.

Entry Requirements for the Major

The Department of Communication faculty seeks highly motivated students and encourages applications from a diverse student population. Admission to the major program is competitive, and students should be advised that meeting the minimum requirements does not guarantee acceptance.

Minimum requirements include the following: a grade-point average of 2.0 or higher; a combined average of C+ (2.5) in 04:189:101 Introduction to Communication and Information Systems and Processes and 102 Introduction to Media Systems and Processes or 103 Information Technology and Informatics, with no grade below C; a grade of C or higher in expository writing (or equivalent for transfer students); and a well-written personal statement.

The admissions committee seeks the following when reviewing student essays: (1) a persuasive statement of purpose, (2) an understanding of issues in communication, (3) strong written communication skills, and (4) evidence that the student will contribute to the community of learners in the Department of Communication.

Applications are available on the department's web site (<http://scils.rutgers.edu>) and are due by the close of business on October 1 for spring term admission or February 15 for fall term admission. Students are advised to consult the department's handbook, web site, and bulletin boards for up-to-date information regarding admissions procedures.

Degree Requirements for the Major

Cook College students majoring in communication also must complete a minor or certificate program offered by the Cook College faculty.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

11:015:101 Perspectives on Agriculture and the
Environment (2)
11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences (7 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

- 04:192:346 Intercultural Communication (3) *or*
04:192:345 International Communication (3)
or 04:192:405 Communication and Gender (3)
or 04:192:434 Intercultural Communication
Workshop (3) *and/or* a course/courses sug-
gested in the Degree Requirements chapter

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

VI. Oral and Written Communication (6 credits)

- 04:192:359 Persuasive Communication (3) *or*
04:192:380 Public Speaking (3) *or*
04:192:381 Argumentation (3) *or*
04:192:407 Health Communication (3)
01:355:101 Expository Writing I (3) *or* equivalent

VII. Experience-Based Education (1–3 credits)

- 04:192:369 Internship in Communication (3) *or*
04:192:470 Research in Communication (3)
or 04:192:491,492 Independent Study in
Communication * (1-3,1-3) *or* an appropriate
cooperative education placement

VIII. Proficiency in Communication (39–48 credits)

A. REQUIRED COURSES (39–42)

Quantitative Skills (3)

- 04:192:300 Communication Research (3)

Computer and Information Technology Competence (3)

- 01:198:110 Introduction to Computers and Their
Application (3) *or* 04:189:103 Information
Technology and Informatics (3) *or* equivalent

Professional Ethics (3)

- 04:192:365 Principles of Public Relations (3)

Additional Requirements (30–33)

- 04:189:101 Introduction to Communication and
Information Systems and Processes (3)
04:189:102 Introduction to Media Systems and
Processes (3) *or* 04:189:103 Information
Technology and Informatics (3)

* 04:192:491,492 does not count toward the minimum 33-credit communication course requirement.

- 04:192:200 Communication Theory (3)
04:192:201 Interpersonal Communication Processes (3)

At least one of the following courses (3):

- 04:192:354 Mediated Communication Theory (3)
04:192:355 Interpersonal Communication Theory (3)
04:192:357 Organizational Communication Theory (3)

A minor or certificate program offered by Cook College (18)

Students should consult the description of the communication program in the School of Communication, Information and Library Studies chapter for a recommended sequence of communication courses.

B. ELECTIVES (6–12)

At least two courses at the 400 level (excluding 04:192:491,492, and 495) must be included *in the total of 33 credits of 04:192 courses required for the major*. Students who have completed 33 credits of courses in communication must apply to the department for special permission to take additional 04:192 courses.

IX. Unspecified Electives (41–46 credits)

ENTOMOLOGY

(See the Minor Programs of Study section at the end of this chapter.)

ECOLOGY AND NATURAL RESOURCES 704

Degree: B.S.

Coordinator: Edwin J. Green (green@crssa.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Timothy M. Casey	(CD)	Martin 216	2-3000 (512)
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Joan G. Ehrenfeld	(EF)	ENR 126	2-1081
Jason Grabosky	(GR)	ENR 144	2-9236
Edwin J. Green	(GJ)	ENR 158	2-9152
Rebecca Jordan	(JF)	ENR 131	2-8242
Karl Kjer	(KQ)	Blake 121	2-9880
Richard G. Lathrop	(LP)	ENR 129	2-1580
Julie Lockwood	(LJ)	ENR 146	2-9336
Peter J. Morin	(MP)	ENR 148	2-3214
Harry W. Power	(PC)	80 Nichol Ave., 114	2-0649 (14)
Peter E. Smouse	(SR)	Waller 001	2-1124
Lena Struwe	(SK)	Foran 237	2-9711 (235)
Michael V.K. Sukhdeo	(SL)	ENR 152A	2-1064
Mark C. Vodak	(VD)	80 Nichol Ave., 110	2-8993 (10)
Ming Xu	(XA)	ENR 132	2-9211

The ecology and natural resources curriculum provides an understanding of how natural living systems function and how they can be managed to provide benefits to people. Students may pursue course work that prepares them for traditional careers in resource management or they may take a broader array of courses that meets interests related to the conservation of natural resources and the ecology of natural systems. Graduates may pursue further study at the graduate level or find career opportunities in academe and in public or private organizations involved in the management of natural resources.

Students are encouraged to organize curricular and elective courses to fulfill simultaneously the requirements of a minor or certificate program. Particularly appropriate are the minor in Teacher Education and the certificates in Environmental Geomatics and Urban/Community Forestry.

The curriculum offers the following options:

Conservation and Applied Ecology. This option provides a broad general understanding of the functioning, significance, and conservation of living systems. The flexibility of this option is intended to meet a variety of student interests and needs.

Ecology and Evolution. This option emphasizes scientific aspects of ecology and is intended for students who plan to attend graduate school for advanced study or who intend to apply for certification as an ecologist or associate ecologist through the Ecological Society of America.

Professional Resource Management. Students selecting this option will pursue course work that has been recommended by professional resource management organizations. Traditional majors in forestry, wildlife, or fisheries can be developed by the selection of specific concentrations within this option. Faculty advisers provide students with a list of courses recommended for specific career directions. However, a broad background in resource management is an appropriate preparation for all resource management professionals.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (17 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)
- 01:750:193-194 Physics for the Sciences (4,4) *or*
01:750:203-204 General Physics (3,3) *and*
01:750:205-206 General Physics
Laboratory (1,1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (0–3 credits)

All students are required to obtain practical experience in an area of ecology and natural resources. Students can complete this requirement without formal credit through summer employment or volunteer service with an appropriate public agency, private industry, or nonprofit organization. Proposed employment or service must be discussed with the adviser or curriculum coordinator.

If the student elects to meet this requirement without applying for credit, then it is the student's responsibility to provide the curriculum coordinator with written documentation of the work experience prior to graduation. Students also may fulfill the practical experience requirement by completing one of the following courses:

- 11:015:497,498 George H. Cook Scholars Program (BA,BA)
- 11:199:___ Cooperative Education (BA)
- 11:300:487 Student Teaching (9)
- 11:372:493,494 Special Problems in Environmental Resources (BA,BA)
- 11:704:375 Practicum in Wildlife Management (BA)
- 11:704:376 Practicum in Fishery Management (BA)
- 11:704:377 Practicum in Forest Management (BA)
- 11:704:483,484 Research Problems in Applied Ecology (BA,BA)

VIII. Proficiency in Ecology and Natural Resources (58–62 credits)

A. REQUIRED COURSES (11)

Quantitative Skills (7)

- 01:640:115 Precalculus College Mathematics (4) *or*
01:640:1__ CALC1 *or* equivalent
- 01:960:401 Basic Statistics for Research (3)

Computer and Information Technology Competence

Students are expected to have or develop basic competence in the use of computers and their application in the field of natural resources. If basic computing skills need to be developed at Cook College, students should take 01:198:110 Introduction to Computers and Their Application (3) *or* equivalent. Students who enter Cook College with basic proficiency in the use of computers will meet the curriculum computing requirement by completing 11:372:369 *or* 11:704:453. Consult the faculty adviser for the appropriate course selection.

Professional Ethics

Ethical aspects of natural resources are incorporated into many of the advanced courses through case studies.

Additional Requirements (4)

- 11:704:351 Principles of Ecology (4)

B. OPTIONS (47–51)

1. Conservation and Applied Ecology (47–49)

Required courses (7–8)

- 11:375:102 Soils and Society (3) *or* 11:375:360 Soils and Water (4)
- 01:460:101 Introductory Geology (3)
- 01:460:103 Introductory Geology Laboratory (1)

Electives (40–41)

Courses chosen in consultation with the student's adviser from among those listed under the other options of this curriculum or logical extensions of the subject matter of these courses. Students must have the approval of their adviser or curriculum coordinator to substitute courses other than those indicated above. At least 20 of the 40 credits must be fulfilled by courses in natural resources (11:704). In general, courses that can be applied to learning about living systems and how they are managed are approved.

2. Ecology and Evolution (49–51)

Required courses (28–30)

- 01:160:307-308 Organic Chemistry (4,4) and 01:160:311 Organic Chemistry Laboratory (2) *or* 01:160:209 Elementary Organic Chemistry (3) and 01:160:211 Elementary Organic Chemistry Laboratory (1) and 11:115:301 Introductory Biochemistry (3) and 11:115:313 Introductory Biochemistry Laboratory (1)
- 01:447:380 Genetics (4)
- 01:640:135 Calculus (4) *or* equivalent
- 11:704:486 Principles of Evolution (3)

At least one of the following courses in biomathematics (3–4):

- 01:146:302 Computers in Biology (3)
- 01:640:136 Calculus *or* 01:640:138 Calculus for the Biological Sciences (4) *or* equivalent
- 01:640:250 Introduction to Linear Algebra (3)
- 11:704:453 Natural Resource Biometrics (3)

At least one of the following courses in systematics (3–4):

- 11:370:381 Insect Biology (4)
- 11:370:402 Aquatic Entomology (4)
- 11:370:409 Insect Classification (4)
- 11:628:321 Ichthyology (4)
- 11:704:272 Dendrology (4)
- 11:704:323 Ornithology (4)
- 11:704:324 Invertebrate Zoology (4)
- 11:704:325 Vertebrate Zoology (4)
- 11:704:411 Taxonomy of the Vascular Plants (4)

At least one of the following courses in environmental pollution and conservation (3):

- 11:374:431 Topics: New and Reemerging Diseases (3)
- 11:375:407 Environmental Toxicology (3)
- 11:375:411 Environmental Microbiology (3)
- 11:375:421 Air Pollution (3)
- 11:375:444 Water Chemistry (3)
- 11:375:445 Problems in Aquatic Environments (3)
- 11:704:317 Conservation Ecology (3)
- 11:704:451 Ecosystems Ecology and Global Change (3)

Electives (21)

Select appropriate courses from the following categories.

Life Sciences (15)

At least 15 credits of courses selected in consultation with an adviser from those offered by Cook College or the Faculty of Arts and Sciences that have 01:119:101-102 General Biology as a prerequisite. At least three of these courses must have a laboratory or field component.

Physical and Quantitative Sciences (6)

At least 6 additional credits of courses selected in consultation with an adviser in Biochemistry (115), Chemistry

(160), Environmental Sciences (375), Geography (450), Geological Sciences (460), Marine Sciences (628), Mathematics (640), Physics (750), or Statistics (960).

3. Professional Resource Management (Fisheries/Forestry/Wildlife) (48)

Required courses (23)

- 11:375:360 Soils and Water (4)
- 01:460:101 Introductory Geology (3)
- 01:460:103 Introductory Geology Laboratory (1)
- 11:704:211 The Natural Resources Professions (1)
- 11:704:272 Dendrology (4)
- 11:704:453 Natural Resource Biometrics (4)
- 11:776:210 Principles of Botany (4)
- Additional course in oral and written communication (3) [01:355:302 Scientific and Technical Writing (3) is recommended.]

Electives (25)

Select appropriate courses from the following categories. Students placing an emphasis on wildlife, fisheries, or forestry should obtain a list of recommended courses from their adviser or curriculum coordinator. The minimum number of credits is indicated. Courses not listed here may be substituted with the approval of the adviser.

Living Systems (16):

- 11:370:381 Insect Biology (4)
- 01:447:380 Genetics (4)
- 11:628:120 Introduction to Oceanography (3)
- 11:628:320 Dynamics of Marine Ecosystems (4)
- 11:628:321 Ichthyology (4)
- 11:704:240 Behavioral Biology (4)
- 11:704:323 Ornithology (4)
- 11:704:324 Invertebrate Zoology (4)
- 11:704:325 Vertebrate Zoology (4)
- 11:704:332 Plant Ecology (4)
- 11:704:335 Limnology (4)
- 11:704:411 Taxonomy of the Vascular Plants (4)
- 11:704:421 Wetland Ecology (3)
- 11:704:422 Ecology of Soil Organisms (3)
- 11:704:441 Animal Behavior (3)
- 11:704:443 Animal Social Behavior (3)
- 11:770:301 General Plant Pathology (3)
- 11:776:382 Plant Physiology (4)

Principles and Applications of Resource Management (6):

- 11:704:317 Conservation Ecology (3)
- 11:704:464 Wildlife Ecology and Conservation (3)
- 11:704:471 Silviculture (3)

Policy/Administration/Law (3):

- 11:372:231 Fundamentals of Environmental Planning (3)
- 11:372:381 Introduction to Systems Thinking and the Systems Approach (3)
- 11:373:362 Natural Resource Economics (3)
- 11:373:363 Environmental Economics (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:375:333 Environmental Law I (3)

Complementary courses

The following courses provide knowledge and skills that are complementary to the study of natural resources. No credits are required, but these courses may be used as unspecified electives or as option electives for the conservation and applied ecology option.

11:015:2__	Topics in Agriculture and Environmental Science (1)
11:015:230	Fundamentals of Agroecology (3)
11:115:301	Introductory Biochemistry (3)
01:160:209	Elementary Organic Chemistry (3)
11:370:202	The World of Insects (3)
11:372:322	Land Measurement and Mapping (3)
11:372:362	Intermediate Environmental Geomatics (3)
11:372:371	Air-Photo Interpretation (3)
11:372:474	Advanced Remote Sensing (3)
11:375:405	Fundamentals of Water and Wastewater Analysis (4)
11:670:201	Elements of Meteorology (3)
11:670:202	Elements of Climatology (3)
11:704:274	Field Techniques in Ecology and Natural Resources (4)
11:704:312	Forest Fire Protection (1.5)
11:704:403	Urban Forestry (3)
11:704:451	Ecosystems Ecology and Global Change (3)
11:704:452	Research Methods in Ecology (3)
11:704:461	Field Ecology (2)
11:704:475	Winter Field Ecology (1)
11:704:486	Principles of Evolution (3)
11:704:488	Restoration Ecology (4)
01:960:4__	A course in statistics (3)
01:960:476	Introduction to Sampling (3)
01:960:490	Introduction to Experimental Design (3)

IX. Unspecified Electives (5–12 credits)

ENVIRONMENTAL AND BUSINESS ECONOMICS 373

Degree: B.S.

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The environmental and business economics program provides students with a foundation in the principles of economics, a knowledge of practical economic and analytical problem-solving techniques, an ability to apply economic concepts to the analysis of public and private policy issues, and an understanding of the institutional factors underlying and influencing policy decisions. The program qualifies students for a broad spectrum of positions in business and government, or for continued study at the graduate level.

To encourage students to develop depth in their understanding of the applications of economics, the curriculum offers the following four options:

Business Economics. This option emphasizes the application of economics to business management, marketing, and finance issues related to food and agriculture. It familiarizes students both with analytical and decision-making techniques used in the business world, and with the public and private institutional framework within which businesses operate. It is appropriate for students interested in employment in business or who are interested in graduate studies in business management or economics.

Environmental and Natural Resource Economics. This option emphasizes the application of economics to policy issues associated with environmental problems and the utilization of natural resources. It familiarizes students both with analytical and decision-making techniques used in assessing problems of the environment and natural resources, and with the institutional framework within which environmental policy must be developed. It is appropriate for students interested in employment either by private organizations concerned with environmental policies or by government agencies responsible for policies relating to the environment and natural resources and for students interested in graduate study in environmental or natural resource economics.

Food Industry Economics. This option emphasizes the application of economics in the areas of food policy, marketing, and finance. It is appropriate for students interested in employment in the food industry or by federal or state departments of agriculture and for students interested in graduate study in agricultural economics.

Food Science and Management Economics. This option, offered in cooperation with the food science curriculum, is designed for students with a strong interest in the management aspects of food science, process, production, and product development. While the option requirements of both programs are similar, students seeking degrees in environmental and business economics take additional courses in economics. This option is appropriate for students interested in employment in the food industry or in graduate study in agricultural economics, economics, or business administration.

Graduation Requirements for the Major

Although students may declare the major before completing these four courses, official admission to the major requires completion of introductory courses in micro- and macroeconomics, a term of calculus, and a term of statistics, with grades of *C* or better. These four courses are prerequisites to junior- and senior-level courses in the required option areas.

Majors must complete all required courses with grades of *C* or better. No more than one *D* is allowed in the option courses.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

11:015:101	Perspectives on Agriculture and the Environment (2)
11:015:400	Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4–8 credits)

- 01:119:103 Principles of Biology (4)
[01:119:101-102 General Biology (4,4) is required in the food science and management economics option.]

B. Physical Sciences (3–13 credits)

See suggested courses in the Degree Requirements chapter. [01:160:161-162 General Chemistry (4,4), 01:160:171 Introduction to Experimentation (1) and 01:750:161 Elements of Physics (4) are required in the food science and management economics option.]

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems (6 credits)

- 11:373:121 Principles and Applications of Microeconomics (3) *or* 01:220:102 Introduction to Microeconomics (3)
01:220:103 Introduction to Macroeconomics (3)

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (9 credits)

- 01:355:101 Expository Writing (3) *or* equivalent
01:355:202 Technical Writing Essentials (3) *or*
01:355:203 Business Writing Essentials (3) *or*
01:355:303 Writing for Business and the Professions (3) *or* 01:355:302 Scientific and Technical Writing (3)

and one of the following:

- 04:192:220 Fundamentals of Speaking and Listening (3)
01:355:201 Research in the Disciplines (3)
(See majors' *Handbook* or adviser for suggested topics.)

VII. Experience-Based Education (3–4 credits)

Each student consults with the academic adviser in planning to meet this requirement. Appropriate cooperative education placements, approved internships, 11:373:402 International Agribusiness Marketing (3), 11:373:465 Agribusiness Marketing Research (4), 11:373:491,492 Research Problems, or equivalents fulfill this requirement.

VIII. Proficiency in Environmental and Business Economics (55–70 credits)

A. REQUIRED COURSES (19)

Majors must complete all VIII A requirements with a grade of C or better.

Quantitative Skills (10)

- 33:010:272 Introduction to Financial Accounting (3)
01:640:1__ CALC1 (4)
01:960:285 Introductory Statistics for Business (3) *or*
01:960:211 Statistics I (3)

Computer and Information Technology Competence

See VIII B, Option requirements.

Professional Ethics

See VIII B, Option requirements.

Additional Requirements (9)

- 11:373:241 Agribusiness Management (3)
11:373:321 Economics of Production (3)
11:373:422 Demand and Price Analysis (3)

B. OPTIONS (36–51)

Majors must complete all option-required courses with a grade of C or better. No more than one grade of D is allowed in the remaining option elective courses.

1. Business Economics (36–38)

Required courses (15–16)

- 11:373:210 Business Decision Computer Tools (4) *or*
01:198:170 Computer Applications for Business (3)
11:373:231 Agribusiness Marketing (3)
11:373:341 Management: Human Systems Development (3)
11:373:351 Agribusiness Finance I (3)
01:730:251 Ethics and Business (3) *or* equivalent

Electives (21)

At least three of the following business/economics courses:

- 01:220:300 International Economics (3)
01:220:301 Money and Banking (3)
01:220:302 Labor Economics (3)
01:220:308 Introduction to Managerial Economics (3)
01:220:311 Methods of Cost Benefit Analysis (3)
01:220:322 Econometrics (3)
01:220:394 Economics of Capital Markets (3)
01:220:415 Portfolio Theory (3)
11:373:331 Economics of Food Marketing Systems (3)
11:373:352 Economics of Futures Markets (3)
11:373:402 International Agribusiness Marketing (3) *
11:373:425 Application of Econometrics in Agricultural Economics (3)
11:373:451 Agribusiness Finance II (3)
11:373:465 Agribusiness Marketing Research (4) *

At least two of the following policy courses:

- 11:373:323 Public Policy toward the Food Industry (3)
11:373:361 Land Economics (3)
11:373:362 Natural Resource Economics (3)
11:373:363 Environmental Economics (3)

* Students fulfilling VII. Experience-Based Education with this course must select an additional course from the list.

- 11:373:371 Food Health and Safety Policy (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:374:315 International Environmental Policy (3)
- 01:790:237 Political Economy and Society (3)
- 01:790:305 Public Policy Formation (3)
- 01:790:327 International Political Economy (3)
- 01:790:337 American Political Economy (3)
- 01:790:338 Government and Business (3)

At least two additional courses in environmental and business economics (373), economics (220), or Calculus II.

2. Environmental and Natural Resource Economics (36–37)

Required courses (15–16)

- 11:373:210 Business Decision Computer Tools (4) *or* 01:198:170 Computer Applications for Business (3)
- 11:373:361 Land Economics (3)
- 11:373:362 Natural Resource Economics (3)
- 11:373:363 Environmental Economics (3) *or* 01:220:332 Environmental Economics (3)
- 01:730:251 Ethics and Business (3) *or* equivalent

Electives (21)

At least three of the following courses in problem solving or policy analysis:

- 01:220:311 Methods of Cost Benefit Analysis (3)
- 01:220:386 Operations Research I (3)
- 01:220:395 Law and Economics (3)
- 11:372:232 Fundamentals of Environmental Geomatics (3)
- 11:373:351 Agribusiness Finance I (3)
- 11:373:425 Application of Econometrics in Agricultural Economics (3)
- 11:375:333 Environmental Law I (3)
- 11:375:409 Environmental Statement and Impact (3)
- 01:790:305 Public Policy Formation (3)
- 01:960:337 Managerial Statistics (3)

At least one of the following courses in policy applications:

- 11:373:231 Agribusiness Marketing (3)
- 11:374:315 International Environmental Policy (3)
- 11:375:301 Environment and Health (3)
- 11:375:410 Workshop in Environmental Assessment and Impact (3)
- 11:375:421 Air Pollution (3)
- 01:450:140 The Greenhouse Effect (3)
- 01:450:370 Global and Regional Climate Change (3)
- 11:628:401 Science in Shoreline Management (3)
- 11:704:451 Ecosystems Ecology and Global Change (3)

At least one of the following interdisciplinary courses:

- 11:372:231 Fundamentals of Environmental Planning (3)
- 11:375:333, 334 Environmental Law I,II (3,3)
- 01:512:323,324 History of the North American Environment (3,3)
- 11:704:351 Principles of Ecology (3)
- 10:975:315 Theory and Methods of Land-Use Planning (3)

Two additional courses in environmental and business economics (373), economics (220), or Calculus II.

3. Food Industry Economics (36–38)

Required courses (15–16)

- 11:373:210 Business Decision Computer Tools (4) *or* 01:198:170 Computer Applications for Business (3)
- 11:373:231 Agribusiness Marketing (3)
- 11:373:331 Economics of Food Marketing Systems (3)
- 11:373:341 Management: Human Systems Development (3)
- 01:730:251 Ethics and Business (3) *or* equivalent

Electives (21)

Four of the following courses, of which at least three must come from group A:

A. Courses in business strategy/policy

- 11:373:323 Public Policy toward the Food Industry (3)
- 11:373:351 Agribusiness Finance I (3)
- 11:373:352 Economics of Futures Markets (3)
- 11:373:371 Food Health and Safety Policy (3)
- 11:373:402 International Agribusiness Marketing (3) *
- 11:373:425 Application of Econometrics in Agricultural Economics (3)
- 11:373:451 Agribusiness Finance II (3)
- 11:373:465 Agribusiness Marketing Research (4) *

B. Courses in environmental/resource economics

- 11:373:361 Land Economics (3)
- 11:373:362 Natural Resource Economics (3)
- 11:373:363 Environmental Economics (3)

At least 3 credits of courses in one of the following areas: animal science (067), soils (in environmental sciences 375), food science (400), nutritional sciences (709), or plant science (776).

At least two additional courses in environmental and business economics (373), economics (220) or Calculus II.

4. Food Science and Management Economics (50–51)

Required courses in the sciences (26)

- 01:160:209 Elementary Organic Chemistry (4)
- 11:400:201 Principles of Food Science (3)
- 11:400:405 Sensory Evaluation of Foods (3)
- 11:400:411 Food Chemistry (3)
- 11:400:412 Food Product Development (3)
- 11:400:423 Food Microbiology (3)
- 11:400:4__ Food Processing (3)
- 11:680:390 General Microbiology (4)

Required courses related to business management (23–25)

- 11:373:210 Business Decision Computer Tools (4) *or* 01:198:170 Computer Applications for Business (3)
- 11:373:231 Agribusiness Marketing (3)
- 11:373:323 Public Policy toward the Food Industry (3) *or* 11:373:371 Food Health and Safety Policy (3)
- 11:373:341 Management: Human Systems Development (3)
- 11:373:351 Agribusiness Finance I (3)
- 11:373:3__ Food Systems Management and Operations (3)
- 11:373:4__ Agribusiness Strategy (3)
- 01:730:251 Ethics and Business (3) *or* 11:400:314 Current Issues in Food Science (2) *or* equivalent

* Students fulfilling VII. Experience-Based Education with this course must select an additional course from the list.

IX. Unspecified Electives (8–25 credits)

ENVIRONMENTAL PLANNING AND DESIGN 573

Degree: B.S.

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This curriculum provides a broad educational experience emphasizing an understanding of planning and design as they relate to the physical environment and the management of that environment. Particular attention is given to the interaction of natural and social systems. The curriculum includes four options: Environmental Geomatics, Environmental Planning, Landscape Architecture, and Landscape Industry.

Environmental Geomatics. Environmental geomatics synthesizes a number of concepts and techniques, including remote sensing, spatial analysis, geographic information systems (GIS), and global positioning systems (GPS) that are used to improve the planning and management of natural resource systems. These techniques include the development of complex spatial databases from a wide range of data sources and the application of this information to solve environmental problems. The option is intended for students interested in pursuing professional careers in environmental planning/management, remote sensing, and geomatics, and provides a basis for graduate and professional studies. An environmental geomatics certificate program also is available for students in other programs of study. (See the Minor and Certificate Programs section at the end of this chapter.)

Environmental Planning. Environmental planning requires the integration of environmental information into the planning process and is concerned with the protection and enhancement of environmental systems while meeting demands for growth and development. This option is intended for students who are interested in pursuing professional careers in environmental planning and related areas. It also provides a basis for graduate and professional studies. An environmental planning certificate program also is available for students in other programs of study. (See the Minor and Certificate Programs section at the end of this chapter.)

Landscape Architecture. Landscape architecture is concerned with the harmonious integration of people and nature in the creation of outdoor spaces for a variety of purposes. Emphasis is on sensitive site design using both social and environmental information. Issues addressed by landscape architects range from the design of parks, housing sites, and gardens to the planning, design, and management of entire regions. This option is intended for

students who are interested in employment with landscape architecture, architecture, engineering, and planning firms and government agencies concerned with parks, recreation, environmental resources, and urban planning. Landscape architecture is a professional curriculum nationally accredited by the American Society of Landscape Architects. Entrance into the upper level (junior year) is competitive, based on an evaluation of the student's performance at the beginning level (sophomore year).

Landscape Industry. This option provides students with a broad-based education in preparation for careers in landscape-related industries such as contracting, maintenance, nursery production, and garden-center operations.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4 credits)

- 01:119:103 Principles of Biology (4) *or* equivalent

B. Physical Sciences (3 credits)

- 01:460:101 Introductory Geology I: Physical (3)

Students who have completed another course in the list of physical sciences courses in the Degree Requirements chapter may substitute a course in physical geography.

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter. Microeconomics is recommended for students in the Landscape Industry option.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (0–3 credits)

Students in the landscape architecture option fulfill this requirement by way of applied problem-solving projects in upper-level courses.

Students in the environmental geomatics, environmental planning, and landscape industry options may complete the requirement without formal credit through option-related summer employment or volunteer service with an appropriate public agency, private industry, or nonprofit organization. If a student elects to meet this requirement without applying for credit, then it is the student's responsibility to provide his or her academic adviser with written documentation of work experience for approval prior to

graduation. Students also may fulfill the experience-based education requirement by completing at least 3 credits from the following courses:

- 11:015:497,498 George H. Cook Scholars Program (BA,BA)
- 11:199:___ Cooperative Education
- 11:300:487 Student Teaching (9)
- 11:372:493,494 Special Problems in Environmental Resources (BA,BA)
- 11:704:483,484 Research Problems in Applied Ecology (BA,BA)

VIII. Proficiency in Environmental Planning and Design (57–81 credits)

A. REQUIRED COURSES (15)

Quantitative Skills (4)

- 01:640:115 Precalculus College Mathematics (4) or equivalent

Computer and Information Technology Competence

Computer applications are integral to all aspects of environmental planning and design.

Professional Ethics

Ethical aspects of environmental planning and design are incorporated into several upper-level courses through the use of case studies and applied problems.

Additional Requirements (11)

- 11:372:231 Fundamentals of Environmental Planning (3)
- 11:372:232 Fundamentals of Environmental Geomatics (3)
- 11:372:233 Fundamentals of Environmental Geomatics Laboratory (1)
- 11:704:351 Principles of Ecology (4) or 11:704:332 Plant Ecology (4)

B. OPTIONS (43.5–59)

1. Environmental Geomatics (42–66)

Required courses (28.5–32)

- 11:372:362 Intermediate Environmental Geomatics (3)
- 11:372:369 Analytical Methods for Environmental Geomatics (3)
- 11:372:371 Air-Photo Interpretation (3)
- 11:372:374 Global Positioning Systems (1.5) or 01:450:355 Principles of Cartography (4) or 11:372:322 Land Measurement and Mapping
- 11:372:442 Applied Principles of Hydrology (3)
- 11:372:462 Advanced Environmental Geomatics (3)
- 11:372:474 Advanced Remote Sensing (3)
- 11:375:102 Soils and Society (3) or 11:375:360 Soils and Water (4) or 11:776:404 Soil Management for Sports and Landscape Applications (3)
- 11:670:202 Elements of Climatology (3) or 11:670:306 Weather, Climate, and Environmental Design (3)
- 01:960:401 Basic Statistics for Research (3) or equivalent

An additional concentration, minor, or certificate program selected from the following (15–27):

Concentration in Landscape Architecture (18–21)

Courses selected from the landscape architecture-option requirements (see VIII B4 below).

Approved Certificate Programs (15–24)

- Environmental Planning (21)
- Historic Preservation (15)
- International Agriculture/Environment (21–23)
- Real Estate Development (24)
- Social Strategies for Environmental Protection (24)
- Urban Planning (24)

Approved Minor Programs (18–27)

- Agroecology (21–24)
- Entomology (19–26)
- Environmental and Business Economics (21–23)
- Environmental Policy, Institutions, and Behavior (18)
- Geography (18)
- Marine Sciences (18)
- Meteorology (18)
- Natural Resource Management (20–25)
- Plant Science (18–20)
- Science and Agriculture Teacher Education (24–27)

Individualized 18–24 credit concentrations may be developed with the approval of the student's adviser. Students must obtain adviser approval for individualized concentrations during the first term of the junior year.

2. Environmental Planning (55–64)

Required courses (22–24)

- 11:372:381 Introduction to Systems Thinking and the Systems Approach (3)
- 11:372:442 Applied Principles of Hydrology (3)
- 11:375:102 Soils and Society (3) or 11:375:360 Soils and Water (4) or 11:776:404 Soil Management for Sports and Landscape Applications (3)
- 11:550:231 Introduction to Environmental Design I (5)
- 11:550:232 Introduction to Environmental Design II (5) or two of the following courses (6): 11:550:230 Environmental Design Analysis (3); 11:550:330 History of Landscape Architecture (3); 10:975:316 Urban Design and Site Planning (3)
- 11:670:202 Elements of Climatology (3) or 11:670:306 Weather, Climate, and Environmental Design (3)

Electives (33–40)

Five additional courses from the following (15):

- 11:372:409 New Jersey Planning Practice (3)
- 11:372:411 Environmental Planning and the Development Process (3)
- 11:375:351 Land Planning and Utilization (3)
- 10:975:250 Introduction to Urban Housing (3)
- 10:975:305 U.S. Urban Policy (3)
- 10:975:306 Introduction to Urban and Environmental Planning (3)
- 10:975:315 Theory and Methods of Land-Use Planning (3)
- 10:975:316 Urban Design and Site Planning (3)
- 10:975:335 Administrative Issues in Environment and Land-Use Planning (3)
- 10:975:420 Computers in Planning and Management (3)
- 10:975:444 American Land (3)
- 10:975:474 Tourism Planning (3)
- 10:975:478 History of Planning Thought (3)
- 10:975:481 Housing and Economic Analysis (3)
- Adviser-approved course(s) in planning

An additional concentration, minor, or certificate program selected from the following (18–25):

Concentration in Landscape Architecture (18–21)

Courses selected from the landscape architecture-option requirements (see VIII B4 below), in addition to 11:550:231.

Approved Certificate Programs (18–24)

- Environmental Geomatics (18)
- Historic Preservation (15)
- International Agriculture/Environment (21–23)
- Real Estate Development (24)
- Social Strategies for Environmental Protection (24)
- Urban Planning (24)

Approved Minor Programs (18–25)

- Agroecology (21–24)
- Environmental and Business Economics (21–23)
- Environmental Policy, Institutions, and Behavior (18)
- Geography (18)
- Marine Sciences (18)
- Meteorology (19)
- Natural Resource Management (20–25)
- Plant Science (18–20)

Individualized 18–24 credit concentrations may be developed with the approval of the student’s adviser. Students must obtain adviser approval for individualized concentrations during the first term of the junior year.

3. Landscape Architecture (65–66)

- 11:372:322 Land Measurement and Mapping (3)
- 11:550:231, 232 Introduction to Environmental Design I,II (5,5)
- 11:550:233-234 Landscape Plants I,II (3,3)
- 11:550:250 Computer-Aided Design for Landscape Architects (3)
- 11:550:330 History of Landscape Architecture (3)
- 11:550:331, 332 Intermediate Landscape Architecture I,II (5,5)
- 11:550:337 Design Communication (3)
- 11:550:340 Planting Design (4)
- 11:550:341 Landscape Architecture Construction I: Site Engineering (4)
- 11:550:342 Landscape Architecture Construction II: Materials and Structures (3)
- 11:550:431, 432 Advanced Landscape Architecture I,II (5,5)
- 11:550:433 Architectural Design (3)
- 11:550:441 Construction Implementation and Practice (4)
- 11:776:202 Applied Physiology of Horticultural Crops (3)

Two of the following science courses (6–8):

- 11:372:442 Applied Principles of Hydrology (3)
 - 11:375:102 Soils and Society (3)
 - 11:375:360 Soils and Water (4)
 - 11:704:403 Urban Forestry (3)
 - 11:776:202 Applied Physiology of Horticultural Crops (3)
 - 11:776:304 Turfgrass Management (4)
 - 11:776:404 Soil Management for Sports and Landscape Applications (3)
- An adviser-approved substitute

4. Landscape Industry (48–52)

Required courses (30)

- 11:372:322 Land Measurement and Mapping (3)
- 11:550:231 Introduction to Environmental Design I (5)
- 11:550:233-234 Landscape Plants I,II (3,3)
- 11:550:235 Herbaceous Plants and Landscape (3)
- 11:550:238 Landscape Management and Maintenance (3)
- 11:550:239 Planning and Planting the Residential Environment (3)
- 11:550:340 Planting Design (4)
- 11:776:211 Introduction to Horticulture (3)

Electives (18–22)

Two of the following courses (6–7):

- 11:370:350 Agricultural Entomology and Pest Management (3)
- 11:770:301 General Plant Pathology (3)
- 11:770:391 Diseases of Urban and Forest Trees (1.5)
- 11:776:200 Modern Crop Production (3)
- 11:776:210 Principles of Botany (4)
- 11:776:242 Plant Science (3)
- 11:776:310 Plant Propagation (3)
- 11:776:401 Postharvest Physiology of Horticultural Crops (3)
- 11:776:439 Nursery Crop Production (3)

Two of the following science courses (6–8):

- 11:372:442 Applied Principles of Hydrology (3)
- 11:375:102 Soils and Society (3)
- 11:375:360 Soils and Water (4)
- 11:704:403 Urban Forestry (3)
- 11:776:202 Applied Physiology of Horticultural Crops (3)
- 11:776:304 Turfgrass Management (4)
- 11:776:404 Soil Management for Sports and Landscape Applications (3)

An adviser-approved substitute science course

Two of the following courses (6):

- 33:010:272 Introduction to Financial Accounting I (3)
 - 11:373:231 Agribusiness Marketing (3)
 - 11:373:361 Land Economics (3) or 11:373:241 Agribusiness Management (3)
 - 10:975:440 Introduction to Real Estate (3)
- An adviser-approved substitute business course

IX. Unspecified Electives (5–32 credits)

**ENVIRONMENTAL POLICY,
INSTITUTIONS, AND BEHAVIOR 374**

Degree: B.S.

Coordinator: George E.B. Morren (morren@crssa.rutgers.edu)

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Bonnie J. McCay	(ME)	COB 210	2-9153 (314)
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The program in environmental policy, institutions, and behavior is concerned with the human dimensions of environmental problems. It addresses such issues as how human actions affect the environment; how societies adapt to changes in natural resource availability; and how individuals, nations, and international agencies respond to environmental hazards. Courses in the program deal with local, regional, and national differences in the use of resources; with social and environmental aspects of health and illness; with alternative strategies for environmental management; with the ethical, moral, and legal dimensions of environmental and resources issues; and with the roles of governmental and nongovernmental agencies in environmental affairs.

To understand these topics, students are exposed to a multidisciplinary view of the environment and draw upon concepts from a variety of fields, including anthropology, ecology, economics, geography, sociology, political science, and psychology.

The objectives of the curriculum are to teach basic concepts and methods from the social, biological, and physical sciences as they relate to the interactions among people and the environment; to train students in the techniques of empirical research; to provide opportunities for experiences in "real world" situations; to guide students in acquiring practical skills such as environmental assessment, professional writing, data analysis, and demographic analysis; and to broaden students' knowledge regarding environmental problems and how people cope with them.

Graduates of the program are prepared for a variety of career paths. In addition, graduates are prepared for graduate study in many social science and some natural science disciplines.

The curriculum offers four options:

Health and Environmental Policy. This option focuses on the links between the environment and health. Students learn to understand health and nutrition as both biological phenomena and products of social, behavioral, and cultural influences. Students are prepared for further training in the health professions, as well as for graduate studies in the social sciences or public health.

Individual Option. This option is for students who wish to develop their own specialized program. Their programs must focus on a particular topic, area of application, or body of knowledge concerned with environmental policy, environmental health, institutions, or behavior. Students must identify, in writing and with the aid of a faculty adviser, the specific intellectual and vocational goals of the individualized program.

International Environmental and Resource Policy. This option focuses on the political, scientific, and economic dimensions of global environmental and resource issues. Particular attention is given to the role of international institutions. Students are prepared for careers in government, industry, or nonprofit organizations, as well as for graduate or professional studies in political science, law, and international development.

United States Environmental and Resource Policy. This option encompasses the political, scientific, institutional, and economic dimensions of environmental and resource policy development in the United States. Students are prepared for careers in government, industry, or nonprofit

organizations, as well as for graduate or professional studies in political science, law, and public administration.

Graduation Requirements for the Major

Students must complete all environmental policy, institutions, and behavior (374) courses with a grade of C or better.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3) *or* an approved 11:374:420–439 topics course

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:103 Principles of Biology (4) *or* 01:119:101 General Biology (4)
- 11:704:351 Principles of Ecology (4)

B. Physical Sciences (3–4 credits)

One of the following courses is recommended.

- 01:460:101 Introductory Geology I: Physical (3)
- 01:460:102 Introductory Geology II: Historical (3)
- 11:628:120 Introduction to Oceanography (3)
- 11:670:202 Elements of Climatology (3)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

- 11:374:101 Introduction to Human Ecology (3)
- 11:374:102 Global Environmental Processes and Institutions (3)

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

- 11:374:322 Environmental Behavior (3) *or* another course suggested in the Degree Requirements chapter

B. Economic Systems (3–6 credits)

- 01:220:103 Introduction to Macroeconomics (3) *or* equivalent
- 11:373:121 Principles and Applications of Microeconomics (3) *or* equivalent
- 11:373:101 Economics, People, and Environment (3) may be substituted in the Health and Environmental Policy and Individualized options.

C. Political Processes (3 credits)

- 11:374:279 Politics of Environmental Issues (3)

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter. Both courses should be completed before the fifth term.

VII. Experience-Based Education (3 credits)

One of the following:

- 11:374:337 Systems Approaches and Interventions in Human Ecology (3)
11:374:491 Readings and Practicum in Human Ecology (3)
11:374:492 Environmental Studies Internship (3)
11:374:493 Environmental Communication Clinic (3)
11:554:424 Practicum in Environmental Protection (3)
An appropriate adviser-approved placement in cooperative education
An appropriate adviser-approved honors project
An appropriate adviser-approved independent study

VIII. Proficiency in Environmental Policy, Institutions, and Behavior (45–67 credits)

A. REQUIRED COURSES (15)

Quantitative Skills (3)

- 01:960:211 Statistics I (3)

Computer and Information Technology Competence (3)

- 11:374:201 Research Methods in Human Ecology (3)

Professional Ethics (3)

- 01:730:250 Environmental Ethics *or* 01:730:105 Current Moral and Social Issues (3) *or* 01:730:249 Medical Ethics (3) *or* 01:730:346 Rights, Justice, and Equality (3)

Additional Requirements (6)

One of the following courses on population issues (3):

- 11:374:269 Population, Resources, and Environment (3)
10:832:417 Introduction to Population Tools and Policy (3) *or* equivalent

One of the following courses on human responses to the environment (3):

- 11:374:322 Environmental Behavior (3)
11:374:325 Environmental Communication (3)
11:374:331 Culture and Environment (3)
11:374:335 Social Responses to Environmental Problems (3)

B. OPTIONS (30–52)

1. Health and Environmental Policy (30)

- 11:374:341 Social and Ecological Aspects of Health and Disease (3)
11:709:255 Nutrition and Health (3)

A course introducing the biological or physiological dimensions of health (3):

- 01:119:150 Biology, Society, and Biomedical Issues (3) *or* 01:146:356 Systems Physiology (3) (recommended for premedical and predoctoral students)

A course presenting the public health perspective (3):

- 10:832:101 Introduction to Policy, Planning, and Health (3) *or* equivalent

A course on epidemiology (3):

- 11:375:403 Principles of Epidemiology (3) *or* 10:832:335 Epidemiology (3) *or* adviser-approved equivalent

A course addressing the social dimensions of health issues (3):

- 01:070:307 Medical Anthropology (3) *or* 01:920:210 Sociology of Medicine and Health Care (3) *or* 01:830:377 Health Psychology (3)

One of the following seminars, selected in consultation with the adviser (3):

- 11:374:420–429 Topics in Environmental and Resource Policy (3)
11:374:430–439 Topics in Health and Environment (3)
11:709:452 Nutrition and Behavior (3)

A planned sequence of three courses on a particular aspect of health, food, and the environment (9):

Suggested areas include public health, environmental/occupational health, the social sciences of health (anthropology, sociology, psychology), food and nutrition, and aging. Written approval of the adviser is required.

2. International Environmental and Resource Policy (36–52)

- 11:373:363 Environmental Economics (3) *or* 01:220:332 Environmental Economics (3)
11:374:301 Environment and Development (3)
11:374:312 Environmental Problems in Historical and Cross-Cultural Perspective (3)
11:374:313 Environmental Policy and Institutions (3)
11:374:314 Human Dimensions of Natural Resource Management (3)
11:374:315 International Environmental Policy (3)
01:790:327 International Political Economy (3) *or* 01:790:319 Issues of American Foreign Policy (3)

A course that focuses on a particular geographical area (3):

This course may be selected from anthropology, geography, history, or political science.

A foreign language (0–16):

Students in the option should demonstrate proficiency in a foreign language by completing either a year of intermediate-level courses or by performance of a foreign language proficiency or placement examination.

One of the following seminars, selected in consultation with the adviser (3):

- 11:374:420–429 Topics in Environmental and Resource Policy (3)
11:374:430–439 Topics in Health and Environment (3)

A planned sequence of three courses on a specific environmental problem (9):

Suggested areas include sustainable agriculture, air pollution, forest conservation and management, land use, marine pollution, fisheries management, and solid waste management. Written approval of the adviser is required.

3. United States Environmental and Resource Policy (36)

- 11:373:363 Environmental Economics (3) *or* 01:220:332 Environmental Economics (3)
11:374:312 Environmental Problems in Historical and Cross-Cultural Perspective (3)
11:374:313 Environmental Policy and Institutions (3)

- 11:374:314 Human Dimensions of Natural Resource Management (3)
 11:375:333 Environmental Law I (3)
 01:790:201 American Government (3) *or* adviser-approved equivalent

Two of the following (6):

- 11:375:334 Environmental Law II (3)
 01:512:323 History of the North American Environment (3)
 01:790:305 Public Policy Formation (3)
 01:790:341 Public Administration: American Bureaucracy (3)
 01:790:342 Public Administration: Policy Making (3)
 01:920:434 Social Science and Public Policy (3)
 10:975:231 Social Public Policy (3)
 10:975:305 U.S. Urban Policy (3)
 10:975:330 Urban Fiscal Policy (3)
 Or adviser-approved equivalents (6)

One of the following seminars, selected in consultation with the adviser (3):

- 11:374:420–429 Topics in Environmental and Resource Policy (3)
 11:374:430–439 Topics in Health and Environment (3)

A planned sequence of three courses on a specific environmental problem (9):

Suggested areas include sustainable agriculture, air pollution, forest conservation and management, land use, marine pollution, fisheries management, and solid waste management. Written approval of the adviser is required.

4. Individual Option (36)

A planned sequence of courses, selected in consultation with a faculty adviser.

The student is required to develop a formal proposal for the individual option that includes the learning goals and lists the specific courses to be taken. This proposal must be approved in writing by the adviser by the beginning of the junior year. The sequence may represent a selection from the courses required for the other three options, or courses from one of the options combined with a Cook College minor (e.g., Science and Agriculture Teacher Education program), or some other well-defined program of study.

IX. Unspecified Electives (12–37 credits)

ENVIRONMENTAL SCIENCES 375

Degree: B.S.

Undergraduate Program Director: Robert L. Tate III (tate@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Donna E. Fennell	(FA)	ENR 231	2-8750
Daniel Gimenez	(GP)	ENR 248	2-9477
William Goldfarb	(GH)	ENR 238	2-1105
Uta Krogmann	(KE)	ENR 246	2-9060
Jerome J. Kukor	(KU)	Foran 318	2-8165 (316)
John Reinfelder	(RG)	ENR 260	2-8013
Marie Siewierski	(SU)	ENR 240	2-9804
Peter F. Strom	(ST)	ENR 228	2-8078
Robert L. Tate III	(TF)	ENR 230	2-9810
Barbara J. Turpin	(TC)	ENR 360	2-9540
Christopher Uchirin	(UA)	ENR 262	2-9444
Lily Y. Young	(YA)	Foran 308B	2-8165 (312)

The environmental sciences program is designed to provide students with an understanding of the application of the biological, chemical, and physical sciences to problems in the environment. Options emphasize the chemical, physical, or biological aspects, and electives allow specialization in the study of air, water, or soils, as well as pollution and treatment sciences, and environmental or occupational health studies.

With the consultation of a faculty adviser, students can design a program to meet requirements for graduate study and provide the basis for a professional career in government, education, consulting, or industry.

Students can meet the requirements for the New Jersey License Examination for Sanitarians by including the following courses in their program:

- 11:375:301 Environment and Health (3)
 11:375:406 Public Health Practice and Administration (3)
 11:375:409 Environmental Statement and Impact (3)
 11:375:455,456 Internship in Environmental Health (2,2)

Recommended

- 11:375:421 Air Pollution (3)
 11:375:430 Hazardous Wastes (3)

Environmental science majors may also complete a joint degree leading to a B.S. in environmental science and a master's degree in public health (M.P.H.). To apply for admission to the master's program, students must have junior status in the environmental science program (64 credits) and a minimum grade-point average of 3.0. Fifteen of the 45 credits required for the M.P.H. may be applied to the 128 credits required for the B.S. in environmental science. Students interested in this opportunity should discuss specific course requirements with Dr. Robert Tate, Undergraduate Program Director for Environmental Science (tate@aesop.rutgers.edu) or Dr. Mark Robson, Chair of the Department of Environmental and Occupational Health (robsonma@umdnj.edu).

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

- 01:355:101 Expository Writing I (3)
01:355:201 Research in the Disciplines (3) *or* 01:355:302
Scientific and Technical Writing (3)

VII. Experience-Based Education (2–6 credits)

- 11:375:431,432 Special Problems in Environmental
Science/Studies (BA,BA) *or* 11:375:455,456
Internship in Environmental Health (2,2) *or*
an appropriate cooperative education place-
ment *or* an independent research project

VIII. Proficiency in the Environmental Sciences (60–71 credits)

A. REQUIRED COURSES (26–31)

Quantitative Skills

See VIII B, Option requirements.

Computer and Information Technology Competence (0–3)

Computer applications are required for environmental sciences courses. Students unfamiliar with basic computer procedures should complete an introductory computer course.

Professional Ethics

Ethical problems in environmental and regulatory fields are addressed throughout the program in both introductory- and advanced-level courses.

Additional Requirements (26–28)

- 11:375:201 Biological Principles of Environmental
Sciences (3)
11:375:202 Chemical Principles of Environmental
Sciences (3)
11:375:203 Physical Principles of Environmental
Sciences (3)
11:375:310 Analytical Environmental Chemistry
Laboratory (2)
11:375:312 Environmental Microbiology Laboratory (2)
11:704:351 Principles of Ecology (4)
01:750:193-194 Physics for the Sciences (4,4) *or*
01:750:203-204 General Physics (3,3)
01:960:211 Statistics I (3) *or* equivalent

B. OPTIONS (34–40)

1. Environmental Science (34–36)

Required courses (28)

- 01:160:307-308 Organic Chemistry (4,4)
01:640:1__-1__ CALC1 and CALC2 (4,4)

At least four of the following (12):

- 11:375:346 Introduction to Atmospheric Chemistry (3)
11:375:407 Environmental Toxicology (3)
11:375:411 Environmental Microbiology (3)
11:375:423 Environmental Fate and Transport (3)
11:375:444 Water Chemistry (3)
11:375:453 Soil Ecology (3)

Electives (6–8)

- 11:115:301 Introductory Biochemistry (3)
01:160:323-324 Physical Chemistry (3,3) *or*
01:160:327-328 Physical Chemistry (4,4)

- 11:375:307 Elements of Solid Waste Management and
Treatment (3)
11:375:333, 334 Environmental Law I,II (3,3)
11:375:360 Soils and Water (4)
11:375:421 Air Pollution (3)
11:375:430 Hazardous Wastes (3)
11:375:445 Problems in Aquatic Environments (3)
11:375:451 Soil Chemistry (3)
11:375:454 Soil Biological Processes (3)
11:375:459 Physical Properties of Soils (3)
11:670:201 Elements of Meteorology (3)
11:680:390 General Microbiology (4)

2. Applied Environmental Science (35–40)

Required courses (26–31)

- 01:160:209 Elementary Organic Chemistry (3) *or*
01:160:307-308 Organic Chemistry (4,4)
[recommended for those considering
graduate study]
11:375:302 Elements of Water and Wastewater
Treatment (3)
11:375:307 Elements of Solid Waste Management and
Treatment (3)
11:375:333 Environmental Law I (3)
11:375:411 Environmental Microbiology (3) *or*
11:375:453 Soil Ecology (3)
11:375:430 Hazardous Wastes (3)
01:640:1__ CALC1 (4)
11:680:390 General Microbiology (4) *or* equivalent

Electives (9)

At least 9 credits in one of the following concentrations:

Concentration in Pollution Science

- 11:375:334 Environmental Law II (3)
11:375:360 Soils and Water (4)
11:375:399 Hazardous Waste Operation and
Emergency Response (1)
11:375:421 Air Pollution (3)
11:375:422 Air Sampling and Analysis (3)
11:375:423 Environmental Fate and Transport (3)
11:375:434 Principles of Industrial Hygiene (3)
11:375:444 Water Chemistry (3)
01:640:1__ CALC2 (4)

Concentration in Environmental Health

- 11:375:301 The Environment and Health (3)
11:375:334 Environmental Law II (3)
11:375:336 Occupational and Community Noise
Control (3)
11:375:360 Soils and Water (4)
11:375:399 Hazardous Waste Operation and
Emergency Response (1)
11:375:403 Principles of Epidemiology (3) *
11:375:406 Public Health Practice and
Administration (3) *
11:375:407 Environmental Toxicology (3)
11:375:421 Air Pollution (3)
11:375:422 Air Sampling and Analysis (3)
11:375:434 Principles of Industrial Hygiene (3)
11:375:435 Introduction to Occupational Safety and
Health (3)
11:375:455,456 Internship in Public Health (2,2) *

* Required for New Jersey license examination for sanitarians.

Concentration in Environmental Science Policy

- 11:372:231 Fundamentals of Environmental Planning (3) *or* 10:975:306 Introduction to Urban and Environmental Planning (3)
- 11:373:363 Environmental Economics (3)
- 11:374:301 Environment and Development (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:315 International Environmental Policy (3)
- 11:374:322 Environmental Behavior (3)
- 11:375:334 Environmental Law II (3)
- 11:375:403 Principles of Epidemiology (3) *or* 11:375:406 Public Health Practice and Administration (3)
- 01:790:305 Public Policy Formation (3) *or* 01:790:341 Public Administration: American Bureaucracy (3) *or* 01:790:342 Public Administration: Policy Making (3)
- 01:790:362 International Law (3)

IX. Unspecified Electives (5–17 credits)

EXERCISE SCIENCE AND SPORT STUDIES 377

Degree: B.S.

Chairperson: David A. Feigley (feigley@rci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Shawn M. Arent	(AC)	Loree 113	2-8669
Mikyle Byrd	(BH)	Loree 111	2-8664
Neil Dougherty	(DN)	Loree 144	2-8673
David A. Feigley	(FR)	Loree 107	2-9525
Myron Finkelstein	(FH)	Loree 112	2-9525
Joanne Hunt	(HW)	Loree 109	2-1130
Susan Kaplowitz	(KH)	Loree 110	2-9525
Linda Sharkey	(SS)	Loree 112	2-8672

Offered in cooperation with the Department of Exercise Science and Sport Studies (Faculty of Arts and Sciences), this program offers four options:

Exercise Physiology. This option provides students with a strong science foundation emphasizing preparation for graduate study or direct entrance into a variety of fields related to exercise physiology, biomechanics, and sport medicine. The program also prepares for direct entrance to upper-level certifications in the rehabilitation and fitness industries.

Exercise Science. This option provides students with a strong science foundation focusing on human anatomy and physiology, emphasizing preparation for specialized graduate study in fields such as physical therapy, occupational therapy, athletic training, physician’s assistant, cardiac rehabilitation, and other subfields of sports medicine. It also permits direct entrance into related careers such as fitness management.

General. This option is available only for students electing exercise science and sport studies as a double major or dual degree program. Their first major must be a program offered by the Cook College faculty.

Sports Management. This option prepares students to enter such fields as sports marketing, sports administration, or sport facilities management. Graduate opportunities also exist in sport management and sport administration.

Departmental Honors

To qualify for departmental honors upon graduation, a student must have attained a cumulative grade-point average of at least 3.4 at the end of the first term of the junior year, with a cumulative average of at least 3.4 in all courses required for the major. By the end of the first term of their junior year, students must apply formally to the department chairperson for admission to the program. In the spring of their junior year, students enroll in an honors seminar in which a research project is designed and developed. In the fall term of their senior year, students whose projects have been approved register for Honors Research in Exercise Science and carry out the research project. Both terms must be successfully completed to receive departmental honors recognition.

Cook College students who qualify for departmental honors may undertake the George H. Cook Scholars Program in conjunction with departmental honors.

Entry Requirements for the Major

To be admitted to the program, students must have a cumulative grade-point average of at least 2.0 and have completed at least three of the courses listed under VIII A and/or VIII B with a minimum grade-point average of 2.0. An interview with the department is required prior to admission to the program.

Degree Requirements for the Major

In order to graduate with a degree in exercise science and sport studies, students must achieve a grade-point average of at least 2.0 in all required courses.

Cook College students also must complete a minor or certificate program offered by the Cook College faculty.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

Courses that meet the introductory life and physical sciences requirement are listed under VIII B, Option requirements.

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (3–6 credits)

See suggested courses in the Degree Requirements chapter. 01:377:324 Movement Experiences for Individuals with Disabilities (3) is required in the exercise science option.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior

Courses that fulfill the human behavior requirement are listed under VIII B, Option requirements.

B. Economic Systems (3–6 credits)

- 11:373:101 Economics, People, and Environment (3)
11:373:121 Principles and Applications of Microeconomics (3) *or* equivalent *and* 01:220:103 Introduction to Macroeconomics (3) are required in the sports management option.

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

- 01:355:101 Expository Writing (3) *and* at least one intermediate or advanced course suggested in the Degree Requirements chapter. Note that 01:355:303 Writing for Business and the Professions (3) *and* 04:192:380 Public Speaking (3) are required in the sport management option.

VII. Experience-Based Education (6 credits)

- 01:377:490, 491 (BA,BA) Internship I in Exercise Science and Sport Studies, Independent Study. Seniors in the exercise science and general options must complete two 3-credit or one 6-credit internship. Seniors in the exercise physiology and sport management options must complete a 6-credit internship.

To be eligible for the internships, students must have completed 90 credits with an overall cumulative grade-point average of at least 2.0 and have completed at least 20 credits in the major with a grade-point average of 2.0 in all major and option requirements.

VIII. Proficiency in Exercise Science and Sport Studies (63.5–99 credits)

A. REQUIRED COURSES (26.5–33.5)

Quantitative Skills (4–8)

- 01:377:275 Statistics and Research Design in Exercise Science (4)
01:640:1__ Precalculus (4) *or* placement in calculus is required in the sport management and general options. At least one term of calculus is required in the exercise physiology and exercise science options.

Computer and Information Technology Competence (3)

- 01:198:110 Introduction to Computers and Their Application (3) *or* equivalent

Professional Ethics (0–3)

- 01:377:406 Management in Exercise Science and Sport (3)
01:377:319 Risk Management for Health and Fitness Professionals may be substituted in the exercise physiology option.

Additional Requirements (19.5)

- 01:377:140 Foundations of Exercise Science and Sport Studies (1.5)

Cook College students majoring in exercise science and sport studies also must complete a minor or certificate program offered by the Cook College faculty (18).

B. OPTIONS (37–65.5)

1. Exercise Physiology (65.5)

Required courses (59.5)

- 01:119:101-102 General Biology (4,4)
01:146:356 Systems Physiology (3)
01:146:357 Systems Physiology Laboratory (1)
01:160:161-162 General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:377:213 Functional Human Anatomy (4)
01:377:303 Neuromechanical Kinesiology (3)
01:377:319 Risk Management for Health and Fitness Professionals (1.5)
01:377:350 Biomechanics (3)
01:377:370 Exercise Physiology (3)
01:377:371 Exercise Physiology Laboratory (1)
01:377:381 Biochemistry of Exercise (3)
01:377:410 Exercise Testing and Prescription (4)
01:377:454 Advanced Exercise Physiology (3)
01:377:496 EKG Use and Interpretation (2)
01:750:193-194 Physics for the Sciences (4,4) *or* equivalent physics courses with laboratories
A course in human behavior (3). See suggested courses in the Degree Requirements chapter.

Electives (6)

Additional 01:377 courses, 3 credits of which must be at the 300 or 400 level and up to 3 credits of which may be minicourses.

2. Exercise Science (58)

Required courses (52)

- 01:119:101-102 General Biology (4,4)
01:146:356 Systems Physiology (3)
01:146:357 Systems Physiology Laboratory (1)
01:160:161-162 General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:377:213 Functional Human Anatomy (4)
01:377:301 Psychology of Sport and Exercise (3)
01:377:303 Neuromechanical Kinesiology (3)
01:377:310 Motor Learning (3)
01:377:324 Movement of Experiences for the Disabled (3)
01:377:370 Exercise Physiology (3)
01:377:371 Exercise Physiology Laboratory (1)
01:750:193-194 Physics for the Sciences (4,4) *or* equivalent (including laboratories)
01:830:101 General Psychology (3)

Electives (6)

- 01:377:___ At least 6 additional credits, 3 of which must be at the 300 or 400 level and up to 3 credits of which may be minicourses

3. Sport Management (49)

Required courses (46)

- 33:010:272 Introduction to Financial Accounting (3)
01:119:103 Principles of Biology (4)
::_: A course in the physical sciences selected from the II B listing in the degree requirements chapter (3)
04:189:101 Introduction to Communication (3) *or* 04:192:201 Interpersonal Communication Processes (3) *or* 04:192:313 Message Design for Public Relations and Organizational Communication (3)

- 04:189:102 Introduction to Media Systems and Processes (3)
- 04:192:380 Public Speaking (3)
- 01:355:303 Writing for Business and the Professions (3)
- 01:377:301 Psychology of Sport and Exercise (3)
- 01:377:305 Sport Sociology (3)
- 01:377:311 Sport Marketing (3)
- 01:377:320 Risk Management in Exercise Science and Sport (3)
- 01:377:323 Sport and the Law (3)
- 01:377:330 Organizational Behavior in Sport Management (3)
- 01:830:101 General Psychology (3)
- 01:920:101 Introduction to Sociology (3)

Electives (6)

- 01:377:___ Exercise science and sport studies electives (3,3)

Up to 3 credits may be minicourses.

4. General Option (37–38)

For Cook College students electing a double major in exercise science and a Cook College program (e.g., nutritional sciences).

Required courses (28–29)

- 01:119:101-102 General Biology (4,4)
- 01:377:213 Functional Human Anatomy (4)
- 01:377:218 Exercise and Health (3)
- 01:377:301 Psychology of Sport and Exercise (3) *or* 01:377:305 Sport Sociology (3)
- 01:377:303 Neuromechanical Kinesiology (3)
- 01:750:193 Physics for the Sciences (4) *or* 01:750:203, 205 General Physics (3) and General Physics Laboratory (1) *or* 01:750:201 Extended General Physics (5)
- 01:830:101 General Psychology (3)

Electives (9)

Students must complete at least 9 additional credits of exercise science and sport studies (377) courses, up to 3 credits of which may be minicourses.

IX. Unspecified Electives (0–32 credits)

FOOD SCIENCE 400

Degree: B.S.

Undergraduate Program Director: Mukund Karwe
(karwe@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
George M. Carman	(CS)	Food Science 203	2-9611 (217)
Mukund Karwe	(KG)	CAFT 221	2-9611 (224)
Tung-Ching Lee	(LL)	CAFT 321-B	2-9611 (236)
Sean Liu	(LS)	Food Science 415	2-9611 (240)
Richard D. Ludescher	(LM)	Food Science 311	2-9611 (231)
Karl Matthews	(MQ)	Food Science 203	2-9611 (219)
Thomas J. Montville	(MV)	Food Science 207	2-9611 (222)
Karen M. Schaich	(SZ)	Food Science 315A	2-9611 (233)
Paul Takhistov	(TP)	Food Science 415	2-9611 (238)
Mikhail Tchikindas	(TK)	Food Science 203	2-9611 (218)
Beverly J. Tepper	(TJ)	Food Science 207	2-9611 (221)
Kit Yam	(YB)	Food Science 415	2-9611 (241)

Food science is the study of the chemical, biological, and engineering aspects of food and its components. While this curriculum applies principles acquired in biology, chemistry, physics, and mathematics to foods, attention also is

given to the development of important problem-solving skills, giving students experience in reasoning and the use of scientific and mathematical techniques. Attention also is devoted to current issues, innovations, and ethical issues in foods and food processing. Finally, students are given an opportunity to utilize their creative abilities in a course devoted to development of new foods and food products.

The program offers four options. Food biological technologies and food chemistry are recommended for students seeking careers in basic or applied food research, as well as for those preparing for graduate or professional study in the sciences. The food operations/management option and the food science and management economics option directly prepare students for careers in the food industry.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences

Specific courses that fulfill the introductory life sciences requirement are listed under VIII B Option required courses.

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems (3–6 credits)

See suggested courses in the Degree Requirements chapter. Both 11:373:121 Principles and Applications of Microeconomics (3) and 01:220:103 Introduction to Macroeconomics (3) *or* equivalents are required of students in the Food Operations/Management and Food Science and Management Economics options.

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (3 credits)

Students are encouraged to seek employment in the food industry, particularly during the summer between junior and senior years. Credit may be obtained for an internship through the Cook College cooperative education program.

Students also may fulfill this requirement by working in the laboratory of a professor in the department (11:400:493,494 Research Problems in Food Science).

An additional adviser-approved cooperative education placement may be substituted for an elective course in all options.

VIII. Proficiency in Food Science (78–93 credits)

A. REQUIRED COURSES (33–40)

Quantitative Skills (11)

- 01:640:135 Calculus I (4) and 01:640:136 Calculus II (4) or 01:640:138 Calculus II for the Biological Sciences (4)
- 01:960:401 Basic Statistics for Research (3) or equivalent

Computer and Information Technology Competence (0–3)

- 01:198:110 Introduction to Computers and Their Application (3) or equivalent or appropriate experience

Professional Ethics (2)

- 11:400:314 Current Issues in Food Science and Food Law (2)

Additional Requirements (20–24)

- 11:400:201 Principles of Food Science (3)
- 11:400:411 Food Chemistry (3)
- 11:400:412 Food Product Development (3)
- 11:400:423 Food Microbiology (3)
- 11:680:390 General Microbiology (4)
- 01:750:193-194 Physics for the Sciences (4,4) [01:750:161 Elements of Physics (4) may be substituted in the Food Science and Management Economics option.]

B. OPTIONS (44.5–53)

1. Food Biological Technologies (49–53)

Required courses (43–46)

- 11:115:301 Introductory Biochemistry (3) and 11:115:313 Introductory Biochemistry Laboratory (1) or 11:115:403 General Biochemistry (4) and 11:115:413 Experimental Biochemistry (3)
- 01:119:101-102 General Biology (4,4)
- 01:160:307-308 Organic Chemistry (4,4)
- 01:160:311 Organic Chemistry Laboratory (2)
- 11:400:104 Food and Health (3) or equivalent
- 11:400:202 Principles of Food Science Laboratory (2)
- 11:400:304 Food Analysis (4)
- 11:400:401 Introduction to Food Engineering Fundamentals (4)
- 11:400:402 Introductory Food Engineering Processes (4)
- 11:400:419 Food Physical Systems (3)
- 11:400:424 Food Microbiology Laboratory (1)

Electives (6–7)

- 11:115:404 General Biochemistry (3)
- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:414 Experimental Biochemistry (2.5)
- 11:115:422 Biochemical Mechanisms of Toxicology (3)
- 11:115:452 Biochemical Separations (3)
- 11:126:406 Plant Gene Transfer (4)
- 11:126:413 Plant Molecular Biology (3)
- 11:126:427 Methods in Recombinant DNA Technology (4)
- 11:126:481 Molecular Genetics (3)
- 11:126:482 Molecular Genetics Laboratory (3)

- 01:146:474 Immunology (3)
- 01:146:475 Immunology Laboratory (1)
- 11:400:405 Sensory Evaluation of Foods (3)
- 01:447:380 Genetics (4)
- 11:776:401 Postharvest Physiology of Horticultural Crops (3)
- 11:776:452 Plant Tissue Culture (3)

2. Food Chemistry (44.5–48)

Required courses (39–42)

- 11:115:301 Introductory Biochemistry (3) and 11:115:313 Introductory Biochemistry Laboratory (1) or 11:115:403 General Biochemistry (4) and 11:115:413 Experimental Biochemistry (3)
- 01:119:103 Principles of Biology (4) or equivalent
- 01:160:307-308 Organic Chemistry (4,4)
- 01:160:311 Organic Chemistry Laboratory (2)
- 11:400:104 Food and Health (3) or equivalent
- 11:400:202 Principles of Food Science Laboratory (2)
- 11:400:304 Food Analysis (4)
- 11:400:401 Introduction to Food Engineering Fundamentals (4)
- 11:400:402 Introductory Food Engineering Processes (4)
- 11:400:419 Food Physical Systems (3)
- 11:400:424 Food Microbiology Laboratory (1)

Electives (5.5–6)

- 11:115:404 General Biochemistry (3)
- 11:115:410 Physical Biochemistry (3)
- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:414 Experimental Biochemistry (2.5)
- 11:115:422 Biochemical Mechanisms of Toxicology (3)
- 11:115:452 Biochemical Separations (3)
- 11:126:413 Plant Molecular Biology (3)
- 01:160:251 Analytical Chemistry (3)
- 11:400:405 Sensory Evaluation of Foods (3)
- 11:400:410 Nutraceuticals in Functional Foods, Herbs, and Supplements (3)

3. Food Operations/Management (45–48)

Required courses (39–42)

- 11:115:301 Introductory Biochemistry (3) and 11:115:313 Introductory Biochemistry Laboratory (1) or 11:115:403 General Biochemistry (4) and 11:115:413 Experimental Biochemistry (3)
- 01:119:103 Principles of Biology (4) or equivalent
- 01:160:209 Elementary Organic Chemistry (3) or equivalent
- 01:160:211 Elementary Organic Chemistry Laboratory (1) or equivalent
- 11:400:104 Food and Health (3) or equivalent
- 11:400:202 Principles of Food Science Laboratory (2)
- 11:400:304 Food Analysis (4)
- 11:400:401 Introduction to Food Engineering Fundamentals (4)
- 11:400:402 Introductory Food Engineering Processing (4)
- 11:400:405 Sensory Evaluation of Foods (3)
- 11:400:419 Food Physical Systems (3)
- 11:400:421 Hazard Control in Food Processes (3)
- 11:400:424 Food Microbiology Laboratory (1)

Electives (6)

- 11:373:231 Agribusiness Marketing (3)
- 11:373:241 Agribusiness Management (3)
- 11:373:331 Economics of Food Marketing Systems (3)
- 11:373:341 Management: Human Systems Development (3)

- 11:400:410 Nutraceuticals in Functional Foods, Herbs, and Supplements (3)
 14:540:333 Quality Control (3)
 01:960:___ Statistics (excluding 960:211 and 401) (3)

4. Food Science and Management Economics (45–47)

- 33:010:272 Introduction to Financial Accounting (3)
 01:119:101-102 General Biology (4,4)
 01:160:209 Elementary Organic Chemistry (4)
 11:373:210 Business Decision Computer Tools (4) *or*
 01:198:170 Computer Applications for Business (3)
 11:373:231 Agribusiness Marketing (3)
 11:373:241 Agribusiness Management (3) *or*
 11:373:341 Management: Human Systems Development (3)
 11:373:323 Public Policy toward the Food Industry (3) *or*
 11:373:371 Food Health and Safety Policy (3)
 11:373:351 Agribusiness Finance I (3)
 11:373:3__ Food Systems Management and Operations (3)
 11:373:4__ Agribusiness Strategy (3)
 11:400:405 Sensory Evaluation of Foods (3)
 11:400:4__ Food Processing (3)

IX. Unspecified Electives (0–8)

GEOGRAPHY 450

Degree: B.A.

Curriculum Coordinator: David A. Robinson (drobins@rci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
David A. Robinson	(RB)	Lucy Stone Hall B230	5-4741

Geography combines aspects of natural and social sciences to analyze processes that influence, and to resolve problems that arise from, human use or modification of natural and built environments. Offered in cooperation with the Department of Geography (Faculty of Arts and Sciences), the program provides skills for direct entry to jobs in public agencies and private firms concerned with a wide range of environmental and social research, planning, development, and management activities.

The program in geography has no formal options, but students are strongly encouraged to select electives from one of the following areas of emphasis: environmental systems and global change, environment and society, urban and international restructuring.

Degree Requirements for the Major

Cook College students majoring in geography also must complete a minor or certificate program offered by the Cook College faculty.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4–8)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

B. Physical Sciences (6)

- 01:450:101 Earth Systems (3)
 01:450:102 Transforming the Global Environment (3)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

- 01:450:103 Human Geography: Space, Place, and Location (3)
 01:450:205 World Cultural Regions (3)

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (3 credits)

- 01:450:485,486 Internship in Geography (BA,BA) *or*
 01:450:491,492 Geographic Problems (3,3)
or equivalent independent research project *or* appropriate placement in cooperative education

VIII. Proficiency in Geography (54–55 credits)

A. REQUIRED COURSES (39–40)

Quantitative Skills (3)

- 01:960:211 Statistics I (3) *or* equivalent

Computer and Information Technology Competence (3)

- 01:450:320 Spatial Data Analysis (3)

Professional Ethics (3)

- 01:730:250 Environmental Ethics (3)

Additional Requirements (30–31)

- 01:450:330 Geographical Methods (3)
 01:450:470 History and Theory of Geography (3)

One additional methods course, selected from the following (3–4):

- 01:450:321 Geographic Information Systems (3)
 01:450:322 Remote Sensing (3)
 01:450:355 Principles of Cartography (4)
 01:450:356 Advanced Cartography (4)
 01:450:357 Spatial Data Representation and Display (3)

One regional geography course elected from the following (3):

- 01:450:332 Newly Independent States and Eastern Europe (3)
 01:450:334 Western Europe (3)
 01:450:335 Caribbean Borderlands (3)
 01:450:336 Latin America (3)
 01:450:338 Africa (3)
 01:450:341 South Asia and the Middle East (3)
 01:450:342 East Asia (3)
 A minor or certificate program offered by Cook College (18)

B. ELECTIVES (15)

At least 15 additional credits, with at least three courses at the 300 or 400 level. (See Geography 450 in the Programs of Study for Liberal Arts Students chapter for a complete listing of courses.) Where appropriate, majors are encouraged to substitute independent research projects under faculty supervision for up to 6 elective credits.

IX. Unspecified Electives (31–32 credits)

GEOLOGICAL SCIENCES 460

Degree: B.S.

Chairperson: Kenneth G. Miller (kgm@rci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Gail M. Ashley	(AG)	Wright Labs 233B	5-2221
Paul Falkowski	(FG)	IMCS 318D	2-5444 (370)
Mark D. Feigenson	(FK)	Wright Labs 339A	5-3149
Claude T. Herzberg	(HH)	Wright Labs 344	5-3154
Roger H. Hewins	(HG)	Wright Labs 343	5-3232
Dennis V. Kent	(KL)	GSLB	5-7049
George R. McGhee	(MR)	Wright Labs 242	5-3832
Kenneth G. Miller	(MN)	Wright Labs 246	5-3622
Peter Rona	(RN)	IMCS 204E	2-6555 (241)
Yair Rosenthal	(RQ)	IMCS 119C	2-6555 (250)
Roy W. Schlische	(SB)	Wright Labs 234	5-3142
Robert M. Sherrell	(SI)	IMCS 211D	2-6555 (252)
Carl C. Swisher	(SG)	Wright Labs 345	5-5363
Martha Oliver Withjack	(WL)	Wright Labs 239A	5-6974
James Wright	(WJ)	Wright Labs 238	5-5722

Offered in cooperation with the Department of Geological Sciences (Faculty of Arts and Sciences), this curriculum provides students with the principles that govern the processes that operate within and on the earth. It offers flexibility in the preparation for career objectives, which might include participation in the environmental/hydrogeology area, marine geology, quaternary geology, classical geology, or preparation for graduate studies.

Students planning professional careers in geology, including graduate study, should take additional courses in mathematics, physics, chemistry, or biology. A list of suggested courses is available in the department office. For more information, see the geological sciences listing in the Programs of Study for Liberal Arts Students section.

Degree Requirements for the Major

Students electing the geology option of the geological sciences major also must complete a minor or certificate program offered by the Cook College faculty.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4 credits)

- 01:119:103 Principles of Biology (4) *or* equivalent

B. Physical Sciences (17 credits)

- 01:160:161-162 General Chemistry (4,4)
 01:160:171 Introduction to Experimentation (1)
 01:750:203-204 General Physics (3,3)
 01:750:205-206 General Physics Laboratory (1,1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (3 credits)

- 01:460:410 Field Geology (3)

VIII. Proficiency in the Geological Sciences (55–69 credits)

A. REQUIRED COURSES (61)

Quantitative Skills (8)

- 01:640:1__ ,1__ CALC1 and CALC2 (4,4)

Computer and Information Technology Competence

Computer applications in the geological sciences are emphasized in several required upper-level courses.

Professional Ethics

Ethical considerations for professional geologists are addressed throughout the advanced courses.

Additional Requirements (53)

- 01:460:101 Introductory Geology I: Physical (3)
 01:460:102 Introductory Geology II: Historical (3)
 01:460:103 Introductory Geology Laboratory (1)
 01:460:301 Mineralogy (4)
 01:460:302 Petrology (4)
 01:460:303 Paleontology (4)
 01:460:307 Structural Geology (4)
 01:460:340 Sedimentology (4)
 01:460:341 Stratigraphy (4)
 01:460:412 Introduction to Geophysics (4)

A minor or certificate program offered by the Cook College faculty also must be completed (18).

IX. Unspecified Electives (11 credits)

INDEPENDENT MAJOR 554

Degree: B.S. or B.A.

Coordinator: Barbara M. Goff, Loree Annex, Room 038, 932-9266
(goff@aesop.rutgers.edu)

Cook College students may elect to design an independent major program if none of the existing undergraduate programs satisfies their needs. Students considering submitting a proposal for an independent major should initially consult the program coordinator for instructions.

Proposals are submitted through the coordinator to the college's Curriculum and Educational Policy Committee, from which they are forwarded to the Cook College faculty for approval. Proposals must include a rationale for the program, the degree sought, a list of courses taken (and to be taken) in fulfillment of the college's degree requirements, and the signature of a faculty member who has agreed to serve as adviser. Students ordinarily should submit proposals prior to the beginning of the junior year.

JOURNALISM AND MEDIA STUDIES 567

Degree: B.A.

Coordinator: Barbara Munson Goff (goff@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Marsha Bergman	(BX)	SCILS 108	2-7500 (8150)
Barbara M. Goff	(GB)	Loree 038	2-9266
Steven A. Miller	(MK)	SCILS 102	2-7500 (8165)

Offered by Cook College in cooperation with the Department of Journalism and Media Studies (School of Communication, Information and Library Studies), the curriculum offers a dynamic program of skills and conceptual courses devoted to the practice and social impact of journalism. Course offerings enhance understanding of the historical, legal, political, and critical dimensions of journalism as practiced in a free and democratic society. The program, as offered through Cook College, provides an opportunity for students to develop expertise that will contribute to the public understanding and discussion of issues in the life sciences and environment.

While all majors in journalism and media studies are considered news-editorial students, they may focus their course work in print, broadcast, or the media studies area. Students also may elect to pursue a research thesis and/or internship.

Journalism is a 30-credit major. Students are encouraged to pursue further study of the arts and sciences and more specialized areas of expertise. Cook College students are further required to complete a minor or certificate program offered by the Cook College faculty. Communication courses (04:189) are not included in the 30-credit limit on journalism courses (04:567).

Entry Requirements

To declare a major in journalism and media studies, students must apply for admission to the School of Communication, Information and Library Studies after they have completed 04:189:102 and either 04:189:101 or 04:189:103. Students also must have successfully completed a term of expository writing (01:355) prior to applying. A personal statement and transcript are necessary to complete the application.

Degree Requirements for the Major

In order to graduate with a degree in journalism and media studies, students must achieve a grade of C or better in all journalism and media studies courses taken for the major. See the Journalism and Media Studies listing in the School of Communication, Information and Library Studies chapter of this catalog for additional department policies.

Cook College students also must complete a minor or certificate program offered by the Cook College faculty.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences (7 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

- 04:567:334 Women, Minorities, and the Mass Media (3) and/or a course/courses suggested in the Degree Requirements chapter

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter. Selection of courses may be determined by the student's choice of minor or certificate program.

VI. Oral and Written Communication

Specific courses that fulfill the oral and written communication requirement are listed under VIII A, required courses for competence in journalism and media studies.

VII. Experience-Based Education (0–3 credits)

The journalism internship or journalism thesis option fulfills this requirement. Other students may fulfill the requirement with an appropriate, adviser-approved placement in cooperative education or independent research project.

VIII. Proficiency in Journalism and Media Studies (45–60 credits)

A. REQUIRED COURSES (45)

Quantitative Skills (3)

01:960:___ One term of statistics or equivalent social science research methods course

Computer and Information Technology Competence

Students receive computer instruction in the journalism skills courses.

Professional Ethics (3)

04:567:480 Media Ethics and Law (3)

Additional Requirements (39)

- 04:189:101 Introduction to Communication and Information Systems and Processes (3) *or* 04:189:103 Information Technology and Informatics (3)
- 04:189:102 Introduction to Media Systems and Processes (3)
- 01:355:101 Expository Writing I (3) *or* equivalent
- 04:567:324 News Reporting and Writing (3)
- 04:567:325 Writing and Editing for Print Media (3) *or* 04:567:310 Broadcast Newswriting (3)

Two of the following conceptual courses, at least one of which must be at the 300 or 400 level (6):

- 04:567:278 News Media and Government in America (3)
- 04:567:334 Women, Minorities, and the Mass Media (3)
- 04:567:335 Mass Communication and the American Image (3)
- 04:567:350 Development of Mass Media (3)
- 04:567:379 Media and Politics (3)
- 04:567:420 Global News (3)
- 04:567:423 Communication Law (3)
- 04:567:458 Media, Government, and Politics (3)
- 04:567:464 Mass Media Management (3)
- 04:567:470 Critical Analyses of News (3)
- 04:567:475 International Media (3)

A minor or certificate program offered by Cook College (18) also must be completed.

B. OPTIONS (0–15)

1. General (15)

Students may complete the program with 15 additional credits of journalism and media studies (04:567) courses.

2. Journalism Internship (0–6)

A professional internship is strongly recommended for students considering careers in journalism and mass media. The internship is limited to students who have completed five courses in journalism, three of which must be in skills courses, with a grade of C or better, have completed at least 75 degree credits with a cumulative grade-point average of 2.5 or better, and have achieved a 2.75 grade-point average in all journalism and media studies courses.

3. Honors Program (6)

Journalism and media studies majors with a cumulative grade-point average of 3.2 or better may apply for the department's honors program. The honors program involves two formal terms of work: an honors seminar

(04:567:489), typically in the junior year, and an honors project or thesis (04:567:490) in the senior year. The thesis entails independent original research (qualitative or quantitative).

Students may participate simultaneously in the honors program of their college (the George H. Cook Scholars Program).

IX. Unspecified Electives (32–50)

Unspecified electives may be taken in any area except journalism and media studies.

MARINE SCIENCES 628

Degree: B.S.

Coordinator: Judith P. Grassle (jgrassle@imcs.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Kenneth W. Able	(AK)	Marine Field Station	609/296-5260 (230)
Robert J. Chant	(CG)	IMCS 111C	2-6555 (544)
Colomban de Vargas	(DB)	IMCS 236	2-6555 (339)
Paul Falkowski	(FG)	IMCS 318D	2-6555 (370)
Scott M. Glenn	(GK)	IMCS 111C	2-6555 (506)
Judith P. Grassle	(GE)	IMCS 309C	2-6555 (351)
Dale B. Haidvogel	(HD)	IMCS 214D	2-6555 (256)
Michael J. Kennish	(KP)	IMCS 204D	2-8959 (240)
Lee Kerkhof	(KC)	IMCS 305C	2-6555 (335)
James R. Miller	(MJ)	IMCS 111D	2-6555 (545)
Kenneth G. Miller	(MN)	Wright Labs 246	5-3622
Karl F. Nordstrom	(NC)	IMCS 103B	2-6555 (502)
John A. Quinlan	(QA)	IMCS 309D	2-6555 (549)
Yair Rosenthal	(RQ)	IMCS 119C	2-6555 (250)
Oscar Schofield	(SH)	IMCS 318C	2-6555 (548)
Robert M. Sherrell	(S1)	IMCS 211D	2-6555 (252)
Gary L. Taghon	(TG)	IMCS 114D	2-6555 (547)
John L. Wilkin	(WE)	IMCS 211C	2-6555 (251)

Marine science is the study of the marine environment and its interactions with the earth, the biosphere, and the atmosphere. It is therefore an interdisciplinary science requiring a knowledge of the principles of physics, geology and geophysics, mathematics, chemistry, and biology. A major in marine sciences provides students with a broad curriculum in the sciences, which demonstrates how the different disciplines can be brought to bear on understanding marine processes and managing ocean resources wisely.

The major prepares students for graduate work in oceanography or one of the basic disciplines, civil service careers in environmental management, employment in the many applied environmental and marine science fields, or teaching in the secondary schools.

The marine science courses emphasize improvement of oral and written communication skills and facility in accessing, reading, and understanding the current primary literature in marine sciences. Many of the courses include hands-on, experiential learning in the laboratory or the field. Students also are required to complete the experience-based education requirement with at least one term or summer of supervised, independent research.

The program includes the following options:

Marine Biology/Biological Oceanography. This option prepares students for professional opportunities or graduate study in oceanography or the biological sciences. Concentrations within the option permit students to focus on different levels of biological organization: at the molecular, cellular, organismic, community, or ecosystem level.

Depending on their choice of electives, students also may fulfill the requirements of a major in the biological sciences or ecology and natural resources.

Marine Chemistry. This option prepares students for professional opportunities or graduate study in oceanography or chemistry. Students who elect 6.5 additional credits of chemistry and 3 additional credits of mathematics also may fulfill the requirements of a major in chemistry. (Beginning with the class of 2005, chemistry majors in options B, C, and D must complete at least one term of biochemistry at the 400 level for ACS certification.)

Marine Geology. This option prepares students for graduate study in oceanography, geology, environmental science, or an allied field, as well as for immediate employment. Students electing three additional courses in geology also may fulfill the requirements for the major in geological sciences.

Physical Oceanography. This option prepares students for graduate study in physical oceanography, meteorology, fluid dynamics, or a related field, as well as immediate employment in environmental agencies or consulting firms and technical positions in marine sciences.

Graduation Requirements for the Major

Students majoring in marine sciences must have a cumulative grade-point average of 2.0.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (6–9 credits)

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems (3 credits)

See suggested courses in the Degree Requirements chapter.

Students considering the fisheries science certificate should note that microeconomics is a prerequisite for 11:373:362 Natural Resource Economics (3) and 11:373:363 Environmental Economics (3).

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (6 credits)

- 11:628:497,498 Special Problems in Marine and Coastal Sciences (BA,BA) or an equivalent independent research or cooperative education placement which includes both oral and written presentations of scientific results

VIII. Proficiency in Marine Sciences (52–74.5 credits)

A. REQUIRED COURSES (10)

Quantitative Skills

See VIII B, Option requirements.

Computer and Information Technology Competence

See VIII B, Option requirements.

Professional Ethics

Ethical issues in marine sciences are addressed throughout the program in both introductory and advanced courses, especially within the framework of the experience-based education requirement.

Additional Requirements (10)

- 11:628:320 Dynamics of Marine Ecosystems (4)
- 11:628:364 Oceanographic Methods and Data Analysis (3)
- 01:960:401 Basic Statistics for Research (3)

B. OPTIONS (42–64.5)

1. Marine Biology/Biological Oceanography (44–54)

- 01:160:307-308 Organic Chemistry (4,4) or 01:160:315-316 Principles of Organic Chemistry (4,4) or 01:160:209 Elementary Organic Chemistry (3) and 01:694:301/11:115:301 Introductory Biochemistry (3) and 01:694:313/11:115:313 Introductory Biochemistry Laboratory (1)
- 01:198:110 Introduction to Computers and Their Application (3) or equivalent
- 01:447:380 Genetics (4) or 11:776:305 Plant Genetics (4)
- 11:628:462 Ocean Ecology (4)
- 01:640:1__,1__ Two terms of calculus (4,4)
- 11:704:351 Principles of Ecology (4)
- 01:750:193-194 Physics for the Sciences (4,4) or 01:750:203-204 General Physics (3,3) and 01:750:205-206 General Physics Laboratory (1,1)

One of the following (3–4):

- 01:146:356 Systems Physiology (3) and 01:146:357 Systems Physiology Laboratory (1)
- 01:447:498 Bacterial Physiology (3)
- 11:776:382 Plant Physiology (4)

One of the following (3–4):

- 11:628:321 Ichthyology (4)
- 11:680:390 General Microbiology (4)

- 11:704:323 Ornithology (4)
- 11:704:324 Invertebrate Zoology (4)
- 11:704:325 Vertebrate Zoology (4)
- 11:770:402 Mycology: Fungi in the Environment (3)

One of the following (3-4):

- 11:628:476 History of the Earth System (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)
- 11:704:240 Behavioral Biology (4)
- 11:704:486 Principles of Evolution (3)

At least 4 credits from the following (4-6):

- 11:628:302 Marine Ecosystems Research (3)
- 11:628:303 Oceanographic Scientific Inquiry (3)
- 11:628:305 Field Course: Coral Reefs (3)
- 11:628:309 Molecular Oceanography (3)
- 11:628:317 Aquaculture (3)
- 11:628:340 Identification of Marine Invertebrates (2)
- 11:628:341 Hydrothermal Vents (3)
- 11:628:342 Marine Conservation (3)
- 11:628:451 Physical Oceanography (4)
- 11:628:472 Chemical Oceanography (4)

2. Marine Chemistry (55.5-64.5)

Required courses (52.5-60.5)

- 01:160:251 Analytical Chemistry Laboratory (3)
- 01:160:307-308 Organic Chemistry (4,4) *or* 01:160:315-316 Principles of Organic Chemistry (4,4)
- 01:160:311 Organic Chemistry Laboratory (2)
- 01:160:323-324 Physical Chemistry (3,3) *or*
 - 01:160:327-328 Physical Chemistry (4,4) *or*
 - 01:160:341-342 Physical Chemistry: Biochemical Systems (3,3)
- 01:160:329 Experimental Physical Chemistry (2.5)
- 01:160:348 Instrumental Analysis (3)
- 11:628:472 Chemical Oceanography (4)
- 01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4)
- 01:640:251 Multivariable Calculus (4)
- 01:750:201-202 Extended General Physics (5,5) *or*
 - 01:750:203-204 General Physics (3,3) *and*
 - 01:750:205-206 General Physics Laboratory (1,1) *or* equivalent

At least 4 credits from the following (4-6):

- 11:628:302 Marine Ecosystems Research (3)
- 11:628:303 Oceanographic Scientific Inquiry (3)
- 11:628:305 Field Course: Coral Reefs (3)
- 11:628:309 Molecular Oceanography (3)
- 11:628:317 Aquaculture (3)
- 11:628:340 Identification of Marine Invertebrates (2)
- 11:628:341 Hydrothermal Vents (3)
- 11:628:342 Marine Conservation (3)
- 11:628:451 Physical Oceanography (4)
- 11:628:462 Ocean Ecology (4)

Electives (3-4)

- 01:160:439 Physical Chemistry of the Environment (3)
- 11:375:416 Chemical Reactions in the Environment (3)
- 11:375:444 Water Chemistry (3)
- 11:375:451 Soil Chemistry (4)
- 01:460:101 Introductory Geology: Physical (3)

- 01:460:401 Introduction to Geochemistry (4)
- 01:460:417 Environmental Geochemistry (3)
- 11:670:323 Thermodynamics of the Atmosphere (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)

3. Marine Geology (42-58)

- 14:440:127 Computers for Engineers (3) *or* 01:460:418 Geological Modeling (3) *or* equivalent
- 01:460:101 Introductory Geology: Physical (3)
- 01:460:103 Introductory Geology Laboratory (1)
- 01:460:312 Introduction to Geophysics (4)
- 01:460:330 Sedimentary Geology (4) *or* 01:460:340 Sedimentology (4) *and* 01:460:341 Stratigraphy (4)
- 01:460:331 Fundamentals of Mineralogy and Petrology (4) *or* 01:460:301 Mineralogy (4) *and* 01:460:302 Petrology (4)
- 01:460:451 Marine Geology (3)
- 01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4)
- 01:750:193-194 Physics for the Sciences (4,4) *or*
 - 01:750:203-204 General Physics (3,3) *and*
 - 01:750:205-206 General Physics Laboratory (1,1)

One of the following courses (4):

- 11:628:451 Physical Oceanography (4)
- 11:628:462 Ocean Ecology (4)
- 11:628:472 Chemical Oceanography (4)

One of the following (3-4):

- 01:460:303 Paleontology (4)
- 01:460:307 Structural Geology (4)
- 01:460:401 Introduction to Geochemistry (4)
- 01:460:402 Ore Deposits (3)
- 01:460:428 Hydrogeology (3)
- 01:460:453 Paleocology (3)
- An adviser-approved equivalent

One of the following (3):

- 01:450:417 Coastal Geomorphology (3)
- 01:460:417 Environmental Geochemistry (3)
- 11:628:476 History of the Earth System (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)

An adviser-approved equivalent

4. Physical Oceanography (46-50)

- 01:198:323 Numerical Analysis and Computing (4)
- 14:440:127 Introduction to Computers for Engineers (3)
- 11:628:451 Physical Oceanography (4)
- 01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4)
- 01:640:251 Multivariable Calculus (4)
- 01:640:252 Elementary Differential Equations (3) *or* 01:640:244 Differential Equations for Engineering and Physics (4)
- 01:750:201-202 Extended General Physics (5,5) *or*
 - 01:750:203-204 General Physics (3,3) *and*
 - 01:750:205-206 General Physics Laboratory (1,1) *or* equivalent

Four of the following courses, with at least one from each group (12–13):

Group A

- 01:640:250 Introduction to Linear Algebra (3)
- 01:640:421 Advanced Calculus for Engineers (3)
- 14:650:312 Fluid Mechanics (3)

Group B

- 11:628:452 Geophysical Data Analysis (3)
- 11:628:462 Ocean Ecology (4) *or* 11:628:472 Chemical Oceanography (4)
- 11:670:323 Thermodynamics of the Atmosphere (3)
- 11:670:324 Dynamics of the Oceans and Atmosphere (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)

IX. Unspecified Electives (0–21 credits)

METEOROLOGY 670

Degree: B.S.

Coordinator: Robert Harnack (*harnack@envsci.rutgers.edu*)

Adviser	Code	Office	Phone (Ext.)
Anthony Broccoli	(BT)	ENR 229	2-9817
Robert Harnack	(HA)	ENR 356	2-9841
Alan Robock	(RP)	ENR 225	2-9478
Dana Lane Veron	(VL)	ENR 227	2-9081

This curriculum provides a firm foundation in the tools and concepts of the atmospheric sciences. The program prepares students to contribute to the solution of environmental problems, either through immediate employment or through further study at the graduate level.

Graduation Requirements for the Major

To enter meteorology courses at the 300 and 400 level, students must have achieved a grade of C or better in 01:160:161-162 General Chemistry or 01:750:193-194 Physics for the Sciences, as well as 01:640:151-152 Calculus for Mathematical and Physical Sciences and 01:640:251 Multivariable Calculus; 11:670:201 Elements of Meteorology and 202 Elements of Climatology.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (4 credits)

- 01:119:103 Principles of Biology (4) *or* equivalent

B. Physical Sciences (17 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)
- 01:750:193-194 Physics for the Sciences (4,4) *or* equivalent

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

- 01:355:101 Expository Writing I (3)
- 01:355:302 Scientific and Technical Writing (3) *or* 01:355:201 Research in the Disciplines (3)

VII. Experience-Based Education (6 credits)

- 11:670:433, 434 Synoptic Analysis and Forecasting I,II (3,3)

VIII. Proficiency in Meteorology (56.5 credits)

Quantitative Skills (18)

- 11:375:303 Numerical Methods in Environmental Science (3)
- 01:640:151-152 Calculus for Mathematical and Physical Sciences (4,4)
- 01:640:244 Differential Equations for Engineering and Physics (4)
- 01:640:251 Multivariable Calculus (4)

Computer and Information Technology Competence (7)

- 01:198:323 Numerical Analysis and Computing (4) *or* an equivalent programming course approved by the curriculum coordinator
- 14:440:127 Introduction to Computers for Engineers (3) *or* an equivalent programming course approved by the curriculum coordinator

Professional Ethics

Ethical problems in environmental, meteorological, and regulatory fields are addressed throughout the program in both introductory and advanced courses.

Additional Requirements (31.5)

- 11:372:442 Applied Principles of Hydrology (3)
- 11:375:203 Physical Principles of Environmental Sciences (3)
- 11:375:421 Air Pollution (3)
- 11:670:201 Elements of Meteorology (3)
- 11:670:202 Elements of Climatology (3)
- 11:670:210 Meteorological Analysis (1.5)
- 11:670:323 Thermodynamics of the Atmosphere (3)
- 11:670:324 Dynamics of the Oceans and Atmosphere (3)
- 11:670:423 Weather Systems (3)
- 11:670:431 Physical Meteorology (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)

IX. Unspecified Electives (12.5 credits)

MICROBIOLOGY 680

Degree: B.S.

Coordinator: Max M. Haggblom (haggblom@aesop.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
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Max M. Haggblom	(HQ)	Lipman 326	2-9763 (326)
Karl Matthews	(MQ)	Food Science 203	2-9611 (219)
Mikhail Tchikindas	(TK)	Food Science 203	2-9611 (218)
Costantino Vetriani	(VE)	IMCS 305B	2-6555 (373)

Microorganisms are the smallest living things, the oldest form of life on earth, ubiquitous in the biosphere, and central to many life processes on earth. The microbiology curriculum emphasizes the uniqueness of microbial biology, its enormous diversity, and the biochemical basis of microbial life. Recent advances in microbial molecular biology and biotechnology have led to a deeper understanding of the physiology, genetics, and taxonomy of microbes.

The curriculum examines the diverse roles of microorganisms and the fundamentals of microbial diversity, physiology, and genetics. It focuses on microorganisms; microbial processes in natural and managed environments; and effects on human, animal, plant, and environmental health. The curriculum provides students with a fundamental understanding of the various applications of microbes in biotechnology, the food industry, agriculture, and medicine. The curriculum examines the nature and activity of microbial populations in aquatic and terrestrial ecosystems, the interactions within microbial communities, biogeochemical cycles, and energy flows. The field is a major contributor to industrial development; human, animal, and plant health; environmental integrity; and agricultural productivity. Microbes are central to the food, biotechnology, and pharmaceutical industries and are broadly used for food fermentations, biosynthesis, and biodegradation of toxic chemicals.

The primary objectives of the curriculum are to educate broadly in the biology of microorganisms and to prepare students for positions in industry, government, and graduate/professional study in the life sciences through extensive course work and laboratory and research experience.

Graduation Requirements for the Major

To enter upper-level microbiology (11:680) courses, students must have completed 01:119:101-102 General Biology and 01:160:161-162 General Chemistry with grades of C or better.

I. College Mission: Interdisciplinary Critical Analysis (5 credits)

- 11:015:101 Perspectives on Agricultural and the Environment (2)
- 11:__:__ A junior/senior colloquium course (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter. 01:355:302 Scientific and Technical Writing (3) is strongly recommended.

VII. Experience-Based Education (0-3 credits)

- 11:680:497,498 Research in Microbiology (BA,BA) *or* an equivalent independent research project in microbiology *or* an appropriate cooperative education placement of at least 3 credits *or* an appropriate noncredit-bearing internship approved by the curriculum coordinator

VIII. Proficiency in Microbiology (75-86 credits)

A. REQUIRED COURSES (56-59)

Quantitative Skills (8)

- 01:640:1__-1__ CALC1-CALC2 (4,4) [01:640:151-152 Calculus for Mathematics and Physical Sciences (4,4) is preferred.]

Computer and Information Technology Competence (0-3)

- 11:126:483 Nucleotide Sequence Analysis (3) *or* 11:115:403 General Biochemistry (4) and 11:115:413 Experimental Biochemistry (3), required below

Professional Ethics (3)

- 11:015:405 Ethics in Science (3) *or* 11:015:433 Critical Thinking in Science (which also fulfill the junior/senior colloquium requirement) *or* 01:119:160 Biology, Society, and Ecological Issues (3) *or* 01:730:249 Medical Ethics (3)

Additional Requirements (44-45)

- 11:115:403-404 General Biochemistry (4,3) *or* 01:694:407-408 Molecular Biology and Biochemistry (3,3)
- 11:115:413 Experimental Biochemistry (3)
- 11:126:481 Molecular Genetics (3) *or* 11:680:__ Microbial Genetics (3)
- 01:160:307-308 Organic Chemistry (4,4) *or* 01:160:315-316 Principles of Organic Chemistry (4,4) *
- 01:447:380 Genetics (4)
- 01:447:498 Bacterial Physiology (3)
- 11:680:390 General Microbiology (4) *or* equivalent
- 11:680:491 Microbial Ecology and Diversity (3)
- 11:680:495 Seminar in Microbiology (1)
- 01:750:193-194 Physics for the Sciences (4,4) *or* equivalent *

* Students intending to apply to medical school should be aware that many schools require laboratories in organic chemistry and 01:750:203-206 General Physics and its laboratories (8) or 01:750:201-202 Extended General Physics (10).

B. ELECTIVES (19–24)

A minimum of 10 credits from the following, including at least one laboratory (10–15)

- 11:126:407 Comparative Virology (3)
- 01:146:474 Immunology (3)
- 01:146:475 Laboratory in Immunology (1)
- 11:375:411 Environmental Microbiology (3)
- 11:400:423 Food Microbiology (3)
- 11:400:424 Food Microbiology Laboratory (1)
- 01:447:392 Pathogenic Microbiology (3)
- 11:628:404 Fungi and Ecosystems (3) or 11:770:403 Fungi in the Environment (3)
- 11:680:394 Applied Microbiology (4) or equivalent (includes laboratory)

At least 9 additional credits from among the electives above or the following (9–10)

- 11:115:412 Protein and Enzyme Chemistry (3)
- 11:115:428 Homology Modeling of Proteins (3)
- 11:126:405 Microbial Technology (3)
- 11:126:412 Process Biotechnology (3)
- 11:126:427 Methods in Recombinant DNA Technology (4)
- 11:126:482 Molecular Genetics Laboratory (3)
- 11:126:484 Biotechnology Robotics (3)
- 11:126:486 Analytical Methods in Microbiology (4)
- 11:127:414 Unit Processes in Bioenvironmental Engineering II (3)
- 01:146:328 Human Parasitology (3)
- 11:375:453 Soil Ecology (3)
- 01:447:398 Electron Microscopy (3)
- 01:447:480 Topics in Molecular Genetics (3)
- 11:680:497,498 Research in Microbiology (BA, BA) (One to 3 credits of research may be substituted for an equal number of credits of elective courses with the permission of the curriculum coordinator.)
- 11:704:422 Ecology of Soil Organisms (3)
- 11:770:301 General Plant Pathology (3)

IX. Unspecified Electives (0–6 credits)

NUTRITIONAL SCIENCES 709

Degree: B.S.

Undergraduate Program Director: Adria R. Sherman
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Adviser	Code	Office	Phone (Ext.)
Dawn Brasaelme	(BG)	Thompson 131	2-6524
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Daniel J. Hoffman	(HR)	Davison 230	2-6568
Debra Palmer Keenan	(KB)	Davison 208	2-6569
Soo-Kyung Lee	(LF)	Davison 213	2-6521
Sue A. Shapses	(SQ)	Thompson 111	2-9403
Adria R. Sherman	(SJ)	Thompson 213	2-6530
Judith Storch	(SN)	Thompson 214	2-1689
Barbara L. Tangel	(TE)	Davison 229B	2-6525
Malcolm Watford	(WR)	Thompson 130	2-7418
Harriet S. Worobey	(WN)	Davison 209	2-8895
John Worobey	(WM)	Davison 208	2-6517

The undergraduate program in nutritional sciences provides students with a strong background in the biological, biochemical, physiological, clinical, behavioral, sociological,

and psychological dimensions of human nutrition. Students must maintain a cumulative grade-point average of 2.0 or better in all required courses. The program offers three options.

Dietetics. The option in dietetics meets the American Dietetic Association's (ADA) Approved Didactic Program in Dietetics. Upon completion of this option, students are eligible to apply for an ADA Accredited Dietetic Internship or an Approved Pre-Professional Practice Program (AP4) in preparation for the Registration Examination for dietitians. With appropriate electives, this option also can lead to work in the food industry, and after graduate study, positions in cooperative extension, nutrition education, nutrition counseling, or clinical research.

Food Service Administration. The option in food service administration emphasizes the managerial aspects of food service operation. Entry-level employment opportunities include food service marketing, or managing food services in schools, hotels, restaurants, industrial cafeterias, corporations, hospitals, and child- or long-term care facilities.

Nutrition. The option in nutrition emphasizes research and prepares students for graduate study in the life sciences and medical, dental, and veterinary studies, as well as for immediate employment in the biomedical industry.

Graduation Requirements for the Major

Students must achieve grades of C or better in all required biological sciences, biochemistry, chemistry, and nutrition courses in order to enter advanced courses in nutritional sciences.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

- 11:709:442 Community Nutrition (4) is required in the dietetics option.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter. Note that both 01:830:101 General Psychology (3) and 01:920:101 Introduction to Sociology (3) are required in the dietetics option.

B. Economic Systems (3–6 credits)

11:373:121 Principles and Applications of Microeconomics (3) and 01:220:103 Introduction to Macroeconomics (3) are required in the food service administration option. 11:373:101 Economics, People, and Environment (3) may be substituted in the nutrition and dietetics options.

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter. 01:355:302 Scientific and Technical Writing (3) is required for the nutrition option. 01:355:303 Writing for Business and the Professions (3) is required for the food service administration option.

VII. Experience-Based Education (3–4 credits)

11:709:344 Quantity Food Production (4) is required in the dietetics and food service administration options.

Students in nutrition must complete a minimum of 3 credits of 11:709:493,494 Problems in Nutrition (3,3) or equivalent independent research project in nutritional sciences or adviser-approved placement in cooperative education.

VIII. Proficiency in the Nutritional Sciences (35–64.5 credits)

A. REQUIRED COURSES (6–7)

Quantitative Skills

See VIII B, Option requirements. Students are required to have placed at the precalculus level or above to take the required biology and chemistry courses.

Computer and Information Technology Competence (3–4)

01:198:110 Introduction to Computers and Their Application (3) or 01:198:111 Introduction to Computer Science (4)

Professional Ethics

Ethical aspects of nutritional sciences are incorporated into several upper-level courses through the use of case studies, research designs, and applied problems.

Additional Requirements (3)

11:709:255 Nutrition and Health (3)

B. OPTIONS (29–57.5)

1. Dietetics (55)

11:115:301 Introductory Biochemistry (3)
01:119:133 Introduction to Microorganisms (3) and 01:119:134 Introduction to the Practice of Microbiology (1) or 01:119:131 Microbiology for the Health Sciences (3) and 01:119:132 Microbiology for the Health Sciences Laboratory (1)
01:146:356 Systems Physiology (3)
01:146:357 Systems Physiology Laboratory (1)

01:160:209 Elementary Organic Chemistry (3)
01:160:211 Elementary Organic Chemistry Laboratory (1)
11:373:341 Management: Human Systems Development (3) or 01:830:373 Organizational and Personnel Psychology (3)
01:640:115 Precalculus College Mathematics (4) or equivalent
11:709:201 Introduction to Foods and Nutrition (3)
11:709:202 Laboratory for Introduction to Foods (1)
11:709:349 Management of Food Service Systems (3)
11:709:400 Advanced Nutrition I: Regulation of Macronutrient Metabolism (3)
11:709:401 Advanced Nutrition II: Energy and Micronutrient Metabolism (3)
11:709:405 Professional Issues in Dietetics (P/NC 1)
11:709:441 Nutrition Counseling and Communication (4)
11:709:442 Community Nutrition (4)
11:709:489 Experimental Foods (3)
11:709:498 Nutrition and Disease (3)
01:830:101 General Psychology (3)
01:920:101 Introduction to Sociology (3) or 11:709:452 Nutrition and Behavior (3)
01:960:401 Basic Statistics for Research (3)

2. Food Service Administration (29)

Required courses (17)

33:010:272 Introduction to Financial Accounting I (3)
01:119:133 Introduction to Microorganisms (3) and 01:119:134 Introduction to the Practice of Microbiology (1) or 01:119:131 Microbiology for the Health Sciences (3) and 01:119:132 Microbiology for the Health Sciences Laboratory (1)
11:373:341 Management: Human Systems Development (3) or 01:830:373 Organizational and Personnel Psychology (3)
11:709:201 Introduction to Foods and Nutrition (3)
11:709:202 Laboratory for Introduction to Foods (1)
11:709:349 Management of Food Service Systems (3)

Electives (12)

33:011:201 Introduction to Management for Nonbusiness Majors (3)
33:011:202 Introduction to Marketing for Nonbusiness Majors (3)
33:011:203 Introduction to Finance for Nonbusiness Majors (3)
33:011:204 Principles of Business Law for Nonbusiness Majors (3)
11:373:241 Agribusiness Management (3)
11:373:331 Economics of Food Marketing Systems (3)
11:373:371 Food Health and Safety Policy (3)
11:375:403 Principles of Epidemiology (3)
11:400:304 Food Analysis (4)
11:400:405 Sensory Evaluation of Foods (3)
11:400:410 Nutraceuticals in Functional Foods, Herbs, and Supplements (3)
11:400:412 Food Product Development (3)
11:709:226 Nutrition for the Developing Child (3)
11:709:441 Nutrition Counseling and Communication (4)
11:709:452 Nutrition and Behavior (3)

3. Nutrition (53.5–58.5)

- 11:115:301 Introductory Biochemistry (3) *or*
11:115:403-404 General Biochemistry (4,3)
or 01:694:407-408 Molecular Biology and
Biochemistry (3,3)
- 01:146:356 Systems Physiology (3) *and* 01:146:357
Systems Physiology Laboratory (1)
or equivalent
- 01:160:307-308 Organic Chemistry (4,4)
- 01:160:311 Organic Chemistry Laboratory (2)
- 01:447:380 Genetics (4)
- 01:640:1__-1__ CALC1-CALC2 (4,4)
- 11:709:400 Advanced Nutrition I: Regulation of
Macronutrient Metabolism (3)
- 11:709:401 Advanced Nutrition II: Energy and
Micronutrient Metabolism (3)
- 11:709:481 Seminar in Nutrition (1.5)
- 11:709:493,494 Problems in Nutrition (BA,BA)
or equivalent
- 01:750:193-194 Physics for the Sciences (4,4) *or*
01:750:203-204 General Physics (3,3)
and 01:750:205-206 General Physics
Laboratory (1,1)
- 01:960:401 Basic Statistics for Research (3)
An additional, adviser-approved advanced biology
course (3–4)

IX. Unspecified Electives (8.5–41 credits)

PLANT SCIENCE 776

Degree: B.S.

Undergraduate Program Director: James C. French (aroid@rci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
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Joel S. Flagler	(FE)		201/336-6781
James C. French	(FD)	Foran 296C	2-9711 (162)
Chaim Frenkel	(FL)	Foran 380	2-8977 (353)
Thomas J. Gianfagna	(GN)	Foran 280	2-9711 (252)
Joseph C. Goffreda	(GG)	Foran 201B	2-9711 (202)
Bingru Huang	(HZ)	Foran 301	2-9375 (302)
Harry W. Janes	(JA)	Foran 123	2-9711 (123)
Gojko Jelenkovic	(JB)	Foran 201A	2-9711 (201)
Richard H. Merritt	(MS)	Foran 272	2-9711 (247)
William Meyer	(MH)	Foran 296A	2-9375 (160)
James Murphy	(MB)	Foran 180	2-9711 (129)
Elwin R. Orton	(OB)	Foran 172	2-9711 (124)
John N. Sacalis	(SA)	Foran 382	2-9711 (131)
James F. White	(WQ)	Foran 263	2-9711 (357)

The plant science program prepares students for careers or further study in areas related to food, fiber, turfgrass, ornamental plant production, pest management, plant breeding, plant pathology, or plant science education. The curriculum offers three options: horticulture and turf industry, for students intending to pursue business careers; research, for students intending to pursue careers in laboratories or graduate study; and professional preparation, for students intending to pursue careers in education or horticultural therapy.

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

- 01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

- 01:160:161-162 General Chemistry (4,4)
- 01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter. Note that 01:830:101 General Psychology (3) is required in the horticultural therapy specialization.

B. Economic Systems (3–6 credits)

See suggested courses in the Degree Requirements chapter. 11:373:121 Principles and Applications of Microeconomics *or* 01:220:103 Introduction to Macroeconomics (3) *or* equivalent is required of students in the horticulture and turf industry option.

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

See suggested courses in the Degree Requirements chapter.

VII. Experience-Based Education (3 credits)

- 11:776:495,496 Special Problems in Plant Science (BA,BA) *or* equivalent *or* an appropriate placement in cooperative education

VIII. Proficiency in Plant Science (52–75 credits)

A. REQUIRED COURSES (9–12)

Quantitative Skills

See 01:640:___ in VIII B below.

Computer and Information Technology Competence (0–3)

- 01:198:110 Introduction to Computers and Their Application (3) *or* equivalent *or* satisfaction of an approved departmental computer competency test

Professional Ethics (3)

- 01:730:250 Environmental Ethics (3) *or* 01:730:251 Ethics and Business (3)

Additional Requirements (6)

- 11:776:211 Introduction to Horticulture (3)
- 11:776:242 Plant Science (3)

B. OPTIONS (43-63)

One of the following three options is required:

1. Horticulture and Turf Industry (52-58)

Required courses (29-30)

- 11:370:350 Agricultural Entomology and Pest Management (3)
- 11:373:231 Agribusiness Marketing (3)
- 11:373:241 Agribusiness Management (3) *or* 11:373:341 Management: Human Systems Development (3)
- 11:375:266 Soils and Their Management (4) *or* 11:375:453 Soil Ecology (3)
- 01:460:101 Introductory Geology I: Physical (3)
- 01:460:103 Introductory Geology Laboratory (1)
- 01:640:115 Precalculus College Mathematics (4) *or* 01:960:401 Basic Statistics for Research (3)
- 11:770:301 General Plant Pathology (3)
- 11:776:382 Plant Physiology (4)
- 11:776:406 Plant Breeding (3)

Electives (23-28)

At least eight additional courses selected from the following list:

Plant Science Curriculum Electives

- 11:015:492 Tropical Agriculture (3)
- 11:015:494 Tropical Agriculture and Natural Resources Field Study (3)
- 11:126:406 Plant Gene Transfer (4)
- 11:126:413 Plant Molecular Biology (3)
- 11:126:427 Methods in Recombinant DNA Technology (4)
- 11:370:350 Agricultural Entomology and Pest Management (3)
- 11:370:381 Insect Biology (4)
- 11:550:230 Environmental Design Analysis (3)
- 11:550:233-234 Landscape Plants I,II (3,3)
- 11:550:238 Landscape Management and Maintenance (3)
- 11:550:239 Planning and Planting the Residential Environment (3)
- 11:680:390 General Microbiology (4)
- 11:704:332 Plant Ecology (4)
- 11:770:402 Mycology: Fungi in the Environment (3)
- 11:776:200 Modern Crop Production (3)
- 11:776:202 Applied Physiology of Horticultural Crops (3)
- 11:776:221 Principles of Organic Crop Production (3)
- 11:776:231 Commercial Floral Design (3)
- 11:776:3__ Plant Nutrition (3)
- 11:776:304 Turfgrass Management (4)
- 11:776:305 Plant Genetics (4)
- 11:776:310 Plant Propagation (3)
- 11:776:312 Medicinal Plants (3)
- 11:776:321 Greenhouse Management and Crop Production (3)
- 11:776:340 Principles and Practices of Fruit Production (4)
- 11:776:341 Fruit Production (3)
- 11:776:362 Principles of Vegetable Culture (3)
- 11:776:401 Postharvest Physiology of Horticultural Crops (3)
- 11:776:402 Principles of Weed Science (3)
- 11:776:403 Plant Science Techniques (3)

- 11:776:404 Soil Management for Sports and Landscape Applications (3)
- 11:776:408 Turfgrass Pest Science (4)
- 11:776:439 Nursery Crop Production (3)
- 11:776:450 Horticultural Topics (2)
- 11:776:451 Fine and Sports Turf (3)
- 11:776:452 Plant Tissue Culture (3)
- 11:776:495,496 Special Problems in Plant Science (BA,BA)
- 01:960:401 Basic Statistics for Research (3)

2. Professional Preparation: Plant Science Teacher Preparation, Plant Protection Preparation, and Horticulture Therapy Specialization (43-57)

Required courses (3-4)

- 01:640:115 Precalculus College Mathematics (4) *or* 01:960:401 Basic Statistics for Research (3)

and one of the following specializations:

A. PLANT SCIENCE TEACHER PREPARATION (46-50)

Required courses (24)

- 05:300:200 Exploring Teaching as a Profession (3)
- 05:300:306 Educational Psychology: Principles of Classroom Learning (3)
- 05:300:401 Individual and Cultural Diversity in the Classroom (3)
- 11:300:450 Biology and Society (3)
- 11:300:453 Teaching Life Science (3)
- 05:300:462 Demonstration and Technology in Science Education (3)

Electives (22-26)

Additional courses from the curriculum electives listed in the horticulture and turf industry option, above, selected in consultation with an adviser.

B. HORTICULTURAL THERAPY SPECIALIZATION (53)

Required courses (40)

- 11:776:225 Introduction to Horticultural Therapy (3)
- 11:776:325 Horticultural Therapy Techniques and Programming (3)
- 11:776:425 Special Topics in Horticultural Therapy (2)
- 11:776:495,496 Special Problems in Plant Science (a minimum of 8 credits, approved by the adviser)

At least eight of the following human science courses (24-26):

- 11:300:327 Applications of Psychology in Education (3)
- 11:373:341 Management: Human Systems Development (3)
- 01:830:101 General Psychology (3)
- 01:830:303, 304 Memory and Memory Laboratory (3,1)
- 01:830:321 Social Psychology (3)
- 01:830:326, 327 Small Groups and Laboratory (3,1)
- 01:830:330 Developmental Psychology (3)
- 01:830:333 Adolescent Development (3)
- 01:830:335 Adult Development and Aging (3)
- 01:830:340 Abnormal Psychology (3)
- 01:830:361 Developmental Psychobiology (3)
- 01:830:377 Health Psychology (3)
- 10:832:416 Mental Illness: Social and Public Policy (3)
- 09:910:352 Groups at Risk in Contemporary Society (3) *or* 09:910:220 Introduction to Social Work and Social Services (3)
- 01:920:210 Sociology of Medicine and Health Care (3)

Electives (13)

Additional courses selected from the curriculum electives listed in the horticulture and turf industry option, above. Recommended electives are 01:119:332, 11:370:350, 11:770:301, and 11:776:231, 310, 321, 439.

C. PLANT PROTECTION (45)

Required courses (15)

- 11:370:352 Toxicology of Pesticides (3)
- 11:370:381 Insect Biology (4)
- 11:770:301 General Plant Pathology (3)
- 11:776:402 Principles of Weed Science (3)
- 11:776:495 Special Problems in Plant Science (3) *or* appropriate adviser-approved internship in plant protection

Electives (30)

A minimum of 30 credits, with at least one course from each of the five following areas. Additional electives may be substituted in consultation with the adviser.

I. Economics, Marketing, and Policy

- 11:373:231 Agribusiness Marketing (3)
- 11:373:241 Agribusiness Management (3)
- 11:373:363 Environmental Economics (3)
- 11:373:371 Food Health and Safety Policy (3)

II. Insect Pests

- 11:370:350 Agricultural Entomology and Pest Management (3)
- 11:370:409 Insect Classification (4)
- 11:770:416 Principles of Applied Nematology (3)

III. Microbial Pathogens

- 11:680:390 General Microbiology (4)
- 11:770:402 Mycology: Fungi in the Environment (3)
- 11:776:408 Turfgrass Pest Science (4)

IV. Agroecology and Ecology

- 11:015:230 Fundamentals of Agroecology (3)
- 11:704:351 Principles of Ecology (4)

V. Production/Management

- 11:015:301 Topics in Agroecology (3)
- 11:375:266 Soils and Their Management (4) *or* equivalent
- 11:776:200 Modern Crop Production (3)
- 11:776:221 Principles of Organic Crop Production (3)
- 11:776:304 Turfgrass Management (4)
- 11:776:321 Greenhouse Management and Crop Production (3)
- 11:776:341 Fruit Production (3)
- 11:776:439 Nursery Crop Production (3)

3. Research (57–63)

Required courses (43–44)

- 11:115:403,404 General Biochemistry (4,3)
- 11:126:413 Plant Molecular Biology (3)
- 01:160:307-308 Organic Chemistry (4,4)
- 01:640:135-136 Calculus I,II (4,4) *or* equivalent
- 01:750:203-204 General Physics (3,3)
- 11:776:305 Plant Genetics (4)
- 11:776:382 Plant Physiology (4)
- 11:776:452 Plant Tissue Culture (3) *or* 11:126:406 Plant Gene Transfer (4)

Electives (14–19)

At least five additional courses selected from the curriculum electives listed in the horticulture and turf industry option, above.

IX. Unspecified Electives (0–24 credits)

PUBLIC HEALTH 832

Degree: B.S.

Coordinator: Dona Schneider (donas@rci.rutgers.edu)

Adviser	Code	Office	Phone (Ext.)
Radha Jagannathan	(JC)	CSB 154	2-4101 (668)
Dona Schneider	(SD)	CSB 172	2-4101 (682)

The curriculum in public health is designed to fill the need for allied health professionals who have a solid background in public health and/or environmental science. The curriculum includes options in health issues and policy, health analysis and research, and environmental health sciences.

The public health program is an interdepartmental curriculum that utilizes the resources of both the Edward J. Bloustein School of Planning and Public Policy and Cook College.

Students learn qualitative, quantitative, and analytical skills used by health program and facility managers, planning agencies, and education and evaluation organizations. They use computers to develop management information systems and learn statistical methodology, including its public health application in epidemiology.

An internship provides practical job experience and gives students the opportunity to apply theory while testing their technical competence under the direct supervision of a knowledgeable health care professional.

Graduates are prepared for employment in areas of the health services delivery and regulation field that require policy development, implementation, and evaluation. Graduates also may prepare for the New Jersey Sanitarian License Examination.

Students who intend to prepare for the New Jersey Sanitarians License Examination must complete at least 32 credits of courses in mathematics and sciences.

See <http://www.policy.rutgers.edu> for further information on the public health major.

Entry Requirements for the Major

To declare a major in public health, students must apply to the Bloustein School of Planning and Public Policy after they have completed 40 credits and achieved a 2.5 grade-point average in the required introductory expository writing and statistics courses, 01:119:150 Biology, Society, and Biomedical Issues (3) *and* 10:832:101 Introduction to Policy, Planning, and Health (3).

I. College Mission: Interdisciplinary Critical Analysis (5–6 credits)

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:400 Junior/Senior Colloquium (3)

II. Introductory Life and Physical Sciences

A. Life Sciences (8 credits)

01:119:101-102 General Biology (4,4)

B. Physical Sciences (9 credits)

01:160:161-162 General Chemistry (4,4)

01:160:171 Introduction to Experimentation (1)

III. Humanities and the Arts (6 credits)

See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)

10:975:303 Urban Poverty in Developing Nations *or*
10:975:304 Urban Poverty (3) *or* 11:374:341
Social and Ecological Aspects of Health and
Disease (3) *or* courses from those suggested
in the Degree Requirements chapter

V. Human Behavior, Economic Systems, and Political Processes

A. Human Behavior (3 credits)

See suggested courses in the Degree Requirements chapter.

B. Economic Systems (3–9 credits)

For students interested in environmental health:

11:373:101 Economics, People, and Environment (3)

For students interested in health policy:

10:832:332 Public Health Economics (4)

For students interested in health administration:

01:220:102 Introduction to Microeconomics (3)

01:220:103 Introduction to Macroeconomics (3)

01:220:316 Health Economics (3)

C. Political Processes (3 credits)

See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)

01:355:101 Expository Writing I (3) *or* equivalent

One of the following:

01:355:302 Scientific and Technical Writing (3)

01:355:303 Writing for Business and the Professions (3)

01:355:315 Writing Grant Proposals (3)

VII. Experience-Based Education (6 credits)

10:832:499 Internship with Seminar (6)

VIII. Proficiency in Public Health (35–40 credits)

A. REQUIRED COURSES (20–24)

Quantitative Skills (4–7)

A term of statistics at the 200 level or above (requires pre-calculus or placement in calculus) or 10:975:205 Basic Statistical Methods (4)

Computer and Information Technology Competence (4)

10:832:395 Research Methods (4)

Professional Ethics (3)

01:119:150 Biology, Society, and Biomedical Issues (3) *or*
other approved course

Additional Requirements (9–10)

11:375:403 Principles of Epidemiology (3) *or* 10:832:335
Epidemiology (3)

10:832:101 Introduction to Policy, Planning, and
Health (3)

10:832:338 Health and Public Policy (3) *or* 10:832:332
Public Health Economics (4) *or* 01:220:316
Health Economics (3) *or* 10:832:333
Financial Aspects of Public Health (3)

B. ELECTIVES (15–16)

Five additional public health (10:832) courses (three of which must be at the 300 level or above) or courses drawn from the following:

11:374:341 Social and Ecological Aspects of Health
and Disease (3)

11:375:302 Elements of Water and Wastewater
Treatment (3)

11:375:307 Elements of Solid Waste Management and
Treatment (3)

11:375:336 Occupational and Community Noise
Control (3)

11:375:407 Environmental Toxicology (3)

11:375:411 Environmental Microbiology (3)

11:375:421 Air Pollution (3)

11:680:390 General Microbiology (4)

10:975:303 Urban Policy in Developing Nations (3)

10:975:304 Urban Poverty (3)

10:975:417 Introduction to Population Tools and
Policy (3)

10:975:456 Housing and Health Care (3)

10:975:462 Human Rights, Health, and Violence (3)

10:975:477 Immigration, Urban Policy, and Public
Health (3)

10:975:483 Urban Revitalization and Public Health (3)

See adviser for approved alternatives from
current offerings.

IX. Unspecified Electives (29–39 credits)

MINOR PROGRAMS OF STUDY

The following minor and certificate programs are open to all undergraduate students at Rutgers. Options in several programs indicate either a subject-matter emphasis or a degree of expertise in cognate fields required by the courses suggested.

Agroecology (21–24 credits)

Adviser: Ralph Coolman: Thompson 123, 932-8406 (coolman@aesop.rutgers.edu)

Required courses (12–13)

11:015:230 Fundamentals of Agroecology (3)

11:015:350 Agroecology Practicum (3)

01:119:1__ At least one term of introductory
biology (3–4)

11:776:221 Principles of Organic Crop Production (3) *or*
11:776:362 Principles of Vegetable Culture (3)
or adviser-approved equivalent

Electives (9–11)

- 11:015:301 Topics in Agroecology (3)
11:015:492 Tropical Agriculture (3)
11:015:494 Tropical Agriculture and Natural Resources Field Study (3)
11:370:350 Agricultural Entomology and Pest Management (3)
11:370:381 Insect Biology (4)
11:375:102 Soils and Society (3)
11:375:360 Soils and Water (4)
11:375:451 Soil Chemistry (3)
11:375:453 Soil Ecology (3)
11:375:454 Soil Biological Processes (3)
11:770:301 General Plant Pathology (3)
11:770:402 Mycology: Fungi in the Environment (3)
11:770:416 Principles of Applied Nematology (3)
11:776:401 Postharvest Physiology of Horticultural Crops (3)
11:776:402 Principles of Weed Science (3)

Animal Science (20–24 credits)

Adviser: James E. Wohlt; Bartlett Hall, Room 306, 932-9454
(wohlt@aesop.rutgers.edu)

Prerequisites: 01:119:101-102 or equivalent

Required courses (10)

- 11:067:142 Animal Science (3)
11:067:327 Animal Reproduction (3)
11:067:330 Animal Nutrition (3)
11:067:331 Animal Nutrition Laboratory (1)

Options (12–14)

1. Livestock Emphasis (14)

- 11:067:335, 336 Livestock Production and Management I,II (3,3)
11:067:337, 338 Livestock Production and Management Laboratory I,II (2,2)
01:447:380 Genetics (4) or equivalent

2. Laboratory Animal Emphasis (12–13)

Required courses (5)

- 11:067:200,204 Animal Practicum: Section LA (P/NC 2,2)
11:067:275 Laboratory Animal Science: Management and Techniques (3)

Electives (7–8)

- 11:067:404 Animal Diseases (3)
11:067:430 Animal Microtechniques and Tissue Culture (4)
01:146:356 Systems Physiology (3) or equivalent and
01:146:357 Systems Physiology Laboratory (1) or equivalent
11:680:390 General Microbiology (4)

3. Science and Research Emphasis (10–13)

Required courses (4)

- 01:146:356 Systems Physiology (3) or equivalent
01:146:357 Systems Physiology Laboratory (1) or equivalent

Electives (6–9)

- 11:067:430 Animal Microtechniques and Tissue Culture (4)
11:067:450 Endocrinology (3)
11:067:493,494 Research in Animal Science (BA,BA)

- 11:126:481 Molecular Genetics (3) and 11:126:482 Molecular Genetics Laboratory (3)
01:694:315 Introduction to Molecular Biology and Biochemistry Research (3) or equivalent

Biochemistry (23–25 credits)

Adviser: Theodore Chase, Jr.; Lipman 220, 932-9763, ext. 220
(chase_c@aesop.rutgers.edu)

Prerequisites: 01:119:101-102; 01:160:161-162.

- 11:115:313 or 01:694:313 Introductory Biochemistry Laboratory (1) or 11:115:413 Experimental Biochemistry Laboratory (3)
11:115:403,404 General Biochemistry (4,3)
01:160:307-308 Organic Chemistry (4,4) or equivalent
01:447:380 Genetics (4) or 11:776:305 Plant Genetics (4)

And one of the following:

- 11:115:412 Protein and Enzyme Chemistry (3)
11:115:421 Biochemistry of Cancer (3)
11:115:422 Biochemical Mechanisms of Toxicology (3)
11:115:428 Homology Modeling of Proteins (3)
11:115:433 Special Topics in Biochemistry (1)
11:115:435 Topics in Biochemistry (3)
11:115:452 Biochemical Separations (3)

Ecology and Evolution (19–25 credits)

Adviser: Edwin J. Green, ENR 158, 932-9152 (green@crssa.rutgers.edu)

Prerequisites: 01:119:101-102

Required courses (10–13)

- 11:704:335 Limnology (4) or 11:704:450 Landscape Ecology (3) or 11:704:451 Ecosystems Ecology and Global Change (3)
11:704:351 Principles of Ecology (4)
11:704:461 Field Ecology (2) or 11:704:475 Winter Field Ecology (1)
11:704:486 Principles of Evolution (3) or 01:070:350 Primatology and Human Evolution (3)

Electives (9–12)

Three of the following courses:

- 11:370:381 Insect Biology (4)
11:370:402 Aquatic Entomology (3)
11:628:321 Ichthyology (4)
11:628:404 Fungi and Ecosystems (3)
11:680:491 Microbial Ecology and Diversity (4)
11:704:240 Behavioral Biology (4)
11:704:272 Dendrology (4)
11:704:317 Conservation Ecology (3)
11:704:323 Ornithology (4)
11:704:324 Invertebrate Zoology (4)
11:704:325 Vertebrate Zoology (4)
11:704:332 Plant Ecology (4)
11:704:335 Limnology (4)
11:704:403 Urban Forestry (3)
11:704:411 Taxonomy of the Vascular Plants (4)
11:704:421 Wetland Ecology (3)
11:704:443 Animal Social Behavior (3)
11:704:464 Wildlife Ecology and Conservation (3)
11:770:402 Mycology: Fungi in the Environment (3)
11:776:210 Principles of Botany (4)

Entomology (19–26 credits)

Adviser: James H. Lashomb: Blake Hall, Room 120, 932-9459
(lashomb@rci.rutgers.edu)

Prerequisites: 01:119:101-102 General Biology (4,4)

Required courses (7–8)

- 11:370:350 Agricultural Entomology and Pest Management (3) *or* 11:370:381 Insect Biology (4)
- 11:370:409 Insect Classification (4)

Electives (12–18)

Any of the following courses for which prerequisites are fulfilled or instructor's permission is granted:

- 11:370:308 Apiculture (3)
- 11:370:350 Agricultural Entomology and Pest Management (3)
- 11:370:352 Toxicology of Pesticides (3)
- 11:370:402 Aquatic Entomology (4)
- 11:370:403-404 Insect Structure and Function I, II (3,3)
- 11:370:406 Medical and Veterinary Entomology (3)
- 11:370:493,494 Research Problems in Entomology (1–4,1–4)

Note: In special circumstances, with prior permission of the department, 11:370:202 The World of Insects (3) may be substituted for 11:370:350 or 11:370:381. Juniors and seniors may, with the permission of the instructor and the graduate dean, register for appropriate graduate courses in entomology for elective credits.

Students intending to minor in entomology are urged to contact the department as early in their program as possible, and no later than the middle of their junior year.

Environmental and Business Economics (21–23 credits)

Adviser: Maurice P. Hartley: Cook Office Building, Room 112,
932-9155, ext. 216 (hartley@aesop.rutgers.edu)

This program is not open to majors in environmental and business economics (373) or economics (220) or to Rutgers Business School: Undergraduate–New Brunswick students. Students must complete introductory micro- and macro-economics with a grade of C or better. No more than one D will be allowed in the remaining five courses.

Required courses (12)

- 01:220:103 Introduction to Macroeconomics (3)
- 11:373:121 Principles and Applications of Microeconomics (3)
- 11:373:241 Agribusiness Management (3)
- 11:373:361 Land Economics (3) *or* 11:373:362 Natural Resource Economics (3) *or* 11:373:363 Environmental Economics (3)

Electives (9–11)

Any three of the following courses for which prerequisites are fulfilled or instructor's permission is granted:

- 11:373:210 Business Decision Computer Tools (4)
- 11:373:231 Agribusiness Marketing (3)
- 11:373:321 Economics of Production (3)
- 11:373:323 Public Policy toward the Food Industry (3)
- 11:373:331 Economics of Food Marketing Systems (3)
- 11:373:341 Management: Human Systems Development (3)
- 11:373:351 Agribusiness Finance I (3)

- 11:373:352 Economics of Futures Markets (3)
- 11:373:361 Land Economics (3)
- 11:373:362 Natural Resource Economics (3)
- 11:373:363 Environmental Economics (3)
- 11:373:371 Food Health and Safety Policy (3)
- 11:373:402 International Agribusiness Marketing (3)
- 11:373:422 Demand and Price Analysis (3)
- 11:373:425 Application of Econometrics in Agricultural Economics (3)
- 11:373:451 Agribusiness Finance II (3)
- 11:373:465 Agribusiness Marketing Research (4)

Environmental Policy, Institutions, and Behavior (21 credits)

Adviser: George E.B. Morren: Cook Office Building, Room 228,
932-9153, ext. 315 (morren@crssa.rutgers.edu)

Required courses (9)

- 11:374:101 Introduction to Human Ecology (3)
- 11:374:102 Global Environmental Processes and Institutions (3)
- 11:374:201 Research Methods in Human Ecology (3)

Electives (12)

Any four of the following courses, of which at least two must be at the 300 to 400 level:

- 11:374:269 Population, Resources, and Environment (3)
- 11:374:279 Politics of Environmental Issues (3)
- 11:374:301 Environment and Development (3)
- 11:374:308 Human Ecology of Maritime Regions (3)
- 11:374:312 Environmental Problems in Historical and Cross-Cultural Perspective (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:374:315 International Environmental Policy (3)
- 11:374:322 Environmental Behavior (3)
- 11:374:331 Culture and Environment (3)
- 11:374:335 Social Responses to Environmental Problems (3)
- 11:374:337 Systems Approaches and Interventions in Human Ecology (3)
- 11:374:341 Social and Ecological Aspects of Health and Disease (3)
- 11:374:420–429 Topics in Environmental and Resource Policy (3 each)
- 11:374:430–439 Topics in Health and Environment (3 each)

Environmental Sciences (21 credits)

Adviser: Robert L. Tate: Environmental and Natural Resources Bldg.,
Room 230, 932-9810 (tate@aesop.rutgers.edu)

*Required courses (9) **

- 11:375:101 Introduction to Environmental Sciences (3)

and two of the following:

- 11:375:201 Biological Principles of Environmental Sciences (3)
- 11:375:202 Chemical Principles of Environmental Sciences (3)
- 11:375:203 Physical Principles of Environmental Sciences (3)

* Many of the courses require the following prerequisites: 01:119:101-102; 01:160:161-162; two terms of calculus; organic chemistry; two terms of physics.

Electives (12)

- 11:375:302 Elements of Water and Wastewater Treatment (3)
- 11:375:303 Numerical Methods in Environmental Science (3)
- 11:375:312 Environmental Microbiology Laboratory (2)
- 11:375:411 Environmental Microbiology (3)
- 11:375:421 Air Pollution (3)
- 11:375:422 Air Sampling and Analysis (3)
- 11:375:430 Hazardous Wastes (3)
- 11:375:444 Water Chemistry (3)
- 11:375:445 Problems in Aquatic Environments (3)
- 11:375:453 Soil Ecology (3)
- 11:670:201 Elements of Meteorology (3) *or* equivalent environmental science (375) course approved by the program adviser

Equine Science (18–21 credits)

Adviser: Sarah L. Ralston: Bartlett Hall, Room 209, 932-9404
(ralston@aesop.rutgers.edu)

Prerequisites: 01:119:101-102 General Biology (4,4)

Required courses (9)

- 11:067:142 Animal Science (3)
- 11:067:327 Animal Reproduction (3)
- 11:067:384 Horse Management (3)

Electives (9–12)

- 11:067:200,204 Animal Practicum: Section HO (P/NC 2,2)
- 11:067:390 Equine Nutrition (3) *
- 11:067:401 Topics in Equine Science (3)
- 11:067:402 Equine Exercise Physiology (3) *
- 11:067:493,494 Research in Animal Science (BA,BA) (with equine research faculty)

Food Science (18–21 credits)

Adviser: Mukund Karwe: Food Science Building, Room 221,
932-9611, ext. 224 (karwe@aesop.rutgers.edu)

Prerequisite: Many electives in this program require chemistry and/or physics.

Required courses (6)

- 11:400:103 Science of Food (3)
- 11:400:104 Food and Health (3)

Electives (12–15)

Any four of the following courses for which prerequisites are fulfilled or instructor's permission is granted. See course descriptions for prerequisites.

- 11:400:201 Principles of Food Science (3)
- 11:400:304 Food Analysis (4)
- 11:400:401 Introduction to Food Engineering Fundamentals (4)
- 11:400:402 Introductory Food Engineering Processes (4)
- 11:400:405 Sensory Evaluation of Foods (3)
- 11:400:410 Nutraceuticals in Functional Foods, Herbs, and Supplements (3)
- 11:400:411 Food Chemistry (3)
- 11:400:412 Food Product Development (3)

- 11:400:419 Food Physical Systems (3)
- 11:400:421 Hazard Control in Food Processing (3)

Marine Sciences (18 credits)

Adviser: Judith Grassle: Marine and Coastal Sciences Building,
Room 309C, 932-6555, ext. 351 (jgrassle@imcs.rutgers.edu)

A term of introductory geology, two terms of biology, calculus, chemistry, and physics are recommended and/or required for many of the courses in the program.

Required course (4)

- 11:628:320 Dynamics of Marine Ecosystems (4)

Electives (14)

At least 14 credits from the following. At least 3 credits must be from marine sciences (628) courses.

- 11:015:401 Colloquium: Earth Systems Science (3)
- 11:374:308 Human Ecology of Maritime Regions (3)
- 11:375:445 Problems in Aquatic Environments (3)
- 01:450:417 Coastal Geomorphology (3)
- 01:460:209 Exploration of the Oceans (3) *or* 01:460:120/11:628:120 Introduction to Oceanography (3)
- 01:460:303 Paleontology (4)
- 01:460:330 Sedimentary Geology (4)
- 01:460:340 Sedimentology (4)
- 01:460:341 Stratigraphy (4)
- 01:460:417 Environmental Geochemistry (3)
- 01:460:451 Marine Geology (3)
- 11:628:110, 111, 211 Topics in Marine Sciences (P/NC 3,3,3)
- 11:628:300–310 Topics in Marine and Coastal Sciences (1–3 each)
- 11:628:317 Aquaculture (3)
- 11:628:321 Ichthyology (4)
- 11:628:340 Identification of Marine Invertebrates (2)
- 11:628:341 Hydrothermal Vents (3)
- 11:628:342 Marine Conservation (3)
- 11:628:352 Ocean, Coastal, and Estuarine Circulation (3)
- 11:628:364 Oceanographic Methods and Data Analysis (3)
- 11:628:401 Science in Shoreline Management (3)
- 11:628:404 Fungi and Ecosystems (3)
- 11:628:451 Physical Oceanography (4)
- 11:628:452 Geophysical Data Analysis (3)
- 11:628:462 Ocean Ecology (4)
- 11:628:472 Chemical Oceanography (4)
- 11:628:476 History of the Earth System (3)
- 11:628:497,498 Special Problems in Marine and Coastal Sciences (BA,BA)
- 11:670:323 Thermodynamics of the Atmosphere (3)
- 11:670:324 Dynamics of the Oceans and Atmosphere (3)
- 11:670:451 Remote Sensing of the Ocean and Atmosphere (3)
- 11:670:458 Air-Sea Interactions (3)
- 11:704:324 Invertebrate Zoology (4)
- 11:704:406 Fishery Science (3)
- 11:704:407 Research Methods in Fishery Science (3)
- 11:704:421 Wetland Ecology (3)
- 11:704:451 Ecosystems Ecology and Global Change (3)

* Note prerequisites.

Meteorology (18 credits)

Adviser: Robert Harmack: Environmental Sciences Building, Room 356,
932-9841 (harmack@envsci.rutgers.edu)

Prerequisites: 01:640:151-152; 01:750:193-194 or equivalent
11:670:201 Elements of Meteorology (3)
11:670:202 Elements of Climatology (3)
11:670:323 Thermodynamics of the Atmosphere (3)
11:670:324 Dynamics of the Oceans and Atmosphere (3)

and two of the following:

11:670:423 Weather Systems (3)
11:670:431 Physical Meteorology (3)
11:670:433 Synoptic Analysis and Forecasting I (3)

Natural Resource Management (20–25 credits)

Adviser: Edwin J. Green: ENR 158, 932-9152 (green@crssa.rutgers.edu)

Prerequisites: 01:119:101 and approval of a minor adviser

Required courses (11–13)

11:704:211 The Natural Resources Professions (P/NC 1)
11:704:272 Dendrology (4)
11:704:274 Field Techniques in Ecology and Natural
Resources (4) or 11:704:461 Field Ecology (2)
11:704:351 Principles of Ecology (4)

Electives (9–12)

Three additional courses in ecology and natural resources
(11:704) at the 300 or 400 level.

Nutrition (20–24 credits)

Adviser: Adria R. Sherman: Thompson Hall, Room 213, 932-6530
(asherman@aesop.rutgers.edu)

Prerequisites: 01:160:161-162, 171, and organic chemistry
11:115:301 Introductory Biochemistry (3) or 11:115:403,
404 General Biochemistry (4,3) or equivalent
01:119:101-102 General Biology (4,4)
11:709:255 Nutrition and Health (3)
11:709:400 Advanced Nutrition I: Regulation of
Macronutrient Metabolism (3)
11:709:401 Advanced Nutrition II: Energy and
Micronutrient Metabolism (3)

Plant Science (18–20 credits)

Adviser: James C. French: Foran, Room 296C, 932-9711, ext. 162
(aroid@rci.rutgers.edu)

Prerequisite: 01:119:101-102 General Biology (4,4)
or equivalent

Required courses (6)

11:776:211 Introduction to Horticulture (3)
11:776:242 Plant Science (3)

Electives (12–14)

Any four of the following courses for which prerequisites
have been fulfilled:

11:015:492 Tropical Agriculture (3)
11:550:233 Landscape Plants I (3) or 11:550:234
Landscape Plants II (3)
11:550:239 Planning and Planting the Residential
Environment (3)

11:776:202 Applied Physiology of Horticultural
Crops (3)
11:776:221 Principles of Organic Crop Production (3)
11:776:231 Commercial Floral Design (3)
11:776:305 Plant Genetics (4)
11:776:310 Plant Propagation (3)
11:776:312 Medicinal Plants (3)
11:776:321 Greenhouse Management and Crop
Production (3)
11:776:340 Principles and Practices of Fruit
Production (4)
11:776:341 Fruit Production (3)
11:776:401 Postharvest Physiology of Horticultural
Crops (3)
11:776:406 Plant Breeding (3)
11:776:439 Nursery Crop Production (3)
11:776:452 Plant Tissue Culture (3)

Teacher Education (21 credits)

Coordinator: Peter J. Bastardo: Waller Hall, Room 209, 932-9164
(bastardo@rci.rutgers.edu)

The teacher education program is available as a minor
course of study open to students at Cook College. This
minor is a prerequisite or “gateway” to a fifth year of study
in the university’s Graduate School of Education, which
culminates in a master’s degree with New Jersey certifica-
tion as a teacher of science or agriculture.

Students in the teacher education minor make applica-
tion to the Graduate School of Education during the spring
term of the junior year. If accepted, graduate level study
begins the summer after graduation with program comple-
tion, including student teaching, projected to occur by the
following May. At the undergraduate level, a minimum of
30 credits is required in life science (e.g., biology, animal,
plant etc.), physical science (e.g., physics, chemistry), or
agricultural science. The professional education courses
(listed below) are treated as unspecified elective credits in
the student’s major program.

The teacher education minor is also appropriate for stu-
dents who may not wish to pursue a master’s degree or
teacher certification but wish to explore courses and other
types of careers in education including environmental/out-
door education and agricultural/extension education.

Required courses (15)

05:300:200 Exploring Teaching as a Profession (3)
05:300:306 Educational Psychology: Principles of
Classroom Learning (3)
05:300:401 Individual and Cultural Diversity in the
Classroom (3) *
11:300:416 Environmental Education in the School
Curriculum (3)
05:300:462 Demonstration and Technology in Science
Education (3)

Two additional courses in one of the following strands:

1. Life Science Strand (6)

11:300:450 Biology and Society (3)
11:300:453 Teaching Life Science (3)

* Course may be used to fulfill 3 credits of the college’s Multicultural/
International Studies requirement.

2. Physical Science Strand (6)

- 05:256:551 Development of Ideas in Physical Science (3)
- 05:256:552 Teaching Physical Science (3)

3. Agricultural Science Strand (6)

- 11:300:425 Development of Ideas in Teaching Agriculture (3)
- 11:300:426 Teaching Agriculture (3)

Note: Students must also complete certain general education courses required for New Jersey teacher certification and admittance to the Graduate School of Education's program. A list of these courses is available in the Teacher Education Office. Chosen carefully, these courses may also satisfy the college's degree requirements. Upon spring graduation, students accepted into the Graduate School of Education's program will take 5 credits in the summer, 13 credits in the fall that include student teaching, and 12 credits in the spring to complete the program. Please consult with the teacher education coordinator, Dr. Peter J. Bastardo, for additional details.

CERTIFICATE PROGRAMS

In addition to teacher certification programs in several of areas, Cook College offers interdisciplinary certificate programs in a number of its mission areas.

Certificates are awarded only with or subsequent to the awarding of a baccalaureate degree in an approved major.

Environmental Geomatics Certificate (19 credits)

The regional and global scope of environmental problems is now well established. Satellite remote sensing provides the only feasible means of monitoring large regions of the earth and its land and water resources in a timely fashion. Remotely sensed data can be combined with other resource data in a computerized geographic information system (GIS). The GIS provides a powerful set of tools to store, integrate, analyze, and graphically display vast amounts of environmental data. The Environmental Geomatics Certificate is designed to give students, regardless of major, an understanding and working knowledge of remote sensing and GIS technology and its application to environmental resource monitoring and management.

The certificate is administered through the Department of Ecology, Evolution, and Natural Resources. For further information, contact Dr. Richard Lathrop in the Environmental and Natural Resource Sciences Building, Room 129, 932-1580, or lathrop@crssa.rutgers.edu.

- 11:372:232 Fundamentals of Environmental Geomatics (3)
- 11:372:233 Fundamentals of Geomatics Laboratory (1)
- 11:372:362 Intermediate Environmental Geomatics (3)
- 11:372:369 Analytical Methods for Environmental Geomatics (3)
- 11:372:371 Air-Photo Interpretation (3)
- 11:372:462 Advanced Environmental Geomatics (3) *or*
11:372:474 Advanced Remote Sensing (3)
- 01:960:401 Basic Statistics for Research (3) *or* equivalent

Environmental Planning Certificate (21 credits)

Environmental planning requires the integration of environmental information into the planning process and is concerned with the protection and enhancement of environmental systems while meeting demands for growth and development. The Environmental Planning Certificate Program provides a basic introduction to the challenges of environmental planning and enables students from a variety of disciplines to pursue professional careers in planning.

The certificate is administered through the Department of Ecology, Evolution, and Natural Resources. For further information, contact Dr. David L. Tulloch in the Environmental and Natural Resource Sciences Building, Room 133, 932-1581, or dtulloch@crssa.rutgers.edu.

Required courses (12)

- 11:372:231 Fundamentals of Environmental Planning (3)
- 11:372:232 Fundamentals of Environmental Geomatics (3)
- 11:372:409 New Jersey Planning Practice (3)
- 11:372:411 Environmental Planning and the Development Process (3)

Electives (9)

- 11:375:409 Environmental Statement and Impact (3)
- 10:975:305 U.S. Urban Policy (3)
- 10:975:306 Introduction to Urban and Environmental Planning (3)
- 10:975:315 Theory and Methods of Land-Use Planning (3)
- 10:975:316 Urban Design and Site Planning (3)
- 10:975:335 Administrative Issues in Environmental and Land-Use Planning (3)
- 10:975:420 Computers in Planning and Management (3)
- 10:975:474 Tourism Planning (3)
- 10:975:478 History of Planning Thought (3)
- 10:975:481 Housing and Economic Analysis (3)
- Adviser-approved course(s) in planning

Fisheries Science Certificate (30 Credits)

This certificate program addresses the growing demand for trained fisheries professionals in the region. The certificate provides students from several curricula with courses and practical experience and is modeled on the guidelines of the American Fisheries Society.

The program was developed by faculty from the departments of ecology, evolution, and natural resources; human ecology; and marine sciences. For more information, contact Dr. John A. Quinlan, IMCS 309D, 932-6555, ext. 549, or quinlan@imcs.rutgers.edu.

Required courses (24)

- 11:373:121 Principles and Applications of Microeconomics (3) *or* equivalent
- 11:373:363 Environmental Economics (3) *or* 11:373:362 Natural Resource Economics (3)
- 11:628:321 Ichthyology (4)
- 11:628:462 Ocean Ecology (4) *or* 11:704:335 Limnology (4)
- 11:704:213 The Natural Resources Professions (P/NC 1)
- 11:704:406 Fishery Science (3)
- 11:704:407 Research Methods in Fishery Science (3) *or* an adviser-approved course in population dynamics

11:704:453 Natural Resource Biometrics (3) *or* 01:960:401
Basic Statistics for Research (3)

Two of the following (6 credits):

11:374:308 Human Ecology of Maritime Regions (3)
11:374:313 Environmental Policy and Institutions (3)
11:374:314 Human Dimensions of Natural Resource
Management (3)
11:374:315 International Environmental Policy (3)
11:375:333, 334 Environmental Law I,II (3,3)
An appropriate, adviser-approved practicum in
fisheries science (3)

Food Systems Education and Administration Certificate (FSEACP) (21–22 credits)

This certificate program is designed to provide practical skills and experiences appropriate for employment in a wide range of careers involving the development, administration, and delivery of educational programs and services provided by both nonprofit and for-profit organizations. Recognizing that interpersonal skills and business savvy are often as important as solid technical and conceptual foundations in a discipline, the program is intended to supplement a variety of discipline-based major programs.

The program explores communication skills; management skills; experience and skill in the development of proposals and reports; the ability to design, implement, and assess educational programs, activities, and related budgets; and the ability to contribute to a program as both an individual and member of a team. An experience-based education component is an integral requisite for the certificate.

For more information, contact Dr. Maurice P. Hartley, Cook Office Building, Room 112, 932-9155, ext. 216, or hartley@aesop.rutgers.edu.

The program requires at least 3 credits selected from each of the following areas:

I. Food Systems/Policy (3)

11:015:430 World Food Problems: Scientific
Solutions? (3)
11:373:323 Public Policy toward the Food Industry (3)
11:373:331 Economics of Food Marketing Systems (3)
11:373:371 Food Health and Safety Policy (3)

II. Communication (3)

04:192:220 Fundamentals of Speaking and Listening (3)
04:192:380 Public Speaking (3) (for admitted communi-
cation majors only)
01:335:202 Technical Writing Essentials (3)
01:335:203 Business Writing Essentials (3)
01:355:302 Scientific and Technical Writing (3)
01:355:303 Writing for Business and the Professions (3)
01:355:402 Advanced Writing Workshop (3)

III. Management (3)

11:373:241 Agribusiness Management (3)
11:373:341 Management: Human Systems
Development (3)

IV. Interpersonal/Intercultural Relations (3)

04:192:345 Intercultural Communication (3) (for
admitted communication majors only)
11:300:327 Applications of Psychology in Education (3)
11:374:101 Introduction to Human Ecology (3)

01:512:___ An American history course emphasizing
minority/gender issues (3)
01:830:___ A psychology course emphasizing minor-
ity/gender issues (3)
01:910:352 Groups at Risk in Contemporary Society (3)
01:920:306 Race Relations (3)

V. Computer Applications (3–4)

01:198:110 Introduction to Computers and Their
Application (3)
11:373:210 Business Decision Computer Tools (4)

VI. Accounting (3)

33:010:272 Introduction to Financial Accounting (3)

VII. On-the-Job Experience (3)

An internship or cooperative education experience for at least one term, enabling the students to learn about organizational structure, teamwork, the work ethic, and leadership. It also should provide experience in program planning and budgeting and expose the students to the technical areas in which they desire to work.

Horticultural Therapy Certificate (29 Credits)

The profession of horticultural therapy employs horticulture to treat mental and physical diseases and disabilities. The profession requires the integration of plant systems and culture techniques with human psychology and health. This program will enable students to pursue professional registration through the American Horticultural Therapy Association.

For additional information, contact Professor Joel Flagler at the Hackensack Cooperative Extension office, 201/336-6781, or on campus at Foran Hall, 732/932-9711, ext. 248, or flagler@aesop.rutgers.edu.

Required courses (16)

11:776:210 Principles of Botany (3)
11:776:225 Introduction to Horticultural Therapy (3)
11:776:310 Plant Propagation (3)
11:776:325 Horticultural Therapy Techniques and
Programming (3)
11:776:495 Special Problems in Plant Science (4);
an approved practical experience in horti-
cultural therapy

Electives (13)

11:770:301 General Plant Pathology (3)
11:776:221 Principles of Organic Crop Production (3)
11:776:231 Commercial Floral Design (3)
11:776:321 Greenhouse Management and Crop
Production (3)
11:776:439 Nursery Crop Production (3)
11:776:496 Special Problems in Plant Science (4)
01:830:377 Health Psychology (3) *or* 01:830:340
Abnormal Psychology (3)
::_: Adviser-approved electives

International Agriculture/Environment Certificate (21–23 credits)

The International Agriculture/Environment Certificate Program has been designed as a supplement to the various academic majors at Rutgers, especially those at Cook College pertaining to agriculture, food, and the environment. Courses selected from several curricula provide a better

understanding of the relationship between these areas and social, cultural, historical, political, and economic factors as they relate to human issues. In short, the academic major provides the knowledge and skill base and the certificate program helps to establish a global perspective. This option should be particularly useful to students in applied science fields who wish to pursue careers in the international arena.

In consultation with their academic advisers and the international environmental studies curriculum coordinator, interested students should select a sequence of courses, one from each of three subject areas (I, II, III), that relate to a particular topic such as agriculture, health, food, or environmental management. The program also requires foreign language training (IV) and practical experience (V). In addition, Cook College courses that offer an international focus are listed following the certificate program. Students are encouraged to consider these as they select courses to fulfill major and elective requirements.

The International Agriculture/Environment Certificate Program is designed to serve Cook College and other Rutgers students who wish to supplement their majors by expanding their understanding of issues and challenges faced in the international arena. The certificate program is administered through the international environmental studies curriculum. Interested students should consult with their advisers and Dr. George E.B. Morren, Cook Office Building, Room 208, 932-9153, ext. 315, or morren@crssa.rutgers.edu.

I. Geography and Physical Environment (3)

Courses whose subject matters focus primarily on environmental and other kinds of physical or biotic systems and problems characteristic of a region, world area, or habitat outside of the United States, or use such bases for assessing human issues.

- 11:015:401 Colloquium: Earth System Science (3)
- 11:015:492 Tropical Agriculture (3)
- 11:374:101 Introduction to Human Ecology (3)
- 11:374:301 Environment and Development (3)
- 01:450:101 Earth Systems (3)
- 01:450:102 Transforming the Global Environment (3)
- 01:450:211 Conservation and Use of Natural Resources (3)
- 01:450:311 Natural Hazards and Disasters (3)
- 11:670:202 Elements of Climatology (3)

II. Historical-Cultural (3)

Courses that focus primarily on comparative, historical, and/or sociocultural factors in examining issues related to environment, food, health, population, or agriculture.

- 01:070:307 Medical Anthropology (3)
- 11:374:211 Rural Communities (3)
- 11:374:223 Urban Society and Environment (3)
- 11:374:269 Population, Resources, and Environment (3)
- 11:374:308 Human Ecology of Maritime Regions (3)
- 11:374:312 Environmental Problems in Historical and Cross-Cultural Perspective (3)
- 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:374:331 Culture and Environment (3)
- 11:374:341 Social and Ecological Aspects of Health and Disease (3)
- 01:450:205 World Cultural Regions (3)

III. Political Economy (3)

Courses that focus primarily on the international or comparative political and/or economic institutions and their dynamics.

- 11:015:430 World Food Problems: Scientific Solutions (3)
- 11:373:371 Food Health and Safety Policy (3)
- 11:374:102 Global Environmental Processes and Institutions (3)
- 11:374:220 Rural Development (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:315 International Environmental Policy (3)
- 01:790:102 Introduction to International Relations (3)
- 01:790:210 Comparative Politics (3)

IV. Foreign Language (6-8)

Completion of at least two terms of foreign language at the intermediate or advanced level.

V. Practical Experience (6)

Relevant research, at home or abroad, overseas work, study and travel, employment or a combination of these focused on international environment, agriculture, food, and the like. Credits are gained through registration for curricular independent study, field study, research, and practicum courses or cooperative education at Cook College.

"International" Courses at Cook College

"International" courses at Cook College are those courses offered by the faculty that consider issues in comparative or global terms and contribute explicitly to international understanding in relation to human welfare.

Such courses may include consideration of (1) the social, cultural, biological, physical, and other institutional characteristics of nations and societies; and (2) the interrelationships between and among nations and societies.

The following Cook College courses currently meet the definition and criteria, in addition to those listed above:

- 11:015:101 Perspectives on Agriculture and the Environment (2)
- 11:015:494 Tropical Agriculture and Natural Resources Field Study (3)
- 11:067:142 Animal Science (3)
- 11:370:406 Medical and Veterinary Entomology (3)
- 11:372:202 Environmental Issues in the United States (3)
- 11:372:231 Fundamentals of Environmental Planning (3)
- 11:372:232 Fundamentals of Environmental Geomatics (3)
- 11:372:371 Air-Photo Interpretation (3)
- 11:372:384 A Systems Approach to Environmental and Agricultural Issues (3)
- 11:373:101 Economics, People, and Environment (3)
- 11:375:321 Environmental Pollution in International Perspective (3)
- 11:375:462 Soil Classification and Survey (4)
- 11:554:305 Ideas of Nature (3)
- 11:670:210 Meteorological Analysis I (1.5)
- 11:704:317 Conservation Ecology (3)
- 11:709:255 Nutrition and Health (3)
- 11:709:363 World Food Customs and Nutrition (3)
- 11:776:330 Conservation Vegetation (3)

Medicinal and Economic Botany Certificate (24 credits)

The medicinal and economic botany certificate is designed for students with an interest in the practical uses of plants, both known and yet to be discovered. The program requires a basic knowledge of biology and chemistry, but is available to students in a variety of majors, such as anthropology, conservation biology, or environmental education.

The program emphasizes historical and cultural botany, modern medicinal plants, and practical plant production and concludes with research or field experience.

For more information, contact Dr. James C. French, Foran Hall, Room 296C, 932-9711, ext. 162 or aroid@rci.rutgers.edu.

Prerequisites: 01:119:101-102 General Biology (4,4); 01:160:161-162 General Chemistry (4,4); 01:160:171 Introduction to Experimentation (1)

Required courses (15)

- 11:776:205 Introduction to Ethnobotany (3)
- 11:776:211 Introduction to Horticulture (3)
- 11:776:242 Plant Science (3)
- 11:776:312 Medicinal Plants (3)
- 11:776:495 Special Problems in Plant Science (3): an adviser-approved internship focusing on an area of medicinal or economic botany

Electives (9)

- 11:770:301 General Plant Pathology (3)
 - 11:770:402 Mycology: Fungi in the Environment (3)
 - 11:776:221 Principles of Organic Crop Production (3)
 - 11:776:310 Plant Propagation (3)
 - 11:776:321 Greenhouse Management and Crop Production (3)
 - 11:776:341 Fruit Production (3)
 - 11:776:439 Nursery Crop Production (3)
 - 11:776:440 Soil Fertility (3) or equivalent
 - 11:776:496 Special Problems in Plant Science (4)
- Adviser-approved electives

Social Strategies for Environmental Protection Certificate (24 credits)

Solving environmental problems often requires social intervention skills and not just an understanding of the biophysical environment. This certificate program is designed to give students, regardless of their major, an understanding of individual behavior, social organization and values, politics, law, and communication as these fields relate to environmental intervention. The aim is to provide action-oriented training in skills that strengthen environmental protection efforts. The program culminates in a practicum experience in which these skills are applied to an environmental issue of current concern.

The certificate is administered jointly through several departments at Cook College. For further information, contact Dr. Neil Weinstein in the Cook Office Building, Room 206, 932-9153, ext. 319, or neilw@aesop.rutgers.edu, or Dr. William K. Hallman, in the Cook Office Building, Room 215, 932-9153, ext. 313, or hallman@aesop.rutgers.edu.

Required courses (15)

- 11:374:279 Politics of Environmental Issues (3)
- 11:374:322 Environmental Behavior (3)
- 11:375:333 Environmental Law I (3)

An independent study project approved by the certificate adviser (3)

One of the following courses in communication skills, in addition to the 6 credits required by the college (3):

- 04:192:220 Fundamentals of Speaking and Listening (3)
- 04:192:359 Persuasive Communication (3)
- 04:192:365 Principles of Public Relations (3)
- 04:192:380 Public Speaking (3)
- 01:355:302 Scientific and Technical Writing (3)
- 01:355:303 Writing for Business and the Professions (3)
- 01:355:402 Advanced Writing Workshop (3)
- 04:567:324 News Reporting and Writing (3)
- 04:567:327 Public Information and Public Affairs (3)

Electives (9)

- 11:373:363 Environmental Economics (3) or 01:220:332 Environmental Economics (3)
- 11:374:201 Research Methods in Human Ecology (3)
- 11:374:313 Environmental Policy and Institutions (3)
- 11:374:335 Social Responses to Environmental Problems (3)
- 11:374:337 Systems Approaches and Interventions in Human Ecology (3)
- 11:375:334 Environmental Law II (3)
- 01:790:301 Political Campaigning (3)
- 01:790:305 Public Policy Formation (3)
- 01:790:330 Interest Groups (3)
- 01:790:341 Public Administration: American Bureaucracy (3) or 01:790:342 Public Administration: Policy Making (3)
- 19:910:666 Social Action Techniques and Methods (3)
- _:_:_: Additional communication skills course from the list above (3)

Other courses approved in advance by the certificate adviser may be substituted.

Urban/Community Forestry Certificate (27.5–29.5 credits)

Urban and community forestry is the fastest growing segment of the forestry profession, especially in the northeast, where the total expenditure of time and money on community forestry (nursery, planting, pruning, removals, and line clearance) exceeds that spent on woodlands. This certificate is designed to provide students with the necessary credentials for employment by providing the fundamental knowledge and expertise required for this field.

The certificate is administered through the Department of Ecology, Evolution, and Natural Resources but is designed for students in several curricula. For further information, contact Dr. Jason Grabosky, ENR 144, 932-9236, or grabosky@aesop.rutgers.edu.

- 11:370:381 Insect Biology (4)
- 11:372:231 Fundamentals of Environmental Planning (3) or 11:374:314 Human Dimensions of Natural Resource Management (3)
- 11:704:332 Plant Ecology (4)
- 11:704:365 Arboriculture (4)
- 11:704:377 Practicum in Forest Management (BA)
- 11:704:403 Urban Forestry (3)
- 11:704:473 Wildlife Damage Management (3) or 11:704:464 Wildlife Ecology and Conservation (3)
- 11:770:391 Diseases of Urban and Forest Trees (1.5)
- 11:776:202 Applied Physiology of Horticultural Crops (3) or 11:776:382 Plant Physiology (4)

COOPERATIVE EDUCATION

Director: Carol M. Rutgers: Martin 211, 932-3000, ext. 523
(rutgers@cook.rutgers.edu)

The cooperative education program at Cook College is an academic program designed to supplement campus-based studies through the practical application of theory in full- and part-time field experiences related to students' majors or career interests. This blending of formal study and supervised employment in areas relevant to the educational and professional goals of the student is subject to the same advice and approval by appropriate members of the faculty as is the student's choice of programs and courses.

Cook College students in good academic standing from all curricula may enter the program upon completion of 24 credits. Nonmatriculated, part-time, readmitted, and transfer students who are in good academic standing after completing at least 24 credits, 12 of which must be taken at Cook College, also are eligible. Transfers from within the university are eligible immediately if they have completed the first year and are in good academic standing. Students who fail to maintain good academic standing are declared ineligible.

Students seeking their first term of co-op employment after the summer of their junior year must secure curricular approval or, in some cases, approval of the Scholastic Standing Committee. A student whose first term of co-op employment occurs in the second term of the senior year must commit to continuing a second term of cooperative education, thereby delaying graduation. Students also must be registered for at least 6 credits in the term prior to cooperative education employment.

It is recommended that students begin their involvement in cooperative education by registering for the 1-credit course 11:015:270 Professional Practices/Introduction to Cooperative Education. This is a self-paced course that follows a video instruction format and prepares the registrant for future employment. Registration for the course is by permission, through the cooperative education director (Martin 211).

Cooperative education typically provides experiences that are relevant to students' career interests and salaries that are commensurate with the position held. However, the emphasis is on the learning experience provided by the job rather than on preparation for a specific job upon graduation or on any single economic factor.

A maximum of 15 credits earned through cooperative education may be applied toward graduation. Credits earned are for the educational benefits of the experience, not for "having a job." Students are required to establish an individualized learning contract under the direction of a faculty sponsor. This memorandum of understanding outlines the student's objectives and scholarly responsibilities, the work plan, the plan for evaluation, and the number of credits to be earned (3 or 6 credits per term).

Cooperative education is one way of fulfilling the Cook College experience-based education requirement. Credit is awarded on a standard letter grade or *Pass/No Credit* basis. Subject to the approval of the student's faculty adviser and the curriculum coordinator, up to 6 credits earned through a given cooperative education experience may be used to satisfy option electives in the student's program of study.

Kappa Theta Epsilon, founded in 1957, is the national cooperative education honor society. Outstanding coopera-

tive education students are invited to join the society in order to promote distinguished scholarship, industrial ability, integrity, breadth of interest, and adaptability.

Students must apply for admission to the program through the office of the director of cooperative education. Subject to the approval of the director and the student's faculty sponsor, the student registers for cooperative education as follows:

11:199:200. COOPERATIVE EDUCATION I (3-6)
First cooperative education registration.

11:199:300. COOPERATIVE EDUCATION II (3-6)
Second cooperative education registration.

11:199:403. COOPERATIVE EDUCATION III (3-6)
Third and subsequent cooperative education registrations and fall/spring graduate registrations.

A maximum of 6 credits earned through participation in a cooperative education program at another institution may be accepted subject to the usual review of transfer credits.

For more information, see the Cook College cooperative education program web site, <http://www.cook.rutgers.edu/~coop>.

MILITARY EDUCATION

See Military Education in the Programs of Study for Liberal Arts Students section.

HONORS PROGRAMS

Cook College offers two collegewide honors programs:

1. The Cook College General Honors Program is a four-year program for which university Merit Scholars and selected high school seniors (with secondary school grade-point averages of at least 3.5 and superior SAT scores) who apply to Cook College prior to the application deadline are invited to compete. Students who join the program are awarded supplementary merit scholarships. There are approximately 80 students in the program.
2. The George H. Cook Scholars Program is Cook College's senior honors thesis program. Students in the top 15 percent of their class in the fall term of the junior year are automatically invited to participate, but Cook College juniors nominated by a faculty member may join the program in their final three terms.

Additionally, several departments offer honors in the major program of study to students who fulfill department requirements, which typically include honors courses and/or independent research projects.

Cook College General Honors Program

Acting Director: Barbara M. Goff: Loree, Room 038, 932-9266 or 9162
(goff@aesop.rutgers.edu)

The Cook College General Honors Program is designed for highly motivated and promising high school seniors who apply to Cook College. Students who fulfill the admissions criteria are invited to the campus to be interviewed by faculty and students who participate in the four-year program. Students selected as Rutgers

Presidential Scholars who have applied to Cook College are also admitted to this program. Successful candidates are typically notified in early April, prior to the deadline for college decision. Several first-year students not in the program, whose first-term performance is outstanding, may be invited in January to join the program.

The program includes a variety of social and academic activities throughout the year, recommended by both faculty and students in the program. The academic requirements of the program are as follows:

1. *First Year:* In the first term, students are registered for an honors section of Exposition and Argument and a 1-credit Readings in Biology course, in addition to the courses they request. Students register for the interdisciplinary honors seminar in the spring term. The honors seminars are team-taught and integrate formal presentations by faculty and students, reading, discussions, and individual and/or small group research projects. The additional courses selected in the first year will depend upon the curriculum in which the student intends to major. Qualifying students also may be invited by departments to take first-year honors courses.
2. *Sophomore Year:* Each term, sophomores register for a 1-credit honors tutorial in which they work with a faculty member on a small independent study project that introduces them to research in their areas of interest. In the spring, sophomores also register for the honors seminar.
3. *Junior Year:* Students register for at least 3 credits of honors tutorial, an independent study program in which each student works with one faculty member. The remaining courses selected for the junior and senior years are determined by the curriculum in which the student is enrolled.
4. *Senior Year:* Each term students register for a 3- to 6-credit Honors Tutorial (11:554:497,498) or the George H. Cook Scholars Program (11:015:497,498).

In order to remain in the Cook College General Honors Program and continue to receive the scholarship award that accompanies participation, honors students must (1) enroll as full-time undergraduates and (2) maintain a cumulative grade-point average of 3.4 or better.

George H. Cook Scholars Program

Director: Barbara M. Goff, Loree, Room 038, 932-9266
(goff@aesop.rutgers.edu)

The George H. Cook Scholars Program is a senior-year honors thesis program administered by the Honors Committee and available to students who have completed a minimum of 24 credits at Rutgers by the end of their junior year. To be eligible, students must have achieved a cumulative grade-point average of 3.0 in the junior year or be recommended to the honors committee by a Cook College faculty member.

This program is designed to develop and encourage interest in scientific research or creative projects in all curricula. Interested students should contact the program director and discuss the program with their faculty adviser prior to preregistration for courses for the second term of the junior year. With the adviser's help, students find an instructor willing to aid in the definition of a project and to supervise the work. In consultation with the honors project adviser, students decide how many credits (from 3 to 6) to assign to each term of the honors course. Students submit

written and oral project proposals for the approval of the Honors Committee at the end of the junior year.

Students who successfully complete the two-term honors course (11:015:497,498), prepare a thesis or other presentation based on these studies, present their work at an open seminar attended by interested faculty members and others, and maintain a satisfactory academic record through the senior year are designated as George H. Cook Scholars at graduation. Honors theses are kept in the permanent collection of the Chang Science Library.

Independent Study, Special Problems, and Departmental Honors

Specific requirements for participating in departmental honors, special problems, or independent study courses are based upon departmental procedures and individual faculty and program of study requirements. For additional information on these honors programs, contact Dean Robert Hills, Cook College, Office of Academic and Student Programs, Martin Hall, second floor.

OFF-CAMPUS PROGRAMS

Study Abroad Programs

Rutgers offers a number of junior-year abroad programs and several summer study abroad programs. Although the majority of the options have been designed for students with majors or interests in the liberal arts, agreements related directly to majors at Cook College have been established with the University of Reading in England and Technion-Israel Institute of Technology in Haifa, Israel.

The Technion program is primarily a junior-year program of study in agricultural engineering. However, on a case-by-case basis, opportunities may be developed for students in other disciplines. With advance planning, a reduced course load coupled with a cooperative education placement at Technion may be arranged.

The University of Reading junior-year study program includes options in the sciences and in agriculture and food. Among these are the biological sciences, microbiology, agricultural botany, agricultural economics, soil science, and physiology and biochemistry.

Students interested in the Technion, University of Reading, or other study abroad options may obtain additional information through the Study Abroad Office, Rutgers, The State University of New Jersey, 102 College Avenue, New Brunswick, NJ 08901-8543. In order to assure optimum planning toward fulfilling major and degree requirements, it is strongly recommended that students contemplating study abroad consult with their faculty adviser, preferably in the fall term of the sophomore year.

OFFICE OF SPECIAL PROGRAMS

The transition from high school to the university is often difficult at best for the academically prepared student and can be disastrous for the economically and academically disadvantaged student. As a result, many capable students become disenchanted with the university and therefore fail to realize their dreams. The Office of Special Programs (formally Educational Opportunity Program—EOP) is

designed for students with potential for success in college. This office, with funding from the state and the college, provides students with a network of academic and student support resources that are essential for success at college.

The Cook College Office of Special Programs provides the opportunity for these students to gain access to the university and the opportunity to experience, maybe for the first time, academic success in a competitive environment. The office represents three distinct programs: the Summer Institute, the Academic Year Program, and the Solid GEMS (General Education in Mathematics and Science) Program.

The Summer Institute is a six-week, residential, academically intensive assessment and orientation program for admitted eligible incoming first-year students. All students who are admitted to the Academic Year Program are required to attend. During this six-week period, students participate in a series of academic and counseling activities. The aim of the program is to diagnose students' academic and nonacademic problem areas. In addition, the program seeks to prepare students to accept and cope with the realities of a competitive college environment. Students take a rigorous course load of English, mathematics, computer applications and operations, and a skills seminar.

This program is free for those who qualify. Failure to attend the Summer Institute for students admitted to Cook College through the Office of Special Programs may result in the student being denied admission to the college. Students who wish to apply to this program must fill out the New Jersey Financial Aid Form (NJFAF). The form is available in the guidance offices of most New Jersey high schools.

The Academic Year Program consists of two 16-week terms. This support program offers individual counseling, tutoring, career information, diagnostic testing, and additional services needed for success at college. Equally important is that students learn to view themselves realistically: to understand their strengths, limitations, defensive styles, and adaptive capabilities.

Solid GEMS is an academically intensive summer program that takes place prior to the student's second year in college. Building on the Summer Institute and the Academic Year Program, Solid GEMS aims to improve performance in entry level science courses. The program works to discourage students from changing their science major before they have established a sound academic foundation and experience from which to make that decision. Participants successfully completing the Solid GEMS summer program earn 4 credits in the 01:160:161 General Chemistry (Solid GEMS) course. Solid GEMS sections of General Chemistry are offered in the fall-to-spring terms. Activities are designed to generate questions, curiosity, and a "feel for the subject."

The program is open and available to all students who qualify. Costs for students who qualify for the Solid GEMS summer program are financed by grants that are received by the Office of Special Programs.

Inquiries about the Office of Special Programs at Cook College should be addressed to Dean Frager Foster, Assistant Dean for Special Programs, Rutgers, The State University of New Jersey, 88 Lipman Drive, New Brunswick, NJ 08901-8525 (732/932-3000, ext. 530).

PREPROFESSIONAL PROGRAMS

Health Professions

All Cook College students are eligible for the services of the Health Professions Advising Center on the Busch campus in Nelson Biology Laboratories A-207. This center advises all Rutgers students interested in careers in medicine, dentistry, and related health professions. In addition to advising, the center maintains the student's file and letters of evaluation, supplies application materials for examinations and professional schools, coordinates workshops, and publishes a monthly newsletter of events and deadlines. The center also maintains a library of materials pertaining to careers in the health professions.

All Cook College students wishing to pursue a career in the health professions must register with the Health Professions Advising Center as early in their academic career as possible to begin maintaining a file. The Cook College Office of Academic and Student Programs also provides individual counseling pertaining to health careers. Interested students should make an appointment with Dean Sharice Richardson in Martin Hall, second floor.

Veterinary Medicine

New Jersey does not have a college of veterinary medicine. New Jersey residents who wish to become doctors of veterinary medicine obtain their professional education in out-of-state universities.

To prepare for admission to a veterinary college, the student must have acquired a strong scientific and liberal arts background, as might be obtained from the following undergraduate subjects: biochemistry, biology, English, genetics, general chemistry, microbiology, and physics. The undergraduate program should provide not only the technical information and skills necessary to complete the study of veterinary medicine, but also a broad background of experience and interest enabling the student to achieve full potential as an individual and a member of society. Experience with a veterinary practice is required by all schools. Special examinations must be taken prior to the submission of applications to veterinary colleges. For example, Graduate Record Examinations are required by most colleges of veterinary medicine. Veterinary Aptitude Tests are, however, required by a few schools. Applicants must check with the individual schools regarding course and test requirements.

Most colleges of veterinary medicine require a minimum of three years of university-level study prior to admission. Most successful candidates for admission have completed a B.S. degree in biological, animal, or agricultural science programs. Colleges of veterinary medicine do not dictate where or in what degree program applicants should be enrolled for preprofessional study. Most veterinary colleges recommend, however, that applicants pursue a baccalaureate degree in the area of their second choice of vocation. If the candidate is not admitted to a college of veterinary medicine, the time spent in preparatory studies may be applied to careers in related sciences, such as animal science, biology, biotechnology, medical technology, or laboratory animal science.

The Veterinary Medical Education Act of 1971

The Veterinary Medical Education Act of 1971 provides for contractual agreements between the New Jersey Department of Higher Education and out-of-state schools of veterinary medicine for the acceptance of New Jersey residents who are and have been residents of the state of New Jersey for 12 consecutive months. Under the terms of the act, the schools receive a substantial subsidy toward educational costs in return for a number of guaranteed reserved seats, at in-state tuition and/or reduced fees, for New Jersey residents.

At present, New Jersey has contractual agreements with the following schools: New York State College of Veterinary Medicine of Cornell University, University of Pennsylvania School of Veterinary Medicine, Tufts University, Iowa State University, Kansas State University, Oklahoma State University, and Tuskegee University School of Veterinary Medicine, all of which reserve seats for New Jersey residents. As of 2003, 24 spaces were available. Students are encouraged to apply to all of these institutions in order to increase their chances of acceptance. Most schools of veterinary medicine also admit a few out-of-state residents without specific contracts. Noncontract schools such as Purdue, Michigan State, Colorado State, Minnesota, Missouri, Ohio State, and Tennessee have admitted students from Cook College.

Further information on application procedures is available in the Department of Animal Sciences, Bartlett Hall.

Law

Prelaw is not a curriculum, curricular option, or academic program, because there are no specific prerequisites for law school. The most important factor in determining which area of study a student should undertake is his or her interest outside of law. The traditional view that political scientists and historians are the only candidates with free access to law school is false. Law schools expect and admit candidates with diversified backgrounds ranging from biology to environmental policy, institutions, and behavior; environmental and business economics; and all other Cook College programs.

Certain courses or areas, however, may prove helpful to students who wish to pursue a career in law. Courses in environmental law (11:375:333,334) provide an introduction to the American legal system, legal reasoning, and legal education. Some background in accounting, government, economics, history, logic, and political science is valuable for prelaw students. Communications skills are vital to lawyers, and courses in speech and expository writing are recommended for students who require improvement in these areas. Another important area is reading comprehension and speed. Students who have average or below average skills should consider taking a course in reading comprehension and skills offered at the university.

Students interested in applying to law school should consult the prelaw society web site at <http://www.eden.rutgers.edu/~ruprelaw>. Donald C. Heilman, director of Rutgers Student Legal Information Center, may also be contacted for advisement (932-9363).

COMBINED DEGREE PROGRAMS

Cook College students may participate in several universitywide programs that provide the opportunity to begin advanced degree work while completing a bachelor's degree.

In addition to the programs described below, which are available to students in any undergraduate major, are several five-year bachelor's/master's programs specifically articulated with Cook undergraduate degree programs: a B.S./M.C.R.P. (Master of City and Regional Planning) program with the Edward J. Bloustein School of Planning and Public Policy (for environmental planning majors); a B.S./M.P.H. (Master of Public Health) program with UMDNJ (for environmental science majors); and a B.S./M.P.H. (Master of Public Health) program with the Edward J. Bloustein School of Planning and Public Policy (for public health majors).

Joint Bachelor/Medical Degree Program

Offered through the Division of Life Sciences in collaboration with the University of Medicine and Dentistry of New Jersey–Robert Wood Johnson Medical School, this eight-year articulated program allows specially selected students to begin medical school courses in their junior year, while completing undergraduate courses and degrees. Students are selected for this program at the conclusion of their fourth term at Rutgers and are granted provisional admission into the medical school, with a second review of the student's credentials during the fourth year of the program. Students maintain affiliation with the undergraduate college until the bachelor's degree requirements are completed.

The program and procedures for admission are outlined in the Division of Life Sciences section of the Programs of Study for Liberal Arts Students. The program is, however, not limited to students majoring in biological sciences.

For further information, see Dean Sharice Richardson in the Office of Academic and Student Programs, Martin Hall, second floor.

Also available are an articulated bachelor's degree/M.D. program with the University of Medicine and Dentistry of New Jersey–New Jersey Medical School and an articulated bachelor's degree/Doctor of Dental Medicine program with the University of Medicine and Dentistry of New Jersey–New Jersey Dental School in Newark.

Five-Year B.A. or B.S./M.B.A. Program

Offered in cooperation with Rutgers Business School: Graduate Programs–Newark and New Brunswick, this program allows specially selected students to earn both a bachelor's degree and an M.B.A. in five years. Students must apply for this program in the spring term of the junior year. If accepted, students will take graduate courses in their fourth year at Rutgers Business School.

Applicants must take the GMAT (Graduate School Management Admissions Test) in their junior year and have a cumulative grade-point average of at least 3.0.

For further information, see Dean Robert Hills in the Office of Academic and Student Programs, Martin Hall, second floor.

Five-Year B.A. or B.S./M.Ed. Program

Undergraduates in any Cook College major who complete the minor program in teacher education offered by Cook College may apply for a fifth year at the Graduate School of Education in New Brunswick. In this summer- and academic-year program, students will complete the course and student-teaching requirements for the master's degree and New Jersey state certification in the sciences or agriculture.

See the Teacher Education program in the Minor Programs of Study section. For further information, contact Dr. Peter J. Bastardo, Waller Hall (732/932-9164).

Five-Year B.A. or B.S./M.P.P. Program

Offered in cooperation with the Bloustein School of Planning and Public Policy, this program allows specially selected students to earn an M.P.P. degree in five years by beginning graduate courses in their senior year and undertaking a summer internship after their fourth year. Students apply for admission in the junior year. They must take the GRE or LSAT in the junior year and have a GPA of at least 3.0.

For further information, see Dean Robert Hills in the Office of Academic and Student Programs, Martin Hall, second floor.

Course Listing

Explanation of Three-Part Course Numbers

The number preceding each course title is divided into three parts. The first two digits are the administrative code (standing for a faculty or a school), the next three digits are the subject code, and the final three digits are the course code.

Administrative Codes

The Cook College administrative code is 11. For a complete list of administrative codes, see the beginning of the Programs of Study for Liberal Arts Students section in this catalog.

Subject Codes

A subject code comprises the third through fifth digits in all course numbers and indicates the subject matter of the course. Courses with the following subject codes are listed in this chapter. (Subject codes are not necessarily major programs of study and do not always have the same code numbers as the curricula.)

- 015 Agriculture and Environmental Science
- 067 Animal Science
- 115 Biochemistry
- 126 Biotechnology
- 127 Bioresource Engineering
- 199 Cooperative Education
- 300 Education
- 370 Entomology
- 372 Environmental Planning and Geomatics
- 373 Environmental and Business Economics
- 374 Environmental Policy, Institutions, and Behavior
- 375 Environmental Sciences
- 400 Food Science
- 550 Landscape Architecture
- 554 Interdisciplinary Studies
- 628 Marine Sciences
- 670 Meteorology
- 680 Microbiology
- 704 Ecology and Natural Resources
- 709 Nutritional Sciences
- 770 Plant Pathology
- 776 Plant Science

Course Codes, Credits, and Hours of Attendance

The sixth, seventh, and eighth digits comprise the course code in all course numbers. Two course codes separated by a comma indicate that each term may be taken independently of the other (example: 11:015:483,484). Two course codes separated by a hyphen indicate that satisfactory completion of the first term is a prerequisite to the second term (example: 01:119:101-102); however, credit may be earned for the first term without registration for the second.

Credits awarded for the successful completion of each course are indicated in parentheses following the course title. The credit-prefix *E* indicates that the credits are not included in the calculation of credits required for

graduation (“degree credits”). The notation *BA* indicates that the number of credits is determined by arrangement with the department offering the course. The notation *P/NC* indicates that the course is offered only for *Pass/No Credit* grading.

Unless otherwise indicated, a course normally meets for a number of lecture hours per week equal to the number of credits to be earned. Special hours or modes of class, other than lecture, are usually indicated in italics below the course title.

Consult the *Undergraduate Schedule of Classes* for the name(s) of the faculty member(s) currently offering each course.

AGRICULTURE AND ENVIRONMENTAL SCIENCE 015

11:015:001. ORIENTATION PROGRAM (BA)
Academic and student life orientation.

11:015:095,096. SEMINAR ON ACADEMIC SKILLS I,II (E3,E3)
Development of cognitive study techniques for course work in mathematics, chemistry, biology, English, and reading.

11:015:097,098. SEMINAR ON ACADEMIC SKILLS III,IV (E3,E3)
Prerequisite: 11:015:095 or 096.
Further development of cognitive skills required for advanced course work in mathematics, chemistry, biology, and English.

11:015:101. PERSPECTIVES ON AGRICULTURE AND THE ENVIRONMENT (2)
Lec./rec. 3 hrs. for the first 10 weeks of fall term. For entering first-year and transfer students with 36 credits or less.
Examines several current issues to introduce the land-grant mission of the college and the multidisciplinary nature of both the problems and solutions it addresses.

11:015:230. FUNDAMENTALS OF AGROECOLOGY (3)
Introduction to concepts of agroecology, including human interactions with the environment, agricultural plants, and animal-plant interactions.

11:015:250 THROUGH 299. TOPICS IN AGRICULTURE AND ENVIRONMENTAL SCIENCE (1 EACH)
A variety of 1-credit courses, some of which are offered on a *Pass/No Credit* basis, covering a wide range of skills and issues relevant to contemporary problems in agriculture and the environment. Topics change from term-to-term and year-to-year. Consult the *Schedule of Classes* for current offerings. Recurrent topics include the following:

35-mm Photography: An introduction to 35-mm photography including exposure, lenses, filters, color temperature, close-ups, flash, and composition.

Cook College CASE courses: Students may add a 1-credit “Citizenship and Service Education” component to an existing course by registering for this course.

Darwin and Darwinisms: The role of domestication and environmental observation in the development of Darwin’s theory and its subsequent (mis)applications. Contemporary evolutionary issues and questions.

Edible and Poisonous Mushrooms: An introduction to the fascinating hobby of mushroom hunting; recognition of common, easily identified edible, poisonous, and hallucinogenic mushrooms.

Field Identification of Birds: An introductory course in birding. Six field trips on alternate Friday mornings during the term and an all-day field trip during the exam period.

History of New Jersey Agriculture: An internship at the New Jersey Museum of Agriculture (located at the edge of the Cook College campus).

Nutrition Today: A series of lectures and class discussions on current topics of nutritional concern, including faddism, megavitamins, and dietary goals.

Solar Energy: Fundamentals of solar energy with focus on useful applications.

Thoreau and Modern Environmentalism: A study of Thoreau’s work and its influence on contemporary environmental writing and ideologies.

Wine Insights: An introduction to grapes and the wine-making process, with special attention to local wines. Students must be at least 21 years old to be registered.

11:015:301. TOPICS IN AGROECOLOGY (3)
Prerequisites: 11:015:230, 11:370:350, 11:776:221 or equivalent.

Issues in ecological agriculture related to such topics as biological control, disease, soil fertility, crop maintenance, and animal husbandry. Emphasis on current scientific literature.

11:015:331,332,333. AGRICULTURAL SCIENCE PRACTICUM (1-3,1-3,1-3)
Prerequisite: Permission of instructor.

Practical experience in the principles and practices of modern agricultural operations, including animal care, tillage, planting, pest control, harvesting, record keeping, and agricultural technologies.

11:015:350. AGROECOLOGY PRACTICUM (3-5)
Prerequisites: 11:015:230, 11:776:221 or equivalent.

A broad range of internship experiences with an academic orientation, approved in advance by the program adviser, such as state regulatory or private agroecology programs, organic farms, master gardening and individual gardens, research programs.

11:015:380. COMMUNICATION FOR TODAY’S LEADER (3)
An online course in the application of critical thinking skills to the evaluation of leadership and communication. Establishment of personal and professional goals. Evaluation of effective leadership communication, group dynamics and strategies, and organizational culture.

11:015:390. GEORGE H. COOK HONORS PROJECT PREPARATION (P/NC 1)
Open only to junior year candidates for the George H. Cook Scholars Program. Students will be registered by the program director.

April evening workshops in library research methods, proposal writing, and oral presentation, culminating in an approved honors-project proposal at the end of the May examination period.

11:015:398. HONORS RESEARCH (BA)
Prerequisite: Juniors beginning the George H. Cook Scholars Program.
Preparation for the research, begun in the junior year, by students undertaking a George H. Cook senior honors thesis project.

11:015:400 THROUGH 450. JUNIOR/SENIOR COLLOQUIUM (3 EACH)
Prerequisite: Open only to students who have completed 90 credits.

A capstone, integrative experience for Cook College students concluding their undergraduate studies. Groups of students with a broad range of disciplinary backgrounds seek interdisciplinary solutions to selected problems in the college’s mission areas. Courses fulfilling this requirement are announced in advance of registration for the term. A complete listing can be found at the web site (<http://www.cook.rutgers.edu/~colloquium>).

11:015:483,484. RESEARCH PROBLEMS: AGRICULTURE AND ENVIRONMENTAL SCIENCE (BA,BA)
Credits and hours by arrangement with a faculty adviser, the appropriate curriculum coordinator, and the Office of Academic and Student Programs.
Original work in the student’s major field.

11:015:492. TROPICAL AGRICULTURE (3)

Pre- or corequisites: 01:119:101, 11:776:200 or 211 or permission of instructor.

Analysis of tropical agriculture systems: climatic parameters, major and important crops, animals, cropping systems, social and technical constraints, and methods of analysis.

11:015:494. TROPICAL AGRICULTURE AND NATURAL RESOURCES FIELD STUDY (3)

Lec. 55 min. Field experience during spring break. Pre- or corequisites: 11:015:492 or equivalent and permission of instructor.

An intensive, 10-day field experience in a tropical country; visits to and analyses of tropical agricultural production and natural resource systems.

11:015:495. TROPICAL AGRICULTURE AND NATURAL RESOURCES INTERNSHIP (BA)

Prerequisite: Open to juniors with permission of instructor. Recommended: 11:015:494.

Supervised research experience in a tropical environment, working with scientists in crop production, aquaculture, and forest management. Offered in Puerto Rico for at least six weeks during the summer.

11:015:497,498. GEORGE H. COOK SCHOLARS PROGRAM (3-6,3-6)

Open only to George H. Cook Scholar candidates.

A two-term independent research project, culminating in an oral presentation to the faculty and a thesis preserved in the Chang Science Library.

AGRONOMY

(See Plant Science 776)

ANIMAL SCIENCE 067**11:067:101. CAREERS IN ANIMAL SCIENCE (1)**

Career opportunities in the field of animal science, with emphasis on goal setting, decision-making strategies, and professional-skills development. Offered in cooperation with several regional animal science programs.

11:067:142. ANIMAL SCIENCE (3)

Fundamental principles and functions important in animal science and zoology; emphasis on growth, nutrition, reproduction, lactation, and heredity in domestic animals.

11:067:175. ANIMAL HANDLING, FITTING, AND EXHIBITION (P/NC 1)

Experience in the handling (using a halter, leading, displaying), fitting (clipping, grooming, cleanliness), and exhibiting (showmanship) of large animals.

11:067:200,204. ANIMAL PRACTICUM (P/NC 2,2)

Prerequisites: Section HO: 11:067:384 or permission of instructor and Section LA: 11:067:275 or permission of instructor.

Practical experience in the principles and practices of care for dairy cattle (DC), horses (HO), laboratory animals (LA), sheep and goats (SH), and swine (SW). Identification, record keeping, handling, feeding, sanitation, health care, facilities/equipment, welfare/safety, and other aspects of proper management.

11:067:275. LABORATORY ANIMAL SCIENCE: MANAGEMENT AND TECHNIQUES (3)

Lec. 2 hrs., lab. 3 hrs.

Principles and practices of laboratory animal science; emphasis on animal care and various animal research techniques.

11:067:322. DAIRY CATTLE ARTIFICIAL INSEMINATION (P/NC 1)

Three-day workshop, held off campus during spring break.

Prerequisite: By permission only.

Anatomy and physiology of the reproductive tract. Training and practical experience in artificial insemination and semen handling.

11:067:327. ANIMAL REPRODUCTION (3)

Prerequisites: 01:119:101-102.

Anatomy and physiology of reproductive organs; reproductive processes including female cycles, pregnancy, parturition, and lactation; fertility control with particular emphasis on domestic animals.

11:067:330. ANIMAL NUTRITION (3)

Prerequisites: 01:119:101-102, 01:160:161-162, and 11:067:142.

Application of nutritional principles to livestock feeding. Nature of nutrients, their metabolism, and physiological function. Factors influencing nutrient requirements for various aspects of production.

11:067:331. ANIMAL NUTRITION LABORATORY (1)

Pre- or corequisite: 11:067:330.

Laboratory to accompany animal nutrition for on-campus students.

11:067:335. LIVESTOCK PRODUCTION AND MANAGEMENT I (3)

Prerequisites: 11:067:142, 327, 328, 330. Corequisite: 11:067:337.

Contributions of beef, dairy, poultry, sheep/goat, and swine industries to food and fiber production. Breeds and improvements. Production requirements: land, housing, feeds, sanitation, environmental/ethical concerns, marketing.

11:067:336. LIVESTOCK PRODUCTION AND MANAGEMENT II (3)

Prerequisites: 11:067:335, 337. Corequisite: 11:067:338.

Management practices in livestock industries: animal evaluation and selection, reproduction techniques (AI, ET), birthing/newborn care, milking, tail docking/castration, shearing, health and disease, animal behavior, feed formulation/production studies, record keeping.

11:067:337. LIVESTOCK PRODUCTION AND MANAGEMENT LABORATORY I (2)

Corequisite: 11:067:335.

Laboratory exercises and field trips illustrating the principles of 11:067:335.

11:067:338. LIVESTOCK PRODUCTION AND MANAGEMENT LABORATORY II (2)

Corequisite: 11:067:336.

Laboratory exercises and field trips illustrating the principles of 11:067:336.

11:067:384. HORSE MANAGEMENT (3)

Lec./rec. 2 hrs., lab. 3 hrs. Prerequisite: 11:067:142 or permission of instructor.

Breeding, feeding, and management of horses; physiology, nutrition, anatomy, and evolution.

11:067:390. EQUINE NUTRITION (3)

Prerequisites: 11:067:142, 330, 384, or permission of instructor.

Nutritional requirements and feeding by type and age; evaluation of feedstuffs and rations; feed and pasture management; nutritional diseases and the nutritional management of certain diseases.

11:067:401. TOPICS IN EQUINE SCIENCE (3)

Pre- or corequisites: 11:067:384, 390.

Reports and discussions in selected areas relating to equines.

11:067:402. EQUINE EXERCISE PHYSIOLOGY (3)

Prerequisites: Course in physiology, 11:067:384, or permission.

Survey and critical evaluation of current concepts regarding the physiological and environmental factors associated with exercise in the horse.

11:067:404. ANIMAL DISEASES (3)

Prerequisites: 01:119:101-102; 11:067:142. Recommended: 11:680:390. Open only to seniors.

The biology of parasites (viruses, bacteria, protozoa, helminths, and arthropods) and the pathogenesis of their associated diseases. Current concepts of prevention and control of common diseases.

11:067:406. FARM PRODUCTIVITY ANALYSIS IN THE ANIMAL SCIENCES (3)

Lec. 80 min. Field trips: Friday afternoons. Prerequisites: 11:067:330, at least two courses in livestock production and business.

Productivity analyses of livestock farms. On-farm visits, problem solving, diagnostic analysis, and development of management recommendations.

11:067:430. ANIMAL MICROTECHNIQUES AND TISSUE CULTURE (4)

Prerequisites: 01:119:101-102; two terms of organic chemistry.

Microscopic, cytological, and cell culture techniques as used in modern research laboratories. Emphasis on aseptic techniques for animal cell culture; requirements for growth *in vitro*; mechanisms for cellular differentiation; immunohistochemistry; *in situ* hybridization; expression of transfected DNA.

11:067:450. ENDOCRINOLOGY (3)

(Formerly 01:119:450)

Prerequisites: 01:119:101-102. Recommended: Courses in physiology and organic chemistry. Open to juniors and seniors.

Endocrinology and neuroendocrinology of animals, including humans. Structure and function of the endocrine glands, including the hypothalamus, and the biosynthesis and chemistry of hormones.

11:067:493,494. RESEARCH IN ANIMAL SCIENCE (BA,BA)

Prerequisite: Permission of instructor.

Individual animal science projects with faculty guidance.

ATMOSPHERIC AND OCEANIC SCIENCES 110

(See Marine Sciences 628 and Meteorology 670)

BIOCHEMISTRY 115

11:115:301. INTRODUCTORY BIOCHEMISTRY (3)

Prerequisites: 01:160:209 or 307-308 or 315-316.

The chemistry and metabolism of proteins, carbohydrates, lipids, nucleic acids, and other biologically important compounds.

11:115:313. INTRODUCTORY BIOCHEMISTRY LABORATORY (1)

Lab. 3 hrs. Pre- or corequisite: 11:115:301 or 403.

Techniques used in research, clinical, and food laboratories, including tests of biological materials, methods of separations, and determinations of enzyme activities.

11:115:403,404. GENERAL BIOCHEMISTRY (4,3)

Prerequisites: 01:160:307-308 or 315-316 with grades of C or better.

A comprehensive survey of the chemistry and metabolism of biological compounds, including proteins, polysaccharides, lipids, and nucleic acids. Enzyme kinetics, bioenergetics, organelles, and cellular organization. Expression and processing of biological information, including DNA replication; transcription into RNA; translation into protein, regulation, and recombinant DNA techniques. Computer modeling of macromolecules.

11:115:406. PROBLEM SOLVING IN BIOCHEMISTRY (1.5)

Rec. 1 hr., lab. 1.5 hrs.

Modern instrumentation and analytical techniques used in biochemistry research. Observation of experiments followed by discussion of techniques and problems.

11:115:412. PROTEIN AND ENZYME CHEMISTRY (3)

Prerequisites: 11:115:403, 413, or equivalents.

Assay and purification of enzymes and other proteins. Chemical modification, site-directed mutagenesis, and enzyme kinetics as tools in understanding structure-function relationships and enzyme mechanisms. Mechanisms of selected enzymes.

11:115:413,414. EXPERIMENTAL BIOCHEMISTRY (3,2.5)

Lec. 1 hr., lab. 4.5 hrs. Corequisites: 11:115:403,404. Recommended: 01:447:380.

Isolation, characterization, and quantitative determination of biological compounds. Spectrophotometric and titrimetric analyses; chromatography and gel electrophoresis; high performance liquid chromatography. Isolation and characterization of enzymes, nucleic acids, and lipids. Graphing and statistical treatment using computers.

11:115:421. BIOCHEMISTRY OF CANCER (3)

Prerequisites: 11:115:403-404.

DNA damage/repair mechanisms; oncogenes/tumor suppressor genes; signaling pathways; apoptosis/cell death; the cell cycle; metastasis-cell, cell contact, and protease activation; tumor growth and angiogenesis; genetic events; genetic polymorphisms; chemical carcinogenesis; chemotherapeutic targeting.

11:115:422. BIOCHEMICAL MECHANISMS OF TOXICOLOGY (3)

Prerequisites: 01:119:101-102, 01:160:307-308 or 315-316. Pre- or corequisites:

11:115:403,404 or equivalent. Recommended: 01:146:356 or equivalent.

General principles and mechanisms of biochemical toxicology, including pharmacokinetics and pharmacodynamics. Examples of metabolism of industrial compounds, organic agrichemicals, and carcinogens.

11:115:428. HOMOLOGY MODELING OF PROTEINS (3)

Prerequisite: 11:115:403.

Computer construction of models of the three-dimensional structure of proteins, based on known structures of proteins with related sequences. Interpretation and prediction of function based on the modeled structure.

11:115:433. SPECIAL TOPICS IN BIOCHEMISTRY (1)

Pre- or corequisite: 11:115:403.

Self-paced computer tutorials in structural biochemistry; designed to supplement courses in molecular biosciences.

11:115:434. MOLECULAR TOXICOLOGY (1.5)

One 80-min. lec. Prerequisites: A course in biochemistry, a course in toxicology, laboratory experience.

Principles and methodologies of toxicology, at the organismal and molecular levels.

11:115:435. TOPICS IN BIOCHEMISTRY (3)

Current research and techniques.

11:115:436. MOLECULAR TOXICOLOGY LABORATORY (2.5)

One 80-min. pre-lab., one 3-hr. lab. Corequisite: 11:115:434.

Techniques currently applied in public and private toxicology laboratories.

11:115:452. BIOCHEMICAL SEPARATIONS (3)

Prerequisites: 11:115:301 or 403, 11:115:313 or 413.

Basic theory and practice of separating biological molecules. Chromatography, centrifugation, electrophoresis, ultrafiltration, and general methods of extracting and purifying proteins, nucleic acids, carbohydrates, and other biological molecules.

11:115:491,492. SEMINAR: BIOCHEMISTRY COMMUNICATION (1,1)

Pre- or corequisites: 11:115:403,404. Open only to senior biochemistry majors.

Practice in techniques for oral presentation of scientific reports and reviews, based on search of research literature in biochemistry and, where applicable, the student's own research results.

11:115:493,494. RESEARCH PROBLEMS IN BIOCHEMISTRY (BA,BA)

Prerequisite: Permission of department.

Research projects under the guidance of faculty members.

11:115:495. SEMINAR: BIOCHEMISTRY AND SOCIETY (1)

Pre- or corequisite: 11:115:403-404. Open only to senior biochemistry majors.
Impacts of biochemical advances on society, and vice versa. Social context of major discoveries in biochemistry. Applications of biochemistry: patents, patent law, patent litigation. Student oral presentations and online discussions.

11:115:497-498. HONORS IN BIOCHEMISTRY (6,6)

Lab. 18 hrs. Open only to majors; others by permission of department. Both terms must be completed to receive credit.
Laboratory research project, reported as an honors thesis.

BIOTECHNOLOGY 126**11:126:110. CONCEPTS AND ISSUES IN BIOTECHNOLOGY (1.5)**

One 80-min. lec.
Applications and implications of molecular biology, including ethical and social controversies.

11:126:394. APPLIED MICROBIOLOGY (4)

Two 80-min. lecs., one 180-min. lab. Prerequisite: 11:680:390 or equivalent.
Microorganisms in foods; their applications in industry, agriculture, environment, and medicine; physical and chemical factors of growth and control in relation to industrial and natural processes.

11:126:401. SEMINAR IN BIOTECHNOLOGY (1)

One 55-min. lec. Open only to seniors in the biotechnology curriculum. Offered only during fall term.
Development of communication skills needed by professionals in the field of biotechnology through student oral presentations and facilitated discussion. Topics include current scientific advances in biotechnology and the social impact of biotechnology.

11:126:405. MICROBIAL TECHNOLOGY (3)

Prerequisites: 11:680:390, 11:680:394 or 11:126:394 or 11:126:491 or 11:680:491.
An integrated discussion of recent genetic, biochemical, and engineering approaches to microbial processing, from antibiotics, biomass, and citric acid to *Zymomonas*.

11:126:406. PLANT GENE TRANSFER (4)

One 80-min. lec., one 55-min. lab. preparation, one 180-min. lab. Prerequisite: 01:447:380 or 11:776:305.
Principles and experimental techniques of nonsexual gene transfer in plants. Application of gene-transfer techniques in crop improvement and research in gene expression.

11:126:407. COMPARATIVE VIROLOGY (3)

Prerequisites: 01:119:101-102, organic chemistry.
Biology of viruses and approaches to control through antivirals and genetic engineering. Genome organization, gene expression, replication, movement, and transmission across kingdoms.

11:126:410. PROCESS BIOTECHNOLOGY (3)

Prerequisites: 11:680:390, one term of biochemistry.
Survey of the applications of biotechnology, emphasizing the pharmaceutical industry and the operation of fermentation systems. Case studies of downstream separation and purification protocols employed on an industrial scale.

11:126:413. PLANT MOLECULAR BIOLOGY (3)

Prerequisites: 01:447:380, 01:447:482/11:126:481 or 11:115:404 or 01:694:408.
Fundamental and applied aspects of plant molecular biology: structure, expression, and isolation of plant nuclear genes; molecular biology of plant development, plant organelles, and plant-microbe interactions; and plant biotechnology.

11:126:420. TRENDS IN BIOTECHNOLOGY (3)

Prerequisite: One term of biochemistry.
Current developments in the understanding and application of principles and processes in cellular and chemical biology, evident in contemporary biotechnology literature and/or core interests of the biotechnology industry.

11:126:427. METHODS IN RECOMBINANT DNA TECHNOLOGY (4)

One 80-min. lec., one 55-min. rec., one 300-min. lab. Prerequisites: 01:447:380, 11:126:481, 482.
Introduction to techniques and experimental approaches used in recombinant DNA technology.

11:126:481. MOLECULAR GENETICS (3)

Prerequisites: Organic chemistry and completion of 01:447:380 with a grade of C or better. Credit not given for both this course and 01:447:482 or 01:119:482.
Principles of genetics at the molecular level, including the chemical nature of hereditary material. The genetic code, regulatory mechanisms, the molecular basis of mutation, DNA replication and recombination.

11:126:482. MOLECULAR GENETICS LABORATORY (3)

One 240-min. lab., one 80-min. lab., one 55-min. lec. Credit not given for both this course and 01:447:483 or 01:119:483. Prerequisites: 11:126:481 and 11:680:390.
Biochemical and molecular aspects of gene function and gene recombination.

11:126:483. NUCLEOTIDE SEQUENCE ANALYSIS (3)

Prerequisites: 11:115:403, 404 or 01:447:482/11:126:481 or 427.
Computer analysis of nucleotide sequences: assembly; restriction analysis; gene location and identification; protein sequence analysis and structure prediction; database searching; sequence alignments; and phylogenetic analysis.

11:126:484. BIOTECHNOLOGY ROBOTICS (3)

One 80-min. lec., 4.5 hrs. lab. Prerequisites: 11:115:403, 11:115:313 or 413, 11:680:390.
Application and use of robotic equipment in the analysis of large numbers of samples; assay and protocol design; data collating, analysis and interpretation; applications in various life science industries.

11:126:486. ANALYTICAL METHODS IN MICROBIOLOGY (4)

One 80-min. lec., one 4.5-hr. lab., one 80-min. rec. Prerequisites: 11:126:394 or 11:680:394, 11:680:390.
Hands-on training in the use of analytical instrumentation in microbiological research and applications, including biotransformations and fermentations, biodegradation, and identification of bacteria and fungi.

11:126:497,498. RESEARCH IN BIOTECHNOLOGY (BA,BA)

Prerequisites: Permission of instructor and faculty adviser.
Independent research projects in biotechnology under the guidance of a faculty member.

BIOSOURCE ENGINEERING 127**11:127:100. INTRODUCTION TO BIOSOURCE ENGINEERING (1)**

Overview of specializations within biosource engineering. Expanding role of biological and environmental sciences in engineering. Analysis of selected problems. Review of professional opportunities.

11:127:240. ELEMENTS OF HORTICULTURAL ENGINEERING (3)

Elements of controlled environment horticulture in crop production systems: greenhouse design, environmental control, intensive production methods, and postharvest handling and storage.

11:127:290. BIOSYSTEMS ENGINEERING MEASUREMENTS (3)

Prerequisite: 01:750:227 or equivalent. Pre- or corequisite: 14:330:373 or equivalent.
Measurement principles including error analysis and transducers. Statistical analysis of experimental data. Electrical measurements. AC and DC circuits. Frequency response and transient analysis. Measurement and interpretation of physical properties of biological materials.

11:127:413. UNIT PROCESSES IN BIOENVIRONMENTAL ENGINEERING I (3)

Prerequisite: 14:155:303 or 14:180:387 or 14:650:312.

Application of theoretical concepts from mass, momentum, heat transfer and reaction kinetics to the design and analysis of unit processes in environmental engineering, with an emphasis on physicochemical operations.

11:127:414. UNIT PROCESSES IN BIOENVIRONMENTAL ENGINEERING II (3)

Prerequisites: 01:447:390, 11:127:413, or permission of instructor.

Biological principles and operations, including microbial ecology, stoichiometry and kinetics of organic contaminant degradation and biomass growth, modeling of ideal biochemical reactors, design criteria for several named biochemical operations used for wastewater treatment.

11:127:423. BIOENVIRONMENTAL ENGINEERING UNIT PROCESSES LABORATORY I (1)

Prerequisite: 01:160:171 or equivalent. Corequisite: 11:127:413.

Demonstration of physicochemical operations used in the treatment of municipal and industrial wastewater, including coagulation, flocculation, sedimentation, filtration, carbon adsorption, chemical oxidation, heat transfer, oxygen transfer, and residence time distribution.

11:127:424. BIOENVIRONMENTAL ENGINEERING UNIT PROCESSES LABORATORY II (1)

Prerequisite: 01:160:171 or equivalent. Corequisite: 11:127:414.

Demonstration of biochemical operations used in the treatment of municipal and industrial wastewater, including biodegradability and biodegradation kinetics, energy balance in a biological reactor, respirometry, activated sludge, anaerobic toxicity, and aerobic digestion.

11:127:450. APPLIED INSTRUMENTATION AND CONTROL (4)

Two 80-min. lects., one 180-min. lab. Prerequisite: 11:127:290.

Digital electronics, advanced sensing techniques, signal conditioning. Computer-based data acquisition, analysis, and control applications.

11:127:462. DESIGN OF SOLID WASTE TREATMENT SYSTEMS (3)

Prerequisite: Open only to junior and senior engineering students.

Design of integrated solid waste management systems, including waste minimization, collection, composting, materials recovery, recycling, incineration, and landfilling.

11:127:468. HAZARDOUS WASTE TREATMENT ENGINEERING (3)

Prerequisites: 01:447:390, 11:127:413, 01:160:209, 14:180:331, or permission of instructor.

Engineering and process design aspects of hazardous waste management. Waste reduction and recovery, waste treatment, and site remediation. Case studies and engineering solutions to model hazardous waste problems.

11:127:474. AIR POLLUTION ENGINEERING (3)

Prerequisite: 14:155:303 or 14:180:387 or 14:650:312 or permission of instructor.

Engineering design techniques for air quality control. Control of particulate and gas emissions from stationary sources. Control of mobile source emissions. Design for indoor air quality and regional air quality control.

11:127:488. BIOSOURCE ENGINEERING DESIGN I (2)

Open only to seniors in bioresource engineering.

Design morphology. Case studies and special design problems. Solutions developed using creative design processes that include analysis, synthesis, and iterative decision making. Safety and professional ethics.

11:127:489. BIOSOURCE ENGINEERING DESIGN II (2)

Prerequisite: 11:127:488.

Completion of bioresource engineering senior design project. Evaluation. Presentation of final report.

11:127:490. STRUCTURAL DESIGN AND ENVIRONMENTAL CONTROL (3)

Prerequisites: 14:180:215, 243.

Functional requirements and design aspects for controlled environment plant production systems including structures, energy flows and balances, and environmental control equipment.

11:127:491. PHYTOMATION (3)

Prerequisites: 14:440:221, 222.

Analysis and design of mechanization and automation for controlled environment plant production systems with special emphasis on flexible automation, machine vision, mechatronics, and knowledge-based systems.

11:127:492. ENERGY CONVERSION FOR BIOLOGICAL SYSTEMS (3)

Prerequisite: 14:650:351.

Principles of energy conversion techniques and their application to various biomechanical systems, including solar energy systems, compostation, methane and alcohol production, and the internal combustion engine.

11:127:493. UNIT PROCESSES FOR BIOLOGICAL MATERIALS (3)

Pre- or corequisite: 14:155:308 or 14:650:351.

Theory and application of unit operations for handling and processing of biological materials, with emphasis on particulate solids separation, comminution, mixing, heat transfer, and dehydration.

11:127:494. LAND AND WATER RESOURCES ENGINEERING (3)

Prerequisite: 14:180:387.

Engineering aspects of land and water conservation: basic hydrology, soil-water-plant relationships, groundwater, surface and subsurface drainage, irrigation, and flood control.

11:127:495. ENVIRONMENTAL SYSTEMS ANALYSIS FOR ENGINEERS (3)

Prerequisite: Open only to juniors majoring in bioresource engineering or by permission of instructor.

Principles of procedural and heuristic systems analysis. Overview of mathematical modeling. Techniques of simulation and optimization. Topics of applied intelligence. Solutions for environmental engineering problems by systems analysis methods.

11:127:496. PLANNING AND DESIGN OF LAND TREATMENT SYSTEMS (3)

Prerequisite: 14:180:387.

Engineering design of land treatment systems for municipal and industrial wastewater, including spray irrigation, overland flow, infiltration/percolation, and subsurface soil adsorption systems. Facilities planning.

11:127:497,498. SPECIAL PROBLEMS IN BIOSOURCE ENGINEERING (BA,BA)

Prerequisite: Permission of department.

Studies of special interest in some selected area of bioresource engineering.

COOPERATIVE EDUCATION 199

11:199:200. COOPERATIVE EDUCATION I (3-6)

Permission of director.

First cooperative education registration.

11:199:300. COOPERATIVE EDUCATION II (3-6)

Prerequisites: 11:199:200 and permission of director.

Second cooperative education registration.

11:199:403. COOPERATIVE EDUCATION III (3-6)

Prerequisites: 11:199:300 and permission of director.

Third and subsequent cooperative education registrations and fall/spring graduate registrations.

EDUCATION 300

11:300:327. APPLICATIONS OF PSYCHOLOGY IN EDUCATION (3)

Prerequisite: Permission of instructor.

Applications of the theoretical constructs and functions of psychology most relevant to education, with emphasis on learning processes, pupil variability, and the role of teachers and parents.

11:300:334. PARTNERSHIPS FOR YOUTH DEVELOPMENT (3)

Process and contextual factors enhancing community cooperation. Integration of youth development research with organizational systems and volunteer management practices for the delivery of youth development programs.

11:300:336. ADMINISTRATION AND MANAGEMENT OF YOUTH AGENCIES (3)

Topics include budgeting, use of computers, program development, marketing, and working with committees, volunteers, and advisory boards.

11:300:411. MATERIALS AND METHODS OF TEACHING SCIENCE (3)

Prerequisite: Permission of instructor.

Techniques of science teaching. Exploring materials and methods for K–12 programs. Science as a basic skill. Emphasis on process approach. Laboratory and field trip safety.

11:300:412. SPECIAL PROBLEMS IN TEACHER EDUCATION (BA)

Prerequisite: Permission of instructor.

Conferences, library research, and curriculum development on topics and contemporary problems in education.

11:300:416. ENVIRONMENTAL EDUCATION IN THE SCHOOL CURRICULUM (3)

Development and integration of environmental education programs for use in existing K–12 curricula. Use of audiovisuals, applied research, evaluation, and other pertinent resources.

11:300:417. OBSERVATION INTERNSHIP (BA)

Prerequisite: Permission of instructor.

Supervised observation of teaching techniques and learning activities in approved classrooms and laboratories; opportunities and responsibilities in instruction; assigned readings, projects, and reports.

11:300:423,424. TEACHING SEMINAR I,II (1.5,1.5)

Alternate weeks. Prerequisite: Permission of instructor.

Guided discussions of contemporary issues and educational problems. Application of theory to classroom and laboratory situations. Program planning and curriculum development.

11:300:425. DEVELOPMENT OF IDEAS IN TEACHING AGRICULTURE (3)

Design and development of curricula and curriculum evaluation procedures appropriate to agricultural/extension education. Principles and techniques for developing leadership skills: interpersonal influence, commitment, goals and power for effective leaders. Issues and problems facing leadership in agriculture.

11:300:426. TEACHING AGRICULTURE (3)

Application of theoretical models and research on effective teaching in agricultural/extension education. Practice in planning and instruction. Principles and application of approaches to teaching and organizing instruction, motivating students, developing objectives, selecting techniques, evaluating instruction, and managing classroom and laboratory instruction.

11:300:438. PRACTICUM IN PROFESSIONAL YOUTH WORK (3)

Prerequisite: 11:300:336. To be taken during final year of minor program in professional youth work. Nine hours per week in fieldwork and occasional class meetings.

Fieldwork experience in student's area of interest. Arranged cooperatively with adviser and organization.

11:300:450. BIOLOGY AND SOCIETY (3)

Prerequisite: Permission of instructor.

Epistemology of the biological sciences and their interaction with human culture from historical and contemporary perspectives. A conceptual framework for appreciating the nature, practice, and culture of the biological sciences.

11:300:453. TEACHING LIFE SCIENCE (3)

Prerequisite: Permission of instructor.

Pedagogical content knowledge and skills for teaching high school biology. Analysis of the biology curriculum; development of teaching strategies and adjustments for different students; lesson planning; design of formative and summative assessment tools.

11:300:487. STUDENT TEACHING (9)

Prerequisites: 11:300:411 and permission of instructor.

Full-time student teaching under supervision of members of the faculty in approved schools for one term.

ENTOMOLOGY 370

11:370:202. THE WORLD OF INSECTS (3)

The nature and importance of insects that affect our personal and professional lives through competition for food, nuisance, and the transmission of disease.

11:370:308. APICULTURE (3)

Lec. 2 hrs., lab. 3 hrs. For students with or without a background in science who are interested in keeping bees or pollinating crops.

Management, honey and wax production, bee language, social behavior, and pollination ecology.

11:370:350. AGRICULTURAL ENTOMOLOGY AND PEST MANAGEMENT (3)

Recognition and ecology of plant pest species; sampling and survey techniques; pest management methods and the environmental impact of control procedures; integrated control.

11:370:352. TOXICOLOGY OF PESTICIDES (3)

Prerequisites: 01:119:101-102, one term of organic chemistry, or permission of instructor.

Effects, side effects, history, hazards, and usefulness of synthetic pesticides essential for the long-term production of food and fiber.

11:370:381. INSECT BIOLOGY (4)

Lec. 2 hrs., lab. 3 hrs. Field trip. Prerequisites: 01:119:101-102.

A survey of insects; their structure, function, behavior, evolution, diversity, and effect on agricultural production, as well as on people and animals.

11:370:402. AQUATIC ENTOMOLOGY (3)

Prerequisite: 11:370:381 or one course in aquatic ecosystems or permission of instructor.

Identification, classification, morphology, and natural history of aquatic insects. Fieldwork emphasizing aquatic insects of New Jersey.

11:370:403-404. INSECT STRUCTURE AND FUNCTION I,II (3,3)

Lec. 2 hrs., lab. 3 hrs. Prerequisite: 11:370:381.

Functional morphology and physiology of insects, with emphasis on evolution and adaptation to the environment.

11:370:406. MEDICAL AND VETERINARY ENTOMOLOGY (3)

Lec. 2 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102.

Insects and other arthropods in relation to human and animal annoyance and disease.

11:370:409. INSECT CLASSIFICATION (4)

Lec. 3 hrs., lab. 3 hrs. Field trips. Prerequisite: 11:370:381 or permission of instructor.

For students interested in insect diversity and evolution. Life histories and sight recognition of major families, especially those of economic or medical importance.

11:370:493,494. RESEARCH PROBLEMS IN ENTOMOLOGY (1-4,1-4)

Prerequisite: Permission of adviser.

Research projects in entomology under the guidance of faculty members.

ENVIRONMENTAL PLANNING AND GEOMATICS 372

11:372:202. ENVIRONMENTAL ISSUES IN THE UNITED STATES (3)

Major trends in contemporary environmental concerns. Analysis of environment as a system of interrelated natural and man-made resources, people, and social institutions. Public policies designed to cope with environmental-human needs.

11:372:231. FUNDAMENTALS OF ENVIRONMENTAL PLANNING (3)

Principles of environmental planning related to the planning process. Special emphasis on natural principles, policy issues, and social concerns impacting land use outcomes.

11:372:232. FUNDAMENTALS OF ENVIRONMENTAL GEOMATICS (3)

New technologies to make better use of geospatial data for environmental and natural resource analysis and management. Basic concepts, definitions, and examples of different applications used in an environmental planning and management context.

11:372:233. FUNDAMENTALS OF ENVIRONMENTAL GEOMATICS LABORATORY (1)

Corequisite: 11:372:232 or by permission.

An optional laboratory to accompany 11:372:233. Experience in the basics of GIS using ArcView.

11:372:322. LAND MEASUREMENT AND MAPPING (3)

Lec./rec. 2 hrs., lab. 3 hrs. Prerequisites: Algebra and trigonometry.

Principles of surveying and mapping. Measurement of distances, angles, and direction. Use of tripod level, transit, compass, plane table, and personal computer.

11:372:362. INTERMEDIATE ENVIRONMENTAL GEOMATICS (3)

Prerequisite: 11:372:232.

Concepts and techniques for the manipulation and analysis of geospatial data. Emphasis on environmental and natural resource management applications. Instruction in desktop geographic information system software.

11:372:369. ANALYTICAL METHODS FOR ENVIRONMENTAL GEOMATICS (3)

Prerequisites: 01:198:110 or equivalent, 01:960:401 or equivalent, or permission of instructor.

Statistical concepts and related quantitative techniques for the analysis of problems in environmental and natural resource management, with emphasis on gathering, processing, and analyzing spatial information.

11:372:371. AIR-PHOTO INTERPRETATION (3)

Prerequisite 11:372:232 or permission of instructor.

Interpretation and analysis of aerial photography and remotely sensed imagery for environmental and natural resource management. Photogrammetry, mapping, geology, land forms, hydrology, soils, vegetation, and cultural features.

11:372:374. GLOBAL POSITIONING SYSTEMS (1.5)

Prerequisite: 11:372:232 or permission of instructor.

Use of Global Positioning Systems (GPS) to capture and integrate field data into a Geographic Information Systems (GIS) database for environmental analysis.

11:372:381. INTRODUCTION TO SYSTEMS THINKING AND THE SYSTEMS APPROACH (3)

Not open to first-year students.

The use of systems thinking and the systems approach for developing comprehensive understandings of and improving complex problem situations. Consideration of both hard and soft systems approaches. Application to a broad range of problems involving environmental and human activity systems.

11:372:384. A SYSTEMS APPROACH TO ENVIRONMENTAL AND AGRICULTURAL ISSUES (3)

Prerequisite: 11:372:381 or permission of instructor.

Exploration of the complexities of environmental and agricultural issues, using a systems approach. The use of both hard and soft systems methods in addressing complex problem situations involving the environment and agriculture.

11:372:409. NEW JERSEY PLANNING PRACTICE (3)

Prerequisite: 11:372:231 or equivalent.

Practice of planning, including land use, environmental, transportation, and other planning fields; structure of planning for all levels of government, covering planning history, legislation (with a focus on the Municipal Land Use Law), intergovernmental relationships, and the various participants in the planning process. Includes a team-based field project.

11:372:411. ENVIRONMENTAL PLANNING AND THE DEVELOPMENT PROCESS (3)

Prerequisites: 11:372:231 and 232, or equivalent.

Comprehensive examination of the relationship of environmental planning to land development; fundamental principles of environmental planning and assessment; analysis of environmental considerations critical to the land-development process using case studies. Includes a team-based field project.

11:372:442. APPLIED PRINCIPLES OF HYDROLOGY (3)

Prerequisite: 01:640:115 or equivalent. Not open to first-year students.

Basic hydrologic concepts and processes and related quantitative techniques appropriate to planning, management, and design considerations; hydrologic cycle, hydrology as a quantitative science, probability and statistics, the drainage basin, precipitation, infiltration, evaporation and evapotranspiration, surface water, hydrographs, soil moisture, groundwater, and managing water and watersheds.

11:372:462. ADVANCED ENVIRONMENTAL GEOMATICS (3)

Prerequisites: 11:372:362 and 369.

Advanced and applied analysis of geospatial data. Emphasis on environmental- and natural resource-management applications. Instruction in state-of-the-art geographical information system software.

11:372:474. ADVANCED REMOTE SENSING (3)

Prerequisites: 11:372:369 and 371.

Principles of satellite remote sensing and digital image analysis for environmental and natural resource applications. Instruction in state-of-the-art digital image processing/analysis software.

11:372:493,494. SPECIAL PROBLEMS IN ENVIRONMENTAL RESOURCES (BA,BA)

Prerequisite: Permission of chairperson of the Department of Ecology, Evolution, and Natural Resources.

Special problems in environmental resources involving original work.

ENVIRONMENTAL AND BUSINESS ECONOMICS 373

11:373:101. ECONOMICS, PEOPLE, AND ENVIRONMENT (3)

Not open to students who have completed a term of microeconomics or macroeconomics.

Applications of economic concepts to problems related to environmental and other social problems. Topics include opportunity cost, marginal analysis, supply and demand, cost-benefit analysis, fiscal and monetary policies, and international trade.

11:373:121. PRINCIPLES AND APPLICATIONS OF MICROECONOMICS (3)

Economic principles, laws, processes, and institutions of a free-enterprise economy with applications to contemporary economic life. Emphasis on individuals and firms within the economic system that bring about resource allocation.

11:373:210. BUSINESS DECISION COMPUTER TOOLS (4)

Lec. 80 min., lab. 160 min. Prerequisite: 11:373:121 or 01:220:102.

Applied business decision making, using computer technology to set up, analyze, solve, and communicate results, using databases, spreadsheets, graphics, word processing, and communication techniques.

11:373:231. AGRIBUSINESS MARKETING (3)

Prerequisite: 11:373:121 or equivalent.

Introduction to business and agricultural marketing, with emphasis on the economics, institutions, and policies of the food marketing system. Consumer behavior, marketing strategies, cooperatives, food markets, and computer applications.

11:373:241. AGRIBUSINESS MANAGEMENT (3)

Prerequisite: 11:373:121 or equivalent.

General application of basic concepts, functions, and tools of management that contribute to success and improve individual performances in decision making and other situations and problems in the field of management.

11:373:321. ECONOMICS OF PRODUCTION (3)

Prerequisites: 11:373:121 or equivalent, 11:373:210 or equivalent computer course, a term of calculus or equivalent, or permission of instructor.

Production theory (factor-product, factor-factor, product-product relationships) and its application to farms, business firms, and industries. Derivation of cost functions, product supply functions, and resource demand functions and their use in constructing theories of value, resource pricing, and distribution.

11:373:323. PUBLIC POLICY TOWARD THE FOOD INDUSTRY (3)

Prerequisite: 11:373:121 or equivalent. Open only to juniors and seniors.

Examination of the major public policies influencing the relationships between business and consumers. Appraisal and analysis of antitrust legislation, consumer protection, and state and federal regulations.

11:373:331. ECONOMICS OF FOOD MARKETING SYSTEMS (3)

Prerequisites: 11:373:210, 231.

The structure and workings of the U.S. food marketing system, including effects on farmers, consumers, processors, wholesalers, retailers, and food services, and the forces shaping this dynamic market.

11:373:341. MANAGEMENT: HUMAN SYSTEMS DEVELOPMENT (3)

Prerequisite: 11:373:101 or a term of microeconomics.

Integration and application of behavioral and managerial sciences to promote processes by which individuals, groups, and organizations work together for common goals and mutual success.

11:373:351. AGRIBUSINESS FINANCE I (3)

Prerequisites: A term of microeconomics, a term of accounting, 11:373:210, 01:960:211 or 285.

Concepts and practices of financial management. Analysis of financial position, working capital management and budgeting, cost of funds and capital structure, and financial instruments and institutions, with applications to emerging issues.

11:373:352. ECONOMICS OF FUTURES MARKETS (3)

Prerequisite: 11:373:210. Open only to juniors and seniors.

Development, functions, operation, and importance of futures markets. Mechanics of trading futures contracts for hedging and speculative purposes. Use of futures contracts as instruments of financing business activities.

11:373:361. LAND ECONOMICS (3)

Prerequisite: 11:373:121 or equivalent.

Application of economic principles to utilization of land resources. Physical and institutional factors affecting land use. Emphasis on real property rights, economics of conservation, the valuation process, cash flow analysis, and public policy.

11:373:362. NATURAL RESOURCE ECONOMICS (3)

Prerequisite: 11:373:121 or equivalent.

Market/nonmarket decision-making structure regarding natural resource use and policy implications, with emphasis on public choice. Benefit-cost analysis and market failure as these apply to natural resource use.

11:373:363. ENVIRONMENTAL ECONOMICS (3)

Prerequisite: 11:373:121 or equivalent.

The economics of pollution. Socioeconomic origins of environmental problems, failures of market economy and property rights systems, public policies to protect environmental quality. Emphasis on economic incentives as a means of control.

11:373:371. FOOD HEALTH AND SAFETY POLICY (3)

Prerequisite: 11:373:121 or equivalent.

The nature, importance, and economic consequences of U.S. agricultural and food policies. Commodity price supports, supply controls, marketing orders, soil and water conservation, food subsidies, food safety, agricultural research, taxation, and macroeconomic policies.

11:373:402. INTERNATIONAL AGRIBUSINESS MARKETING (3)

Prerequisites: Microeconomics and 11:373:231 or equivalent. Nonmajors by permission.

The sociocultural, economic, and geopolitical environments in which strategies and programs are formulated, the cumulative impact on marketing opportunities and threats, and the management skills relevant to global planning and expansion.

11:373:422. DEMAND AND PRICE ANALYSIS (3)

Prerequisites: 01:220:103, 11:373:210, a term of calculus, a term of statistics.

Advanced analysis of consumer behavior, market demand, producer behavior, and price determination under alternative market structures. Introduction to empirical price analysis.

11:373:425. APPLICATION OF ECONOMETRICS IN AGRICULTURAL ECONOMICS (3)

Prerequisites: Micro- and macroeconomics; a term of calculus; a term of statistics.

Applications of econometrics to problems in environmental and business economics. Estimation techniques, model specification, problem diagnostics, and forecasting.

11:373:451. AGRIBUSINESS FINANCE II (3)

Prerequisites: 11:373:210 or equivalent computer course; 11:373:351 or equivalent; Calculus I; a term of statistics.

Efficient capital markets, asset pricing models, risk, return, portfolio theory, equity valuation; fixed-income and derivative investment instruments, with emphasis on practical application of theoretical concepts.

11:373:465. AGRIBUSINESS MARKETING RESEARCH (4)

Two 80-min. lecs., one 55-min. rec. Prerequisites: 11:373:210, 231; a term of statistics.

Marketing research techniques and methods used to aid management decision making; application of concepts and techniques to real-world situations.

11:373:491,492. RESEARCH PROBLEMS IN AGRICULTURAL, ENVIRONMENTAL, AND BUSINESS ECONOMICS (BA,BA)

Prerequisite: Permission of adviser.

Research problems and independent projects under guidance of faculty members.

11:373:495. ISSUES IN AGRICULTURAL, ENVIRONMENTAL, AND BUSINESS ECONOMICS (3)

Prerequisite: Permission of instructor. Open only to juniors and seniors.

Senior seminar on major current issues in environmental and business economics. Emphasis on the total system in evaluating rational approaches to issues. Problem solving using best allocation of resources. Debate and discussion.

ENVIRONMENTAL POLICY, INSTITUTIONS, AND BEHAVIOR 374

11:374:101. INTRODUCTION TO HUMAN ECOLOGY (3)

The study of complex and varied patterns of interaction between people and the environment, with special attention to concepts, concerns, and methods of human ecology.

11:374:102. GLOBAL ENVIRONMENTAL PROCESSES AND INSTITUTIONS (3)

Prerequisite: 11:374:101.

Scientific and policy dimensions of international environmental affairs; problems, response mechanisms, regional and national activities, and alternative strategies.

11:374:175. ENERGY AND SOCIETY (3)

Main sources, transfers, and losses of energy in the biosphere; how they relate to human resources and enter the immediate environments of humans and other organisms.

11:374:201. RESEARCH METHODS IN HUMAN ECOLOGY (3)

The basic research techniques used by social scientists, planners, and others in writing social impact statements, evaluating programs, and carrying out basic research on human problems.

11:374:211. RURAL COMMUNITIES (3)

Investigations of the patterns of social life that prevail in the rural communities of developed and developing countries.

11:374:220. RURAL DEVELOPMENT (3)

Analysis of private and public efforts to make fuller use of human and natural resources in impoverished rural areas of the developed and developing worlds.

11:374:223. URBAN SOCIETY AND ENVIRONMENT (3)

Growth of cities in industrial countries, with emphasis on their physical and social environments and on policies for improvement.

11:374:269. POPULATION, RESOURCES, AND ENVIRONMENT (3)

The interaction between populations, resources, and the environment in the developed and developing worlds.

11:374:279. POLITICS OF ENVIRONMENTAL ISSUES (3)

The content and process of policy making concerning air and water quality, toxic wastes, energy, and other environmental issues.

11:374:301. ENVIRONMENT AND DEVELOPMENT (3)

Prerequisites: 01:119:103 or equivalent; 11:374:101, 102, 201; 11:704:351.

Conflicts between development objectives and conservation goals. Institutional, scientific, and political factors in international agency activities. Focus on variations in environment-development conflicts according to development sectors.

11:374:308. HUMAN ECOLOGY OF MARITIME REGIONS (3)

The study of sociocultural factors affecting marine resource use, management, and conservation.

11:374:312. ENVIRONMENTAL PROBLEMS IN HISTORICAL AND CROSS-CULTURAL PERSPECTIVE (3)

Prerequisites: 01:119:103 or equivalent; 11:374:101, 102, 201; 11:704:351.

Historical aspects of environmental use and change in relation to present-day problems in sustaining the productivity of physical and biological systems.

11:374:313. ENVIRONMENTAL POLICY AND INSTITUTIONS (3)

Prerequisites: 01:119:103 or equivalent; 11:374:101, 201; 11:704:351.

Political, scientific, and economic dimensions of international resource and environmental policy development. Emphasis on the U.S. experience.

11:374:314. HUMAN DIMENSIONS OF NATURAL RESOURCE MANAGEMENT (3)

Prerequisite: 11:374:101.

Application of theory and methods of social science, particularly the study of common property theory, to problems in natural resource management. Focus on water use, forestry, rangelands, and fisheries.

11:374:315. INTERNATIONAL ENVIRONMENTAL POLICY (3)

Prerequisites: 01:119:103 or equivalent; 11:374:101, 102, 201; 11:704:351.

The creation of international institutions to deal with shared and global environmental problems, such as ocean use and population. Assessment of the effectiveness of existing/proposed regimes, using decision-making simulations.

11:374:322. ENVIRONMENTAL BEHAVIOR (3)

Prerequisites: 01:119:103 or equivalent; 11:374:101, 102, 201; 11:704:351.

Understanding human behavior and attitudes as they relate to environmental protection efforts. Field project conducted by the class to promote environmentally desirable behavior.

11:374:325. ENVIRONMENTAL COMMUNICATION (3)

Development of skills in various modes to encourage environmental change: fact sheets, letters to the editor, press releases. Identification of key audiences and development of effective communication plans. Analysis and evaluation of efforts by industry, government, and advocacy groups.

11:374:331. CULTURE AND ENVIRONMENT (3)

The interrelationship between culture and the environment among a wide variety of human groups.

11:374:335-336. SOCIAL RESPONSES TO ENVIRONMENTAL PROBLEMS I,II (3,3)

Analysis of people's responses to environmental stresses or disturbances and the ways in which response patterns change. *Second term: individual or group field research.*

11:374:337. SYSTEMS APPROACHES AND INTERVENTIONS IN HUMAN ECOLOGY (3)

To be taken concurrently with 11:374:490 or 491. Pre- or corequisite: 11:374:101 or permission.

Systems thinking and social-scientific perspectives for intervention; problem solving; and planning in agricultural, urban, environmental, and related organizational contexts. Field research, group facilitation, simulation, planning, and mediation. Ethics and professional practice.

11:374:341. SOCIAL AND ECOLOGICAL ASPECTS OF HEALTH AND DISEASE (3)

The sociocultural factors affecting health status and disease frequency in human populations.

11:374:343. ADVANCED RESEARCH METHODS AND THEORY (3)

Prerequisite: 11:374:201.

Analysis of modes of explanation in social and ecological sciences: causal and noncausal explanations; the relation of processes and events; their usefulness for understanding behavior in different cultures and time periods.

11:374:420 THROUGH 429. TOPICS IN ENVIRONMENTAL AND RESOURCE POLICY (3 EACH)

Open only to juniors and seniors.

Policy issues associated with a selected environmental and/or resource problem, focusing on risk and risk communication, science and policy, institutions, comparative national approaches, and policy implications of environmental change.

11:374:430 THROUGH 439. TOPICS IN HEALTH AND ENVIRONMENT (3 EACH)

Open only to juniors and seniors.

Policy issues associated with a selected problem in human health and disease, food and hunger, or environmental and occupational health. The social sources of disease and malnutrition, and interventions to improve health.

11:374:451. QUALITATIVE RESEARCH METHODS (3)

Prerequisite: 11:374:201 or permission.

Fundamentals of qualitative research, including research design, developing useful questions, in-depth interviewing, summarizing information and data analysis, and their applications in various settings. Team research projects applied to current environmental problems.

11:374:490,491. READINGS AND PRACTICUM IN HUMAN ECOLOGY (3,3)

Advanced interdisciplinary reading and independent research in human ecology under the guidance of a faculty member.

11:374:492. ENVIRONMENTAL STUDIES INTERNSHIP (BA)

Prerequisite: Permission.

Internships involving environmental research and policy at Rutgers, other institutions, public agencies, nongovernmental organizations, or businesses.

11:374:493. ENVIRONMENTAL COMMUNICATION CLINIC (3)

Prerequisite: 01:355:202, 203 or equivalent, or permission.

Practicum in developing and implementing communication strategies. Team projects for nonprofit or government organizations facing environmental problems that require effective communication.

ENVIRONMENTAL SCIENCES 375**11:375:101. INTRODUCTION TO ENVIRONMENTAL SCIENCES (3)**

The impact of physical, chemical, and biological assaults on man and environment in air, water, wastewater, streams, noise, occupational health, and solid wastes.

11:375:102. SOILS AND SOCIETY (3)

An introduction to soil processes; their role in the ecosystem; basic management concerns; soil quality, human health, and global processes.

11:375:201. BIOLOGICAL PRINCIPLES OF ENVIRONMENTAL SCIENCES (3)

Prerequisites: 01:119:101-102, 01:160:161.

Hazardous agents, pollution, population interactions and dynamics; biogeochemical cycles in damaged and remediated ecosystems; environmental risk, management, and remediation; human health impacts.

11:375:202. CHEMICAL PRINCIPLES OF ENVIRONMENTAL SCIENCES (3)

Pre- or corequisite: 01:160:209 or 307.

Biogeochemical cycles: mass balances within and among environmental reservoirs; importance of water; chemical properties of water and aquatic chemistry.

11:375:203. PHYSICAL PRINCIPLES OF ENVIRONMENTAL SCIENCES (3)

Pre- or corequisites: 01:750:194 or 202 or 204.

Physical properties of water, air, and soils; energy and water in the earth system; kinetic and potential energy; and soil/plant/atmosphere relations.

11:375:266. SOILS AND THEIR MANAGEMENT (4)

Lec./lab. Prerequisites: 01:160:161-162, 171; 01:460:101; or equivalent.

Formation; physical and chemical properties; classification; conservation and management; uses of organic matter, limestone, and fertilizers; suitability for land application of sludge, septage, and hazardous wastes.

11:375:301. ENVIRONMENT AND HEALTH (3)

Examination of the relationship between human health and environmental disease agents; exposure and risk assessment of health hazards; origin, evaluation, and control of environmental health problems common to modern societies, such as pesticide use, environmental cancer, indoor air pollution, toxic wastes.

11:375:302. ELEMENTS OF WATER AND WASTEWATER TREATMENT (3)

Prerequisites: Two terms each of general chemistry and calculus.

Introduction to unit operations that constitute the state of the art of water and wastewater treatment.

11:375:303. NUMERICAL METHODS IN ENVIRONMENTAL SCIENCE (3)

(Formerly 11:375:437)

Prerequisites: Two terms of calculus or equivalent.

Formulation and solution of environmental science problems by applying analytical and numerical techniques. Principles of data analysis. Generation and solution of mass and energy balances.

11:375:307. ELEMENTS OF SOLID WASTE MANAGEMENT AND TREATMENT (3)

Prerequisite: 11:375:203. Pre- or corequisite: 11:375:303.

The generation, storage, transport, processing, ultimate disposal, and regulation of municipal solid wastes, including discussion of agricultural and hazardous wastes and recovery of resources.

11:375:310. ANALYTICAL ENVIRONMENTAL CHEMISTRY LABORATORY (2)

Prerequisites: 01:160:162, 11:375:202.

Analysis of environmental samples; environmental sampling procedures; experimental ethics; data analysis; HPLC, gc, and atomic adsorption spectroscopic analysis of organic and inorganic substances.

11:375:312. ENVIRONMENTAL MICROBIOLOGY LABORATORY (2)

Pre- or corequisites: 11:375:201, 202.

Hands-on introduction to microbiological techniques related to environmental issues. Bacterial growth and nutrition, nutrient cycles, waste treatment, and water quality testing.

11:375:321. ENVIRONMENTAL POLLUTION IN INTERNATIONAL PERSPECTIVE (3)

Resolution of problems of environmental pollution by international cooperation. Accomplishments presented through unifying themes.

11:375:322. ENERGY TECHNOLOGY AND ITS ENVIRONMENTAL IMPACT (3)

Environmental consequences of energy utilization (transportation, space heating, etc.) and the production of power; the indirect effects of the isolation, purification, and transportation of primary energy resources.

11:375:333. ENVIRONMENTAL LAW I (3)

Theory and practice of environmental law in the context of common law remedies, constitutional environmental rights, and the public trust doctrine. Emphasis on constitutional "takings" and "preemption" issues, and on public policy and science interactions.

11:375:334. ENVIRONMENTAL LAW II (3)

Prerequisite: 11:375:333.

Administrative agencies and legislatures as sources of environmental law, with emphasis on pollution control law. Topics include judicial review; the National Environmental Policy Act; federal and state statutory control of hazardous substances; and air, water, and land pollution.

11:375:336. OCCUPATIONAL AND COMMUNITY NOISE CONTROL (3)

Fundamentals of sound and sound measurement. The effects of noise, regulations, and enforcement. Field exercises.

11:375:345. ENVIRONMENTAL TRANSPORT PHENOMENA (3)

Prerequisites: 11:375:203, 01:640:252.

Vectoral and Einstein notation and rules; conservation principles; scaling; vorticity, circulation, and flow lines; turbulence; diffusion/conduction; and radiative transfer.

11:375:346. INTRODUCTION TO ATMOSPHERIC CHEMISTRY (3)

Prerequisites: 01:160:161, Calculus I, and two terms of physics.

Principles of atmospheric chemistry. Issues include the Antarctic ozone hole, ozone smog, acid rain, air toxics, greenhouse gases, and aerosols. Environmental implications of changing atmospheric composition.

11:375:351. LAND PLANNING AND UTILIZATION (3)

Lec. 2 hrs., fieldwork 3 hrs. Prerequisite: 11:375:266.

Land as a natural resource; its use, capabilities, and conservation, with particular reference to erosion control.

11:375:360. SOILS AND WATER (4)

Lec. 3 hrs., lab. 3 hrs. Prerequisite: 01:460:101 or equivalent.

Physical and chemical properties of soils, soil-water interactions, erosion, etc. Soil properties important to environmental planning. Soil survey interpretation and use.

11:375:399. HAZARDOUS WASTE OPERATION AND EMERGENCY RESPONSE (1.5)

Offered in the winter session. Prerequisite: Open to junior or senior majors, or by permission.

Classroom instruction and hands-on learning of general skills required for working safely at a hazardous waste site. Meets the 40-hour OSHA requirement for hazardous waste site access certification.

11:375:403. PRINCIPLES OF EPIDEMIOLOGY (3)

Prerequisite: 11:375:301.

Study of environmental disease patterns in human populations; emphasis on the association between environmental exposures and disease occurrence; analysis of causal relationships and risk estimates.

11:375:405. FUNDAMENTALS OF WATER AND WASTEWATER ANALYSIS (4)

Lec./rec. 3 hrs., lab. 3 hrs. Prerequisites: 01:160:161-162 or equivalent.

Principles of quantitative and qualitative determinations of pollutants in waters, with special emphasis on modern techniques.

11:375:406. PUBLIC HEALTH PRACTICE AND ADMINISTRATION (3)

Identification and control of community health problems. Organization and functions of public health agencies discussed in conjunction with utilization of law in implementing health programs.

11:375:407. ENVIRONMENTAL TOXICOLOGY (3)

Prerequisite: An organic chemistry course.

Basic principles and applications of toxicology to environmental problems.

11:375:408. TREATMENT PLANT AND RECEIVING WATER SURVEYS (4)

Prerequisite: 11:375:405.

Wastewater treatment plant and receiving water surveys, sampling technology, data interpretation. Field trips to treatment plants and polluted streams with the required chemical, physical, and biological analyses.

11:375:409. ENVIRONMENTAL STATEMENT AND IMPACT (3)

Methods, procedures, and regulations involved with preparation of environmental impact and assessment statements. Critical review of currently issued statements and evaluation of construction impacts.

11:375:410. WORKSHOP IN ENVIRONMENTAL ASSESSMENT AND IMPACT (3)

Prerequisite: 11:375:409.

Firsthand experience in research, preparation, writing, and presentation of an environmental impact statement.

11:375:411. ENVIRONMENTAL MICROBIOLOGY (3)

Prerequisite: One term of introductory microbiology or bacteriology.

Microorganisms in carbon, nitrogen, sulfur cycling, biogeochemical processes, and water and wastewater treatment systems; biodegradation strategies and pathways; and bioremediation of toxic contaminants in the environment.

11:375:416. CHEMICAL REACTIONS IN THE ENVIRONMENT (3)

Transformation of toxic environmental chemicals by plants, animals, sunlight, and microorganisms; mechanisms involved in the formation of cancer-causing materials; analysis and identification of environmental metabolites.

11:375:421. AIR POLLUTION (3)

Fundamental factors of atmospheric contamination; effect of pollution on man and environment; principles of measurement and survey; methods of control; air cleaning; legal aspects.

11:375:422. AIR SAMPLING AND ANALYSIS (3)

Prerequisite: 11:375:421 or equivalent.

Methods for collection and analysis of particulate and gaseous pollutants. Stack sampling techniques.

11:375:423. ENVIRONMENTAL FATE AND TRANSPORT (3)

Pre- or corequisites: 11:375:444 and 451.

The fate and transport of chemicals to determine chemical exposures in aquatic systems and predict future conditions. Emphasis on water quality problems introduced by addition of nutrients, metals, and toxic organic chemicals to water, soil, and air.

11:375:425. RADIOACTIVITY AND THE ENVIRONMENT (3)

Atomic and nuclear radioactivity, fission, fusion, interaction of radiation with matter, biological effects. Radiation exposure limits, sources of environmental contamination, radioactive waste treatment and disposal.

11:375:426. INTRODUCTION TO HEALTH PHYSICS (3)

Prerequisites: 01:640:138 and 01:750:203-204, or equivalent.

The protection of people and the environment from unnecessary radiation exposure; principles and practices.

11:375:428. INTRODUCTION TO RADIOISOTOPE TOXICOLOGY (3)

Development of radionuclides transport and metabolism models. Associated dosimetry and mechanism of induced radiopathological states. Contemporary problems in medical radioisotope toxicology.

11:375:430. HAZARDOUS WASTES (3)

Pre- or corequisite: 11:375:307.

Hazardous waste management: case studies, RCRA and other legislation and regulations, treatment and disposal technology, sampling and analysis, fate in the environment, site cleanup.

11:375:431,432. SPECIAL PROBLEMS IN ENVIRONMENTAL SCIENCE/STUDIES (BA,BA)

Prerequisites: Permission of adviser and curriculum coordinator of environmental science.

Conferences; library and laboratory work on assigned topics.

11:375:434. PRINCIPLES OF INDUSTRIAL HYGIENE (3)

Identification, evaluation, and control of chemical and physical stresses of industrial environment. Gases, aerosols, nonionizing radiation, noise, lighting, ergonomics, industrial ventilation, heat, and health standards.

11:375:435. INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH (3)

Systems safety, accident causation and investigation, hazard analysis, and loss control. Safety and risk management, including Worker's Compensation and safety regulations.

11:375:444. WATER CHEMISTRY (3)

Prerequisites: 01:160:161-162 and 01:640:135, 138, or equivalent.

Chemistry of natural and polluted waters; water quality; equilibrium models for several chemical systems in natural waters; stability of organic compounds.

11:375:445. PROBLEMS IN AQUATIC ENVIRONMENTS (3)

Prerequisites: 01:119:101-102, 01:160:161-162.

Effects of chemical and biological pollutants on marine and estuarine environments; demographic stresses.

11:375:451. SOIL CHEMISTRY (3)

Prerequisite: 11:375:266. Offered odd-numbered years.

Chemical behavior in soils as it relates to their preservation, maintenance, and improvement for use by man.

11:375:453. SOIL ECOLOGY (3)

Prerequisites: 01:119:101-102.

Soil microbial contribution to ecosystem function, microbial diversity, nutrient cycling, soil enzymes, fate of soil amendments, soil flora and fauna, energy cycling, quantification of soil biological processes.

11:375:454. SOIL BIOLOGICAL PROCESSES (3)

Prerequisites: 01:119:101-102, a term of organic chemistry.

Analysis of the properties defining the nature, function and sustainability of the soil biological community, including soil chemical, biological, and physical properties; microbial metabolic processes and their rates in the soil; and limitations to bioremediation.

11:375:455,456. INTERNSHIP IN ENVIRONMENTAL HEALTH (2,2)

Prerequisite: Written consent of instructor. Open only to environmental and public health students.

A field program in which a student observes the practice of an environmental health department.

11:375:459. PHYSICAL PROPERTIES OF SOILS (3)

Prerequisite: 11:375:266.

Characteristics of water, air, and heat movement and retention in soils. Contaminant movement and leaching. Soil mechanical properties, erodibility, and other physical properties.

11:375:462. SOIL CLASSIFICATION AND SURVEY (4)

Prerequisite: 11:375:266.

Formation, development, and classification of natural soil types. Field trips and surveying of selected areas.

11:375:491. RADIOISOTOPE THEORY AND TECHNIQUES (3)

Theory and use of radioisotopes; principles and operation of radiation-counting systems; selected radiochemical techniques; emphasis on biological and medical applications of radioisotopes.

11:375:493. APPLIED HEALTH PHYSICS (2)

Basic concepts and practices of radiation protection. Designed for personnel involved with the use of ionizing radiation sources and radioisotopes.

11:375:494. RADIATION LABORATORY (2)

Prerequisite: 11:375:425 or 491.

Laboratory practicum, with introductory lectures, in the use and detection of radioactive isotopes. Principles and operation of major radiation measurement systems, sample preparation, and protection techniques.

FOOD SCIENCE 400

11:400:103. SCIENCE OF FOOD (3)

Intended for all students; no science required.

Overview of major food components (carbohydrates, fats, proteins, vitamins, and minerals); process of digestion; major food-related diseases in the United States; the bases for food preservation, including processing, food legislation, and current food issues, such as the use of food additives, irradiation, and genetic engineering.

11:400:104. FOOD AND HEALTH (3)

Intended for all students; no science required.

Personal nutrition and its relationship to health by way of food and nutraceuticals.

11:400:201. PRINCIPLES OF FOOD SCIENCE (3)

Prerequisites: 01:119:101-102, or 103. Pre- or corequisite: 01:160:209 or 307 or 315.

Overview of food safety, composition, and preservation methods. Structure-function relationships of water, protein, lipids, carbohydrates, minerals, and natural products in food systems.

11:400:202. PRINCIPLES OF FOOD SCIENCE LABORATORY (2)

Lec. 80 min., lab. 3 hrs. Corequisite 11:400:201.

Introduction to food systems, fundamental principles underlying food function and stability, and analysis of food properties.

11:400:304. FOOD ANALYSIS (4)

Lec. 80 min., lab. 4 hrs. Pre- or corequisites: 01:160:307-308.

Modern methods of analytical chemistry, with emphasis on chromatography. Application of analytical methodology to lipids, amino acids, carbohydrates, and other food components. Importance of precision, accuracy, and significance of results.

11:400:314. CURRENT ISSUES IN FOOD SCIENCE AND FOOD LAW (2)

Prerequisite: Open to juniors and seniors.

Food laws of the United States and their impact. The role of federal regulatory agencies in the administration of law. Current food safety controversies.

11:400:401. INTRODUCTION TO FOOD ENGINEERING FUNDAMENTALS (4)

Lec./lab. Prerequisites: Two terms each of calculus and physics.

Engineering principles of processing and preserving food: material balance, gases and vapor, psychrometry, energy balance, rheology and fluid flow, heat transfer, mass transfer, and drying. Laboratory experiments and weekly problem assignments.

11:400:402. INTRODUCTORY FOOD ENGINEERING PROCESSES (4)

Lec. 4 hrs. Prerequisite: 11:400:401.

Unit operations and processes for food manufacture. Two field trips with reports; laboratory experiments, engineering problems, weekly problem assignments.

11:400:405. SENSORY EVALUATION OF FOODS (3)

Pre- or corequisite: 01:960:401 or equivalent. Open to food science or nutritional sciences majors, or by permission.

Experience in using the senses as analytical tools. Principles of sensory evaluation of foods, including sample presentation, data recording and analysis, and report writing.

11:400:408. FOOD SCIENCE TOPICS (2)

Prerequisite: Permission of instructor. (Taught by visiting professor.)

Special assignments in any field of food science.

11:400:410. NUTRACEUTICALS IN FUNCTIONAL FOODS, HERBS, AND SUPPLEMENTS (3)

Prerequisites: 11:400:201 or equivalent, 11:400:104 or 11:709:255 or equivalent.

Principles of food processing reviewed with emphasis on the nutritional and nutraceutical impact of modern food industry practices.

11:400:411. FOOD CHEMISTRY (3)

Lec. 3 hrs. Open only to seniors. Prerequisites: 01:160:209; 11:400:201, 202; 01:447:390.

Basic chemical, biochemical, and physical principles underlying food systems. Factors contributing to the color, flavor, texture, nutrition, and safety of food. Food applications of basic principles.

11:400:412. FOOD PRODUCT DEVELOPMENT (3)

Lec. 2 hrs., lab. 3 hrs. Prerequisites: 11:400:201, 202, 304, 402, 411.

A comprehensive consideration of food product development, including fact finding, prototype and process development, shelf life, technical and financial feasibility, distribution, and consumer acceptance.

11:400:419. FOOD PHYSICAL SYSTEMS (3)

Prerequisites: One term of organic chemistry, two terms of calculus, two terms of physics.

The physical chemistry of foods and food ingredients; microscopic properties of foods in terms of molecular structure and physical principles; properties of aqueous solutions, colloids, biopolymers, and crystalline and amorphous solids; effects of temperature, pressure, water activity, solvent, and matrix properties.

11:400:421. HAZARD CONTROL IN FOOD PROCESSING (3)

Prerequisite: 11:126:394 or 01:447:390.

Principles and application of processing controls to reduce or eliminate hazards in foods; hazard analysis and identification of critical control points (HACCP); good manufacturing practices: sanitation, monitoring, and risk analysis; regulatory requirements.

11:400:422. COLLOQUIUM: FOOD SAFETY: FADS, FACTS, AND POLITICS (3)

Prerequisite: Open only to Cook College juniors and seniors.

Dynamic interactions of science, law, agribusiness interests, and consumer concerns. Case studies and participatory exercises to explore a variety of issues.

11:400:423. FOOD MICROBIOLOGY (3)

Prerequisite: 01:447:390. 11:115:301 or 403 recommended.

The role of microorganisms in food processing and preservation and health promotion. The relation of microorganisms to food spoilage, food-borne illness and intoxication, and general food quality.

11:400:424. FOOD MICROBIOLOGY LABORATORY (1)

Corequisite: 11:400:423.

Methods of microbiological analysis of foods. Identification of food-related microorganisms and fermentation processes.

11:400:493,494. RESEARCH PROBLEMS IN FOOD SCIENCE (1-4,1-4)

Prerequisite: Permission of adviser.

Research projects in food science under the guidance of the faculty.

LANDSCAPE ARCHITECTURE 550

11:550:230. ENVIRONMENTAL DESIGN ANALYSIS (3)

Analysis of the quality of the physical environment: perception, awareness, design, and planning process. Governmental controls that affect quality. Private, public, urban, rural, and recreational environments considered.

11:550:231. INTRODUCTION TO ENVIRONMENTAL DESIGN I (5)

Lec. 1.5 hrs., studio 6 hrs. Prerequisite: Permission of department. Not open to first-year students.

Design fundamentals and creativity through design process; application to fundamental landscape architecture at small-site scale. Graphic skills and techniques. Impact of environmental design on people and nature.

11:550:232. INTRODUCTION TO ENVIRONMENTAL DESIGN II (5)

Lec. 1 hr., studio 5 hrs. Prerequisites: 11:550:231 and acceptance into landscape architecture program.

Refinement of design process and graphic skills, including perspective and paraline drawing, through projects of increasing complexity and magnitude. Site planning, principles of auto and pedestrian circulation, behavioral aspects of design, basic landform manipulation.

11:550:233-234. LANDSCAPE PLANTS I,II (3,3)

Lec. 2 hrs., lab. 3 hrs.

Identification, environmental requirements, and landscape assets and liabilities of ornamental plants. *First term:* fall aspects of deciduous trees and shrubs. *Second term:* the broadleaf and narrow-leaf evergreens and the spring aspect of deciduous trees and shrubs.

11:550:235. HERBACEOUS PLANTS IN THE LANDSCAPE (3)

Identification, uses, and care of herbaceous plants in private gardens and public spaces: annuals, herbaceous perennials, ornamental grasses, herbs, and plants for ponds and pools.

11:550:238. LANDSCAPE MANAGEMENT AND MAINTENANCE (3)

Maintenance and culture of landscape plantings.

11:550:239. PLANNING AND PLANTING THE RESIDENTIAL ENVIRONMENT (3)

Lec. 2 hrs., lab. 3 hrs.

Contact with the living, green environments provided by the grounds of private residences. Planning, land use, selection and planting of landscape plants, turf, fruiting plants, and interior plantings.

11:550:250. COMPUTER-AIDED DESIGN FOR LANDSCAPE ARCHITECTS (3)

Lec. 2 hrs., lab. 3 hrs. Prerequisite: Open only to majors or by permission of instructor.

Introduction to the use of computer-aided design (CAD) as a design and graphics tool in landscape architecture.

11:550:330. HISTORY OF LANDSCAPE ARCHITECTURE (3)

Historical analysis of landscape theory and practice; design as a physical expression of environmental and cultural determinants; its evolution as a profession in the United States.

11:550:331. INTERMEDIATE LANDSCAPE ARCHITECTURE I (5)

Lec. 1.5 hrs., studio 6 hrs. Prerequisite: 11:550:232. Open only to students accepted into the landscape architecture program.

Analysis and interpretation of the physical environment with emphasis on methodologies such as GIS, suitability mapping, and visual resource management as applied to land planning, design, and management problems.

11:550:332. INTERMEDIATE LANDSCAPE ARCHITECTURE II (5)

Lec. 1.5 hrs., studio 6 hrs. Prerequisite: 11:550:331.

A continuation of 11:550:331 with an emphasis on the design of public open spaces including plazas, squares, parks, and pedestrian streets.

11:550:337. DESIGN COMMUNICATION (3)

One 80-min. lec., studio/lab. 1–3 hrs.

Prerequisites: 11:550:232, 250, and acceptance into the professional program.

Presentation and communication techniques applicable to landscape architecture: visualization skills, hand drawing, and computer applications.

11:550:340. PLANTING DESIGN (4)

Lec. 2 hrs., studio 3 hrs. Prerequisites: 11:550:231, 232, or permission of instructor.

Plants as design elements affecting function, comfort, energy efficiency, and aesthetic quality. Selection of plants to serve functional and aesthetic purposes. Specification for planting design.

11:550:341. LANDSCAPE ARCHITECTURE CONSTRUCTION I (4)

Lec./rec. 2 hrs., studio 3 hrs. Prerequisite: 11:372:322.

Site engineering principles; grading, drainage, earthwork, and road alignment; their integration with landscape architecture design.

11:550:342. LANDSCAPE ARCHITECTURE CONSTRUCTION II (3)

Lec. 3 hrs. Prerequisite: 11:550:341.

Introduction to properties of construction materials, structural principles, and methods of construction.

11:550:360. INTERNATIONAL STUDIES IN LANDSCAPE ARCHITECTURE (BA)

Prerequisite: Open only to juniors in landscape architecture, with permission.

An opportunity to study in a landscape architecture program abroad with which the department has established an articulated exchange agreement. Course equivalences will be determined upon completion of the program.

11:550:430. ADVANCED LANDSCAPE HISTORY SEMINAR (3)

Prerequisite: 11:550:330 or permission of instructor.

History of gardens in Italy, France, England, or the United States from the Renaissance to the present. Emphasis on form and meaning of garden design and widespread influence of this genre.

11:550:431. ADVANCED LANDSCAPE ARCHITECTURE I (5)

Lec./rec. 2 hrs., studio 6 hrs. Prerequisites: 11:550:332 and 342.

Advanced landscape architecture theory with application to problems of increasing scope and complexity. Social and cultural contexts, with emphasis on design sites for housing and community design.

11:550:432. ADVANCED LANDSCAPE ARCHITECTURE II (5)

Lec./rec. 3 hrs., studio 7 hrs., 3 hrs. by arrangement. Prerequisite: 11:550:431.

Advanced applications focused on complex land planning, design, and management issues.

11:550:433. ARCHITECTURAL DESIGN (3)

Lec. 1 hr., studio 3 hrs. Prerequisites: 11:550:232 and permission of department.

Concepts of architectural and urban design process, systems, and practice. Built environments in relation to human functions, perception, and needs. Space and form design and sketch studies.

11:550:435. PROFESSIONAL PRACTICE (1)

Lec. 1.5 hrs. Open only to seniors in the landscape architecture program.

Survey of general professional practice, office management, client relationships, collaborative practice, contracts, and specifications.

11:550:437,438. SPECIAL PROBLEMS IN LANDSCAPE ARCHITECTURE (BA,BA)

Open only to majors in the landscape architecture program; others by permission of instructor.

Independent projects. Terminal comprehensive project, research of appropriate scope and complexity, or community involvement in environmental design problems.

11:550:441. CONSTRUCTION IMPLEMENTATION AND PRACTICE (4)

Two 80-min. lecs., studio 1–3 hrs.

Introduction to the construction implementation process; development of technical competence; integration of sustainable design principles; communication through technical documentation. Additional topics related to professional practice.

11:550:460. FIELD STUDY IN LANDSCAPE ARCHITECTURE (1–5 BA)

Open only to landscape architecture majors; others with departmental permission.

Case study and field investigation of landscape planning, design, and management issues.

11:550:497. SENIOR THESIS PREPARATION (1)

Prerequisite: Departmental approval.

Development of independent research and comprehensive design project proposal, including literature review and research methodology, to be submitted to the departmental faculty for approval.

11:550:498. SENIOR THESIS IN LANDSCAPE ARCHITECTURE (4–5)

Prerequisites: 11:550:497 and departmental approval.

Execution of the project proposed in 11:550:497. May not be used in conjunction with the George H. Cook Scholars Program or a cooperative education course.

INTERDISCIPLINARY STUDIES 554**11:554:196. HONORS SEMINAR I (3)**

Open only to first-year students in the Cook College General Honors Program.

The topic for each term addresses current issues from the perspectives of the humanities, sciences, and social sciences.

11:554:296. HONORS SEMINAR II (3)

Open only to sophomores or juniors in the Cook College General Honors Program.

The topic for each term addresses current issues from the perspectives of the humanities, sciences, and social sciences.

11:554:297,298. HONORS TUTORIAL I,II (1,1)

Open only to first-year and sophomore students in the Cook College General Honors Program.

An independent study project on a topic agreed upon by the student and the cooperating faculty member. Short written report required at the end of each term.

11:554:301. THE USE OF ANIMALS (3)

First-year students by permission only.

Animals as the object of utilitarian relationships: for food, for labor, for pets, for sport, for science. Comparative history and ethics of human attitudes toward animals and the question of animal rights.

11:554:305. IDEAS OF NATURE (3)

First-year students by permission only.

Critical and historical analysis of basic assumptions about the nature of "Nature" (mother, machine, mystery, mathematics, matter) and their relationship to modern attitudes and behavior.

11:554:346. ENVIRONMENTAL DOCUMENTATION IN PHOTOGRAPHY, FILM, AND VIDEO (3)

A study of the use of photographic documentation of environmental issues, as both a record of scientific data and an expression of humanistic concerns. Emphasis on documentary film.

11:554:347. ENVIRONMENTAL PHOTOGRAPHY (4)

Lec. 3 hrs., lab. 3 hrs.

An introductory photo/darkroom course, with emphasis on photographing the landscape environment.

11:554:391,392. INDEPENDENT STUDY (BA,BA)

Individualized research project under the direction of one or more faculty members.

11:554:397,398. HONORS TUTORIAL III,IV (BA,BA)

Open only to sophomores or juniors in the Cook College General Honors Program.

An independent study project in the student's field of interest, carried out with a cooperating faculty member. Written report required at the end of each term.

11:554:424. PRACTICUM IN ENVIRONMENTAL PROTECTION (3)

Prerequisite: Permission of instructor.

Development and implementation of policy on a specific environmental problem. Research conducted under faculty guidance; policy and procedures administered by student-faculty team.

11:554:491,492. INDEPENDENT STUDY (BA,BA)

Individualized research project under the direction of one or more faculty members.

11:554:497,498. HONORS TUTORIAL V,VI (BA,BA)

Open only to seniors in the Cook College General Honors Program.

An independent study project in the student's field of interest, carried out with a cooperating faculty member. A written report or presentation appropriate to the work is required at the conclusion of the project.

MARINE SCIENCES 628

11:628:110. TOPICS IN MARINE SCIENCES [MAST] (P/NC 3)

Offered in cooperation with the Marine Academy of Science and Technology at Sandy Hook, an introduction to marine biology, chemistry, and mathematical physics, with opportunities for field and laboratory experience.

11:628:111. TOPICS IN MARINE SCIENCES [BCC I] (P/NC 3)

Offered in cooperation with Brookdale Community College, an introduction to oceanography.

11:628:120. INTRODUCTION TO OCEANOGRAPHY (3)

Plate tectonics, properties and motion of the ocean (waves, tides, currents), ocean resources (food, energy, minerals), and related marine environmental issues changing our understanding of the planet and its impact on our lives.

11:628:211. TOPICS IN MARINE SCIENCES [BCC II] (P/NC 3)

Offered in cooperation with Brookdale Community College, an introduction to marine biology or coastal zone management.

11:628:300 THROUGH 310. TOPICS IN MARINE AND COASTAL SCIENCES (1-3 EACH)

Prerequisite: Permission of instructor.

Offered each term by faculty members in the Institute of Marine and Coastal Sciences. Topics, prerequisites, schedule, and credits vary with the topic/instructor.

11:628:317. AQUACULTURE (3)

Prerequisites: 01:119:101-102; 01:160:161-162.

Aquaculture production methods, fish and shellfish growth and reproduction, nutrition, genetics, disease control, economics, environmental consequences, and public policy issues.

11:628:320. DYNAMICS OF MARINE ECOSYSTEMS (4)

Three 80-min. lects. Prerequisites: 01:119:102, 01:160:162, and CALC 1.

Fundamental processes in the marine environment, with emphasis on interdisciplinary linkages in the functioning of marine ecosystems: dynamics in the physics, chemistry, and biology of the oceans.

11:628:321. ICHTHYOLOGY (4)

(Formerly 01:119:321)

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102.

The biology of fish with emphasis on functional morphology, ecology, and behavior.

11:628:340. IDENTIFICATION OF MARINE INVERTEBRATES (2)

Class initially meets in Tuckerton for one week in January. Prerequisite: Permission of instructor.

Lectures, intensive daily laboratories, a field trip, and collection of invertebrates.

11:628:341. HYDROTHERMAL VENTS (3)

Prerequisites: 01:119:102 and CALC 1.

Composition and dynamics of deep-sea hydrothermal vent communities and the geology of seafloor spreading centers.

11:628:342. MARINE CONSERVATION (3)

Prerequisite: 11:628:320 or 11:704:351 or equivalent.

Heterogeneity, complexity, and diversity of coastal ecosystems and their increasingly concentrated human populations. Conservation issues and tools. Linkages between science and policy. Case studies examined and developed.

11:628:352. OCEAN, COASTAL, AND ESTUARINE CIRCULATION (3)

Major coastal and estuarine processes, coastal upwelling, wave and tidal effects, currents, climatic effects. Types of estuaries. Coastal modification, development, and management.

11:628:364. OCEANOGRAPHIC METHODS AND DATA ANALYSIS (3)

Lec./lab./field. Prerequisite: 11:628:320.

A field and laboratory course in the analytical tools of oceanography. A three-hour laboratory each week and two field trips, one of which is overnight at the Rutgers Field Station at Tuckerton.

11:628:401. SCIENCE IN SHORELINE MANAGEMENT (3)

Prerequisite: Open only to juniors and seniors who have completed a course in biology, earth science, or environmental science.

Examination of coastal environments based on the use of science in the management of shoreline resources, culminating in a student project evaluating the conversion of shoreline by direct and indirect human action.

11:628:404. FUNGI AND ECOSYSTEMS (3)

Prerequisites: 01:119:101-102. Recommended: 01:447:390, 11:375:453, and/or 11:770:402.

Ecophysiology of fungi and their role in the processes of decomposition, pathogenicity, and plant nutrient acquisition. Growth habit; colonization ability; resource availability and requirements; and community structure in terrestrial, aquatic, and marine ecosystems.

11:628:451. PHYSICAL OCEANOGRAPHY (4)

Two 80-min. lects., one 55-min. rec. Prerequisite: 01:750:204.

Principles of ocean physics. Mass, momentum, heat, and freshwater conservation and atmospheric exchange. Influence of Earth's rotation. The ocean's role in climate. Tides, waves, and currents. Effects of ocean circulation on its biology and chemistry.

11:628:452. GEOPHYSICAL DATA ANALYSIS (3)

Prerequisites: 01:640:152, 250, and 252.

Quantitative analysis and display of spatial and time series data, filters, spectral analysis, covariance, coherence, confidence intervals, goodness-of-fit, optimal interpolation of unequally spaced data, empirical orthogonal functions, harmonic analysis. Practical exercises in Matlab analysis. Individual projects and presentations.

11:628:462. OCEAN ECOLOGY (4)

Two 80-min. lects., one 55-min. rec. Prerequisites: 01:119:101-102, two terms of calculus, 11:628:320.

Biological and ecological processes in the ocean, emphasizing interactions with physical and chemical processes. Factors controlling the production and utilization of organic matter. Food web structure, biogeochemical cycles, structure and composition of marine communities.

11:628:472. CHEMICAL OCEANOGRAPHY (4)

Two 80-min. lects., one 55-min. rec. Prerequisites: 01:160:161-162, 01:640:151-152, 11:628:320.

Chemical description of the sea and how the distributions of chemical species in the world ocean are related to physical, chemical, biological, and geological processes.

11:628:476. HISTORY OF THE EARTH SYSTEM (3)

Prerequisites: Any three of the following: 01:119:102, 01:160:162, 01:460:101, 01:750:204; or permission of instructor.

The Earth as an evolving physical/biological system; physical and biogeochemical processes that have shaped the environment over geologic time.

11:628:497,498. SPECIAL PROBLEMS IN MARINE AND COASTAL SCIENCES (BA,BA)

Prerequisite: Permission of instructor.

Practical field/laboratory experience with faculty in the Institute of Marine and Coastal Sciences.

METEOROLOGY 670**11:670:201. ELEMENTS OF METEOROLOGY (3)**

Overview of current weather maps. Structure of the atmosphere and the role of moisture in the development of dew, clouds, and precipitation. Air masses, fronts, cyclones, thunderstorms, tornadoes, and hurricanes. Elements of forecasting, instrumentation, and communication.

11:670:202. ELEMENTS OF CLIMATOLOGY (3)

Major climatic controls. Climatic classifications and comparisons of major types. Overview of current climate issues, such as global warming and El Niño, and the global climate.

11:670:210. METEOROLOGICAL ANALYSIS (1.5)

One 80-min. lec. Pre- or corequisite: 11:670:201 or permission of instructor.

Surface observation codes. Preparation of surface, upper air, and sounding charts. Forecast guidance, weather map interpretation, concepts of stability, and preparation of weather forecasts. Map discussions.

11:670:305. APPLIED METEOROLOGY (3)

Prerequisites: 01:640:251, 252; 11:670:201, 210.

Atmospheric dispersion modeling; analysis and interpretation of climate statistics; agricultural, hydrological, and biological applications; operational and media meteorology, with applications to transportation and communication systems; forensic and professional meteorology and ethical considerations.

11:670:306. WEATHER, CLIMATE, AND ENVIRONMENTAL DESIGN (3)

Weather and climate impact on environmental engineering issues and design applications in agriculture, stormwater management, air pollution, coastal management, extreme weather, and global warming.

11:670:307. AGRICULTURAL METEOROLOGY (3)

Prerequisites: 01:640:152 and one term of physics.

Meteorological effects on agriculture; plant growth development and diseases. Soil climate; evaporation; hydrologic cycle. Agricultural forecasts and warning.

11:670:323. THERMODYNAMICS OF ATMOSPHERE (3)

Prerequisites: 01:640:152 and 251; 01:750:194 or equivalent.

Thermodynamics of the atmosphere, energy conservation, ideal gas law, water and its transformations, moist air, aerosols, hydrostatic stability and convection, vertical motion, cloud formation, and precipitation.

11:670:324. DYNAMICS OF THE OCEANS AND ATMOSPHERE (3)

Prerequisite: 11:670:323.

Hydrodynamics of the oceans and atmosphere. Equations of motion on rotating earth. Vorticity, potential vorticity, and divergence. Boundary layer dynamics.

11:670:325. SPECIAL TOPICS IN METEOROLOGY (BA)

Topics selected to meet specific needs.

11:670:412. METEOROLOGICAL INSTRUMENTATION (3)

Prerequisite: 11:670:323 or permission of instructor.

Theory of meteorological instrumentation. Use of meteorological instruments for research; maintenance, calibration, and experimental design.

11:670:423. WEATHER SYSTEMS (3)

Prerequisites: 11:670:201 and/or 202, and either both 11:670:323 and 324 or their equivalents. Corequisite: 11:670:433.

Applied dynamics of the atmosphere, including quasi-geostrophic theory. Development of cyclones, vertical motion, jet streams, and fronts. Synoptic-scale weather phenomena.

11:670:424. MESOSCALE WEATHER SYSTEMS (3)

Prerequisite: 11:670:423 or equivalent. Corequisite: 11:670:434.

Convective weather systems, including severe storm structure, evolution, and forecasting.

11:670:431. PHYSICAL METEOROLOGY (3)

Prerequisites: 01:750:194 and 01:640:151-152 and 251 or equivalents.

Atmospheric optics and acoustics; radio wave propagation; cloud and precipitation formation; atmospheric electricity; geomagnetic phenomena.

11:670:433. SYNOPTIC ANALYSIS AND FORECASTING I (3)

Lab. 4 hrs. Prerequisite: 11:670:324.

Observation and forecast model data decoding and interpretation. Weather forecast preparation. Use of microcomputers to analyze and display data. Thermodynamic diagrams, cross-section analysis, and wind profiler data.

11:670:434. SYNOPTIC ANALYSIS AND FORECASTING II (3)

Lab. 4 hrs. Prerequisite: 11:670:433.

Case studies and preparation of weather briefings. Observation and forecasting of convection, winter weather, and heavy precipitation.

11:670:451. REMOTE SENSING OF THE OCEAN AND ATMOSPHERE (3)

Prerequisites: 01:640:251; 01:750:193-194 or equivalent.

Methods and instruments of observation of the ocean (temperature, salinity, currents, sea state, turbidity, and pollutants) and atmosphere (temperature, water vapor, ozone, clouds, and wind).

11:670:458. AIR-SEA INTERACTIONS (3)

Prerequisite: 11:670:324 or permission of instructor.

Composition and structure of the marine atmosphere; dynamics of the air-sea interface; dynamic and thermodynamic processes of the atmospheric and oceanic boundary layers.

11:670:493,494. RESEARCH PROBLEMS IN METEOROLOGY (BA,BA)

Prerequisite: Permission of instructor.

Independent study on atmospheric projects. Topics and requirements to be determined with the supervising instructor.

MICROBIOLOGY 680**11:680:390. GENERAL MICROBIOLOGY (4)**

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102; 01:160:161-162, 171, and 307.

Basic principles of microbiology. An introduction to the physiology, morphology, pathogenicity, and genetics of groups of microorganisms.

11:680:394. APPLIED MICROBIOLOGY (4)

Lec. 3 hrs., lab. 3 hrs. Prerequisite: 11:680:390 or equivalent. Credit not given for both this course and 11:126:394.

Microorganisms in foods; their application in industry, agriculture, environment, and medicine. Physical and chemical factors of growth and control in relation to industrial and natural processes.

11:680:491. MICROBIAL ECOLOGY AND DIVERSITY (3)

Two 80-min. lects., one 180-min. lab. Prerequisite: 01:447:390 or 11:680:390.

Ecological determinants; characteristics of aquatic and terrestrial ecosystems; nature and activity of microbial populations; biogeochemical cycles and energy flow; microbial interactions and community structures.

11:680:495. SEMINAR IN MICROBIOLOGY (1)

Open only to senior microbiology majors.

Practice in techniques for oral presentation of scientific reports and reviews, based on search of research literature in microbiology and, where applicable, the student's own research results.

11:680: 497,498. RESEARCH IN MICROBIOLOGY (BA,BA)

Prerequisite: Permission of instructor.

Research projects in microbiology under the guidance of faculty members.

ECOLOGY AND NATURAL RESOURCES 704

11:704:211. THE NATURAL RESOURCES PROFESSIONS (P/NC 1)

Open only to students in professional resource management; others by permission of instructor.

Survey of the wildlife, forestry, and fishery professions. Guest lectures, class discussions, and field experience.

11:704:240. BEHAVIORAL BIOLOGY (4)

(Formerly 01:119:240)

Prerequisites: 01:119:101-102.

Basic principles of animal behavior, including social behavior, animal communication, and physiological mechanisms underlying behavior. Topics include ethology, aggression, displays and communication, territoriality, and ethological view of human behavior. Motion pictures observe the behavior of fish, birds, reptiles, and primates.

11:704:272. DENDROLOGY (4)

One 80-min. lec., one 280-min. lab. Prerequisite: 01:119:101. Not open to first-year students.

Nomenclature, identification, ranges, and habitats of important native and naturalized trees of North America. Shrubs and vines important as wildlife food and cover. Forest regions and types, emphasizing the Middle Atlantic area.

**11:704:274. FIELD TECHNIQUES IN ECOLOGY AND NATURAL
RESOURCES (4)**

Lec. 1 hr. Three weeks of fieldwork at college forest. Prerequisite: 11:704:272.

Forest measurements and field practice in the use of forest instruments; forest surveying and mapping; measurements of natural resources; visits to nearby logging operations.

11:704:312. FOREST FIRE PROTECTION (1.5)

Lec./lab.

Prevention, suppression, and suppression of forest fires. Controlled burning. Enforcement of forest fire policy.

11:704:317. CONSERVATION ECOLOGY (3)

Prerequisites: 01:119:101-102 or equivalent, and permission of instructor.

Effects of technology and population growth on species, ecosystems, and human communities. Environmental impact of agricultural and industrial systems. Global environmental change. Biological and social underpinnings of conservation. Extensive scientific and nonscientific readings.

11:704:323. ORNITHOLOGY (4)

(Formerly 01:119:323)

Lec. 3 hrs., lab. 3 hrs. Weekly field trips and two all-day field trips. Prerequisites: 01:119:101-102.

The biology, ecology, and field identification of birds of the region.

11:704:324. INVERTEBRATE ZOOLOGY (4)

(Formerly 01:119:324)

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102.

Comparative study of some representative invertebrates as a basis for understanding the interrelationship between the physiological activity and the structure of organisms.

11:704:325. VERTEBRATE ZOOLOGY (4)

(Formerly 01:119:325)

Lec. 3 hrs., lab. 3 hrs. Seven field trips required, including one two-day weekend trip and one evening trip. Prerequisites: 01:119:101-102.

The classification, evolution, ecology, and life histories of the order and families of the vertebrates, especially of the eastern United States.

11:704:332. PLANT ECOLOGY (4)

(Formerly 01:119:332)

Lec. 3 hrs., lab. 3 hrs., field trips. Pre- or corequisites: 01:119:101-102 or 103 and a course in organismic biology (some aspect of botany or zoology).

Study of plant life histories, populations, communities, and plant-animal interactions (pollination, dispersal, herbivory). Evolutionary basis for plant ecological traits. Weekly field trips to representative habitats in the state, including a weekend trip. Lab includes greenhouse, field experiments, and library reports.

11:704:335. LIMNOLOGY (4)

(Formerly 01:119:335)

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102.

Interactions of biological, physical, and chemical factors in lakes and streams. Emphasis is biological.

11:704:351. PRINCIPLES OF ECOLOGY (4)

Two 80-min. lects., one 55-min. rec. Prerequisite: 01:119:101 or equivalent.

Concepts underlying the organization of living systems. Environmental adaptations of species, population, and community dynamics, energetics, nutrient flux. Practical applications of ecological concepts.

11:704:365. ARBORICULTURE (4)

Two 80-min. lects; one 3-hr. lab.

An overview of tree biology and practical techniques as they impact design, establishment, production, care, and management approaches in developed landscapes.

11:704:375. PRACTICUM IN WILDLIFE MANAGEMENT (BA)

Graded on a P/NC basis. Open only to professional resource management majors. Five days of fieldwork.

Practical experience in wildlife management under the direction of biologists working for state, federal, or private wildlife management agencies.

11:704:376. PRACTICUM IN FISHERY MANAGEMENT (BA)

Graded on a P/NC basis. Open only to professional resource management majors. Five days of fieldwork.

Practical experience in fishery management under the direction of fishery scientists of N.J. Division of Fish, Game, and Wildlife; National Marine Fisheries Service; or other appropriate state or federal agencies.

11:704:377. PRACTICUM IN FOREST MANAGEMENT (BA)

Graded on a P/NC basis. Open only to professional resource management majors. Five days of fieldwork.

Practical experience in forest management under the direction of foresters working for private industry; local, state, and federal government agencies; and in consulting capacities for landowners.

11:704:403. URBAN FORESTRY (3)

One 80-min. lec., one 180-min. lab. Prerequisite: 11:704:272 or 275 or permission of instructor.

Benefits and costs of trees, planning and design, soils, tree selection and nursery stock, IPM, composting, removal, wildlife; laws, finance, inventories, maintenance scheduling, planting. Field trips.

11:704:406. FISHERY SCIENCE (3)

Prerequisite: Permission of instructor. Friday all-day field trips.

Social, economic, ecological, and biological aspects of freshwater and marine fisheries. Emphasis on use of science in decision making and problem solving: life history, population dynamics, habitat, and biological basis of management. Review of sport and commercial fisheries.

11:704:407. RESEARCH METHODS IN FISHERY SCIENCE (3)

Prerequisite: 11:704:406.

Research methods used in freshwater and marine fishery science. Not limited to fishery science majors.

11:704:411. TAXONOMY OF THE VASCULAR PLANTS (4)

(Formerly 01:119:411)

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102; 11:776:210.

Principles, classification, identification, and nomenclature of selected orders, families, genera, and species.

11:704:421. WETLAND ECOLOGY (3)

Prerequisites: 11:704:351 or equivalent and permission of instructor.

Ecology, management, and utilization of wetlands. Basic aspects of wetland ecosystems and the nature of major types. Issues and problems of wetlands management and use.

11:704:422. ECOLOGY OF SOIL ORGANISMS (3)

Prerequisites: 01:119:101-102.

Diversity of organisms and complexity of communities in below-ground ecosystems. Range and diversity of soil organisms and their role in the development of soils, soil structure, soil fertility, and ecosystem processes.

11:704:431. INTRODUCTION TO ECOLOGICAL AND ENVIRONMENTAL MODELING (4)

Prerequisites: CALC1, statistics, or permission of instructor.

General model formulation, validation, hypothesis testing, non-linear phenomena, and forecasting. Review of necessary mathematical and statistical tools. Recommended for advanced ecosystem modeling courses.

11:704:441. ANIMAL BEHAVIOR (3)

(Formerly 01:119:441)

Lec./rec. 3 hrs. Prerequisites: 01:119:101-102, a course in physiology, or permission of instructor. Recommended: Vertebrate or invertebrate biology and ecology.

Physiological foundations and principles of animal behavior, with particular emphasis on mechanisms underlying sexual behavior, feeding aggression, and behavioral development.

11:704:442. ANIMAL BEHAVIOR LABORATORY (1)

(Formerly 01:119:442)

Pre- or corequisite: 11:704:441.

A laboratory to accompany 11:704:441.

11:704:443. ANIMAL SOCIAL BEHAVIOR (3)

(Formerly 01:119:443)

Lec./rec. 4 hrs. Prerequisites: Four terms of biology and junior status, or permission of the instructor; for students majoring in psychology or anthropology.

An examination of animal social behavior, including the behavior of individuals (agnostic, reproductive, and communicative behavior) and the social organization of groups. Emphasizes the adaptive significance of social systems and concentrates on mammals, birds, and social insects. Animal navigation and orientation.

11:704:444. ANIMAL SOCIAL BEHAVIOR LABORATORY (1)

(Formerly 01:119:444)

Pre- or corequisite: 11:704:443.

A laboratory to accompany 11:704:443.

11:704:450. LANDSCAPE ECOLOGY (3)

Prerequisite: 11:704:351 or equivalent. Pre- or corequisite: 01:960:401.

Overview of the concepts, methods, and applications of landscape ecology; causes, development, and importance of spatial patterning; ecological and anthropogenic aspects of landscape pattern and change.

11:704:451. ECOSYSTEMS ECOLOGY AND GLOBAL CHANGE (3)

Prerequisite: 11:704:351 or equivalent.

Analysis of the major global changes based on principles of ecosystems ecology; carbon, nutrient, and pollution cycling mechanisms and budgets; the methods used to study these phenomena.

11:704:452. RESEARCH METHODS IN ECOLOGY (3)

Prerequisite: 11:704:351 or equivalent.

Methods used in ecological research, including methods for the field analyses of plants, animals, and microbes in both terrestrial and aquatic environments; for laboratory experimentation; and for data analysis.

11:704:453. NATURAL RESOURCE BIOMETRICS (4)

Two 80-min. lects., one 180-min. lab. Prerequisites: 11:704:272, 274; 01:960:401.

Probability- and nonprobability-based sampling schemes for natural resource attributes: traditional random-sampling techniques as well as model-based and probability-proportional-to-size techniques; estimation of parameters of natural resource populations.

11:704:461. FIELD ECOLOGY (2)

One 320-min. lab. Prerequisite: 11:704:351.

Concepts of ecological organization developed through field experience in the principal habitat types of New Jersey. Emphasis on field application of ecological knowledge.

11:704:464. WILDLIFE ECOLOGY AND CONSERVATION (3)

One 80-min. lec., one 280-min. lab. Prerequisite: 11:704:351.

Quantitative analysis and understanding of the ecology, management, and conservation of game and nongame wildlife (terrestrial and aquatic). Population censusing and dynamics, harvesting, habitat requirements and fragmentation, migration, conservation genetics, and managing protected areas.

11:704:466. ECOSYSTEM MODELING AND MANAGEMENT (4)

Two 80-min. lects., one 3-hr. lab. Prerequisites: A term of calculus, 11:704:351, or permission.

Basic quantitative/computer skills for modeling major ecosystem processes: carbon, water, energy balance. Spatial modeling using remote sensing/GIS for management and global change.

11:704:471. SILVICULTURE (3)

Two 80-min. lects., one 400-min. lab. Seven-week course. Prerequisites: 11:704:332 or 351; 11:704:272, 456.

Biological principles applicable to the establishment and manipulation of forests for production of or influence on wood, water, wildlife, and aesthetics.

11:704:473. WILDLIFE DAMAGE MANAGEMENT (3)

Pre- or corequisite: 11:704:464.

Principles of wildlife damage management, with emphasis on integrated approaches to minimize conflict between wildlife, agriculture, and people.

11:704:475. WINTER FIELD ECOLOGY (P/NC 1)

Prerequisite: Permission of instructor.

A one-week, off-campus field experience in January, exploring the adaptations of temperate plants and animals to the harshness of winter.

11:704:483,484. RESEARCH PROBLEMS IN APPLIED ECOLOGY (BA,BA)

Prerequisite: Permission of adviser.

Research projects in applied ecology under the guidance of faculty members.

11:704:486. PRINCIPLES OF EVOLUTION (3)

(Formerly 01:119:484)

Prerequisites: 01:160:161-162, 01:447:380. Not open to students who have taken 01:119:485.

Theories, principles, and mechanisms of the evolution of cellular and organismic systems, with some attention to human evolutionary studies.

11:704:488. RESTORATION ECOLOGY (4)

(Formerly 01:119:488)

Lec. 3 hrs., lab. 3 hrs. Pre- or corequisites: 11:704:351 and one course in plant or animal organismic biology (e.g., mammalogy, principles of botany, insect biology, etc.).

Study of the ecological processes that underlie the re-creation of a natural community. Habitat characteristics, life histories, reproductive ecology, biological invasions, mutualism, societal laws, and attitudes toward restoration. Field trips to representative restored habitats.

NUTRITIONAL SCIENCES 709

11:709:201. INTRODUCTION TO FOODS AND NUTRITION (3)

Nutritional needs of the family. Consumer aspects of food selection and meal preparation.

11:709:202. LABORATORY FOR INTRODUCTION TO FOODS (1)

Pre- or corequisite: 11:709:201.

Application of knowledge of food composition and nutritive values to food preparation.

11:709:224. INDIVIDUAL, MARRIAGE, AND THE FAMILY (3)

Individual development throughout the life cycle. Interactions and relationships within couples, marriages, and families. (Not a nutrition-based course.)

11:709:226. NUTRITION FOR THE DEVELOPING CHILD (3)

Concepts of food and nutrition as applied to the growth and development of the young child. Laboratory included.

11:709:255. NUTRITION AND HEALTH (3)

Introductory nutrition. Nutrients and their functions in the human body throughout the life cycle.

11:709:323. NUTRITION FOR THE CHILD IN THE FAMILY AND COMMUNITY (3)

Nutrition as applied to the young child, in the context of family dynamics, community resources, and government programs. Laboratory included.

11:709:344. QUANTITY FOOD PRODUCTION (4)

Lec./lab. Prerequisites: 11:709:201, 202. White lab coat required.

Planning and organization of work, menus, preparation, and service of food for mass feeding. Evaluation of supervisory techniques, equipment, and cost control.

11:709:345. NUTRITION AND DEVELOPMENT THROUGH THE LIFE SPAN (3)

Prerequisites: 11:709:255, 01:830:101.

Human nutrition across the life span, from both biological and psychosocial perspectives.

11:709:349. MANAGEMENT OF FOOD SERVICE SYSTEMS (3)

Prerequisite: 11:709:344.

Purchasing policies as related to food equipment in the food service industry. Study of quantity kitchen layout; systems approach to resource management and financial control. Field trip fee.

11:709:363. WORLD FOOD CUSTOMS AND NUTRITION (3)

Open only to juniors and seniors.

Food patterns, food customs, and nutritional status of peoples from various racial, regional, and religious backgrounds of the world.

11:709:400. ADVANCED NUTRITION I: REGULATION OF MACRONUTRIENT METABOLISM (3)

Prerequisites: 11:115:301 or 11:115:403,404 or 01:694:407-408. All prerequisite courses must be completed with a grade of C or better.

Comprehensive study of regulation of carbohydrate, lipid, and protein metabolism at cellular and organismal levels. Integration of metabolism by hormones, diet, and pathophysiological states.

11:709:401. ADVANCED NUTRITION II: ENERGY AND MICRONUTRIENT METABOLISM (3)

Prerequisites: 11:115:301 or 11:115:403,404 or 01:694:407-408. All prerequisite courses must be completed with a grade of C or better.

Intensive study of body composition and energy expenditure. Biological function, requirements, and pathological aspects of vitamins and minerals.

11:709:402. READINGS IN ADVANCED NUTRITION I (1)

Corequisite: 11:709:400.

Discussion of problems set by instructors of Advanced Nutrition I to develop understanding of the topics covered.

11:709:403. READINGS IN ADVANCED NUTRITION II (1)

Corequisite: 11:709:401.

Discussion of problems set by instructors of Advanced Nutrition II to develop understanding of the topics covered.

11:709:405. PROFESSIONAL ISSUES IN DIETETICS (P/NC 1)

Prerequisite: Open only to seniors.

Trends in the field of dietetics and the effects of legislative, health care, marketing, and entrepreneurial issues on the profession.

11:709:440. CONTEMPORARY ISSUES IN NUTRITIONAL SCIENCES (3)

Open only to junior and senior majors; others by permission of instructor.

Investigations of recent trends and issues in nutrition and development.

11:709:441. NUTRITION COUNSELING AND COMMUNICATION (4)

Two 80-min. lecs., one 180-min. rec. Prerequisites: 11:709:201, 202, 255; or permission of instructor.

Assessing client needs; identifying relevant nutrition concepts; application of educational principles, techniques, and evaluation strategies for nutrition educators operating in a variety of settings. Applied nutrition education experience.

11:709:442. COMMUNITY NUTRITION (4)

Two 80-min. lecs., one 3-hr. rec. Prerequisite: 11:709:441.

The teaching, science, and philosophy of community nutrition and the programs and agencies designed to improve the nutritional status of various populations.

11:709:452. NUTRITION AND BEHAVIOR (3)

Prerequisites: 11:709:255 and 01:830:101.

The bidirectional relationship between nutrition and behavior, with emphasis on behavioral and social sciences research strategies.

11:709:481. SEMINAR IN NUTRITION (1.5)

Review of nutrition journals, critical reading in topics in the history of nutrition, and specific nutrition problems of current interest.

11:709:489. EXPERIMENTAL FOODS (3)

Lec./lab. Prerequisites: 01:160:209, 211; 11:709:201, 202; 01:960:401.

Physical and chemical properties of foods; laboratory investigation of effects of alteration in preparation, storage, and preservation on quality and acceptability.

11:709:490. NUTRITION RESEARCH METHODS (3)

Lab. hrs. by arrangement. Prerequisite: 11:709:400 or 401.

Laboratory class including diet preparation and feeding, enzyme activity, urine analysis, and molecular biology (Northern Blot and PCR).

11:709:493,494. PROBLEMS IN NUTRITION (BA,BA)

Prerequisite: Permission of instructor.

Special problems in the field of nutrition.

11:709:498. NUTRITION AND DISEASE (3)

Prerequisite: 11:709:400 or 401.

Nutritional aspects and dietary treatments of diseases in which nutrition plays a major role.

11:709:499. NUTRITION AND DISEASE: CLINICAL CASE STUDIES (1)

Pre- or corequisite: 11:709:498.

Application of scientific knowledge to actual case studies. Techniques for effective nutrition counseling.

PLANT PATHOLOGY 770

11:770:301. GENERAL PLANT PATHOLOGY (3)

Prerequisites: 01:119:101-102.

The occurrence, economic importance, symptoms, causes, and control of plant diseases.

11:770:311. GENERAL PLANT PATHOLOGY LABORATORY (1)

Pre- or corequisite: 11:770:301.

An optional laboratory course utilizing specific techniques and plant diseases to illustrate the basic principles of plant pathology.

11:770:391. DISEASES OF URBAN AND FOREST TREES (1.5)

Prerequisite: 11:770:301.

The pathological and environmentally induced diseases of urban, shade, and forest trees. Lectures, laboratory demonstrations, and field trips to acquaint students with the primary diseases of shade and forest trees.

11:770:402. MYCOLOGY: FUNGI IN THE ENVIRONMENT (3)

Two 55-min. lec., one 180-min. lab. Prerequisites: 01:119:101-102.

Identification, ecology, and biodiversity of fungi. Laboratory includes sampling techniques, identification and descriptive procedures, culture collections, mycological herbaria, and field trips.

11:770:416. PRINCIPLES OF APPLIED NEMATOLOGY (3)

Lec./lab.

The principles and practices of detection, identification, and control of nematodes causing diseases of plants. Interrelationships between nematodes and other soil-borne pathogens.

PLANT SCIENCE 776

11:776:170. PLANTS AND PEOPLE (3)

(Formerly 01:119:170)

The influence of plants on the economic, social, and cultural history of man, especially as sources of food, shelter, clothing, drugs, and industrial raw materials. Current problems of agriculture, plant industry, medicine, and conservation.

11:776:200. MODERN CROP PRODUCTION (3)

Introduction to agronomic crops and their relationship to the environment; importance, classification, production practices and problems, and utilization.

11:776:202. APPLIED PHYSIOLOGY OF HORTICULTURAL CROPS (3)

Prerequisite: 01:119:101 or permission of instructor.

The physiology of plants and regulation of their growth. Emphasis on the environmental and developmental aspects of plant physiology that allow plants to survive, grow, and reproduce despite transient and seasonal periods of environmental stress.

11:776:205. INTRODUCTION TO ETHNOBOTANY (3)

Pre- or corequisite: 01:119:102 or 103.

Broad overview of the science of ethnobotany (how people use plants), with emphasis on current research and issues.

11:776:210. PRINCIPLES OF BOTANY (4)

(Formerly 01:119:210)

Lec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102. Credit not given for both this course and 11:776:242.

Structure, function, diversity, reproduction, and evolution in the plant kingdom.

11:776:211. INTRODUCTION TO HORTICULTURE (3)

Lec. 2 hrs., lab. 3 hrs. Pre- or corequisite: 01:119:101.

The art and science of horticulture: its historical impact, biology, technology, and industry. Laboratory exercises applying horticultural techniques to growing plants.

Lab. fee.

11:776:221. PRINCIPLES OF ORGANIC CROP PRODUCTION (3)

Prerequisites: 01:119:101-102.

Cultural management practices that form the basis for organic crop production: soil stewardship, plant health, and avoiding competition without synthetic chemicals. Implementation of cropping techniques and emerging technologies.

11:776:225. INTRODUCTION TO HORTICULTURE THERAPY (3)

Brief history of the practice of horticulture therapy and the special needs populations it benefits. Adaptations and modifications enabling individuals to participate. Professional requirements.

11:776:231. COMMERCIAL FLORAL DESIGN (3)

Fundamentals of commercial floral design theory, applied in laboratory sessions. Demonstrations and practice in the development of proper handling techniques and design skills for a variety of occasions, with emphasis on creativity, salability, and vase life.

11:776:232. RETAIL FLOWER SHOP MANAGEMENT (3)

Lec. and lab. Prerequisite: 11:776:231.

Operation and management of the retail florist business. Application of principles of postharvest physiology. Experience in merchandising and the operation of the college florist shop.

11:776:242. PLANT SCIENCE (3)

Lec. 2 hrs., lab. 3 hrs. Prerequisite: 01:119:101.

Fundamentals of structure, taxonomy, growth and development, metabolism, reproduction, and ecology of plants. Dynamics, manipulation, biotechnology, and the development of new characteristics in plants.

11:776:304. TURFGRASS MANAGEMENT (4)

Two 80-min. lec., lab. 3 hrs.

Growth, development, adaptation, and selection of the major turfgrass species. Principles of establishment, mowing, nutrition, irrigation, and pest control of home lawn, athletic field, golf, and utility turfs.

11:776:305. PLANT GENETICS (4)

Lec. 2.66 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102.

Heritable variation, strategies, and consequences of sexual/asexual reproduction, inbreeding and outbreeding. Chromosome structure, behavior, and mapping. Uses of tissue culture and recombinant DNA techniques in plant genetic manipulation.

11:776:310. PLANT PROPAGATION (3)

Lec./rec. 2 hrs., lab. 3 hrs. Prerequisite: 11:776:210 or 211 or 242 or permission of instructor.

Theory and practice of multiplying plants by seeds and vegetative means such as cuttings, grafts, buds, and layers.

11:776:312. MEDICINAL PLANTS (3)

Use of plants for medicinal and other purposes; poisonous plants; cross-cultural aspects; chemistry and biological significance of natural products; natural products from higher plants in modern medicine.

11:776:321. GREENHOUSE MANAGEMENT AND CROP PRODUCTION (3)

Lec. 2 hrs., lab. 3 hrs. Prerequisite: 11:776:211 or permission of instructor.

The greenhouse environment, its manipulation and control in the production of florist plants. Principles of production of major cut-flower and plant crops.

11:776:325. HORTICULTURE THERAPY TECHNIQUES AND PROGRAMMING (3)

Prerequisite: 11:776:225.

Use of adaptive devices and enabling tools. Methodologies for program evaluation and for documentation of program effectiveness.

11:776:330. CONSERVATION VEGETATION (3)

Prerequisite: 11:776:200 or permission of instructor.

History and theory of vegetative covers and their use in various climates. Environmental significance of defoliation, pollution involvement, and techniques of establishment and maintenance.

11:776:340. PRINCIPLES AND PRACTICES OF FRUIT PRODUCTION (4)

Lec. 2 hrs., rec. 3 hrs., lab. 3 hrs. Prerequisite: 11:776:211.

The culture of tree fruits, including orchard establishment, nutrition, pest control, pruning, fruit development, variety and root-stock selection, and growth regulators. Field trip fee.

11:776:341. FRUIT PRODUCTION (3)

Prerequisite: 11:776:210 or 211 or permission of instructor.

The growing of small fruits and grapes. Varieties, fruit-growing systems, and harvesting methods involved in grapes, strawberries, blueberries, brambles, and cranberries.

11:776:362. PRINCIPLES OF VEGETABLE CULTURE (3)

Prerequisite: 11:776:211 or permission of instructor.

Cultural practices of growing major vegetable crops examined with particular emphasis on how they affect plant environment interactions. An applied physiological perspective on the optimization of crop yield and quality.

11:776:382. PLANT PHYSIOLOGY (4)

Lec./rec. 3 hrs., lab. 3 hrs. Prerequisites: 01:119:101-102, 11:776:210 or 242. Recommended: Organic chemistry.

Water relations, photosynthesis, inorganic nutrition, metabolism of organic materials, and plant growth regulation. Emphasis on environmental factors in the physiology of plants.

11:776:401. POSTHARVEST PHYSIOLOGY OF HORTICULTURAL CROPS (3)

Prerequisite: A course in plant physiology or plant physiology background or permission of instructor.

A study of metabolic processes including aging and stress phenomena in harvested horticultural crops. Postharvest preservation concepts and technologies, food crops, distribution, and marketing.

11:776:402. PRINCIPLES OF WEED SCIENCE (3)

General principles of weed science; growth, development, and identification of weeds; economic losses; cultural, biological, and chemical methods of control; special weed problems.

11:776:403. PLANT SCIENCE TECHNIQUES (3)

Two 55-min. lecs., lab. 1 hr. by arrangement. Prerequisites: 01:119:101-102, 01:160:161-162.

The use of experimental systems and assays to obtain specific information about plant characteristics and responses. Advantages and limitations of various protocols and instrumentation.

11:776:404. SOIL MANAGEMENT FOR SPORTS AND LANDSCAPE APPLICATIONS (3)

Lecture, field experience, field trips. Prerequisite: 11:375:102 or 360.

Principles of turf soil science and management. Managing soils for plant nutrition, manipulation for water supply and drainage, efficient irrigation, and use of poor quality water.

11:776:405. SOIL FERTILITY (3)

Prerequisite: 11:375:266 or permission of instructor.

Soil-plant relationships in the field and methods of diagnosing deficiencies in soils and plants.

11:776:406. PLANT BREEDING (3)

Prerequisite: 01:119:380 or 11:776:305.

History, theory, and practice of plant breeding.

11:776:408. TURFGRASS PEST SCIENCE (4)

Prerequisites: 01:119:101-102 or 103; 11:776:238 or 304 or permission.

Biology, etiology, and management of major turfgrass pests, including fungal, bacterial, and viral pathogens; insects, nematodes, vertebrates, and weeds. Includes a laboratory in diagnostics.

11:776:425. SPECIAL TOPICS IN HORTICULTURE THERAPY (2)

Prerequisite: 11:776:325 or permission of instructor.

Independent research in the area of people-plant relationships. Several formal class meetings at the beginning and conclusion of the project.

11:776:439. NURSERY CROP PRODUCTION (3)

Prerequisites: 11:776:211 or equivalent and a course in plant materials.

Principles, practices, and production of temperate-zone woody ornamental plants. Both field and container growing considered.

11:776:450. HORTICULTURAL TOPICS (2)

Prerequisite: 11:776:211. Open only to juniors and seniors.

Conferences with growers, marketers, and other business representatives to learn opinions, insights, and experiences related to their specific fields of horticulture.

11:776:451. FINE AND SPORTS TURF (3)

Prerequisites: 11:375:266; 11:776:200, 304, 402, and 452, or permission of instructor.

Grass identification and selection, the diagnosis and treatment of disease and pests, fertilizer and weed control programs, irrigation, drainage, thatch control, and maintenance.

11:776:452. PLANT TISSUE CULTURE (3)

Lec./rec. 2 hrs., lab. 3 hrs. Prerequisite: 11:776:210 or 242.

Principles and culture techniques of cells, callus, organs, pollen, anthers, embryos, and protoplasts. The applications in clonal propagation and research in breeding, physiology, and pathology.

11:776:495,496. SPECIAL PROBLEMS IN PLANT SCIENCE (BA,BA)

Prerequisites: Permission of instructor and special problems adviser.

Projects in plant science with assigned reading, laboratory work, and conferences.

SOILS 930

(See Environmental Sciences 375)

Administration, Centers, and Faculty

ADMINISTRATION

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Cook College

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New Jersey Agricultural Experiment Station

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Jack Rabin, *Associate Director of Off-Campus Stations*
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Rutgers Cooperative Extension

Karyn Malinowski, *Director, Rutgers Cooperative Extension*
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Food Innovation Research and Extension Center, Bridgeton

Louis Cooperhouse, *Director*

Haskin Shellfish Research Laboratory, Bivalve

Eric N. Powell, *Director*

Philip E. Marucci Center for Blueberry and Cranberry Research, Chatsworth

Nicholi Vorsa, *Director*

Rutgers Agricultural Research and Extension Center, Upper Deerfield

Bill Nicholson, *Director*

Rutgers Ecocomplex, Bordentown

David Specca, *Acting Director*

Rutgers Fruit Research and Extension Center, Cream Ridge

Joseph C. Goffreda, *Director*

Rutgers Plant Science Research and Extension Farm, Adelpia

William Meyer, *Director*

Clifford E. and Melda C. Snyder Research and Extension Farm, Rutgers Center for Sustainable Agriculture, Pittstown

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Interregional Research Project (IR-4)

Robert Holm, *Director*

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Wildlife Damage Control Center

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Larry S. Katz, *Associate Director*
John A. Grande, *Associate Director*

FACULTY

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Arthur R. Brown, Jr., *ASB III*
Winfred P. Cowgill, Jr., *Hunterdon County*
Joel Flagler, *Bergen County*
Jerome L. Frecon, *Gloucester County*
James R. Johnson, *Cumberland County*
David L. Lee, *Salem County*
Dean Polk, *IPM-Cream Ridge*
Jack Rabin, *Martin Hall*
Raymond J. Samulis, *Burlington County*
Richard W. Van Vranken, *Atlantic County*

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Everett A. Chamberlain, *Warren County*
George E. Flimlin, *Ocean County*
William Hlubik, *Middlesex County*
Michelle Infante-Casella, *Gloucester County*
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Daniel Kluchinski, *Martin Hall*
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County Agents III (Assistant Professors):

Russell Blair, *Cape May County*
Madeline Flahive-DiNardo, *Union County*
Pedro Perdomo, *Morris County*
Nicholas Polanin, *Somerset County*
William Sciarappa, *Monmouth County*

Department of Agricultural, Food, and Resource Economics

Chairperson: Calum G. Turvey, Cook Office Building, Room 103

Professors:

Robin G. Brumfield, *B.S., Eastern Kentucky; M.S., Ph.D., North Carolina State*
Michael Camasso, *B.A., King College; M.A., Virginia; M.S.W., Maryland; Ph.D., Pennsylvania State*
Maurice P. Hartley, *B.A., Carson-Newman; M.A., Appalachian State; Ed.D., Rutgers*
Barbara O'Neill, *B.S., SUNY (Oneonta); M.S., Cornell; Ph.D., Virginia Polytechnic*
Carl E. Pray, *B.A., Carleton; Ph.D., Pennsylvania*
Leslie E. Small, *B.S., Ph.D., Cornell*
Calum G. Turvey, *B.S., M.S., Guelph; Ph.D., Purdue*

Associate Professors:

Sanjib Bhuyan, *B.Sc., Assam Agricultural; M.Sc., Asian Institute; M.S., Nebraska; Ph.D., Connecticut*
Donn A. Derr, *B.S., M.S., Ph.D., Ohio State*
Pritam Dhillon, *B.S., M.A., Punjab; Ph.D., Pennsylvania State*
Paul D. Gottlieb, *A.B., Harvard; M.P.A., Ph.D., Princeton*
Ramu Govindasamy, *B.S., Tamil Nadu Agricultural; M.S., Ph.D., Iowa State; M.B.A., Newport*
Peter J. Parks, *B.S., Oregon State; M.S., Ph.D., California*
Edmund M. Tavernier, *B.S., Tuskegee; M.S., Ph.D., Minnesota*

Assistant Professor:

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Ramu Govindasamy, *B.S., Tamil Nadu Agricultural; M.S., Ph.D., Iowa State; M.B.A., Newport*
Barbara O'Neill, *B.S., SUNY (Oneonta); M.S., Cornell; Ph.D., Virginia Polytechnic*
Edmund M. Tavernier, *B.S., Tuskegee; M.S., Ph.D., Minnesota*
Calum G. Turvey, *B.S., M.S., Guelph; Ph.D., Purdue*

Research Associates:

Priscilla Hayes, *B.S., Princeton; J.D., Duke*
Venkata S. Puduri, *B.A., Sri Venkateswara; M.A., Ph.D., Sri Krishnadevaraya (India)*

Lecturers:

Penny Carlson, *B.S., Rutgers*
John Italia, *B.S., M.S., Rutgers*
Edward V. Lipman, *B.A., Ohio; M.S., Rutgers*
Edwin Robinson, *B.A., Tulane*
Brian Schilling, *B.S., M.S., Rutgers*
Paula L. Ward, *Ph.D., Rutgers*

Department of Animal Sciences

Chairperson: Larry S. Katz, Bartlett Hall, Room 106

Professors:

Juan P. Advis, *B.S., Liceo de Hombres (Chile); D.V.M., Austral (Chile); Ph.D., Texas*
Carol A. Bagnell, *B.A., Glassboro State; M.S., West Virginia; Ph.D., Georgia*
Harold D. Hafs, *B.S., Wisconsin; M.S., Ph.D., Cornell*
Henry John-Alder, *B.A., Franklin and Marshall College; M.S., Pennsylvania State; Ph.D., California (Irvine)*
Karyn Malinowski, *B.S., M.S., Ph.D., Rutgers*
Dipak K. Sarkar, *B.Sc., M.Sc., Ph.D., Calcutta; D.Phil., Oxford*
James E. Wohlft, *B.S., Kansas State; M.S., Maine; Ph.D., Illinois*

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Julie Fagan, *A.B., Syracuse; M.S., Massachusetts; Ph.D., Arizona*
Barry Jesse, *B.S., M.S., Illinois; Ph.D., Michigan State*
Larry S. Katz, *B.S., M.S., Cornell; Ph.D., California (Davis)*
Kenneth H. McKeever, *B.S., California State Polytechnic (Pomona); M.S., Fresno State; Ph.D., Arizona*
Sarah L. Ralston, *B.A., Pennsylvania; M.S., Colorado; V.M.D., Ph.D., Pennsylvania*
Michael Westendorf, *B.S., Idaho; M.S., Ph.D., Kentucky*

Assistant Professors:

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Carey Williams, *B.S., Colorado State; M.S., Ph.D., Virginia Polytechnic*

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D. Bradley Imwalle, *B.A., Purdue; M.S., Ph.D., Kentucky*

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Peter E. Kuhn, *B.S., M.S., Fordham; M.S. Rensselaer Polytechnic Institute; Ph.D. Rutgers*
Ming Yao, *M.D., China Medical; Ph.D. Okayama (Japan)*

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Department of Biochemistry and Microbiology

Chairperson: Alan D. Antoine, Lipman Hall, Room 121

Professors:

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Keith R. Cooper, *B.S., College of William and Mary; M.S., Thomas Jefferson; M.S., Texas A&M; Ph.D., Rhode Island*
Max M. Häggblom, *B.S., M.S., Lic.Ph., Ph.D., Helsinki (Finland)*
Peter C. Kahn, *A.B., Harvard; Ph.D., Columbia*
Stanley E. Katz, *B.S., Upsala; M.S., Delaware; Ph.D., Rutgers*
Ronald D. Poretz, *B.A., Hartwick College; M.S., Long Island; Ph.D., SUNY (Buffalo)*
Theodorus van Es, *B.S., B.S. (M.A.), Ph.D., Witwatersrand (South Africa)*
Gerben J. Zylstra, *B.S., Calvin College; Ph.D., Michigan*

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Tamar Barkay, *B.S., Hebrew (Rehurvot); M.S., Hebrew (Jerusalem); Ph.D., Maryland*
George Pieczenik, *A.B., Harvard; M.S., Miami; Ph.D., New York*
William W. Ward, *B.S.Ed., M.S., Florida; Ph.D., Johns Hopkins*

Assistant Professors:

Cook College

ADMINISTRATION, CENTERS, AND FACULTY

Elisabetta Bini, M.S., *D.Prot., Pisa (Italy)*; Ph.D., *Nebraska*
Costantino Vetriani, M.S., *Rome (La Sapienza)*; Ph.D., *Rome (Tor Vergata)*
Lori A. White, B.A., M.S., *Maine*; Ph.D., *Dartmouth*

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Department of Ecology, Evolution, and Natural Resources

Chairperson: Michael V.K. Sukhdeo, Environmental and Natural Resource Sciences Building, Room 152A

Professors Emeriti:

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John E. Kuser, B.A., *Princeton*; M.S., *Rutgers*; Ph.D., *Oregon State*
Roger Locandro, B.S., M.S., Ph.D., *Rutgers*
Ian E.L. Maw, B.S., *Indiana University of Pennsylvania*; M.S., Ph.D., *Pennsylvania State*
John Tedrow, B.Sc., *Pennsylvania State*; M.Sc., *Michigan State*; Ph.D., *Rutgers*

Professors:

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Timothy M. Casey, B.S., *Pennsylvania State*; Ph.D., *California (Los Angeles)*
David W. Ehrenfeld, B.A., M.D., *Harvard*; Ph.D., *Florida*
Joan G. Ehrenfeld, B.A., *Columbia (Barnard College)*; M.A., *Harvard*; Ph.D., *CUNY*
Douglas E. Eveleigh, B.S., *London*; Ph.D., *Exeter*
Edwin J. Green, B.S., M.S., *SUNY*; Ph.D., *Virginia Polytechnic*
Steven N. Handel, A.B., *Columbia College*; M.S., Ph.D., *Cornell*
Peter J. Morin, B.S., *Trinity College*; Ph.D., *Duke*
George Heinz Nieswand, B.S., *Rutgers*; M.S., *Cornell*; Ph.D., *Rutgers*
Peter E. Smouse, B.S., *California (Berkeley)*; Ph.D., *North Carolina State*
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Michael V.K. Sukhdeo, B.Sc., M.Sc., Ph.D., *McGill (Canada)*

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Lena Struwe, B.Sc., *Stockholm (Sweden)*; M.S., Ph.D., *Minnesota*
Ming Xu, B.S., *Beijing*; Ph.D., *Berkeley*

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Department of Entomology

Chairperson: James Lashomb, Blake Hall, Room 114

Professors:

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Randy R. Gaugler, B.S., M.S., *North Carolina State*; Ph.D., *Wisconsin*
Michael L. May, B.S., *Davidson College*; Ph.D., *Florida*

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Peter W. Shearer, B.S., *Rutgers*; M.S., *Oregon State*; Ph.D., *Hawaii*

Assistant Extension Specialist:

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Department of Environmental Sciences

Chairperson: Lily Young, Environmental and Natural Resource Sciences Building, Room 252

Professors:

William Goldfarb, B.A., *Colgate*; M.A., *Columbia*; J.D., *Yale Law School*; Ph.D., *Columbia*
Robert P. Harnack, B.S., *Rutgers*; M.S., Ph.D., *Maryland*

Alan Robock, B.A., *Wisconsin*; M.S., Ph.D., *Massachusetts Institute of Technology*
Georgiy Stenchikov, M.S., Ph.D., *Moscow Physical-Technical*
Peter F. Strom, B.S., *Massachusetts Institute of Technology*; M.S., Ph.D., *Rutgers*
Robert L. Tate III, B.S., M.S., *Arizona*; Ph.D., *Wisconsin*
Christopher Uchirin, B.E., M.E., *Manhattan College*; Ph.D., *Michigan*
Lily Young, B.A., M.S., *Cornell*; Ph.D., *Harvard*

Associate Professors:

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Daniel Gimenez, B.S., *National University of Tucuman*; M.S., *Agricultural University of Wageningen (The Netherlands)*; Ph.D., *Minnesota*
Uta Krogmann, B.S., M.S., *Rhenish Westphalian Technical University (Germany)*; Ph.D., *Technical University of Hamburg-Harburg (Germany)*
Jerome Kukor, B.A., *College of Steubenville*; M.S., Ph.D., *Michigan*
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Assistant Professors:

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Weilin Huang, B.S., *Zhongshan (China)*; Ph.D., *Institute of Geochemistry (China)*; Ph.D., *Michigan*
Gediminas Mainelis, M.S., *Vilnius (Lithuania)*; Ph.D., *Cincinnati*
Christopher C. Obropta, B.S., M.S., *New Jersey Institute of Technology*; Ph.D., *Stevens Institute of Technology*
Marie Siewierski, B.A., *Rutgers (Douglass)*; M.L.S., *Rutgers*
Lisa A. Totten, B.A., *Wittenberg*; Ph.D., *Johns Hopkins*
Dana E. Veron, B.A., *SUNY*; Ph.D., *California (Scripps Institution of Oceanography)*
Christopher Weaver, A.B., *Princeton*; Ph.D., *California*

Instructor/Extension Staff Meteorologist:

Keith R. Arnesen, B.A., *Kings College*; M.S., *South Dakota School of Mines and Technology*

Department of Extension Specialists

Chairperson: Zane R. Helsel, Martin Hall

Extension Specialists (Professors):

Jerry Baron, *IR-4*
Robin G. Brumfield, *Farm Management, Department of Agricultural, Food, and Resource Economics (AFRE)*
Carol Byrd-Bredbenner, *Family and Consumer Sciences*
Bruce B. Clarke, *Plant Nutrition Pathology, Department of Plant Biology and Pathology*
Wayne Crans, *Mosquito Research Unit, Department of Entomology*
Gerald M. Ghidui, *Entomology, Department of Entomology*
George C. Hamilton, *Pest Management, Department of Entomology*
Joseph R. Heckman, *Soil Fertility, Department of Plant Biology and Pathology*
Melvin R. Henninger, *Vegetable Crops, Department of Plant Biology and Pathology*
Harry W. Janes, *Horticulture, Department of Plant Biology and Pathology*
James H. Lashomb, *Entomology, Department of Entomology*
Bradley A. Majek, *Weed Science, Department of Plant Biology and Pathology*
Thomas J. Orton, *Vegetable Crops, Department of Plant Biology and Pathology*
Joseph T. Ponessa, *Housing and Energy, Department of Human Ecology*
Donald W. Schaffner, *Food Quality, Department of Food Science*
Nicholi Vorsa, *Blueberries/Cranberries, Department of Plant Biology and Pathology*
James E. Wohl, *Animal Sciences, Department of Animal Sciences*
George J. Wulster, *Floriculture, Department of Plant Biology and Pathology*

Associate Extension Specialists (Associate Professors):

Ann Brooks Gould, *Plant Pathology, Department of Plant Biology and Pathology*
Ramu Govindasamy, *Agricultural Marketing, Department of Agricultural, Food, and Resource Economics (AFRE)*
Bruce A. Hamilton, *Landscape Architecture, Department of Landscape Architecture*
Larry S. Katz, *Animal Sciences, Department of Animal Sciences*
Debra P. Keenan, *Community Nutrition, Department of Nutritional Sciences*
Albrecht Koppenhöfer, *Turfgrass Entomology, Department of Entomology*
Uta Krogmann, *Solid Waste Management, Department of Environmental Sciences*
Norman Lalancette, *Tree Fruit Pathology, Department of Plant Biology and Pathology*
James A. Murphy, *Turfgrass Management, Department of Plant Biology and Pathology*
Peter Oudemans, *Plant Pathology, Department of Plant Biology and Pathology*
Sarah Ralston, *Animal Sciences, Department of Animal Sciences*
Peter W. Shearer, *Tree Fruit Entomology, Department of Entomology*
Edmund Tavernier, *Agricultural and Environmental Economic Policy, Department of Agricultural, Food, and Resource Economics (AFRE)*
Barbara J. Turpin, *Air Quality, Department of Environmental Sciences*
Mark C. Vodak, *Forestry, Department of Ecology, Evolution, and Natural Resources*

Michael Westendorf, *Animal Nutrition, Department of Animal Sciences*
Assistant Extension Specialists (Assistant Professors):
Lydia Blalock, *4-H Youth Development*
Arend-Jan Both, *Controlled-Environment Agriculture, Department of Plant Biology and Pathology*
Stephen Hart, *Weed Management, Department of Plant Biology and Pathology*
Chris Obropta, *Water Resources, Department of Environmental Sciences*
Carey Williams, *Equine Management, Department of Animal Sciences*
Gladis Zinati, *Nursery Management, Department of Plant Biology and Pathology*
Extension Staff:
Keith Arnesen, *Meteorology, Department of Environmental Sciences*

Department of Food Science

Chairperson: Jozef L. Kokini, Food Science Building

Professors:

George Carman, *B.A., William Paterson College; M.S., Seton Hall; Ph.D., Massachusetts*
Henryk Daun, *M.S., D.T.S., Politechnika Gdanska (Poland)*
Chi-Tang Ho, *B.S., National Taiwan; M.S., Ph.D., Washington (St. Louis)*
Jozef Kokini, *B.S., Bosphorus (Turkey); M.S., Ph.D., Carnegie Mellon*
Tung-Ching Lee, *B.S., Tung-Hai (Taiwan); M.S., Ph.D., California (Davis)*
Thomas J. Montville, *B.S., Rutgers; Ph.D., Massachusetts Institute of Technology*
Joseph D. Rosen, *B.S., CUNY (City College); Ph.D., Rutgers*

Associate Professors:

Mukund Karwe, *B.S., India; M.S., Ph.D., Rutgers*
Richard D. Ludescher, *B.A., Iowa; Ph.D., Oregon*
Donald W. Schaffner, *B.S., Cornell; M.S., Ph.D., Georgia*
Karen M. Schaich, *B.S., Purdue; Sc.D., Massachusetts Institute of Technology*
Paul Takhistov, *B.S., National Technical University of the Ukraine; M.S., Notre Dame; Ph.D., Academy of Science of the USSR*
Beverly J. Tepper, *B.S., Northeastern; M.S., Ph.D., Tufts*
Kit L. Yam, *B.S., M.S., Ph.D., Michigan State*

Assistant Professors:

Qinrong Huang, *B.S., Shanghai University of Science and Technology; M.S., Ph.D., Nebraska*
Sean Liu, *B.S., China; M.S., Ph.D., Kansas State*
Karl Matthews, *B.S., Iowa; M.S., Ph.D., Kentucky*
Michael Tchikindas, *B.S., M.S., Yerevan (Armenia); Ph.D., All Union Research Institute of Genetics (Moscow)*

Department of Family and Community Health Sciences

Chairperson: Carol Byrd-Bredbenner

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Patricia Q. Brennan, *Morris County*
Karen Ensle, *Union County*
Kathleen Shimomura, *Hunterdon County*
Daryl L. Minch, *Somerset County*
Marilou Rochford, *Cape May County*
Maria C. Young, *Passaic County*

County Agents III (Assistant Professors):

Luanne Hughes, *Gloucester County*
Maureen Scaramella, *Salem County*

Department of 4-H Youth Development

Chairperson: Virginia Powell, Martin Hall

County 4-H Agents II (Associate Professors):

Terese Buchanan, *Hunterdon County*
Annette Devitt, *Salem County*
Gloria Kraft, *Burlington County*
James Nichnadowicz, *Union County*
Virginia Powell, *Regional 4-H Agent, North*
Jeannette Rea-Keywood, *Cumberland County*
Lisa Rothenburger, *Somerset County*
Rita Natale Saathoff, *Regional 4-H Agent, South*
Carol Ward, *Somerset County*
Betty Jean Webersinn, *Cape May County*
Ellen Williams, *Monmouth County*

County 4-H Agents III (Assistant Professors):

Laura Bovitz, *Middlesex County*
Gayle Brown, *Bergen/Passaic County*
Deborah Cole, *Atlantic County*
Kevin Mitchell, *Sussex County*
Chad Ripberger, *Mercer County*
Linda Strieter, *Gloucester County*
Alayne Torretta, *Warren County*

Department of Human Ecology

Chairperson: Peter Guarnaccia, Cook Office Building, Room 202

Professors:

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George E.B. Morren, Jr., *B.A., M.Phil., Ph.D., Columbia*
Thomas K. Rudel, *B.A., Princeton; M.Phil., Ph.D., Yale*
Neil D. Weinstein, *B.S., Wisconsin; Ph.D., Harvard*

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Karen O'Neill, *B.A., San Francisco; M.A., Ph.D., California (Los Angeles)*

Assistant Instructor:

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Humanities and Communication Group

Lecturers:

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Anthony D. Masso, *B.A., SUNY (Binghamton); M.F.A., Rutgers*
Albert Gabriel Nigrin, *M.A., M.F.A., Rutgers*

Assistant Writing Director:

Michael J. Goeller, *B.A., M.A., Ph.D., Rutgers*

IR-4

Executive Director: Robert E. Holm, 681 Route 1 South Technology Centre, North Brunswick

Professor and Associate Director:

Jerry J. Baron, *B.S., M.S., Ohio State; Ph.D., North Carolina State*

Department of Landscape Architecture

Chairperson: Steven Strom, Blake Hall

Professor Emeritus:

Roy Harvey De Boer, *B.S., Cornell; M.S., Rutgers*

Associate Professors:

Bruce A. Hamilton, *B.S., Rutgers; M.S., Ph.D., Pennsylvania State*
Jean Marie Hartman, *B.S., M.S., Wisconsin; Ph.D., Connecticut*
Steven Strom, *B.S., Rutgers; M.L.A., Massachusetts*
David Tulloch, *B.S.L.A., Kentucky; M.L.A., Louisiana State; Ph.D., Wisconsin*

Assistant Professor:

Jeremy Woland, *B.S., Tufts; M.L.A., Washington*

Department of Marine and Coastal Sciences

Chairperson: Gary L. Taghon, Marine and Coastal Sciences, Room 114D

Undergraduate Director: Judith P. Grassle

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Scott M. Glenn, *B.S., Rochester; Ph.D., Massachusetts Institute of Technology and Woods Hole Oceanographic Institution*

Cook College

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Daniel M. Grzebyk, *Ph.D., Aix-Marseille II (France)*
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Liping Wei, *B.S., M.S., Nanjing (China); Ph.D., Cornell*

Meteorology

(See Department of Environmental Sciences)

Microbiology

(See Department of Biochemistry and Microbiology)

Department of Nutritional Sciences

Interim Chairperson: John Worobey, Thompson Hall, Room 107

Professors:

Hans Fisher, *B.S., Rutgers; M.S., Connecticut; Ph.D., Illinois*
Adria R. Sherman, *B.A., Temple; M.S., Ph.D., Pennsylvania State*
Judith Storch, *B.A., Brooklyn College; M.S., Ph.D., Columbia*

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