

CORNELL
UNIVERSITY

GRADUATE
SCHOOL



TENTATIVE GRADUATE SCHOOL CALENDAR

Fall

Registration begins
Registration ends
Instruction begins
Fall recess begins
Instruction resumes
Thanksgiving recess begins

1988-89

Tuesday, August 23
Wednesday August 24
Thursday, August 25
Saturday, October 22, 1:10 p.m.
Wednesday, October 26
Wednesday, November 23, 1:10 p.m.

1989-90

Tuesday, August 22
Wednesday, August 23
Thursday, August 24
Saturday, October 21, 1:10 p.m.
Wednesday, October 25
Wednesday, November 22, 1:10 p.m.

Instruction resumes
Instruction ends
Study period begins
Study period ends
Final examinations begin
Final examinations end

Monday, November 28
Saturday, December 3
Sunday, December 4
Wednesday, December 7
Thursday, December 8
Saturday, December 17

Monday, November 27
Saturday, December 2
Sunday, December 3
Wednesday, December 6
Thursday, December 7
Saturday, December 16

Spring

Registration begins
Registration ends
Instruction begins
Spring recess begins
Instruction resumes
Instruction ends
Study period begins
Study period ends
Final examinations begin
Final examinations end
Commencement

Thursday, January 19
Friday, January 20
Monday, January 23
Saturday, March 18, 1:10 p.m.
Monday, March 27
Saturday, May 6
Sunday, May 7
Wednesday, May 10
Thursday, May 11
Saturday, May 20
Sunday, May 28

Thursday, January 18
Friday, January 19
Monday, January 22
Saturday, March 17, 1:10 p.m.
Monday, March 26
Saturday, May 5
Sunday, May 6
Wednesday, May 9
Thursday, May 10
Saturday, May 19
Sunday, May 27

This calendar is subject to modification and is not legally binding. The Law School calendar differs in a number of ways from the university academic calendar. Please consult the catalog of the Law School for details.

In enacting this calendar, the university has scheduled classes on religious holidays. It is the intent of the university that students missing classes due to the observance of religious holidays be given adequate opportunity to make up work.

CORNELL UNIVERSITY

GRADUATE SCHOOL

1988-90

**Cornell University
(USPS 132-860)**

Volume 79 of the series Cornell University consists of nine catalogs, of which this is number nine, dated October 2, 1987. Issued twice in March, once in June, three times in July, once in August, once in September, and once in October. Published by the Office of Publications Services, East Hill Plaza, Ithaca, New York 14850-2805. Second-class postage paid at Ithaca, New York.

Postmaster: Send address changes to "Cornell University," Graduate School, Sage Graduate Center, Ithaca, New York 14853-6201.

.....

CONTENTS

Cornell University	3
Location	3
Graduate Students	3
Graduate Program	5
Special Committee	5
Degree Requirements	6
Degrees Offered	7
Opportunities for Study	11
Fields of Study	17
Admission	121
Categories of Admission	121
Application Procedures	122
Additional Application Procedures for Foreign Applicants	122
Finances	125
Tuition and Expenses	125
Financial Support	125
Academic Resources	129
Libraries	129
Programs	130
Research Centers and Facilities	138
Cornell Computer Services	145
Art Museum	145
General Information	147
Housing	147
Health Services and Health Insurance	147
Student Services and Facilities	147
Recreation and Athletics	148
Register	149
Index to Fields, Subjects, and Concentrations	150
General Index	157
Directory	160

Although every effort has been made to ensure the accuracy of the information contained in this catalog, the fields of study, curricula described, and teaching personnel listed herein are subject to change at any time by official action of Cornell University.

CORNELL UNIVERSITY

Cornell University is a major teaching and research institution with an international reputation. The university comprises nine privately endowed and four state-supported colleges, as well as over twenty interdisciplinary research centers. Cornell's outstanding faculty includes several Nobel laureates, members of the National Academy of Sciences, and Pulitzer Prize recipients. The most comprehensive school in the Ivy League and the land-grant institution of the state of New York, Cornell provides an abundance of opportunities for graduate study and research.

Cornell offers an impressive range of academic resources and research facilities to its graduate students. The library system, with more than five million volumes, is one of the largest in the country. Many of its special holdings and collections are unexcelled anywhere in the United States or in the world. The research facilities, laboratories, and programs available to graduate students span all major disciplines.

The cultural and intellectual life of the university community is stimulating and varied. Cornell, with a total student population on the Ithaca campus of about eighteen thousand, provides excellent opportunities for participation in and enjoyment of art, athletics, cinema, music, and theater. Its concert series and art exhibitions feature artists of international stature. A new performing arts center will enhance the offerings in theater and dance.

Location

Cornell is located in Ithaca, a city of about twenty-nine thousand in the Finger Lakes region of New York State, a beautiful area of rolling hills, deep valleys, scenic gorges, and clear lakes. The university's 740-acre campus is bounded on two sides by gorges and

waterfalls. Open countryside, state parks, and year-round opportunities for outdoor recreation, including excellent sailing, swimming, skiing, hiking, and other activities, are only minutes away.

Ithaca is one hour by plane and five hours by car from New York City, and other major metropolitan areas are easily accessible. Direct commercial flights connect Ithaca with New York City, Boston, Chicago, Pittsburgh, Washington, D.C., and other cities.

The tradition of academic excellence, the cultural vigor of a distinguished university, and the magnificent setting create a stimulating environment for graduate study.

Graduate Students

The students enrolled in the Graduate School come from across the nation and from over one hundred countries. Enrollment is around 4,200 students; of these, 36 percent are women and 64 percent men. While most students are from the United States, over one-third are from foreign countries. The majority of the students, 75 percent, are enrolled in programs leading to a doctoral degree. Students from ethnic backgrounds traditionally underrepresented in higher education make up about 7 percent of the students enrolled in the Graduate School. The cosmopolitan mixture of Cornell's talented students greatly enriches the campus and the lives of those who study here.

Each year the Graduate School receives over nine thousand applications from prospective students; about 37 percent of those applicants are offered admission. The percentage of applicants offered admission, however, varies greatly among fields. In 1986 the Graduate School welcomed 1,417 incoming students to Cornell.



GRADUATE PROGRAM

If there be any intangible possession which distinguishes this university, it is the tradition of freedom united with responsibility—freedom to do what one chooses, responsibility for what it is that one chooses to do.

—Carl Becker

The ideal of freedom with responsibility distinguishes the graduate program at Cornell. This unique educational philosophy encourages the student to take an active role in developing a program of study suited to his or her interests and talents. The student is expected to act independently in selecting a course of study and in satisfying the requirements for a graduate degree. Integral to developing an individualized course of study is the freedom the student has to draw on faculty members and course offerings from across the university. The graduate program is interdisciplinary and cross-disciplinary; no special permission is required for such study.

Two unique characteristics of the graduate program ensure that the student can define and pursue an individualized plan of study: the organization of the Graduate School and the Special Committee system. The Graduate School is organized into eighty-nine fields of study, or subject areas. Fields are independent of traditional college or department divisions so they may draw faculty from several colleges, departments, and related disciplines in accordance with scholarly interests. While the student is admitted into a specific field of study and selects a major subject from that field, he or she frequently draws minor subjects from related fields. Thus the student at Cornell interacts with faculty from a wide range of scholarship in his or her area of interest.

Special Committee

The student's graduate program is supervised by a Special Committee composed of graduate faculty members chosen by the student. The committee system places considerable responsibility on the student to determine, with his or her Special Committee, appropriate courses and an appropriate program of study to fulfill the requirements for the degree. Under this system the student works with the committee of faculty members who can best direct the student's course of study regardless of college, department, or field affiliation.

During the first semester each student chooses Special Committee members to represent his or her major and minor subjects. The doctoral candidate's Special Committee is composed of a chairperson, who represents the major subject, and two faculty members who represent minor subjects. Most fields require two minor subjects for doctoral programs, but a few require only one. The Special Committee for a master's candidate is composed of a chairperson, representing the major subject, and one faculty member representing a minor subject.

The Special Committee and the student constitute an independent working unit. The members of the Special Committee direct the student's program and decide whether satisfactory progress is being made toward the degree. They set specific degree requirements, conduct and report on oral examinations, and approve the thesis. A student is recommended for a degree when Special Committee members agree that an appropriate level of scholarly achievement has been reached.

in the area of study and that the Graduate Faculty regulations regarding general examinations, residency, and thesis preparation have been satisfied.

The student may ask any member of the Graduate Faculty in his or her field to serve as chairperson and to represent the major subject. The chairperson usually supervises the student's thesis research, although that is not required.

Students are encouraged to change the membership of their Special Committee if their academic interests change.

In some professional master's programs, students have advisers rather than Special Committees directing their programs. Frequently the adviser is assigned to the student by the field.

Degree Requirements

The Graduate School's degree requirements are kept to a minimum in order to give the Special Committee and the student freedom to determine appropriate degree requirements and to define a course of study best suited to the student's particular goals. Except in certain professional degree programs, no requirements for credits, courses, or grades are imposed by the Graduate School; however, grades of C+ or below do not normally constitute satisfactory progress.

RESIDENCE

Residence is defined as the time spent at Cornell in full-time study and research. All candidates for an advanced degree must earn a specified number of residence units. One semester of full-time study in residence at Cornell at a satisfactory level of performance constitutes one residence unit. The Special Committee chairperson is responsible for evaluating the student's progress and approving residence units.

Doctoral candidates must earn at least six residence units before the degree is granted. Normally a Ph.D.

candidate takes four to five years of full-time study to complete all degree requirements, including residency requirements. All requirements for the doctoral degree must be completed within seven years of the first registration in the Graduate School. At least four of the six units required for the Ph.D. must be earned as a full-time student.

Master's candidates must earn at least two residence units. Usually two to three years of full-time study are necessary to fulfill all degree requirements. A student must complete the requirements for a master's degree within four years of first registration in the Graduate School.

Some professional programs have residency requirements different from those stated above.

Transfer of residence credit A Ph.D. candidate may be granted a maximum of two residence credits for a master's degree earned at another institution if that degree is relevant to the doctoral program. No commitment regarding transfer of residence credit may be made until after the student has matriculated and the Special Committee has had an opportunity to judge the student's accomplishments. A candidate for the M.A. or M.S. degree may not receive residence credit for previous study in other graduate schools.

Summer study and residence credit A student in a doctoral program may earn up to two units of residence credit, and a master's candidate may earn up to one unit of residence credit, for all work done in summer session, summer research, and in the Division of Extramural Study. A student interested in earning residence credit through summer study and/or research must obtain prior approval of the Special Committee and follow the proper registration procedures. Some fellowships, assistantships, and partial tuition awards are available for summer study from the Graduate School.

PART-TIME STUDY

Most graduate students at Cornell are full-time students. If employment is necessary, students may hold on-campus positions requiring up to twenty hours of work each week and off-campus positions requiring up to ten hours a week without reduction of residence credit. On- and off-campus employment requiring work commitments beyond the above limits reduces the residence credit that can be earned. The Graduate School can supply details on the effect of employment on residence credit.

Area residents may be accepted into a number of master's degree programs on a half-time basis. Study for a doctorate, however, may not be conducted in this manner.

Although students enrolled in the Division of Extramural Study are not considered to be registered as graduate students, such students can earn some residence units. Information on extramural courses and registration procedures may be obtained from the Division of Extramural Study, B12 Ives Hall.

EXAMINATIONS

The Graduate School requires two examinations for the doctoral degree. A comprehensive admission to candidacy examination is taken after a student has earned at least two units of residence credit, and a final examination is given after completion of the doctoral dissertation. A final examination is required for an M.A. or M.S. degree. Some professional master's programs also require a final examination. The Special Committee conducts the examinations required for the degree. At the discretion of the committee the examinations may be oral or oral and written.

Some fields of study give a qualifying examination early in the program to determine the student's fitness for advanced study and to help the Special Committee plan a program of study.

FOREIGN LANGUAGES

Some fields require proficiency in one to two languages. In addition, any Special Committee may, at its discretion, require knowledge of foreign languages beyond the minimum requirements of the field.

The Department of Modern Languages and Linguistics offers courses designed specifically to aid graduate students in learning to read French, German, Russian, and Spanish. It also offers the Full-year Asian Language Concentration (FALCON) program for intensive language study in Chinese, Indonesian, and Japanese. In addition, the department regularly offers more than thirty languages. For a listing of languages see page 13.

TEACHING

Some fields require a certain number of semesters of teaching.

THESIS

Each candidate for the Ph.D. is required to submit a dissertation. For the M.A. or M.S. degree each candidate is required to submit a thesis. Some fields also require a thesis or special project of professional-degree candidates.

Degrees Offered

Consult the section "Fields of Study" for the offerings of particular fields.

DOCTOR OF PHILOSOPHY DEGREE

Most fields offer a program of study leading to a Doctor of Philosophy degree. Some fields require or recommend that a student receive a master's degree before working on a doctorate. In those fields applicants for a doctoral program are usually admitted into an M.A.-Ph.D. or M.S.-Ph.D. program.

MASTER OF ARTS OR MASTER OF SCIENCE DEGREE

Many fields offer programs of study leading to either the Master of Arts or the Master of Science degree.

PROFESSIONAL DEGREES

The following advanced professional degrees, designed as preparation and training for a specific profession, are approved by the Graduate Faculty and are offered by fields indicated below.

Doctor of Musical Arts—D.M.A.

Comprehensive professional training in musical composition or in eighteenth-century performance practice or preparation for teaching music at the university level.

Doctor of Science of Law—J.S.D.

For the student who wants to become a proficient scholar through original investigation into the functions, administration, history, and progress of law.

Master of Architecture—M.Arch.

Training in architectural design, urban design, and regional design.

Master of Arts in Teaching—M.A.T.

For those preparing for careers in agricultural or occupational education or in home economics education in secondary schools.

Master of Engineering—M.Eng.

Programs offered in computer science, engineering physics (in the field of Applied Physics), materials science, operations research and industrial engineering, and aerospace, agricultural, chemical, civil, electrical, mechanical, and nuclear engineering.

Master of Fine Arts—M.F.A.

Offered in the fields of Art (graphic arts, painting, photography, sculpture), English Language and Literature (creative writing—for professional writing or teaching of creative writing), and Music (composition training, teaching of composition and theory at the university level).

Master of Food Science—M.F.S. For the student who holds a four-year engineering degree and wants preparation for work in the food industry.

Master of Industrial and Labor Relations—M.I.L.R. For those with professional interest in industrial and labor relations.

Master of Landscape Architecture—M.L.A. Professional training in the areas of land-use planning and design.

Master of Laws—LL.M. For students who want to increase their knowledge of the law by working in a specialized field.

Master of Nutritional Science—M.N.S. The degree has specific course requirements and entails six months of field experience in clinical dietetics.

Master of Regional Planning—M.R.P. Training for a professional career in planning at the city, regional, or national level.

Master of Science in Industrial and Labor Relations—M.S.I.L.R. Provides the opportunity for people in the New York City area to undertake professional graduate study while continuing their daytime employment. Offered jointly with the Bernard M. Baruch College of the City University of New York.

MASTER OF PROFESSIONAL STUDIES DEGREES

Master of professional studies degrees are offered in the following:

African and Afro-American Studies—M.P.S.(A.A.A.) Preparation for teaching, research, and other professional careers related to Black studies.

Agriculture—M.P.S.(Agr.) For professional agriculturalists who want further study in a subject or a problem area pertinent to their profession. Applicants may choose agricultural economics, agricultural education, agricultural engineering, agronomy, animal science, development sociology, floriculture and ornamental horticulture, food science, international agriculture and rural development, natural resources, plant breeding, plant pathology, plant protection, pomology, or vegetable crops.

Communication—M.P.S.(Comm.) For those who want to work with agencies concerned with organized public communication. Focuses on strategic application of communication knowledge and technology.

Hotel Administration—M.P.S.(H.Ad.) For students with bachelor's degrees in hotel administration or other areas who want to pursue a more professionally oriented, and less research-directed, degree than the Master of Science.

Human Ecology—M.P.S.(Hu.Ec.) For practicing professionals in fields related to human ecology who want further study pertinent to their profession. Offered in design and environmental analysis, health services admin-

istration, human development and family studies, human services studies, nutrition, and textiles.

International Development—M.P.S.(I.D.) Provides interdisciplinary study for experienced practitioners in international development.

OTHER DEGREES

Programs leading to the Doctor of Law (J.D.), Doctor of Medicine (M.D.), Doctor of Veterinary Medicine (D.V.M.), and Master of Business Administration (M.B.A.) are not administered by the Graduate School. Information on those programs may be obtained from the Law School, the Medical College (New York City), the College of Veterinary Medicine, and the Johnson Graduate School of Management, respectively. See the directory on page 160 for addresses and available publications.



OPPORTUNITIES FOR STUDY

At Cornell the selection of areas of study and research is limited only by the student's interests and the university's resources. Many traditional subjects can be studied in any one of several fields or programs. To assist prospective students in identifying possible options, a list of some traditional disciplines and corresponding fields of study, research facilities, and programs follows.

If the prospective applicant is unable to find a particular area of interest in the following list or in the index of fields, subjects, and concentrations, he or she is encouraged to contact the Graduate School for assistance. The Graduate School can inform the applicant whether the area of interest is offered at Cornell.

AGRICULTURE

Fields

agricultural economics
agricultural engineering
agronomy
animal breeding
animal science
biochemistry, molecular and cell biology
biometry
botany
development sociology
ecology and evolutionary biology
education
entomology
epidemiology
floriculture and ornamental horticulture
food science and technology
genetics
immunology
international agriculture and rural development
nutrition
physiology
plant breeding
plant pathology
plant protection

pomology
vegetable crops
veterinary medicine
zoology

Research Facilities and Programs

Agricultural research stations, James A. Baker Institute for Animal Health, Biophysics Program, Biotechnology Program, Boyce Thompson Institute for Plant Research, Laboratory of Ornithology, Center for Theory and Simulation of Science and Engineering

ANIMAL SCIENCE

Fields

animal breeding
animal science
ecology and evolutionary biology
epidemiology
food science and technology
genetics
immunology
neurobiology and behavior
nutrition
physiology
veterinary medicine
zoology

Research Facilities and Programs

James A. Baker Institute for Animal Health, Laboratory of Ornithology

AREA STUDIES

Fields

African and Afro-American studies
Asian studies
East Asian literature
English language and literature
Germanic studies
Latin American studies
Near Eastern studies
Romance studies
Slavic studies

Programs

China-Japan Program, Latin American Studies Program, South Asia Program, Southeast Asia Program, Committee on Soviet Studies, Western Societies Program

BIOLOGICAL SCIENCES

Fields

agronomy
animal breeding
animal science
biochemistry, molecular and cell biology
biometry
botany
cognitive studies
ecology and evolutionary biology
entomology
environmental toxicology
epidemiology
floriculture and ornamental horticulture
food science and technology
genetics
immunology
microbiology
natural resources
neurobiology and behavior
nutrition
physiology
plant breeding
plant pathology
plant protection
pomology
psychology
vegetable crops
veterinary medicine
zoology

Research Facilities and Programs

Agricultural research stations, Biophysics Program, Biotechnology Program, James A. Baker Institute for Animal Health, Boyce Thompson Institute for Plant Research, Laboratory of Ornithology, Statistics Center, Center for Theory and Simulation of Science and Engineering

BIOTECHNOLOGY

Fields

animal science
biochemistry, molecular and cell biology
botany
food science and technology
genetics
microbiology
plant pathology
veterinary medicine

Research Facilities and Programs

Biotechnology Program

CHEMISTRY

Fields

biochemistry, molecular and cell biology
chemical engineering
chemistry
environmental toxicology
food science and technology
materials science and engineering
textiles

DESIGN AND VISUAL ARTS

Fields

art
architecture
city and regional planning
design and environmental analysis
history of art and archaeology
landscape architecture
theater arts

ECONOMICS

Fields

agricultural economics
city and regional planning
consumer economics and housing
economics
industrial and labor relations
management
regional science
textiles

Research Facilities and Programs

Cornell Institute for Social and Economic Research, Statistics Center, Center for Theory and Simulation of Science and Engineering

ENGINEERING

Fields

aerospace engineering
 agricultural engineering
 applied mathematics
 applied physics
 chemical engineering
 civil and environmental engineering
 computer science
 electrical engineering
 food science and technology
 geological sciences
 materials sciences and engineering
 mechanical engineering
 nuclear science and engineering
 operations research
 statistics
 textiles
 theoretical and applied mechanics

Research Facilities and Programs

Center for Applied Mathematics,
 Biophysics Program, Biotechnology
 Program, Program of Computer
 Graphics, Institute for the Study of
 Continents, Cornell High Energy
 Synchrotron Source, Cornell Manufac-
 turing Engineering and Productivity
 Program, Materials Science Center,
 Mathematical Sciences Institute,
 National Nanofabrication Facility,
 Semiconductor Research Corporation
 Program, Statistics Center, Center for
 Radiophysics and Space Research,
 Center for Theory and Simulation of
 Science and Engineering

ENVIRONMENTAL STUDIES

Fields

agricultural engineering
 agronomy
 architecture
 city and regional planning
 civil and environmental engineering
 design and environmental analysis
 ecology and evolutionary biology
 environmental quality
 environmental toxicology
 landscape architecture
 natural resources

regional science
 urban studies
 water resources
 zoology

Research Facilities and Programs

Center for Environmental Research,
 Institute for Comparative and Environ-
 mental Toxicology

HISTORY

Fields

architecture
 classics
 history
 history and philosophy of science and
 technology
 history of art and archaeology
 medieval studies
 Near Eastern studies

LANGUAGES

The Department of Modern Languages
 and Linguistics regularly offers courses
 in the following languages: Bantu,
 Bengali, Burmese, Cambodian,
 Cebuano, Chinese, Czech, Danish,
 Dutch, French, German, Hindi, Hittite,
 Hungarian, Indonesian, Irish, Italian,
 Japanese, Nepali, Old Norse, Polish,
 Portuguese, Quechua, Romanian,
 Russian, Sanskrit, Serbo-Croatian,
 Sinhala, Spanish, Swedish, Tagalog,
 Tamil, Telugu, Thai, Tocharian, Turkish,
 Ukrainian, and Vietnamese.

In addition, members of the depart-
 ment design and administer tests or
 serve as consultants for programs in
 many other languages, including
 Afrikaans, Albanian, Basque, Belorus-
 sian, Bulgarian, Ewe, Georgian, Greek,
 Huichol, Icelandic, Igbo, Macedonian,
 Malayan, New Guinea Pidgin, Norwe-
 gian, Slovak, Slovenian, and Susu.

Fields

Asian studies
classics
English language and literature
Germanic studies
linguistics
Near Eastern studies
Romance studies
Slavic studies

Programs

FALCON Program for Chinese, Indonesian, and Japanese

LITERATURE

Fields

African and Afro-American studies
classics
comparative literature
East Asian literature
English language and literature
Germanic studies
medieval studies
Near Eastern studies
Romance studies
Slavic studies

Program

Renaissance Studies

MANAGEMENT

Fields

agricultural economics
city and regional planning
civil and environmental engineering
economics
education

hotel administration
human service studies
industrial and labor relations
management
operations research

Research Facilities

Cornell Institute for Social and Economic Research, Statistics Center

MATHEMATICS

Fields

applied mathematics
biometry
chemical engineering
cognitive studies
computer science
education
mathematics
operations research
physics
statistics
theoretical and applied mechanics

Research Facilities and Programs

Center for Applied Mathematics, Statistics Center, Center for Theory and Simulation of Science and Engineering

PLANNING AND POLICY STUDIES

Fields

agricultural economics
city and regional planning
design and environmental analysis
economics
environmental toxicology
government
human service studies
international development
management
public policy
regional science
sociology
urban studies

PHYSICS

Fields

applied physics
materials science and engineering
physics

Research Facilities and Programs

Biophysics Program, Brookhaven
National Laboratory, Fermi National
Accelerator Laboratory, Cornell High
Energy Synchrotron Source, Laboratory
of Atomic and Solid State Physics,
Laboratory of Nuclear Studies, Labora-
tory for Plasma Studies, National
Nanofabrication Facility, Center for
Radiophysics and Space Research,
Center for Theory and Simulation of
Science and Engineering

PLANT SCIENCE

Fields

agronomy
biochemistry, molecular and cell biology
biometry
botany
ecology and evolutionary biology
floriculture and ornamental horticulture
genetics
plant breeding
plant pathology
plant protection
pomology
vegetable crops

Research Facilities and Programs

Agricultural research stations, Biophys-
ics Program, Biotechnology Program,
Boyce Thompson Institute for Plant
Research, Center for Theory and
Simulation of Science and Engineering

PSYCHOLOGY

Fields

cognitive studies
education
human development and family studies
industrial and labor relations
psychology
sociology

SOCIOLOGY

Fields

anthropology
city and regional planning
development sociology
education
human development and family studies
industrial and labor relations
sociology

Research Facilities and Programs

Center for Theory and Simulation of
Science and Engineering

STATISTICS

Fields

biometry
economics
industrial and labor relations
mathematics
operations research
statistics



FIELDS OF STUDY

A student is admitted into a field of study and selects a major subject and, in most cases, an area of concentration from among those listed under that field in this catalog. Minor subjects may be chosen from the field or related fields. A student interested in taking a minor subject in one of the Graduate School's nine *minor* fields must first be registered in a major field. This section describes all the fields of study of Cornell's Graduate School, the degrees offered in each field, and the major and minor subjects and concentrations.

Degrees The degrees offered by each field are listed under the field title. Parentheses around an M.A. or M.S. indicate that the field does not normally accept students into a terminal master's degree program. However, the student who is working toward the Ph.D. degree can receive a master's as part of the degree program.

Subject(s) All fields of study offer a subject or subjects that may be used as a major for degrees offered in the field and as a minor for a degree in the same or another field unless otherwise indicated. In parentheses following the subject are listed *aréas* of concentration. Concentrations are the specializations available within the field. Fields or Special Committees may place restrictions on the choice of minor subjects.

Inquiries Applicants are encouraged to communicate with individual members of the Graduate Faculty with whom they may want to study. For the benefit of those not acquainted with faculty members in the field(s) of their interest, each field has a graduate faculty representative who serves as director of graduate studies and to whom inquiries may be addressed. Requests for further information should be directed to the address indicated in each field of study as follows:

Graduate Faculty Representative
Field of [supply name of Field]
Cornell University
[Supply building address]
Ithaca, New York 14853

AEROSPACE ENGINEERING

M.S., Ph.D., M.Eng.(Aerospace)
Graduate faculty representative Zellman
Warhaft, 250 Upson Hall

Subjects Aerospace engineering;
aerodynamics [minor only]

Applicants should hold a bachelor's degree in engineering or the physical sciences. It is not recommended that candidates apply for admission at midyear except in unusual cases. It is recommended, but not required, that applicants submit GRE test scores.

A reading knowledge of French, German, or Russian is required of Ph.D. candidates whose native language is English. Ph.D. candidates may be asked to take a qualifying examination in addition to the examinations required by the Graduate School.

In the Field of Aerospace Engineering emphasis is placed on basic aerospace sciences to prepare students to cope with the characteristic diversity in research frontiers and industrial development. The faculty is particularly strong and active in fluid mechanics in its broadest definition. Current research includes various fundamental studies in fluid dynamics and aerodynamics, such as noise generation, non-Newtonian fluid mechanics, numerical methods, transonic flows, turbulence, and unsteady flows. There is also a program in combustion processes, plus research in chemical kinetics and plasma dynamics.

Faculty and Specializations

Peter L. Auer: plasma physics; fusion power; energy policy analysis
David A. Caughey: fluid dynamics; transonic flow; computational aerodynamics
P. C. Tobias de Boer: combustion processes; alternative fuels for combustion engines; high-temperature gas dynamics
Albert R. George: aerodynamics; fluid dynamics; aeroacoustics; sonic boom; turbulence

Frederick C. Gouldin: fluid dynamics; combustion; propulsion
 Sidney Leibovich: fluid dynamics; wave propagation; air-sea interactions; dynamics of vortex flows
 John L. Lumley: fluid dynamics; turbulence
 Franklin K. Moore: fluid mechanics; turbomachinery
 Stephen B. Pope: combustion; fluid mechanics
 Edwin L. Resler, Jr.: high-temperature gas dynamics; pollution control; ferrofluid mechanics
 Shan-fu Shen: aerodynamics; computational fluid mechanics; polymer processing
 Dennis G. Shepherd: fluid mechanics; turbomachinery; thermal and wind power
 Donald L. Turcotte: geomechanics; geophysical fluid dynamics
 Zellman Warhaft: experimental fluid mechanics; turbulence; micrometeorology
 The regular faculty is supplemented by distinguished visitors from the United States and abroad. Visitors have included Hannes Alfvén, G. K. Batchelor, J. M. Burgers, L. F. Crabtree, Nima Geffen, Isao Imai, R. T. Jones, Theodore von Karman, S. Kitagorodskii, J. W. Linnett, P. S. Lykoudis, F. E. Marble, R. S. B. Ong, E. R. Oxburgh, D. A. Spence, Ko Tamada, Itiro Tani, and R. T. Jones.

AFRICAN AND AFRO-AMERICAN STUDIES

M.P.S.(A.A.A.)

Graduate faculty representative Robert L. Harris, Jr., Africana Studies and Research Center, 310 Triphammer Road.

Subject Africana studies

The field offers a program leading to the degree of Master of Professional Studies (African and Afro-American Studies). It is intended primarily for students interested in specializing in scholarly work—teaching, research, or creative arts—in some facet of the rapidly developing academic area of Black studies. The graduate program affords an opportunity for structuring a course of study to meet the specific interests of its own students as well as students from other fields who select a minor concentration in either African or Afro-American studies. The curriculum reflects a multidisciplinary and comparative approach to the experience of African peoples throughout the world.

Applicants for the master's degree program are expected to have some undergraduate preparation in African or Afro-

American studies. Degree candidates take a major concentration in either African or Afro-American studies and a minor concentration in one of the areas not selected for the major or in another graduate field. After the first semester the student forms a Special Committee to supervise his or her program. A thesis proposal must be submitted at the end of the first year of graduate study. The Africana Studies and Research Center encourages each student to develop a thesis selected from a range of topics and based on library research, creative work, field study, or internship.

Financial support for graduate students is available through Cornell fellowships, teaching assistantships, and research assistantships. The center also supports a small number of students through teaching and research assistantships.

Faculty and Specializations

Anne A. Adams: African and Caribbean literature; Francophone and Anglophone African and Caribbean literature; Afro-American writing and expression
 William E. Cross: Black psychology; identity, family, and child development; education
 Henry L. Gates: African and Afro-American literary theory and history; Black women's literature; Black periodical literature
 Robert L. Harris: Afro-American history; Afro-American historiography; thought and culture; leaders and movements
 Jeremiah C. Mbata: African history; research methodology; comparative race relations; resistance movements; South African affairs
 James E. Turner: Black political sociology; Black politics; social and political philosophy; racism and social analysis; Afro-American urban community development and public policy

AGRICULTURAL ECONOMICS

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative

William H. Lesser, 310 Warren Hall

Subjects Agricultural economics (agricultural finance; applied econometrics and quantitative analysis; economics of development; farm management and production economics; marketing and food distribution; public policy analysis); resource economics

The M.S. and Ph.D. programs are research oriented, and each require a thesis. Students normally are expected to obtain the M.S. or equivalent degree before entering a

Ph.D. program. The Ph.D. student must take at least one minor in another field, such as economics. The Master of Professional Studies (Agriculture) is a terminal degree for persons with experience who want additional training pertinent to their profession.

To understand the breadth of theoretical and applied economics at Cornell, prospective applicants should review programs offered by the Fields of Management, Consumer Economics and Housing, Economics, Industrial and Labor Relations, and City and Regional Planning.

Applicants, especially those for the Ph.D. program, are strongly urged to take the GRE general test; all applicants for Cornell fellowships must take this examination. An undergraduate major in agricultural economics is not required for admission, but a lack of intermediate-level economics is a deficiency that will lengthen the student's program. First-year calculus is also important for Ph.D.-level work. Foreign applicants must take the Test of English as a Foreign Language unless their native language is English.

Application for fellowships or assistantships is made by checking the appropriate boxes on the application for admission form. Assistantships involve part-time employment in teaching or research for the Department of Agricultural Economics, and awards are made by the department. Thesis research is often conducted as a part of assistantship duties. The department also awards two fellowships annually, a Morgenthau Fellowship for a person with a special interest in agricultural finance and a Crowe Fellowship for a person with a special interest in college-level teaching in agricultural or resource economics. Such special interest should be mentioned in the statement of purpose.

Faculty and Specializations

David J. Allee: resource economics
 Bruce L. Anderson: marketing and food distribution
 Richard D. Aplin: marketing and food distribution
 Randolph Barker: economics of development
 Nelson L. Bills: resource economics
 David Blandford: economics of development; public policy analysis
 Richard N. Boisvert: applied econometrics and quantitative analysis; public policy analysis; resource economics
 John R. Brake: agricultural finance; farm management and production economics

W. Keith Bryant: marketing and food distribution; public policy analysis
 Joseph B. Bugliari: agricultural finance
 George L. Casler: farm management and production economics
 L. Duane Chapman: resource economics
 George J. Conneman, Jr.: agricultural finance; farm management and production economics
 Jon M. Conrad: applied econometrics and quantitative analysis; resource economics
 Lee M. Day: resource economics
 Enrique E. Figueroa: applied econometrics and quantitative analysis; marketing and food distribution; public policy analysis
 Olan D. Forker: marketing and food distribution; public policy analysis
 Donald K. Freebairn: economics of development
 Gene A. German: marketing and food distribution
 Harry M. Kaiser: marketing and food distribution; public policy analysis
 Robert J. Kalter: resource economics
 Wayne A. Knoblauch: farm management and production economics
 Eddy L. LaDue: agricultural finance; farm management and production economics
 William F. Lazarus: farm management and production economics
 David R. Lee: public policy analysis
 William H. Lesser: marketing and food distribution
 Edward W. McLaughlin: marketing and food distribution
 Robert A. Milligan: applied econometrics and quantitative analysis; farm management and production economics
 Timothy D. Mount: applied econometrics and quantitative analysis; resource economics
 Andrew M. Novakovic: marketing and food distribution
 Per Pinstrup-Andersen: economics of development; marketing and food distribution; public policy analysis
 Thomas T. Poleman: economics of development
 Christine K. Ranney: public policy analysis; resource economics
 Daniel G. Sisler: economics of development; public policy analysis
 Bernard F. Stanton: farm management and production economics; public policy analysis
 Deborah H. Streeter: farm management and production economics; marketing and food distribution

Loren W. Tauer: agricultural finance; farm management and production economics
 Erik Thorbecke: economics of development
 William G. Tomek: applied econometrics and quantitative analysis; marketing and food distribution

Gerald B. White: farm management and production economics

AGRICULTURAL ENGINEERING

M.S., Ph.D., M.Eng.(Agriculture), M.P.S.(Agr.)

Graduate faculty representative Louis D. Albright, 206 Riley-Robb Hall

Subject Agricultural engineering (energy; environmental engineering and waste management; food and biological engineering; handling and processing materials; international agricultural development; local roads; power and machinery; soil and water engineering; structures and their environments)

Ph.D. and M.S. Programs

An applicant to the Ph.D. or the M.S. program must have a baccalaureate degree in an area of engineering, physical science, or biological science with a strong preparation in mathematics and physics. Deficiencies in undergraduate training must be made up early in the advanced degree program. Applicants are strongly urged to submit scores of the GRE general test and subject test in engineering.

Ph.D. candidates are requested to select at least one minor subject from outside the field. M.S. candidates are required to take agricultural engineering as their major subject and to select one minor outside the field. The M.S. and Ph.D. research degrees require the submission of an acceptable thesis.

Professional Degrees

The professional degree of Master of Engineering (Agriculture) is intended primarily for students who plan to enter engineering practice. Applicants for the Master of Engineering program must have a baccalaureate in engineering or its equivalent. This program is intended to develop students' backgrounds in engineering design as well as to improve their fundamental engineering knowledge. For further information, see the catalog *Graduate Study in Engineering and Applied Science*.

The professional degree of Master of Professional Studies (Agriculture) with a concentration in agricultural engineering is

intended for those who want to further their training for practitioner-type work in agricultural technology and who do not intend to become involved in engineering design and research. An applicant must have a baccalaureate degree in agricultural technology or a related physical or biological sciences-oriented curriculum. Each M.P.S. (Agr.) degree applicant must submit scores of either the GRE or the Miller Analogies Test. A preliminary curriculum proposal must accompany an application for the M.P.S. (Agr.) program.

Faculty and Specializations

Louis D. Albright: energy; food and biological engineering; structures and their environment

James A. Bartsch: food and biological engineering; handling and processing materials; structures and their environment

Wilfried H. Brutsaert: environmental engineering and waste management; soil and water engineering

James R. Cooke: energy; food and biological engineering; power and machinery

Ashim K. Datta: food and biological engineering

Ronald B. Furry: food and biological engineering; handling and processing materials; structures and their environment

Kifle Gebremedhin: structures and their environment

Richard W. Guest: environmental engineering and waste management; handling and processing materials; structures and their environment

Wesley W. Gunkel: energy; international agricultural development; power and machinery

Douglas A. Haith: environmental engineering and waste management; soil and water engineering

Jean B. Hunter: food and biological engineering

Lynne H. Irwin: international agricultural development; local roads

William J. Jewell: energy; environmental engineering and waste management

David C. Ludington: energy; food and biological engineering; structures and their environment

John L. Lumley: food and biological engineering

Jean Y. Parlange: international agricultural development; soil and water engineering

Ronald E. Pitt: food and biological engineering; power and machinery
 Richard H. Rand: food and biological engineering
 Gerald E. Rehkugler: energy; food and biological engineering; handling and processing materials; power and machinery
 Norman R. Scott: food and biological engineering; structures and their environment
 Christine A. Shoemaker: environmental engineering and waste management; food and biological engineering
 Tamme S. Steenhuis: environmental engineering and waste management; international agricultural development; soil and water engineering
 Michael B. Timmons: energy; structures and their environment
 Larry Walker: energy
 Michael F. Walter: environmental engineering and waste management; international agricultural development; soil and water engineering

AGRONOMY

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Timothy L. Setter, 519 Bradfield Hall

Subject Agronomy (atmospheric sciences; field crop science; remote sensing; seed technology; soil science)

Native English-speaking applicants should submit GRE results.

Ordinarily students must first complete a master's program, but direct admission to a doctoral program is permitted for exceptionally well prepared students.

The field occupies one of the most modern and diversified agronomic research facilities in the world. An air-conditioned eleven-story research tower and adjoining wings incorporate fully equipped laboratory, teaching, office, and supporting spaces. Growth chambers and greenhouses are on the campus, and there are three main field stations near Ithaca. Some members of the field are staff members at the U.S. Plant, Soil, and Nutrition Laboratory (USDA) or the Boyce Thompson Institute for Plant Research on the campus.

Many of the faculty have research programs concerning international agricultural development in tropical and subtropical regions. A limited number of students can do most or all of their research overseas.

Additional information may be obtained from the graduate faculty representative.

Research Opportunities

Atmospheric sciences Research concerns measuring, processing, and analyzing meteorological, climatic, and air pollution data that are relevant to agriculture and in other applications.

Field crop science Research covers a wide spectrum from field-scale applied projects to cell physiology and biotechnology. Studies seek to improve crop productivity and quality and to identify physiological factors that are in need of improvement through plant breeding or genetic engineering.

Remote sensing Research concerns methods of collecting, analyzing, and interpreting remotely sensed data for use in crop and soil resource inventories and land-use planning.

Seed technology Research seeks to improve the storage, genetic purity, and performance of seeds.

Soil science Research seeks to improve our understanding of the processes and properties of the soil environment. It emphasizes improving the suitability of soil for crop growth while preserving its value as a natural resource by using ecologically sound approaches.

Faculty and Specializations

Martin A. Alexander: soil microbiology; microbial ecology
 David R. Bouldin: soil fertility; chemistry of root-soil interface
 Ray B. Bryant: soil genesis and morphology
 William J. Cox: grain crop management
 Stephen D. DeGloria: resource inventory and analysis
 Bernard E. Dethier: climatology
 John M. Duxbury: soil chemistry; organic soils; soil organic matter
 Gary W. Fick: forage crop management; ecology; simulation modeling
 David L. Grunes: soil fertility; mineral nutrition
 Gary E. Harman: seed microbiology
 Anwar A. Khan: seed physiology and biochemistry
 Warren W. Knapp: physical and dynamical meteorology
 Thomas A. LaRue: crop physiology, N₂ fixation
 Douglas J. Lathwell: soil fertility
 A. Carl Leopold: crop physiology; biology of seed desiccation
 Dean L. Linscott: weed control; herbicide metabolism

Robert F. Lucey: forage and pasture management
 Murray B. McBride: soil chemistry and mineralogy; soil surface reactions
 Robert D. Miller: soil physics; freezing processes
 Ralph L. Obendorf: physiology and biochemistry of seeds and seedlings
 Gerald W. Olson: soil survey interpretation
 Douglas A. Paine: synoptic and dynamical meteorology
 William D. Pardee: crop cultivar improvement and management
 Jean Y. Parlange: soil physics
 John H. Peverly: soil and plant chemistry in aquatic environments
 Warren R. Philipson: satellite and aircraft image analysis
 William S. Reid: soil fertility; fertilizer recommendations
 Susan J. Riha: forest soil ecosystems
 Thomas W. Scott: soil fertility and crop management
 Robert R. Seaney: forage crop management
 Timothy L. Setter: crop physiology; environmental stress
 Peter L. Steponkus: crop physiology; cell biology; low temperature stress
 Alan G. Taylor: seed quality; seedling establishment
 Armand Van Wambeke: tropical soils; survey and taxonomy
 Robert J. Wagenet: soil physics; water and chemical movement
 Norman F. Weeden: seed genotype identification
 Ross M. Welch: crop physiology; mineral nutrition
 Daniel S. Wilks: statistical and agricultural meteorology
 Madison J. Wright: grain crop management
 Richard W. Zobel: physiological genetics and ecology

ANIMAL BREEDING

M.S., Ph.D.

Graduate faculty representative Lloyd D. Van Vleck, B22 Morrison Hall

Subject Animal breeding (animal breeding; animal genetics)

Entering students are expected to have had good basic undergraduate training in biology, chemistry, and mathematics. Previous experience with large animals or with poultry is desirable but not essential. GRE general test scores are recommended but not required.

Graduate students are required to do some teaching during their course of study.

Superior facilities are available to graduate students training in each of the following areas: animal cytogenetics, genetics of physiological and behavioral traits in domestic animals, immunogenetics, livestock breeding in the tropics, and statistical and quantitative genetics with emphasis on selection programs for improvement of domestic animals (especially beef and dairy animals). Students are expected to participate actively in these research programs. Some assistantships are available.

Faculty and Specializations

Robert W. Blake: livestock breeding in the tropics
 Stephen E. Bloom: animal cytogenetics
 Rodney R. Dietert: immunogenetics
 Robert W. Everett: statistical and quantitative genetics
 Elizabeth A. B. Oltenacu: genetics of physiological and behavioral traits in domestic animals
 Pascal A. Oltenacu: statistical and quantitative genetics
 Emil J. Pollak: statistical and quantitative genetics
 Richard L. Quaas: statistical and quantitative genetics
 Lloyd D. Van Vleck: statistical and quantitative genetics

ANIMAL SCIENCE

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Richard L. Quaas, 114 Morrison Hall

Subject Animal science (animal nutrition; animal science; physiology of reproduction)

Preference is given to applicants whose credentials indicate strong undergraduate preparation both in the animal sciences and in related biological and physical sciences. GRE general test scores are required.

The field requires an additional member on the Special Committee of both M.S. and Ph.D. candidates (i.e., three for the M. S., four for the Ph.D.). This is one more than is required by the Graduate School. At least one member of the Special Committee must not be a member of the faculty in the department in which the chairperson holds an appointment. As part of their training students are required to assist with the teaching program of the department. The F. B. Morrison Fellowship in Livestock Feeding and a number of departmental assistantships are available on a competitive basis to students with appropriate interests.

In addition to M.S. and Ph.D. programs, a program leading to the Master of Professional Studies (Agriculture) degree is available in this field. This program is intended primarily for applicants who want to further their academic training in animal science but whose interests may not be oriented toward research.

Depending on specific objectives, applicants may also want to examine opportunities in the Fields of Animal Breeding, Food Science and Technology, Nutrition, and Physiology.

Faculty and Specializations

Richard E. Austic: animal nutrition; amino acids; nitrogen metabolism
 Robert C. Baker: food science; poultry, meat, eggs, and fish
 Dale E. Bauman: nutritional biochemistry; intermediate metabolism
 Donald H. Beermann: meat processing; muscle biochemistry
 Alan W. Bell: nutritional physiology; pregnancy and growth
 Robert W. Blake: animal science, livestock production in developing countries
 Stephen E. Bloom: animal cytogenetics
 Raymond D. Boyd: monogastric nutrition
 Walter R. Butler: animal physiology; neuroendocrinology
 Larry E. Chase: ruminant nutrition
 Gerald F. Combs, Jr.: animal nutrition; nutritional biochemistry
 Dan L. Cunningham: poultry management
 W. Bruce Currie: animal physiology
 Terence Dockerty: meat processing
 J. Murray Elliot: dairy cattle management
 Hollis N. Erb: herd health management
 Robert W. Everett: dairy cattle management
 R. H. Foote: animal physiology; artificial insemination
 Danny G. Fox: beef cattle nutrition
 David M. Galton: dairy cattle management
 Ronald C. Gorewit: lactation biology; reproductive physiology
 William Hansel: animal physiology; endocrinology
 Harold F. Hintz: equine nutrition
 Douglas E. Hogue: animal nutrition; sheep
 Kavous Keshavarz: poultry nutrition
 Charles C. McCormick: mineral nutrition; adrenal function
 James A. Marsh: physiology; immunology
 William G. Merrill: dairy cattle management
 Elizabeth A. B. Oltenacu: animal breeding; genetics
 Pascal A. Oltenacu: livestock production and animal breeding

Richard L. Quaas: animal breeding; genetics
 James B. Russell: rumen microbiology
 R. David Smith: physiology; reproduction; lactation
 Terry R. Smith: dairy management information systems; dairy farm economics
 Charles Sniffen: dairy cattle nutrition
 J. R. Stouffer: meat science; muscle biology
 Michael L. Thonney: animal nutrition; beef cattle management
 Peter J. Van Soest: ruminant nutrition; rumen metabolism
 Ari Van Tienhoven: reproductive physiology; neuroendocrinology
 R. G. Warner: animal nutrition

ANTHROPOLOGY

M.A., Ph.D.

Graduate faculty representative Carol J. Greenhouse, 212 McGraw Hall

Subjects Anthropology (applied anthropology; archaeology; culture and meaning; historical anthropology; physical anthropology; psychological anthropology; social anthropology); archaeology [M.A. major only]

Since the faculty members conceive of their discipline as a unified field, an area of concentration may be designated only for the minor.

A committee consisting of three members of the faculty and a graduate student (the graduate faculty representative is chairperson) evaluates all applications for admission and financial support. All applicants must submit GRE scores unless they reside in an area where the test is not given or the requirement is waived for some other reason. Applications should also include a term paper, an honors thesis, a research report, or some other sample of written work. The deadline for receipt of completed applications is January 15.

The Field of Anthropology recommends that graduate students seeking a career in anthropology plan to complete the Ph.D. program. Since opportunities for persons holding only the M.A. are limited, applicants who intend to terminate their studies at the master's level are admitted only under special circumstances, which are stated in the field's brochure.

Every graduate student must pass an examination in at least one language that has a literature other than his or her native language. The student's Special Committee may set additional language requirements.

Every graduate student is expected to gain experience as a teaching assistant.

The field's brochure, available from the graduate faculty representative, contains detailed information about policies, the curriculum, and sources of financial aid.

Faculty and Specializations

- Robert Ascher: expressive culture; United States culture and society
 James A. Boon: anthropological history and theory; culture and meaning; social organization; Southeast Asian studies
 V. Rada Dyson-Hudson: Africa
 Carol J. Greenhouse: Latin American studies; legal and political anthropology; United States society and culture
 Davydd J. Greenwood: anthropological history and theory; biological (physical) and biocultural anthropology; economic anthropology; European studies; historical anthropology; social organization
 Jere D. Haas: biological (physical) and biocultural anthropology
 John S. Henderson: archaeology; Latin American studies
 David H. Holmberg: culture and meaning; comparative religion; social organization; South Asian studies; women's studies
 Billie J. Isbell: culture and meaning; Latin American studies; psychological anthropology; urban studies
 Kenneth A. Kennedy: anthropological history and theory; biological (physical) and biocultural anthropology; demography; South Asian studies
 Anthony T. Kirsch: anthropological history and theory; culture and meaning; historical anthropology; comparative religion; Southeast Asian studies
 Bernd Lambert: Oceania; social organization
 William W. Lambert: cross-cultural studies; psychological anthropology
 Thomas F. Lynch: archaeology; Latin American studies
 Kathryn S. March: culture and meaning; expressive culture; social organization; South Asian studies; women's studies
 Paul S. Sangren: Chinese studies; demography; economic anthropology; comparative religion
 James T. Siegel: culture and meaning; legal and political anthropology; comparative religion; social organization; Southeast Asian studies
 Robert J. Smith: anthropological history and theory; expressive culture; historical anthropology; Japanese studies; comparative religion; social organization; urban studies

Thomas P. Volman: Africa; archaeology
 Frank W. Young: applied anthropology and culture change; cross-cultural studies; Latin American studies

APPLIED MATHEMATICS

(M.S.), Ph.D.

Graduate faculty representative Michael J. Todd, 305 Sage Hall

Subject Applied mathematics

The graduate program in applied mathematics is based on a solid foundation in pure mathematics, which includes the fundamentals of algebra and analysis. It involves a grounding in the methods of applied mathematics and studies of areas in which significant applications of mathematics are made. The field has a broadly based interdepartmental faculty that can direct student programs in a large number of areas of the mathematical sciences.

Many rather specialized or interdisciplinary programs can be designed for the individual student, including, for example, a variety of possibilities in biomathematics.

The program is open to applicants with undergraduate backgrounds that contain a substantial mathematical component. Applicants interested in applied mathematics may also want to investigate programs offered by the Fields of Computer Science, Mathematics, Operations Research, Statistics, and Theoretical and Applied Mechanics and by various other fields in the physical sciences and engineering.

All applicants should submit GRE scores, and foreign students for whom English is not the native language should submit TOEFL scores.

A candidate for the Ph.D. degree must demonstrate reading knowledge of French, German, or Russian. The thesis is normally a mathematical contribution toward the solution of a problem arising outside mathematics.

Faculty and Specializations

- Toby Berger: information theory; statistical communication; random processes
 Louis J. Billera: combinatorics; game theory
 Robert G. Bland: linear programming; combinatorial optimization; networks and matrices
 James H. Bramble: numerical analysis; partial differential equations
 Herbert J. Carlin: microwave and network techniques
 David A. Caughey: computational fluid dynamics; aerodynamics

- Claude Cohen: fluid dynamics; transport phenomena; light scattering; polymer systems
- Thomas F. Coleman: algorithms; numerical optimization
- Robert Connelly: geometry; topology
- Robert L. Constable: theory of computing; automata; logic
- David F. Delchamps: linear and nonlinear dynamical systems; control theory; estimation and identification
- Richard T. Durrett: probability theory
- Eugene B. Dynkin: probability theory
- Gregory S. Ezra: theoretical chemistry; chemical physics
- Roger H. Farrell: mathematical statistics
- Terrence L. Fine: decision theory; foundations of probability; modeling
- Michael E. Fisher: foundation and applications of statistical mechanics; combinatorics
- Leonard Gross: analysis; mathematics of quantum theory
- Keith E. Gubbins: statistical mechanics of liquids; computer simulation of liquids
- John Guckenheimer: dynamical systems; differential equations
- Timothy J. Healey: nonlinear structural and solid mechanics; bifurcation theory; computational mechanics
- David C. Heath: applied probability; stochastic control; game theory
- Chris Heegard: communications; information systems
- Philip Holmes: nonlinear mechanics; dynamical systems; bifurcation theory
- John H. Hubbard: fractals; iteration; ordinary differential equations
- Chung-Yuen Hui: fracture mechanics; high-temperature crack propagation; geomechanics; asymptotic methods
- Robert A. Jarrow: mathematical economics
- James T. Jenkins: nonlinear field theories in mechanics; continuum mechanics
- Harry Kesten: probability theory
- Myunghwan Kim: biomathematics; bioengineering
- James A. Krumhansl: solid state physics; microscopic description of macroscopic properties of materials
- Sidney Leibovich: fluid dynamics; magnetohydrodynamics
- Simon A. Levin: mathematical biology; differential equations
- Richard L. Liboff: kinetic theory; plasma physics; electrodynamics; quantum mechanics
- Franklin T. Luk: parallel matrix computations
- John L. Lumley: fluid mechanics; stochastic processes; turbulence
- Mukul K. Majumdar: mathematical economics
- Anil Nerode: logic; recursive functions and computability; automata
- Lawrence E. Payne: partial differential equations
- S. Leigh Phoenix: probability models of the failure of materials
- Stephen B. Pope: turbulence; combustion; computational fluid mechanics
- Narahari Umanath Prabhu: stochastic processes; analysis and control of stochastic systems
- Richard H. Rand: differential equations; dynamical systems; biomechanics
- Edwin E. Salpeter: theoretical astrophysics; nuclear theory; statistical mechanics
- Thomas J. Santner: biomedical statistics; discrete data; selection theory
- Alfred H. Schatz: numerical analysis; partial differential equations
- Karl Shell: extrinsic uncertainty in economics; overlapping generations economies; dynamical systems
- Shan-fu Shen: aerodynamics; rarefied gas dynamics
- Christine Shoemaker: applications of optimization methods to environmental and ecological problems
- Frank L. Spitzer: probability theory and analysis
- Jery R. Stedinger: stochastic hydrology; water resource systems
- Paul H. Steen: hydrodynamic stability; nonlinear fluid dynamics
- James Shelby Thorp: optimal control with application to power systems and robotics
- Michael J. Todd: mathematical programming; combinatorics
- Leslie E. Trotter: discrete optimization
- Charles F. Van Loan: numerical analysis
- Lars B. Wahlbin: numerical analysis of partial differential equations
- Lionel I. Weiss: statistical decision theory
- Benjamin Widom: physical chemistry; statistical mechanics

APPLIED PHYSICS

(M.S.), Ph.D., M.Eng.(Engineering Physics)

Graduate faculty representative Robert A. Buhrman, 211 Clark Hall

Subjects Applied physics (only students not majoring in applied physics may take this as a minor); engineering physics [M.Eng.]

Graduate study in the field offers the opportunity to achieve proficiency in physics, mathematics, and applied science. Applied physics is particularly suitable for students preparing for a scientific career in areas of applied science based on principles and techniques of physics.

A student may choose for specialization and thesis research any subject compatible with an approach based on the application of principles of physics and mathematics. Current areas of advanced study and research include applied theoretical physics, biophysics, chemical physics, cryogenics, physics of fluids, nuclear and reactor physics, optics, plasma physics, radiation and matter, solid-state physics and materials science, space physics, and surface physics. Additional details about current programs are given in brochures obtainable from the graduate faculty representative.

Students in applied physics usually receive some sort of financial aid during their entire graduate study program, including summers. Most students serve as research assistants at least during the period of thesis research.

Applicants should have undergraduate preparation in physics or another physical science or in an engineering field with strong emphasis on mathematics and modern physics. Submission of GRE general test scores is required. The GRE subject test in physics is recommended.

In addition to the examinations required by the Graduate School, every student in the Ph.D. program takes a written qualifying examination covering the core course program after three semesters of graduate study.

A professional degree program leading to the degree of Master of Engineering (Engineering Physics) offers students the opportunity to master advanced topics in physics and extend their skills in their chosen engineering specialties.

The field does not usually accept students into a terminal M.S. degree program but grants the M.S. degree as part of the doctoral program.

Faculty and Specializations

- Dieter G. Ast: amorphous materials and polymeric materials
- Peter L. Auer: energy policy; plasma physics
- Joseph M. Ballantyne: integrated optical devices; semiconductor lasers and detectors; solar cells
- Boris W. Batterman: solid-state physics; synchrotron radiation; X-ray and neutron diffraction
- John M. Blakely: surface physics and chemistry
- Robert A. Buhrman: superconducting devices; solid-state and low-temperature physics; submicron lithography
- K. Bingham Cady: reactor physics
- David D. Clark: experimental nuclear and reactor physics
- Terrill A. Cool: molecular lasers; chemical physics
- P. C. Tobias de Boer: high-temperature gas dynamics; plasma physics
- Lester F. Eastman: microwaves; solid-state plasma
- Donald T. Farley: geomagnetic physics
- Michael E. Fisher: mathematical physics; statistical mechanics; phase transitions and critical phenomena
- Hans H. Fleischmann: plasma physics; thermonuclear fusion
- Keith E. Gubbins: statistical mechanics of liquids; liquid surfaces
- David A. Hammer: plasma physics; thermonuclear fusion
- Martin O. Harwit: astrophysics
- James R. Houck: astrophysics
- Paul L. Houston: molecular and chemical physics
- Michael S. Isaacson: scanning transmission electron microscopy; electron nano-lithography
- Bryan L. Isacks: seismology; global tectonics
- Herbert H. Johnson: mechanical behavior of solids
- Michael C. Kelley: geomagnetic physics
- Paul M. Kintner: geomagnetic physics
- Vaclav O. Kostroun: low-energy nuclear and atomic physics
- Edward J. Kramer: low-temperature physics; polymers
- James A. Krumhansl: theoretical and applied physics
- J. Peter Krusius: semiconductor device and process physics
- Arthur F. Kuckes: geophysics; plasma physics
- Bruce R. Kusse: electron-beam physics; plasma physics

Charles A. Lee: solid-state physics; semiconductors

Aaron Lewis: cellular biophysics; transduction mechanisms in visual photoreceptor cells; active transport across cell membranes

Richard L. Liboff: plasma physics; statistical mechanics

Richard V. E. Lovelace: plasma-physics theory; astrophysics

Noel C. MacDonald: solid-state electronic devices; nanostructure fabrication; particle-beam instrumentation

James W. Mayer: particle-solid and solid phase reactions

Robert P. Merrill: surface physics

John K. Moffat: protein crystallography; structure and function of proteins

John A. Nation: plasma physics; thermonuclear fusion

Mark S. Nelkin: statistical physics; turbulent fluid flow

Jack E. Oliver: seismology; global tectonics

Clifford R. Pollock: lasers; molecular spectroscopy; quantum electronics

Thor N. Rhodin: physics and chemistry of surfaces; interfaces of metals and semiconductors

Arthur L. Ruoff: high-pressure phenomena; imperfections in crystals; creep

Miriam M. Salpeter: biophysics

Charles E. Seyler, Jr.: plasma physics and space plasma; relativistic electron beams; fusion

John Silcox: electron microscopy and spectroscopy

Roger M. Spanswick: biophysics; ion transport

Ravindra N. Sudan: plasma physics

Chung-liang Tang: quantum electronics

Donald Turcotte: aerospace engineering; gas dynamics; geophysics

Watt W. Webb: cellular biophysics; chemical physics; cooperative phenomena; hydrodynamics; physical optics; photon correlation spectroscopy

Charles B. Wharton: plasma physics; microwave electronics

John R. Wiesenfeld: physical chemistry; chemical physics; chemical lasers; chemical application development

Edward D. Wolf: microcircuits; solid-state devices

George J. Wolga: magneto-optics; quantum electronics; light scattering in solids; photoacoustic spectroscopy

ARCHITECTURE

M.A., M.S., Ph.D., M.Arch.

Graduate faculty representative Werner H. Goehner, 155 East Sibley Hall

Subjects Architectural science [M.S.] (building technologies and environmental science; computer graphics); design [M.Arch.] (architectural design; theory and criticism of architecture [minor only]; urban design); history of architecture and urban development [M.A., Ph.D.] (history of architecture; history of urban development; theory and criticism of architecture [minor only])

Graduate study in the Field of Architecture may be pursued in design, leading to the Master of Architecture degree; in architectural science, leading to the degree of M.S.; or in history of architecture and urban development, leading to an M.A. and/or a Ph.D. degree. There is a joint degree program with the Field of City and Regional Planning. Every applicant for graduate work is expected to specify in advance the intended program of study.

Foreign students whose undergraduate training has been completed outside the United States are admitted to provisional candidacy. They should plan to spend at least four terms in residence for the master's degree.

GRE general test scores are required of all applicants who reside in the United States and are recommended for foreign students.

Design

Students who have satisfactorily completed an accredited undergraduate professional program for the Bachelor of Architecture (B.Arch.) degree may be admitted as candidates for the degree of Master of Architecture. Those who have completed four years of a six-year degree program with a major in architecture or environmental design, or who have yet to receive a qualifying professional degree, should apply as transfer students to the undergraduate program, since the B.Arch. is the qualifying degree at Cornell. On fulfilling the requirements for the B.Arch., they may be admitted to the graduate program.

Two areas of major concentration are offered: architectural design and urban design. These areas are sufficiently broad to verge on each other while focusing in general on the scale of problems suggested by the designation. It is assumed that each student will develop an elective program to

reinforce and supplement studio work. Normally four terms of study are required, and the student should not anticipate completing studies in less than this time.

The programs leading to the M.Arch. are administered by Program Concentration Committees, consisting of the graduate faculty representative and those faculty offering work in the area of the concentration. The Special Committee includes two advisers in the area of the major concentration, one adviser in the area of minor concentration, and additional members at the student's option. The thesis is directed by the Special Committee.

History of Architecture and Urban Development

Applicants should have an undergraduate degree in architecture, archaeology, history, history of art, anthropology, or appropriate experience in the field. Individuals residing in the United States must submit GRE scores. Candidates may apply for the master's or doctoral programs in architectural history or urban development history. Applicants with previous graduate work can be considered for advanced standing. Master's candidates in the history of architecture or urban development programs are required to have reading proficiency in at least one modern language other than English; Ph.D. candidates must have proficiency in two languages other than English before beginning the second year of study.

This area offers many opportunities for enrichment by working with other educational institutions and public or nonprofit agencies. Cornell cooperates with Harvard University in the archaeological exploration of Sardinia in Turkey. Qualified students are encouraged to participate as archaeological assistants on this and other excavations in the Mediterranean area. An overseas program that can be taken for academic credit is conducted each summer. Cornell programs in Washington, D.C., and Rome are available to students for research and course work throughout the academic year. Students and faculty often work with summer programs in architectural design, history of architecture, and landscape architecture offered by departments and graduate fields.

Architectural Science

Students with undergraduate degrees in architecture, architectural engineering, or the various branches of engineering or computer science are likely candidates for the

graduate program in architectural science. Its objectives are (1) to afford an opportunity for students of architecture to expand their creative design potential by increasing their knowledge and understanding of environmental science and building technologies and (2) to provide a framework within which students who have graduated in other technical disciplines may explore computer science, computer graphics, and computer-aided design methods. Students enrolling for studies in computer graphics use the facilities of the interdisciplinary Laboratory of Computer Graphics.

Ordinarily four terms of residence will be required to complete the program of study, depending on the student's background and experience.

Faculty and Specializations

James W. Axley: architectural technology
 Michael F. Cohen: computer graphics
 Michael D. Dennis: architectural design; urban design; theory of architecture
 Werner H. Goehner: architectural design; urban design; theory of architecture
 Donald P. Greenberg: architectural technology; structural analysis and design; suspension structures
 Lee F. Hodgden: architectural design; theory and criticism (for M.Arch. degree *only*)
 Barclay G. Jones: architectural history; architectural structures; city and regional planning
 Alexander Kira: human engineering and psychological aspects of architecture
 Martin Kubelik: architectural history
 Archie B. MacKenzie: architectural design methods; urban design
 John C. Miller: architectural design
 Vincent Mulcahy: architectural design
 John P. Ostlund: architectural design
 Christian F. Otto: architectural history
 Kermit C. Parsons: urban design; land use; institutional planning; history of collegiate architecture
 Charles W. Pearman: architectural design; urban design; housing; building systems
 Tom F. Peters: architectural technology
 John W. Reps: city and regional planning
 Henry W. Richardson: architectural design; urban design; housing in developing countries
 Colin Rowe: history of Renaissance and modern architecture; urban design; architectural criticism; contemporary European and American architecture
 Mario L. Schack: architectural design; urban design

John P. Shaw: architectural design; urban design
 Stuart W. Stein: urban design; site planning; urban renewal; housing
 Oswald M. Ungers: housing; urban design
 Val K. Warke: architectural design; theory of architecture
 J. Alan Wells: urban design; housing; building systems
 Mary N. Woods: architectural history

ART

M.F.A.

Graduate faculty representative Zevi Blum, 100 Tjaden Hall

Subject Creative visual arts (graphic arts; painting; photography; sculpture)

Applicants must have a bachelor's degree or its equivalent and must clearly demonstrate professional promise in art by submission of a slide portfolio (maximum, twenty slides). Further information is available from the graduate faculty representative.

The Master of Fine Arts program requires four terms of residence and sixty credits and is intended for those who want to further their education as artists. Candidates must complete eighteen credits for courses in the history of art, either as graduate or undergraduate students, and must earn at least twelve credits for academic work outside the Department of Art.

The buildings that house the programs are open twenty-four hours a day; they are adjacent to the Fine Arts library (100,200 volumes) and next door to the university's Herbert F. Johnson Museum of Art.

Every M.F.A. candidate must (1) prepare a written thesis, (2) offer a thesis exhibition of studio work completed during residency, and (3) give an oral defense of the written thesis and exhibition. The written thesis may deal with the major concerns of the student's own work or with some aesthetic or historical issue in art. The oral defense of the written thesis is to be presented at the time of the thesis exhibition.

Graduate painting is under the direction of Professors Blum, Mikus, Singer, and Taft. Students work in private studios in Tjaden Hall. Graduate sculpture is under the direction of Professors Bertoia, Cole, and Squier. The sculpture program has its own building, a 45-by-180-foot converted foundry with 14-foot ceilings and a bronze casting facility. Separate studios, complete gas- and arc-welding facilities, heavy-duty grinders, a

drill press, a band saw, and a variety of portable power tools are provided. Graduate students in the graphic arts program study the various techniques, including relief, intaglio, lithography, and various photographic processes. Experiment and tradition, theory, history, and practice are part of the program. Graduate graphic arts is under the direction of Professors Poleskie, Page, and Meyer. The program's facilities in Olive Tjaden Hall include etching presses, lithographic presses, and proof presses. The photography program, directed by Professors Bowman, Locey, and Perlus, has facilities in Sibley Hall, which is located next to Olive Tjaden Hall. The program involves the study of various photographic processes such as black and white, color, nonsilver, and large-format, with emphasis on both aesthetics and technique.

Faculty and Specializations

Roberto G. Bertoia: sculpture
 Zevi Blum: drawing
 Stanley J. Bowman: photography
 James W. Cole: sculpture
 Richard Estell: painting (*available for consultation 1987-88*)
 Jean N. Locey: photography
 Elisabeth H. Meyer: graphic arts
 Eleanore A. Mikus: painting and drawing
 Gregory Page: painting and drawing
 Barry A. Perlus: photography
 Steve Poleskie: graphic arts
 Arnold Singer: painting and drawing
 Jack L. Squier: sculpture
 W. Stanley Taft: painting

ASIAN STUDIES

M.A.

Graduate faculty representative Edward M. Gunn, 375 Rockefeller Hall

Subject Asian studies (East Asian studies; Southeast Asian studies; East Asian linguistics [minor only]; South Asian linguistics [minor only]; Southeast Asian linguistics [minor only])

Asian studies is available as a minor field of concentration for Ph.D. candidates admitted in a major field of the Graduate School. The Ph.D. candidate may select a minor in the field consisting of either (a) concentrated interdisciplinary study of one area of Asia or (b) disciplinary or topical concentration that cuts across area boundaries. Since specialization in Asian studies usually involves the study of an Asian language, it is essential that the

candidate discuss language work with the entire Special Committee, particularly with the member representing the major field.

Major and minor work is also offered in various social science fields and in oriental art, East Asian literature and religion, medieval or modern Chinese history, and Southeast Asian history.

M.A. candidates may major in East Asian or Southeast Asian studies. This program is designed for students whose career goals require only the M.A. degree, as well as for those who want to continue in a major Ph.D. field but do not have the necessary language or area background.

Proficiency in speaking and reading Chinese or Japanese is required for the M.A. in East Asian Studies. Candidates who have never studied an East Asian language will be expected to complete Cornell's FALCON Program. This program offers full-time intensive language training in Chinese and Japanese. Thereafter each candidate must complete one year of full-time study (normally four courses each semester) in Asian studies. Students who have some previous language training will have language programs individually designed for their particular needs and may, if they are advanced enough, complete the M.A. requirements in as little as one academic year. All students are required to write an M.A. thesis.

The M.A. in Southeast Asian studies requires a minimum level of proficiency in one or more Southeast Asian languages, the equivalent of three years of nonintensive language study. This can be obtained in two academic years plus one summer, or in two summers and one academic year. For those interested in Indonesia, the language requirement can be satisfied through enrollment in Cornell's FALCON program for Indonesian. In addition to language study, each M.A. candidate is expected to complete successfully a minimum of eight one-semester courses. While most of these courses are expected to be those taught by Southeast Asian Program faculty, it is also possible to enroll in other courses in the social sciences and humanities. A written thesis thirty to fifty pages in length must be submitted by all candidates on a topic approved by the thesis adviser. The M.A. thesis should be an independent contribution to scholarship on Southeast Asia.

Cornell has three programs concerned with teaching and research on Asia—the China-Japan Program, the South Asia

Program, and the Southeast Asia Program (see pp. 131 and 136). The Southeast Asia Program in languages and area studies receives funding through the Higher Education Act of the U.S. Department of Education.

Asian languages currently offered are Burmese, Cambodian, Cebuano, Chinese (Mandarin, Cantonese, and Hokien), Hindi-Urdu, Indonesian, Japanese, Javanese, Malay, Pali, Sanskrit, Sinhalese, Tagalog, Tamil, Telegu, Thai, and Vietnamese.

Graduate students in Asian studies are eligible for the Foreign Language and Area Studies (FLAS) Fellowships offered by the U.S. Department of Education; application forms should be requested from the Graduate School. They are also eligible for the Foreign Area Training Fellowships administered by the Social Science Research Council for study in the United States and for research overseas. Qualified graduate students who are citizens of the United States may apply for Fulbright research awards for Taiwan, India, Indonesia, Japan, Malaysia, Pakistan, the Philippines, and Thailand.

All applicants are required to submit GRE test scores (general and subject tests).

For additional details, consult the Department of Asian Studies, 388 Rockefeller Hall.

Faculty and Specializations

China

Martin G. Bernal: political science
Sherman G. Cochran: history
Patricia J. Graham: art history
Edward M. Gunn, Jr.: modern literature
C. T. James Huang: linguistics
Lee C. Lee: human ecology
Tsu-Lin Mei: literature and philosophy
Victor Nee: sociology
Charles A. Peterson: medieval history
Paul S. Sangren: anthropology
Vivienne B. Shue: government
Julian K. Wheatley: linguistics
Martie W. Young: art history

Japan

Karen Brazell: literature
Brett deBary: literature
Bernard R. Faure: religion
Eleanor H. Jorden: linguistics
J. Victor Koschmann: history
T. John Pempel: government
Robert J. Smith: anthropology
Martie W. Young: art history

South Asia

Eugene C. Erickson: rural sociology
 James W. Gair: linguistics
 David H. Holmberg: anthropology
 Mary F. Katzenstein: government; India; ethnicity
 Kenneth A. R. Kennedy: anthropology
 Kathryn S. March: anthropology
 Gordon M. Messing: classics and linguistics
 Stanley J. O'Connor: art history
 Thomas T. Poleman: agricultural economics

Southeast Asia

Benedict R. Anderson: government
 Randolph Barker: agricultural economics
 James A. Boon: anthropology
 E. Walter Coward, Jr.: rural sociology
 Gary Fields: labor economics
 Martin F. Hatch: music
 Franklin E. Huffman: linguistics
 Robert B. Jones, Jr.: linguistics
 George McT. Kahin: government
 Anthony T. Kirsch: anthropology
 Stanley J. O'Connor: art history
 Takashi Shiraishi: history
 James T. Siegel: anthropology
 John U. Wolff: linguistics
 David K. Wyatt: history

Visiting Professors

Southeast Asia: Alexander B. Griswold,
 Breezewood Foundation; Carolina G.
 Hernandez, University of the Philippines;
 Christine P. White, Sussex University
 China-Japan: Thomas Lyons, visiting
 assistant professor of economics

ASTRONOMY AND SPACE SCIENCES

M.S., Ph.D.

Graduate faculty representative Joseph F. Veverka, 312 Space Sciences Building

Subject Astronomy (astronomy; astrophysics; infrared astronomy; planetary studies; radio astronomy; radiophysics; space sciences [general])

Students admitted to this field must have a strong background in electrical engineering, engineering physics, mathematics, or, especially, physics. The GRE general test and the subject test in physics are required and are often of great help in admitting outstanding students from less well known institutions.

Research Opportunities

Members of the staff are particularly interested in directing graduate research in the following subjects:

Astronomy and astrophysics Relativity and cosmology; dynamics of the interstellar gas; solar system dynamics and magnetohydrodynamics; theory of stellar structure; stellar evolution; nuclear astrophysics; stellar systems and stellar statistics; gravitational theory; X-ray sources; black holes; chemistry of interstellar medium

Atmospheric and ionospheric radio investigations Dynamics of the atmosphere and ionosphere; incoherent electron scattering; refraction, scattering, and attenuation due to the inhomogeneous nature of the troposphere and ionosphere; propagation of radio waves and ionized media

Infrared astronomy Spectroscopic studies of dust clouds, ionized hydrogen regions, and shocked regions; development of novel spectrometric techniques; observations from ground-based telescopes and aircraft

Planetary studies Observational, theoretical, and laboratory studies of planetary atmospheres, surfaces, and interiors; spacecraft investigations such as *Viking*, *Voyager*, and *Galileo*, and earth orbital missions; investigations of asteroids, comets, and ring systems; dynamics of planetary atmospheres; exobiology and prebiological organic chemistry

Radio astronomy Distribution and classification of radio sources; radar investigations of the planets and asteroids; solar radio observations; studies of gaseous nebulae; interstellar radio lines; radio galaxies, quasars, and pulsars

Space vehicle instrumentation Instrumentation relating to solar system exploration, including cameras and spectral mappers; tenuous gas and particle-flux measurements; infrared observations from rockets and satellites

Graduate students in this field may be connected with the Cornell University Center for Radiophysics and Space Research, which possesses and is planning important facilities for solar system investigations both by space vehicle and by radio methods. Center personnel use large optical telescopes in the American Southwest and Hawaii and actively cooperate with the Jet Propulsion Laboratory and NASA centers such as Goddard and Ames. Students may also be connected with the Cornell-operated National Astronomy and Ionosphere Center, in Arecibo, Puerto Rico, the largest radar-radio telescope in the world. Students often conduct thesis research at Arecibo or at other major radio observatories.

Further details of the above organizations and facilities are available in brochures and can be obtained by writing to the respective organizations or to the graduate faculty representative.

Faculty and Specializations

Stephen V. Beckwith: infrared astronomy; molecular spectroscopy; interstellar clouds
 Arthur L. Bloom: geomorphology; planetary geosciences
 Joseph A. Burns: solar system physics; celestial mechanics
 Donald B. Campbell: radar astronomy; planetary studies
 James M. Cordes: radio astronomy; pulsar research
 Donald T. Farley: electrical engineering; ionospheric physics
 Peter J. Gierasch: atmospheric dynamics and planetary meteorology
 Riccardo Giovanelli: observational cosmology; galactic structure
 Thomas Gold: solar system physics; high-energy astrophysics; cosmology
 Tor Hagfors: ionospheric studies; radar astronomy
 Martin O. Harwit: infrared astronomy; interstellar and interplanetary dust; optical-transform techniques
 Martha P. Haynes: radio astronomy; galaxy evolution; structure of superclusters
 James R. Houck: infrared astronomy; interstellar and interplanetary dust
 Michael C. Kelley: electrical engineering; ionospheric physics
 Richard V. E. Lovelace: plasma astrophysics; galactic structure
 Philip D. Nicholson: planetary sciences; celestial mechanics
 Carl E. Sagan: planetary studies; solar system and interstellar organic chemistry
 Edwin L. Salpeter: theoretical physics; astrophysics; radio astrophysics
 Stuart L. Shapiro: theoretical and relativistic astrophysics
 Stephen W. Squyres: surfaces and interiors of planets, satellites, and comets
 Ravindra N. Sudan: electrical engineering; plasma physics
 Yervant Terzian: radio astronomy; interstellar matter; radio galaxies
 Saul A. Teukolsky: relativistic astrophysics
 Donald Turcotte: geophysics; planetary geosciences
 Joseph F. Veverka: planetary and satellite surfaces; asteroids and comets
 Ira M. Wasserman: theoretical astrophysics

BIOCHEMISTRY, MOLECULAR AND CELL BIOLOGY

(M.S.), Ph.D.

Graduate faculty representative

Gerald W. Feigenson, 252 Clark Hall

Subjects Biochemistry (biochemistry; biophysics [minor only]); molecular and cell biology (cell biology; molecular biology; biophysics [minor only])

Prior training should include calculus, physics, and chemistry sequences through introductory physical chemistry and general biochemistry. The GRE general test and subject test in chemistry or biology are required.

Ph.D. candidates are required to teach for two semesters. The field has no foreign language requirement.

Ph.D. candidates who intend to minor in biochemistry should consult a member of their field as soon as possible. Approximately eleven credits of upper-level biochemistry course work, including a laboratory course, are required for the minor.

Faculty and Specializations

William J. Arion: structure, function, and regulation of the hepatic glucose-6-phosphatase system; metabolite transport systems in the hepatic and renal endoplasmic reticulum
 Barbara A. Baird: molecular immunology; membrane biochemistry
 R. Barker: carbohydrates; glycosyl transferases; sugar phosphates
 Anthony P. Bretscher: cytoskeleton
 William J. Brown: targeting of newly synthesized proteins
 Joseph M. Calvo: control of metabolic pathways in bacteria; bacterial genetics
 Colin T. Campbell: role of nutrition in chemical carcinogen metabolism; adducts of carcinogen metabolites and macromolecules
 Gerald W. Feigenson: lipid-protein interactions; calcium-induced membrane rearrangements related to fusion
 June Fessenden-Raden: biochemistry; public policy
 Thomas D. Fox: mitochondrial genetics
 A. Jane Gibson: growth regulation and membrane function in photosynthetic prokaryotes
 Quentin H. Gibson: hemoproteins; flavoproteins; rapid-reaction spectrophotometry; physical methods in enzyme kinetics
 Gordon G. Hammes: biophysical chemistry, especially enzyme kinetics and mechanisms

- Leon A. Heppel: nucleic acid biochemistry; transport and energy coupling in bacteria; membrane properties of tumor cells
- George P. Hess: protein chemistry; chemical and kinetic studies of the interrelationship of structure and function in proteins, with special reference to acetylcholine receptor—mediated ion flux
- Peter C. Hinkle: mitochondrial ion transport and oxidative phosphorylation
- Andre T. Jagendorf: electron transport and phosphorylation mechanisms in chloroplasts; synthesis of chloroplast proteins
- Michael N. Kazarinoff: enzyme structure and function; protein metabolism
- Elizabeth B. Keller: messenger RNA synthesis on DNA and its use for protein synthesis
- A. Lewis: vision; bacteriorhodopsin; laser resonance; Raman spectroscopy
- John T. Lis: control of gene expression in *Drosophila*
- Richard E. McCarty: photosynthetic phosphorylation and electron transport
- Russell E. MacDonald: microbial membrane transport; energy coupling; regulation of cell growth
- James T. Madison: amino acid and protein synthesis in plants
- John K. Moffat: X-ray determination of protein structure; relationship between structure and function in hemoglobin and calcium-binding proteins; time-resolved diffraction
- Efraim Racker: mechanisms of enzyme action; control mechanism, structure, and function in mitochondria and chloroplasts; mechanisms in bioenergetics
- Jeffrey W. Roberts: biochemistry of genetic control
- Miriam Salpeter: functional ultrastructure and cellular interactions in the nervous system; techniques in quantitative EM autoradiography
- Harold A. Scheraga: protein structure
- John F. Thompson: mechanisms and controls of storage-protein synthesis in legume seeds; nitrogen and sulfur metabolism of plants
- Bik-Kwoon Tye: mechanism and regulation of DNA replication
- Virginia Utermohlen: cell-mediated immunity and slow virus diseases; fatty acids and immunity
- Volker M. Vogt: structure and assembly of tumor viruses; gene expression in slime molds
- Malcolm Watford: metabolic regulation
- Watt W. Webb: biological membranes
- David B. Wilson: biochemical genetics; membrane transport
- Mariana F. Wolfner: control of gene expression during *Drosophila* development
- John F. Wootton: enzyme chemistry; relationships between structure and function
- Ray J. Wu: nucleotide sequence analysis of phage and viral DNA; control of enzyme and DNA synthesis in eucaryotic cells
- Donald B. Zilversmit: lipid and lipoprotein transport; membrane structure; atherosclerosis

BIOMETRY

M.S., Ph.D.

Graduate faculty representative Steven J. Schwager, 337 Warren Hall

Subject Biometry

Applicants must have evidence in their bachelor's or master's transcript of strength in the biological and mathematical sciences or equivalent experience. Students are required to submit scores from the GRE general test.

The program in biometry deals with the development and application of statistical and mathematical methods in biology. Research may involve purely theoretical work, computer simulation studies, innovative statistical analyses of real data, or a combination of these approaches.

In addition to the other examinations required by the Graduate School, the field requires a qualifying examination taken after the second term of residence.

Faculty and Specializations

- Naomi S. Altman: time series; nonlinear smoothing
- George Casella: estimation and testing; regression
- Walter T. Federer: design and analysis; biological statistics
- Charles E. McCulloch: ecological statistics; linear models
- Douglas S. Robson: biological statistics; sampling theory
- Thomas J. Santner: loglinear models; selection and ranking
- Steven J. Schwager: multivariate analysis; data analysis
- Shayle R. Searle: linear models; variance components
- Bruce W. Turnbull: biomedical statistics; reliability and life testing

BOTANY

(M.S.), Ph.D.

Graduate faculty representative Karl J. Niklas, 214 Plant Science Building

Subject Botany (cytology; mycology; paleobotany; plant cell biology; plant ecology; plant molecular biology; plant morphology and anatomy; plant physiology; systematic botany)

Applicants are required to submit GRE test scores. Successful applicants usually achieve a combined verbal and quantitative score of at least 1,200. Students who want to major in plant physiology are advised to obtain a background in calculus, inorganic and organic chemistry, and physics before entry. Students who want to major in plant ecology should apply through the Field of Ecology and Evolutionary Biology.

Prospective applicants are invited to correspond with faculty in their area of interest. Further details, including descriptions of courses available in the field, can be obtained from the graduate faculty representative.

In addition to a major subject in the Field of Botany, students also take course work in two other subjects of their choice, either within or outside the field. The Field of Botany has no language requirement, but individual advisers may require proficiency in one or two languages for the Ph.D. and in one language for the master's.

Research Facilities

The field offers facilities for all research programs related to the special interests of its faculty. Modern instrumentation, ranging from ultracentrifuges and electron microscopes to a gas chromatograph/mass spectrometer for hormone identification, is routinely available, as are growth and culture chambers and greenhouse facilities. The library is well stocked in botanical volumes, and the herbaria collectively represent one of the nation's major systematics resources. Cornell owns many nearby areas that are available for student research. Most of them are undeveloped and include a variety of habitats; some, however, such as the experimental ponds, are developed for specific research needs.

Students majoring in plant physiology will be able to obtain training leading to professional competence in the physiology, biochemistry, biophysics, or cellular biology of plants. Research may be directed toward fundamental science or toward the interface between theory and agricultural or oceanographic applications.

Requirements for Majors in Plant Physiology

In addition to advanced courses in the three main areas of plant physiology (water and ion movements, plant biochemistry, and plant development), degree requirements include a minimum of one intermediate or higher-level course in three other relevant biological subjects (e.g., animal physiology, cell biology, cytology, ecology, genetics, microbiology, plant morphology, and plant pathology) and one course in each of two supporting fundamental sciences (usually biochemistry and either organic or physical chemistry, biophysics, or relevant mathematics, including computer science). These requirements may coincide in part with those of the minor subjects or may be satisfied by courses taken before entry.

Faculty and Specializations

- Ruth Alscher: light-mediated regulation of chloroplast metabolism; oxygen toxicity: physiological and metabolic consequences for plants of environmental stress (air pollutants, herbicides)
- David M. Bates: biosystematics and evolution of flowering plants; ethnobotany
- Brian F. Chabot: physiological ecology and population biology
- Leroy L. Creasy: physiology and biochemistry of plant phenolics
- Peter J. Davies: use of genotypes in the investigation of controls in plant development; physiology and hormonal regulation of plant senescence, stem elongation, and fruit ripening
- Jerrold I. Davis: plant systematics
- Jeffrey J. Doyle: molecular approaches to plant systematics; evolutionary studies of gene structure and function
- Elizabeth D. Earle: plant tissue and cell culture; genetic manipulation; cytology and physiology of protoplasts
- Elmer E. Ewing: physiology of tuberization with emphasis on hormonal control; carbohydrate transformations in plants and tubers
- Maureen R. Hanson: structure and function of organelle genomes; nuclear genes for organelle proteins; mitochondrial recombination
- Geza Hrazdina: enzymology of flavonoid biosyntheses; chemistry and enzymology of secondary plant metabolites
- Andre T. Jagendorf: photophosphorylation and chemistry of the coupling factor; chloroplast ribosomes and protein synthesis

- Leon V. Kochian: mechanism(s) and regulation of root ion transport; interactions at the root-soil interface; ion selective microelectrode and electro-physiological studies of root-cell membranes
- Richard P. Korf: systematics and nomenclature of fungi, lichens, and mycetozoa
- Thomas A. LaRue: biological nitrogen fixation; metabolism and analysis of nitrogenous compounds
- A. Carl Leopold: developmental physiology; seed physiology; physiology of senescence; physiology of growth regulation
- Pamela M. Ludford: postharvest physiology with emphasis on hormonal balances that influence storage and yield
- Richard E. McCarty: plant molecular biology; bioenergetics of photosynthesis
- Peter L. Marks: plant succession; woody plant demography; plant community
- Martha A. Mutschler: physiological genetics in tomato and *Brassica* species; insect resistance and ripening
- June B. Nasrallah: self-incompatibility phenomena in plants
- Fayek Negm: carbohydrate metabolism in higher plants
- Karl J. Niklas: plant evolution and functional morphology
- Kevin C. Nixon: plant systematics
- Ralph L. Obendorf: seed physiology; seed formation; germination; seedling growth
- Thomas G. Owens: photosynthesis in algae and higher plants; algal light-harvesting complexes; excitation energy transfer and electron transport; light adaptation in algae
- Peter F. Palukaitis: development of plant virus vectors; isolating stress-inducible genes; molecular mechanisms of plant-virus interactions
- Dominick J. Paolillo, Jr.: developmental plant morphology and anatomy
- Mandayam V. Parthasarathy: cytoskeleton; cell motility; cytology; phloem structure and function
- Lloyd E. Powell, Jr.: plant hormones; shoot growth and dormancy; growth and development, especially of woody plants
- Timothy L. Setter: photosynthate assimilation and partitioning; sugar transport in sink tissues; seed development and storage processes
- Roger M. Spanswick: ion transport in plant cells; partitioning of photosynthate in plants and transport of organic molecules into developing embryos; mechanisms of chilling injury and disease resistance involving calcium
- Peter L. Steponkus: stress physiology; cold acclimation and freezing injury; drought resistance
- Aladar A. Szalay: molecular genetics of nitrogen fixation; homologous recombination in blue-green algae; chromosomal gene transfer in plant cells using promoter fusions
- Steven D. Tanksley: structural analysis of higher plant nuclear genome using electrophoretic methods with marker DNA restriction fragments
- John F. Thompson: reactions and control mechanisms in amino acid biosynthesis and protein synthesis; seed storage proteins and their genes
- Robert Turgeon: leaf development and movement of photosynthates; crown gall physiology
- Natalie W. Uhl: systematics and anatomy of the Palmae and other monocotyledons
- Norman F. Weeden: genetics and biochemical evolution of flowering plants; subcellular compartmentation of enzymes
- Ray J. Wu: cloning and DNA sequence analysis of plant genes
- Olen C. Yoder: molecular biology of filamentous fungi; molecular mechanisms of host-parasite interaction
- David A. Young: plant systematics; angiosperm phylogeny; cladistics
- Milton Zaitlin: mechanisms of replication and pathogenesis of plant viruses and viroids

CHEMICAL ENGINEERING

M.S., Ph.D., M.Eng.(Chemical)

Graduate faculty representative Claude Cohen, 318 Olin Hall

Subject Chemical engineering (applied mathematics and computational methods; biochemical engineering; chemical reaction engineering; classical and statistical thermodynamics; fluid dynamics, rheology and biorheology; heat and mass transfer; kinetics and catalysis; polymers and materials science; surface science)

Although most applicants will have satisfactorily completed the equivalent of the fundamental work required by an accredited curriculum in chemical engineering, outstanding students with such undergraduate majors as chemistry, materials science, microbiology, or physics are encouraged to apply. Such students will normally require an extra semester or summer term of residence.

Chemical engineering is required of all students, either as a major or as a minor. Candidates are expected to pursue study

and research that will give them a deeper comprehension of the basic and applied sciences and will develop initiative, originality, and creative ability. Theses may involve either research or special projects in such subjects as design, economics, and mathematical analysis. There is no language requirement for students majoring in chemical engineering.

Faculty and Specializations

- A. Brad Anton: mechanisms of reaction on crystal surfaces
- Paulette Clancy: applications of computers in chemical engineering; molecular thermodynamics of fluid mixtures
- Peter Clark: process control; computer-aided design
- Claude Cohen: polymer solutions; polymer composites; rheology; light scattering; injection molding
- Robert K. Finn: fermentation of kinetics; agitation and aeration; microbial polysaccharides; chemical waste treatment
- Keith E. Gubbins: classical and statistical thermodynamics of liquid mixtures; prediction of multicomponent phase equilibria; transport properties; computer simulation of liquids
- Peter Harriott: kinetics and catalysis; process control; diffusion in membranes and porous solids
- Donald L. Koch: rheological and transport properties of suspensions and porous media; applied mathematics
- Robert P. Merrill: surface chemistry and physics; scattering of electrons, atoms, and molecules from solids; catalysis corrosion; adhesion
- William L. Olbricht: fluid mechanics; polymer rheology; biomedical engineering
- Athanassis Panagiotopoulos: thermodynamics of fluids and fluid mixtures; conformations of biological macromolecules; engineering modeling of phase equilibria; thermodynamics of surfaces and micelles
- Ferdinand Rodriguez: polymerization; properties of polymer systems
- George F. Scheele: hydrodynamic stability; coalescence; fluid mechanics of liquid drops and jets
- Michael L. Shuler: food production; immobilized microbes; microbial growth and interaction; growth of plant cells; mathematical models of cells
- Paul H. Steen: fluid mechanics; hydrodynamic stability; mathematical methods in chemical engineering

- William B. Streett: high pressure experiments on fluids; computer simulation
- Raymond G. Thorpe: phase equilibria; fluid flow; kinetics of polymerization
- Robert L. Von Berg: liquid-liquid extraction; reaction kinetics; effect of radiation on chemical reactions; saline-water conversion

CHEMISTRY

(M.S.), Ph.D.

Graduate faculty representative Barry K. Carpenter, 328 Baker Laboratory

Subject Chemistry (analytical chemistry, bioorganic chemistry, biophysical chemistry, inorganic chemistry, organic chemistry, physical chemistry, theoretical chemistry)

With the consent of the Special Committee, a student may elect one or two minors from the above list or from another field.

Applicants for the Ph.D. program should have the equivalent of an A.B. with a major in chemistry, including courses in analytical, inorganic, organic, and physical chemistry as well as mathematics and physics. Unusually promising students may be admitted with deficiencies in undergraduate training but will have to make up the deficiencies. Applicants should take the GRE general test and subject test in chemistry.

The program of graduate study is designed to give broad training in the fundamentals of chemistry and in methods of research. Graduate students will ordinarily pursue those objectives by taking advanced courses, participating in organized and informal seminars, and carrying out and reporting on research projects in their major subject.

Graduate students normally carry on research during the summer and receive financial support for this purpose.

Entering graduate students are required to register with the Department of Chemistry on the registration days at the beginning of their first term. They will consult with the chairperson of the department and with their temporary Special Committees.

Proficiency tests in analytical, inorganic, organic, and physical chemistry will be required of all entering Ph.D. candidates. A proficiency test in biochemistry is offered for students who plan to carry on related work. Those tests are given a few days before registration for the fall term. Results will be used to help the Special Committee plan the student's program. Remedial course work may be required of students with poor test scores.

Students majoring in organic and bioorganic chemistry must pass two cumulative examinations prior to the admission to candidacy examination and six examinations prior to the thesis presentation. In addition, they must prepare and defend an original research proposal, usually after passing the admission to candidacy examination.

Specific inquiries from prospective graduate students are welcomed and should be addressed to the graduate faculty representative or to any member of the faculty. Applications for teaching assistantships should be addressed to the graduate faculty representative. Two brochures, *Introduction to Graduate Study* and *Research Interests of the Faculty*, are available from the graduate faculty representative.

Faculty and Specializations

Hector D. Abruna: analytical
 Andreas C. Albrecht: physical
 Barbara A. Baird: biophysical
 Simon H. Bauer: physical
 Tadhg P. Begley: bioorganic
 James M. Burlitch: inorganic; organic
 Barry K. Carpenter: inorganic; organic
 Jon C. Clardy: analytical; bioorganic; organic
 David B. Collum: organic
 William D. Cooke: analytical
 Gregory S. Ezra: theoretical
 Robert C. Fay: inorganic
 Michael E. Fisher: theoretical
 Jack H. Freed: physical; theoretical
 Bruce Ganem: bioorganic; organic
 Keith E. Gubbins: theoretical
 Gordon G. Hammes: biophysical; physical
 Roald Hoffmann: theoretical
 Paul L. Houston: physical
 Atsuo Kuki: physical
 Fred W. McLafferty: analytical; organic; physical
 John E. McMurtry: bioorganic; organic
 Jerrold Meinwald: bioorganic; organic
 William T. Miller: organic
 George H. Morrison: analytical
 Richard F. Porter: inorganic; physical
 Thor N. Rhodin: physical
 Harold A. Scheraga: biophysical; physical
 Klaus H. Theopold: inorganic
 David A. Usher: bioorganic; biophysical; organic
 Benjamin Widom: physical; theoretical
 John R. Wiesenfeld: physical
 Charles F. Wilcox, Jr.: bioorganic; organic; theoretical
 Peter T. Wolczanski: inorganic

CITY AND REGIONAL PLANNING

M.A., Ph.D., M.R.P.

Graduate faculty representative John Forester, 219 West Sibley Hall

Subjects City and regional planning [Ph.D., M.R.P.]; (city and regional planning, planning theory and systems analysis, regional science, urban and regional theory, urban planning history, environmental planning and design [minor only], international development planning [minor only], regional economics and development planning [minor only], social and health systems planning [minor only]); historic preservation planning [M.A.]

Students in city and regional planning learn to design, evaluate, and implement policies and programs that affect the social, economic, and physical development of urban and regional areas, including those in the Third World.

The field offers programs leading to the professional degree of Master of Regional Planning and the Ph.D. in city and regional planning and the M.A. in historic preservation planning. The field also participates in the program leading to the Master of Professional Studies (International Development M.P.S. (I.D.)). Special joint degree programs are available with the Law School, the Field of Architecture, and the Field of Landscape Architecture. Applicants who have lived in the United States for the past year are required, and others are strongly urged, to submit recent GRE general test scores.

Requirements for the professional degree of M.R.P. differ from those required by the Graduate School for other master's degrees. In this program students may use resources from throughout the university to select an area of specialization from such concentrations as community development and land use; environmental, social, and health systems planning; historic preservation; planning information systems; planning politics; quantitative methods and modeling; and regional and international planning, as well as others listed under faculty specializations. Other specializations in education, housing, manpower, public management, and transportation can be organized in conjunction with programs in other units on the campus. The M.R.P. program normally requires four residence units, sixty credits, and the completion of a satisfactory thesis or project report.

Historic preservation planning is a special program of study preparing students for work

in the history and preservation of buildings in a variety of urban and rural contexts. Two years of course work are normally needed. The M.A. degree requires the student to have successfully completed sixty credits, including a six-credit thesis. All students are required to enroll in a basic core of three preservation classes. In addition, all students must have two semesters of course work in American architectural history. This fundamental requirement may have been satisfied by prior undergraduate work; if not, it should be completed in the first year at Cornell. For the balance of the schedule the student may choose from a number of courses in such areas as the economics of neighborhood conservation, urban history, real estate development, building materials conservation, preservation law, or community assistance design. The summer between the two years is not formally organized; however, students are strongly encouraged to seek employment in the field. The program receives numerous inquiries from public agencies and private firms that are looking for help. In some cases an internship will provide a student with his or her thesis topic.

The M.P.S. (I.D.) program, offered in conjunction with the Field of International Development, is a twelve- to eighteen-month program (2½ residence units) for experienced professionals who have specific training needs or for midlevel professionals from other fields who want short-term training in planning. The program is described in the department's brochure *International Studies in Planning*.

Most Ph.D. candidates transfer from the Cornell M.R.P. program. Applications are also welcomed from outside the university. Most applicants who do not hold M.R.P. degrees from recognized programs will first be required to enroll in the Cornell M.R.P. program and to complete course work at least equivalent to that required for the first year M.R.P. program. Applicants who hold the master's degree in related fields and who have had acceptable experience in planning practice will sometimes be considered for direct admission. Competence in basic analytical and research methods is required. This requirement may be fulfilled after entering the program. The field recommends that a qualifying examination be taken during the first year of study.

Research and Study Opportunities

Some recent research projects and specialized training programs in which faculty and students in the field have been engaged include a work-study training program, a local government assistance program, a study of the effects of natural disasters, a comparative analysis of development policies for lagging regions in the United States and abroad, a history of urban development and planning, an economic/demographic/energy-demand model of New York State, a study of the impact of industrial locations on regional economies, studies of technology assessment and science policy, and evaluations of state environmental policies and technical assistance for urban and regional plans in various developing countries. Research is carried out within the department as well as within such specialized units as the Center for International Studies and the Center for Environmental Research.

Introductions to the various aspects of the field are available through the summer Program in Progressive Planning, the Summer Institute on Historic Preservation Planning, the other formal summer programs, and other summer courses. Details are available in the catalog of the summer session.

The department awards a limited number of teaching and research assistantships and encourages participation in internship programs in Washington, D.C.; Albany, New York; and other urban centers that allow students to spend a semester or a year on a job and in part-time study.

Additional information may be obtained from the graduate faculty representative.

Faculty and Specializations

Lourdes Beneria: labor economics; women's work; international economics; economic development

Richard S. Booth: land-use and environmental law; critical area preservation; historic preservation law

Susan M. Christopherson: changing industrial structures and regional development; gender issues in planning; social geography; culture of cities

Pierre Clavel: administration; regional development

Stan Czamanski: economic analysis; growth models; location theory; regional accounts

- Arch T. Dotson: comparative planning; administrative theory; developing countries
- John Forester: social and political theory; social policy; planning organization; critical theory
- William W. Goldsmith: regional development and administration; political economy; international development
- Barclay G. Jones: quantitative analysis; urbanization theory; environmental health; historic preservation
- David B. Lewis: planning in developing countries; technology transfer
- Dorothy W. Nelkin: science and technology; environmental policy
- Porus Olpadwala: political economy; international rural development; technology development and transfer; transnational corporations
- Kermit C. Parsons: urban land use; large-scale development; university planning
- Sidney Saltzman: quantitative methods and modeling; systems analysis; information processing; regional analysis
- Stuart W. Stein: land use; design; housing; historic preservation
- Ian R. Stewart: urban housing; urban and suburban development; American urban history
- Michael A. Tomlan: building conservation technology; documentation methods for preservation; history of the preservation movement
- Roger T. Trancik: urban design; landscape and environmental planning; urban development issues

CIVIL AND ENVIRONMENTAL ENGINEERING

M.S., Ph.D., M.Eng.(Civil)

Graduate faculty representative James J. Bisogni, 215 Hollister Hall

Subject Civil and environmental engineering (environmental engineering, environmental systems engineering, geotechnical engineering, hydraulics and hydrology, remote sensing, structural engineering, transportation engineering, water resource systems, structural mechanics [minor only])

GRE test results, although not required, are useful in the objective evaluation of credentials, particularly for Ph.D. admission and financial aid decisions.

For either an M.S. or Ph.D. program, an area of concentration may be selected from the above list.

Each student in the Ph.D. program must take a qualifying examination shortly after receiving the M.S., or, if a student comes to Cornell with an M.S., within nine months after arrival. A reading knowledge of one foreign language, usually French, German, or Russian, may be required of Ph.D. candidates at the discretion of each student's Special Committee.

Additional information may be obtained by writing to the graduate faculty representative, School of Civil and Environmental Engineering

The School of Civil and Environmental Engineering also offers the professional degree of Master of Engineering (Civil), which is intended primarily for persons who plan to practice engineering directly. Admission preference is given to applicants with an accredited United States civil engineering degree or a substantial equivalent. The professional degree requires a minimum of thirty credits of graduate-level work in the principles and practices of the field. Specific exit requirements include a broad-based technical background in the field, courses in design, and professional practice. Students concentrate in one of the areas within civil and environmental engineering. Additional information may be obtained by writing to the chairperson, M.Eng.(Civil) Program, Hollister Hall. Brochures that more fully describe the separate areas are available on request.

Research Opportunities

Study and research are usually carried on in one of the major subject areas listed below.

Environmental engineering Environmental (sanitary) engineering is concerned with the protection and management of the quality of the environment for the benefit of society. Degree programs emphasize biological, chemical, and physical phenomena and engineering principles; laboratory and computational skills; and their application to the analysis of relevant problems.

Environmental systems engineering This area involves the application of systems engineering, economic and political theory, and environmental law to public sector problems, including environmental quality management, public health services, population management, and other urban and regional planning problems.

Geotechnical engineering This area is concerned with the study of the engineering properties and use of earth materials and the

measurement of the behavior of earth and rock structures. It includes soil and rock mechanics and foundation engineering.

Hydraulics and hydrology This subject involves the study of fluid mechanics of the environment and the associated application to hydraulics, hydrology, coastal oceanography, and meteorology as related to the wet earth and atmosphere.

Remote sensing Qualitative and quantitative analyses of aircraft and satellite images, as well as other remotely sensed data, are used in inventorying, monitoring, and assessing earth resources and the environment.

Structural engineering In addition to the conventional aspects of structural analyses and design, interests in this department include such relatively new topics as computer-aided analysis and design, computational structural mechanics, nuclear reactor containment structures, small-scale models, shells, earthquake engineering, control of large space structures, behavior of thin-steel structures, structural safety analysis using probability theory, and structural materials. Emphasis is placed on the common fundamental background, theoretical and experimental, of all structural engineering.

Transportation engineering Study and research in transportation engineering embrace policy, planning, design, and evaluation of transport systems and the relationship between transport supply and demand, land use, and regional development. The approach is multimodal and systems oriented; it emphasizes the use of quantitative and analytical techniques of operations research and economics. Urban transport of people and goods is stressed in both course work and research.

Water resource systems This area involves the integration of systems analysis, economic theory, and applicable engineering sciences for defining and evaluating alternative designs, plans, and policies for managing the quantity, quality, and reliability of water resources. Water resource system components for water and wastewater treatment facilities, multipurpose reservoir systems, regional water quality control, power plant siting and capacity, water pricing, and other institutional and structural measures for controlling and using water resources are included.

Faculty and Specializations

John F. Abel: structures.
James J. Bisogni, Jr: environmental engineering
Wilfried H. Brutsaert: hydrology
Richard I. Dick: environmental engineering
Gordon P. Fisher: environmental systems
Peter Gergely: structures
James M. Gossett: environmental engineering
Donald P. Greenberg: structures
Mircea D. Grigoriu: structures
Douglas A. Haith: water resource systems
Kenneth C. Hover: structures; engineering materials
Anthony R. Ingraffea: structures
Gerhard H. Jirka: environmental hydraulics
Fred H. Kulhawy: geotechnical engineering
James A. Liggett: hydraulics
Leonard W. Lion: environmental engineering
Philip L-F. Liu: hydraulics
Daniel P. Loucks: water resource and environmental systems
Walter R. Lynn: environmental systems
William McGuire: structures
Arnim H. Meyburg: urban transportation planning and engineering
Arthur H. Nilson: structures; engineering materials
Neil Orloff: technology assessment
Thomas D. O'Rourke: geotechnical engineering
Teoman Pekoz: structural engineering
Warren R. Philipson: remote sensing
William D. Philpot: remote sensing
Richard E. Schuler: economics
Christine A. Shoemaker: environmental systems; ecosystem analysis
Floyd O. Slate: engineering materials
Jery R. Stedinger: stochastic hydrology; environmental systems
Harry E. Stewart: geotechnical engineering
Mark A. Turnquist: transportation systems analysis
Richard N. White: structures

CLASSICS

M.A., Ph.D.

Graduate faculty representative Judith R. Ginsberg, 129 Goldwin Smith Hall

Subject Classics (ancient philosophy, classical archaeology, Greek and Latin language and linguistics, Greek language and literature, Latin language and literature, medieval and Renaissance Latin literature, ancient history [minor only], classical

mythology [minor only], classical rhetoric [minor only], Indo-European linguistics [minor only])

Applications must include GRE scores.

Degree Requirements

The M.A. degree requires two semesters of course work (including three seminars), satisfactory performance on the qualifying examination and on an oral examination in two areas of study, reading knowledge of French or German, and an M.A. thesis.

The Ph.D. degree requires six semesters in residence and the successful completion of one of the four programs listed below that are currently offered by the Field of Classics (the M.A. is not a prerequisite for the Ph.D.).

Greek and Latin language and literature Fourteen courses (including six seminars), satisfactory completion of a written Greek and Latin translation examination (the qualifying examination) and a written and oral examination (the "A" examination) on Greek and Latin literature and a minor subject, reading knowledge of French and German, and presentation and defense of a doctoral dissertation

Classical archaeology The requirements differ from those outlined above in that readings and examinations in archaeology are substituted for some of those in Latin and Greek. Details are available on request. There are also opportunities to participate in excavations during the summer. Cornell is currently initiating an archaeological project in Lokris (Greece) under the direction of J. E. Coleman.

Ancient philosophy The Departments of Classics and Philosophy cooperate in offering a program leading to a Ph.D. in the Field of Classics with ancient philosophy as the major subject. The course of study includes two courses on Plato and one on the pre-Socratics (one in the Department of Classics, one in the Department of Philosophy), two courses on Aristotle and the Hellenistic philosophers (similarly divided), and such other courses in the Departments of Classics and Philosophy as the student and adviser decide.

Greek and Latin language and linguistics Eighteen courses in general, Indo-European, and Greek and Latin linguistics, Greek and Latin language, and Greek and Latin literature; satisfactory performance on a written Greek and Latin translation examination; and a written and oral examination on Greek and Latin language and linguistics.

Among awards available to incoming students are the Florence May Smith Fellowships, the Ida Blinkoff Fellowship, and the Townsend Fellowships.

Cornell Studies in Classical Philology

Since 1887, forty-six volumes have appeared in the series Cornell Studies in Classical Philology. The volumes include grammatical, historical, and archaeological studies and studies in classical literature and thought. The series continues to be published.

Faculty and Specializations

Frederick M. Ahl: epic and tragedy; mythology
 Kevin M. Clinton: Greek epigraphy; Greek religion; Greek literature
 John E. Coleman: Greek archaeology and art
 Margaret L. Cook: Greek historians; Greek science and medicine
 Gail J. Fine: ancient philosophy
 Judith R. Ginsburg: Roman history and historiography
 Terence H. Irwin: ancient philosophy
 Jay Jasanoff: Indo-European linguistics
 James J. John: paleography and medieval history
 Norman Kretzmann: medieval philosophy
 Nita Krevans: Greek and Roman lyric poetry; Hellenistic culture
 Peter I. Kuniholm: classical archaeology; Aegean dendrochronology
 Phillip T. Mitsis: ancient philosophy
 Alan Nussbaum: Greek and Indo-European linguistics
 David I. Owen: Assyriology; ancient near Eastern history and archaeology
 Pietro Pucci: textual criticism; Greek epic, drama, mythology
 Andrew Ramage: Greek and Roman art and architecture
 Barry Strauss: Greek history
 Winthrop Wetherbee: medieval Latin; medieval philosophy and literature

COGNITIVE STUDIES

Minor field

Graduate faculty representative Barbara C. Lust, NG28 Martha Van Rensselaer Hall

Minor subject Cognitive studies

Cognitive studies is a *minor* field that focuses on the nature and representation of knowledge. Among the many topics examined from the perspective of cognitive studies are logic and the justification of

belief; the nature of mind and action; knowledge representation; knowledge acquisition; the knowledge and use of language; perception; concepts and conceptual change; artificial intelligence and parallel distributed processing; and the neurobiology of cognition.

The minor in cognitive studies is open to students who have elected a major field in which the minor can be appropriately included. Field members offer guidance to students in setting up and carrying out an integrated program of interdisciplinary study in conjunction with their major field. Major fields include, but are not limited to, computer science, human development and family studies, linguistics, mathematics, neurobiology and behavior, philosophy, and psychology.

The field sponsors a series of lectures and colloquia by internationally recognized scholars. Students are actively encouraged to avail themselves of the opportunity to meet with the speakers for informal discussion during their visits.

Faculty and Specializations

Anthony Appiah: philosophy
 John S. Bowers: modern languages and linguistics
 Richard Boyd: philosophy
 Gennaro Chierchia: modern languages and linguistics
 G. Nickerson Clements: modern languages and linguistics
 John C. Condry: human development and family studies
 Robert L. Constable: computer science
 James Cutting: psychology
 Bruce R. Donald: computer science
 Barbara Finlay: psychology
 Jennifer Freyd: psychology
 James W. Gair: modern languages and linguistics
 Eleanor Gibson: psychology
 Carl Ginet: philosophy
 Wayne E. Harbert: modern languages and linguistics
 James Huang: modern languages and linguistics
 Frank Keil: psychology
 Barbara Koslowski: human development and family studies
 Carol L. Krumhansl: psychology
 Howard Kurtzman: psychology
 Alfred Landman: modern languages and linguistics
 Harry Levin: psychology

Barbara Lust: human development and family studies
 David A. McAllister: computer science
 Sally McConnell-Ginet: modern languages and linguistics
 Anil Nerode: mathematics
 Jay E. Russo: management
 Alberto M. Serge: computer science
 Sydney Shoemaker: philosophy
 Elizabeth Spelke: psychology
 Robert Stalnaker: philosophy
 George J. Suci: human development and family studies
 Linda R. Waugh: modern languages and linguistics

COMMUNICATION

M.P.S.(Comm.)

Graduate faculty representative Ronald E. Ostman, 309 Roberts Hall

Subject Communication

The program emphasizes (1) analysis of the communication process, (2) exploration of the potential of communication techniques and technology, (3) application of these elements to specific communication problems, and (4) evaluation of communication effectiveness. The focus of the program is on communication planning—the strategic application of communication knowledge and technology (both mass media and interpersonal) to information or education campaigns in or for organizations—rather than on technical competence in media operation.

Applicants from the United States and Canada must submit recent GRE scores. Applicants from other countries should submit recent TOEFL scores. Applications are encouraged from persons with experience in communication. Evidence of superior performance in the professional field will be considered in combination with academic records and GRE scores.

All applicants are expected to have some competence in one area or several areas of communication or to be willing to spend time beyond the normal degree requirements to gain this competence.

The faculty in this field has research interests in communication and rural development, diffusion of news and information, intercultural communication, interpersonal communication, mass communication, new communications technology, organizational communication, public relations—public information, public opinion, telecommunications, and video communication.

Faculty

Njoku E. Awa
 Robert Lee Bruce
 Royal D. Colle
 J. Lin Compton
 John C. Condry
 William W. Frank
 Carroll J. Glynn
 James B. Maas
 Daniel G. McDonald
 Ronald E. Ostman
 Clifford W. Scherer
 Donald F. Schwartz
 Michael A. Shapiro
 William B. Ward
 Shirley A. White
 J. Paul Yarbrough

COMPARATIVE LITERATURE**(M.A.), Ph.D.**

Graduate faculty representative Walter Cohen, 343 Goldwin Smith Hall

Subject Comparative literature

The Field of Comparative Literature at Cornell offers a Ph.D. in all major areas of literary study with particular emphasis on European literature from the Renaissance to the modern period and on literary criticism and theory. Because the field is small (about twenty students), it is possible to plan individual programs of study that ensure thorough preparation in literary traditions and detailed awareness of literary and theoretical problems. In addition to providing extensive coverage of primary literary texts from Europe and much of the rest of the world, the field devotes much attention to theoretical studies (for example, hermeneutics, Marxist theories, the aesthetics of the Frankfurt School, structuralism and semiotics, deconstruction, rhetorical studies, stylistics, and the problems of reader response).

The entering student designs a program in consultation with the Field Committee, which is chaired by the graduate faculty representative. Areas of concentration and principal advisers (the Special Committee) should be selected by the end of the first year of residence. Since each student focuses on three literatures (one of which may be English), on entrance he or she should have a good reading knowledge of at least two foreign languages. Anyone intending to specialize in a foreign literature is strongly encouraged to acquire fluency in the relevant language. Students normally take fourteen courses, ten of them dealing

with texts in the chosen languages. Selected primarily from the Field of Comparative Literature and the fields of separate national literatures, these courses prepare the student for the general ("A") examination, which is usually taken in the third year of study and is both written and oral.

There are two examination options, each of which has three fields. In both, the student is required to demonstrate knowledge of (1) a historical period in three literatures. In the first option the other fields are (2a) a genre in three national literatures and (3a) a major author. (A minor concentration, such as literary theory or literature and art history, may be substituted for the author.) In the second option the other fields are (2b) additional periods in one national literature and (3b) a minor concentration (as above). Although the department has no terminal M.A. program (and consequently does not admit students seeking that degree only), an M.A. is granted after satisfying these requirements. The student then begins work on a dissertation, which upon completion is defended at an oral ("B") examination administered by the Special Committee.

The field requires applicants to submit scores of the Graduate Record Examination general test and recommends that they take a relevant subject test (any literature, philosophy, or history). Foreign students who are not native speakers of English must take the TOEFL examination and are encouraged to take the GREs to be considered for financial aid. The majority of students accepted for the Ph.D. program are offered a multiyear financial aid package combining nonteaching fellowship and teaching assistantship support. Each candidate is required to do at least one year of classroom teaching as part of the doctoral program.

Faculty and Specializations

Ciriaco M. Arroyo: Spanish and comparative literature
 James A. Boon: anthropology; Asian studies; comparative literature
 Anthony F. Caputi: English and comparative literature
 Calum M. Carmichael: biblical studies; comparative literature
 Walter I. Cohen: comparative literature
 Jonathan D. Culler: English and comparative literature
 Ephim G. Fogel: English
 Henry L. Gates: English; Africana studies; comparative literature

George Gibian: Russian and comparative literature
 Sander L. Gilman: German
 Anita Grossvogel: French and Italian
 David I. Grossvogel: French and comparative literature
 Peter U. Hohendahl: German and comparative literature
 William W. Holdheim: French and comparative literature
 Robert E. Kaske: English
 William J. Kennedy: comparative literature
 Jonathan B. Monroe: comparative literature
 Edgar Rosenberg: English and comparative literature
 Enrico M. Santi: Spanish and comparative literature
 Kathleen Vernon: Spanish
 Linda R. Waugh: linguistics and comparative literature

COMPUTER SCIENCE

M.S., Ph.D., M.Eng.(Computer Science)

Graduate faculty representative Dexter Kozen, 4126 Upson Hall

Subject Computer science (artificial intelligence, computer science, distributed computation, information processing, numerical analysis, programming languages, robotics, theory of computation)

Applicants are expected to have had significant experience in programming a digital computer, and appropriate background in the particular major subject chosen, to permit immediate enrollment in graduate-level courses.

Applications must include general GRE scores and the score of one subject test in any area.

The field is concerned with fundamental knowledge in automata, computability, and programming languages and systems programming, as well as with subjects such as numerical analysis, information processing, robotics, and artificial intelligence, which underlie broad areas of computer applications. Graduate students should consider majoring in computer science if they are primarily interested in the general aspects of computational processes, both theoretical and practical (e.g., theory of algorithms, methods by which algorithms are implemented on a computer, and information structures).

A booklet describing graduate work in computer science may be obtained by writing to the graduate faculty representative.

Computer Facilities

The departmental facility consists of several VAXes, a Gould, fifty Xerox Dandelion workstations, twenty-five AT&T 3B2s, six IBM RTs, ten Symbolics Lisp machines, and a dozen Sun workstations.

Faculty and Specializations

Ozalp Babaoglu: programming languages and systems
 Gianfranco Bilardi: VLSI systems
 Kenneth P. Birman: programming languages and systems
 James H. Bramble: numerical analysis
 Thomas F. Coleman: numerical analysis
 Robert L. Constable: theory of computation and algorithms
 Richard W. Conway: programming languages and systems
 Bruce R. Donald: artificial intelligence
 John R. Gilbert: theory of computation and algorithms
 Donald P. Greenberg: graphics
 David J. Gries: programming languages and systems
 Juris Hartmanis: theory of computation and algorithms
 John E. Hopcroft: robotics
 Gregory F. Johnson: programming languages and systems
 Kevin Karplus: VSLI systems
 Dexter Kozen: theory of computation
 Franklin T. Luk: numerical analysis
 David A. McAllester: artificial intelligence
 Keith A. Marzullo: information processing
 Abha Mittra: programming languages and systems
 Anil Nerode: theory of computation and algorithms
 Alexandru Nicolau: programming languages and systems
 Gerard Salton: database systems and information retrieval
 Fred B. Schneider: programming languages and systems
 Alberto M. Segre: artificial intelligence
 Ray Teitelbaum: programming languages and systems
 Sam Toueg: programming languages and systems
 Charles F. Van Loan: numerical analysis
 Vijay V. Vazirani: theory of computation and algorithms

CONSUMER ECONOMICS AND HOUSING

M.S., Ph.D.

Graduate faculty representative Jennifer L. Gerner, 137 Martha Van Rensselaer Hall
Subjects Consumer economics (consumer and household economics, family resource management); housing

All candidates must submit scores of the GRE general test with their applications.

Consumer economics and housing is a multidisciplinary field that applies economics, sociology, and home economics to the study of family and consumer behavior and their welfare. Although the overall focus is on the economics of family and consumer behavior, consumer economics and housing also uses the theories and practical concerns of sociology and family management. The two major subjects, housing and consumer economics, emphasize a blend of theory and application. The program's goal is to equip students with a broad social science perspective and with the techniques for applying this perspective to a wide range of problems and issues facing families.

Consumer economics focuses on the household and consumer. It is concerned with household decision-making behavior (e.g., household demand, household production, market work decision making), with consumer information and regulation, with the effects of consumer-related policies on the behavior of households, with the quality of family life, and with the functioning of consumer markets. The area of concentration family resource management seeks to improve family life by examining how families organize their collective resources as a means of meeting their needs and goals. This area studies decision-making processes within the family, how families use resources, and how changes in these processes affect (or can affect) the quality of family living.

Housing broadly looks at the residential environment from economic and sociological perspectives. This area examines the behavior of individuals and institutions in the housing market and explores the impact of local and federal policies on housing markets, housing availability, and spatial distribution. Emphasis is placed on the neighborhoods, demographic aspects of housing demand, the housing finance system, land-use regulation, consumer and producer market behavior, and residential attitudes.

Faculty and Specializations

W. Keith Bryant: economics of the household; consumer policy; welfare policy
 Peter S. K. Chi: demography; residential mobility; housing; health; consumer policy
 Jennifer L. Gerner: household production; consumer policy; labor supply; human capital
 Ramona K. Z. Heck: family resource management; household consumption and savings; consumer credit; household insolvency; financial counseling
 Jeanne M. Hogarth: family resource management; consumer policy
 Carol S. Kramer: food policy; health policy; economics of consumer protection
 E. Scott Maynes: consumer economics and policy; consumer behavior; economics of informational imperfections
 Patricia B. Pollak: political economy of housing; dynamics of neighborhood change; housing policy
 James D. Reschovsky: housing economics; housing policy; urban economics; public finance
 Jean R. Robinson: family resource management and marketing
 Nancy C. Saltford: consumer economics and marketing
 Shelly White-Means: health policy; regulatory policy
 Peter M. Zorn: housing economics; local government financing; zoning and residential choice

DESIGN AND ENVIRONMENTAL ANALYSIS

M.A., M.S., M.P.S.(Hu.Ec.)

Graduate faculty representative Franklin D. Becker, E-425 Martha Van Rensselaer Hall

Subjects Design [M.A.] (interior design); design and environmental analysis [M.P.S.]; human-environment relations [M.S.] (facilities planning and management, human-environment relations)

The field offers graduate study leading to the M.A., M.S., or Master of Professional Studies (Human Ecology) degree. Within the Field of Design and Environmental Analysis, one may study in two major areas: design, concentrating on the creation of interior spaces and associated products and understanding these in their historical context, and human-environment relations, which focuses on the interaction of people with their physical surroundings and on the planning and management of complex work, residential, and health facilities.

The M.A. (design) and the M.S. (human-environment relations) degrees are for students who want to develop and demonstrate their research skills. A written research thesis is required for these degrees. The M.P.S. (Hu.Ec.) degree is for students interested in developing their professional skills. A special problem-solving project is required for this degree.

Admission to graduate study is based primarily on evidence of the student's capability for advanced study. All candidates must submit GRE general test scores. A portfolio of visual materials or slides is required of design majors. It should be sent to the graduate faculty representative. About two-thirds of the graduate students in the field hold teaching or research assistantships. General fellowships are also available to students in the field.

Research and Study Opportunities

The field has well-equipped computer laboratories, an art and environmental design gallery, a learning resource center, darkrooms and photography facilities, instruments for behavioral analysis, and a wood workshop.

Students often work with faculty on research conducted in locations throughout the Northeast. To complement their academic study, students in the facility planning and management and interior design concentrations are encouraged and helped to find paid professional internships in organizations throughout the United States during the summer between their first and second years.

Research is typically carried out in one of the concentrations listed below.

Human and environment relations

This area is concerned with applying knowledge from environmental psychology and human factors (ergonomics) to such problems as housing for the elderly and handicapped, indoor air pollution, and the design of offices to improve individual, group, and organizational performance. Research on developing and testing design and planning methods also occurs in this concentration.

Facility planning and management

This area combines study in human-environment relations, business and real estate, planning and design, and organizational behavior. The research focuses on improving the ways in which complex facilities such as offices, multifamily housing,

and health centers can be planned, designed, and managed to enhance building and human performance.

Interior design This area is concerned with developing a research basis for the practice of interior design. The focus is on the satisfaction of human needs in interior settings and on developing and testing new design methods. Projects include the use of computers to aid in imagining and communicating new design forms and as a technique for improving user involvement in the design process. Understanding design in its social and historical context is another research focus.

Faculty and Specializations

- Franklin D. Becker: facility planning and management; office planning and design; postoccupancy evaluation; design programming; environmental psychology
 Ronald H. Beckman: interior design; product design research; experiential education; postoccupancy evaluation; design theory
 Allen R. Bushnell: interior design and space planning; interior product design
 Sheila Danko: interior design; lighting and furniture acoustics research; graphic design
 Paul Eshelman: interior design and space planning; interior product design; computer workstation design and analysis
 Alan Hedge: human factors; indoor air pollution; lighting; acoustics
 Joseph Laquatra, Jr.: housing technology; energy-efficient design; construction materials and techniques; housing policy
 G. Cory Millican: interior design; design history
 Edward R. Ostrander: programming and postconstruction evaluation; interdisciplinary collaboration; gerontological applications of environmental research
 William R. Sims: facility planning and management; environment perception-cognition; design methods; environmental programming; postoccupancy evaluation

DEVELOPMENT SOCIOLOGY

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Frank W. Young, 34 Warren Hall

Subject Development sociology (agricultural and natural resource sociology, community and regional sociology, population and development, development sociology [minor only], methods of social research [minor only])

In the M.S. and Ph.D. degree programs, emphasis is placed on rural or agricultural societies, community and regional organizations, and development processes in these contexts. The program offers preparation for research, for the application of sociology in public service work, for rural development work in the United States and other countries, and for college teaching.

For students interested in a professional program, the field offers the Master of Professional Studies (Agriculture) degree. The requirements are the same as those for the Field of International Agriculture and Rural Development, but the emphasis is more sociological.

GRE general test scores are requested of United States and Canadian applicants and are essential for fellowship applicants. Completion of the master's at an institution of recognized standing is prerequisite to acceptance in the Ph.D. program. Foreign students who are offered admission must provide evidence of adequate financial support for the duration of study here; first-year foreign students are not usually awarded a fellowship or an assistantship.

Typically a Ph.D. candidate must demonstrate proficiency in at least one of the foreign languages used for scholarly purposes or in a language appropriate to the special area of interest, such as Latin America, South Asia, or Southeast Asia. Students entering the Ph.D. program must take a diagnostic examination given in conjunction with the master's final examination (for those who complete the master's at Cornell) or during the first term after entry in the Ph.D. program. Doctoral candidates are generally expected to have directed teaching experience.

A thesis is required for the M.S.

Assistantships provide part-time employment in teaching, research, or public service. The field may recommend candidates for the Liberty Hyde Bailey Research Assistantships in the Agricultural Sciences, awarded to students in a Ph.D. program. Thesis research is often conducted as part of an assistantship in connection with research supervised by the faculty.

Research and Study Opportunities

Some field members draw on the resources of the New York State Agricultural Experiment Station for their research. Recent activities under this sponsorship include studies of small-town growth and decline, service delivery in rural areas, decision

making in farm families, employment trends in the northeastern United States, the social organization of agriculture, multicounty and regional development, the perception and management of environmental problems, and the social impact of biotechnology. Research abroad includes studies of small irrigation systems, small-farmer agriculture, processes of village and regional development, and social demography. Students and faculty are actively conducting research in Southeast Asia, Latin America, and Africa. Many of these studies deal with the relationship of agricultural production to social organization and the conditions of growth for communities and regions.

Members of the field participate in the Cooperative Extension Service and the International Agricultural Development programs of the New York State College of Agricultural and Life Sciences, in the Center for International Studies, and in the programs for Africa, Latin America, South Asia, and Southeast Asia. Several of these programs have supported dissertation research overseas.

Although most doctoral theses are based on field-collected data, the department and the university have rich resources for the study of New York State rural areas, past and present, as well as a great number of data tapes for the study of less-developed countries.

Requirements for Areas of Concentration

Agricultural and natural resource sociology

For the Ph.D. a student is expected to demonstrate (1) a thorough knowledge of social theory with special emphasis on theories of social organization and social change, (2) knowledge of past and current research on the analysis of systems of agriculture and natural resources, and (3) knowledge of research methods with special emphasis on research design, data collection, and analytical techniques relevant to the study of agricultural and natural resource systems. For the M.S. a student is expected to demonstrate a general knowledge of (1) and of (2) or (3).

Community and regional sociology

For the Ph.D. a student is expected to demonstrate (1) a thorough knowledge of social theory with special emphasis on theories of social change and socioeconomic development, (2) knowledge of past and current research on change and development in communities and regions, and (3) knowledge of research methods with special emphasis

on research design, data collection, and analytical techniques relevant to the study of change. For the M.S. a student is expected to demonstrate a general knowledge of (1) and of (2) or (3).

Population and development For the Ph.D. a student is expected to demonstrate (1) a thorough knowledge of social theory, especially as it relates to demography and to socioeconomic development; (2) knowledge of past and current research on population, especially in the context of regional, national, and international population change; and (3) knowledge of research methods with emphasis on research design, data collection, and analytical techniques relevant to the study of population change. For the M.S. a student is expected to demonstrate a general knowledge of (1) and of (2) or (3).

Faculty

Frederick H. Buttel
Pierre Clavel
E. Walter Coward, Jr.
Paul R. Eberts
Eugene C. Erickson
Shelley C. Feldman
Joe D. Francis
Charles C. Geisler
Thomas A. Hirschl
Thomas A. Lyson
James C. Preston
Lawrence K. Williams
Robin M. Williams, Jr., (emeritus)
Frank W. Young

EAST ASIAN LITERATURE

M.A., Ph.D.

Graduate faculty representative Tsu-Lin Mei, 388 Rockefeller Hall

Subject East Asian literature (Asian religions, Chinese philology, classical Chinese literature, classical Japanese literature, modern Chinese literature, modern Japanese literature, Chinese linguistics [minor only], Japanese linguistics [minor only])

At least two years of Chinese or Japanese language study are required for admission, and prior work in English or European literature is desirable. Candidates for the Ph.D. whose undergraduate education has been in a Chinese or Japanese university are normally expected to have taken a degree in English or European literature before admission. All applicants are required to submit GRE scores for the general and subject tests.

Students may concentrate exclusively in either Japanese or Chinese, or they may do work in both areas. Minor subjects may also be chosen from other fields in the university, such as other literatures, comparative literature, linguistics, and theater arts. Individual programs are designed in consultation with the Special Committee chairperson.

Candidates for the M.A. are expected to take five semester courses and write a thesis. A reading knowledge of Japanese is essential for the M.A. in Chinese, and candidates in Japanese must study either Chinese or *Kambun*.

A Ph.D. qualifying examination is given during the second semester of the first year. For the Ph.D., a reading knowledge of a second East Asian language is normally required, and reading knowledge of at least one European language is highly desirable. Candidates for the Ph.D. are eligible for fellowships offered under the China-Japan Program.

Faculty and Specializations

Karen Brazell: Japanese literature
Brett deBary: Japanese literature
Bernard R. Faure: Asian religions
Edward M. Gunn, Jr.: Chinese literature
C. T. James Huang: Chinese linguistics
Eleanor H. Jorden: Japanese linguistics
Tsu-lin Mei: Chinese literature and philology
Chi-Lin Shih: Chinese linguistics

ECOLOGY AND EVOLUTIONARY BIOLOGY

M.S., Ph.D.

Graduate faculty representative Peter L. Marks, 427B Corson Hall

Subjects Ecology (animal ecology, applied ecology, community and ecosystem ecology, limnology, oceanography, physiological ecology, plant ecology, population ecology, theoretical ecology, vertebrate zoology); evolutionary biology (ecological genetics, population biology, systematics)

The program is intended to provide students with broad exposure to concepts and research approaches within ecology and evolution (primarily through seminars and formal course work) as well as in-depth study in one or more subdisciplines (normally guided by the student's Special Committee). The specific course of study is tailored to the needs of each individual student. Excellent laboratory and nearby field facilities are available, as are numerous collections and libraries.

It is the policy of the field to provide full financial support to all students who are admitted, and normally such support is continued for the duration of graduate study. Financial support is through university fellowships, departmental teaching assistantships, or research assistantships provided by individual faculty research grants.

Applicants are required to present GRE general test and biology subject test scores. Reading proficiency in one foreign language is required of Ph.D. students. Students also must obtain teaching experience by serving as teaching assistants for at least two semesters.

Inquiries from prospective graduate students are welcomed and should be addressed to the graduate faculty representative or to any member of the faculty.

Faculty and Specializations

Kraig Adler: photoreception, orientation, navigation, and circadian rhythms of vertebrates
 Martin Alexander: microbial ecology
 Charles F. Aquadro: population genetics
 Barbara L. Bedford: wetland plant ecology
 William L. Brown: systematics of ants; evolutionary theory
 Tom J. Cade: environmental biology of vertebrates
 Brian F. Chabot: plant ecophysiology
 John L. Cisne: arthropod biology and paleobiology; marine ecology and paleoecology
 George C. Eickwort: systematics; behavior and evolution; wild bees and mites; pollination ecology
 Thomas Eisner: behavior of insects; chemical basis of behavior; biocommunication
 Stephen T. Emlen: behavioral ecology; evolution of behavior
 Howard E. Evans: developmental and gross anatomy; teratology (fish to mammal)
 Paul P. Feeny: chemical ecology of insect-plant relationships
 Thomas A. Gavin: ecology and behavior
 Nelson G. Hairston, Jr.: limnology; population ecology and selective forces influencing zooplankton
 Richard G. Harrison: evolution; population genetics; molecular evolution
 C. Drew Harvell: invertebrate zoology
 Robert W. Howarth: aquatic ecosystem biology
 Kenneth A. R. Kennedy: physical anthropology

John P. Kramer: ecology and biology of entomopathogenic microbes, especially protozoans
 Simon A. Levin: population biology; mathematical biology; applied mathematics
 Gene E. Likens: limnology; aquatic ecology; analysis of ecosystems
 Amy R. McCune: ichthyology; evolutionary biology and systematics
 William N. McFarland: comparative and environmental physiology of vertebrates
 Ross J. MacIntyre: molecular evolution
 Peter L. Marks: plant ecology
 Aaron N. Moen: wildlife ecology; environmental stress on physiology and ecology of mammals and birds
 Karl J. Niklas: plant evolution and morphology
 Ray T. Oglesby: ecosystems, with particular emphasis on enrichment and population problems
 Barbara L. Peckarsky: invertebrates
 David Pimentel: population ecology; ecosystems
 F. Harvey Pough: environmental physiology, especially of lower vertebrates; herpetology
 Alison G. Power: agricultural ecology; ecology of cropping systems and epidemiology of insect-vectored diseases
 William B. Provine: history of biology, especially evolutionary theory
 Milo E. Richmond: vertebrate ecology and reproduction
 Richard B. Root: comparative ecology and the organization of terrestrial communities
 Christine A. Shoemaker: applications of mathematics and operations research to problems in ecosystems management
 Maurice J. Tauber: reproductive behavior; photoperiodism and biological control
 Sara Via: insect population genetics
 William D. Youngs: fishery biology

ECONOMICS

(M.A.), Ph.D.

Graduate faculty representative David Easley, 446 Uris Hall.

Subject Economics (applied economics, econometrics and economic statistics, economic development and planning, economic history, economic systems, economic theory, economics of participation in labor-managed systems, industrial organization and control, international

economics, labor economics, monetary and macroeconomics, peace science, public finance, basic analytical economics [minor only])

In addition to their major and two minors, doctoral candidates are expected to be familiar with the methods of quantitative analysis and the fundamentals of economic theory.

The field does grant a master's degree, but generally only students who ultimately expect to complete a Ph.D. are admitted.

Students should consult with descriptions of the Fields of Agricultural Economics, Management, City and Regional Planning, and Industrial and Labor Relations for other related subjects. Attention is also directed to the various international studies programs discussed on pp. 130-137.

The GRE general test is strongly recommended for all applicants.

Since some mathematics is used in graduate courses and current economics literature, every applicant should have at least two courses in calculus. Linear algebra is also recommended. Exceptional candidates who lack such preparation may be admitted, but they will find their first year of graduate study seriously disrupted by the need to remedy this deficiency.

A more detailed brochure is available from the graduate faculty representative on request.

Faculty and Specializations

Kenneth Burdett: econometrics and economic statistics; economic theory
 Tom E. Davis: economic development and planning; economic history; economics of participation and labor-managed systems; international economics; monetary and macroeconomics
 David Easley: econometrics and economic statistics; economic theory
 Ronald G. Ehrenberg: econometrics and economic statistics; labor economics
 Gary Fields: economic development and planning; labor economics
 Robert H. Frank: econometrics and economic statistics; economic theory
 George A. Hay: industrial organization and control
 M. Beth Ingram: econometrics and economic statistics; monetary and macroeconomics
 Walter Isard: peace science
 George Jakobson: econometrics and economic statistics; labor economics
 Alfred E. Kahn: industrial organization and control

Nicholas M. Kiefer: econometrics and economic statistics; economic theory; labor economics

Peter D. McClelland: economic history

Mukul Majumdar: econometrics and economic statistics; economic theory; peace science

Robert T. Masson: economic theory; industrial organization and control

Tapan Mitra: econometrics and economic statistics; economic theory

Lars T. Muus: econometrics and economic statistics; labor economics; monetary and macroeconomics

Uri M. Possen: economic theory; monetary and macroeconomics

Richard E. Schuler: econometrics and economic statistics; economic theory; industrial organization and control; peace science; public finance

Karl Shell: economic theory; monetary and macroeconomics

George J. Staller: economic development and planning; economics of participation and labor-managed systems; international economics

Jan Svejnar: economic development and planning; economics of participation and labor-managed systems; labor economics

Erik Thorbecke: econometrics and economic statistics; economic development and planning; international economics; peace science

Insan F. Tunali: econometrics and economic statistics; economic development and planning

Jaroslav Vanek: economic development and planning; economics of participation and labor-managed systems; economic theory; international economics

Henry Y. Wan, Jr.: economic development and planning; economic theory; peace science

Jennifer Wissink: industrial organization and control; public finance

EDUCATION

M.A., M.S., Ph.D., M.A.T., M.P.S.(Agr.)

Graduate faculty representative Jason Millman, 442 Roberts Hall

Subjects Education (agricultural and occupational education; curriculum and instruction; educational psychology and measurement; educational research methodology; extension, continuing, and adult education; home economics education; philosophical and social foundations; educational administration; science and

mathematics education); home economics education [M.A.T.]; mathematics 7–12 [M.S.]

The Field of Education is conceived broadly and reflects a dual concern for theoretical and professional knowledge. Areas of practical study include public and private schools, colleges, universities, state and federal agencies, and industrial enterprises.

All applicants whose native language is English are required to submit scores from either the GRE general test (required for fellowship applications) or the Miller Analogies Test.

Information on research assistantships, teaching assistantships, and fellowships may be obtained from the Secretary, Field of Education, 442 Roberts Hall.

Agricultural and occupational education This program serves students seeking permanent certification as teachers of agriculture in secondary schools and prepares teacher educators in agriculture, administrators in occupational education, and faculty members in two-year agricultural colleges. Current research includes curriculum development, education applications of microcomputers, information systems, and employment projections. The coordinator for this program is William E. Drake.

Curriculum and instruction The analysis of curriculum documents, the principles of curriculum design, and the identification of the philosophical, psychological, and sociopolitical assumptions underlying curricular and instructional decisions are emphasized in this program. Students typically bring to their study previous elementary, secondary, or postsecondary professional experience and a solid background in either a subject taught in educational institutions or one of the fundamental disciplines of education. The coordinator for this program is George J. Posner.

Educational psychology and measurement This area focuses on the psychology of instruction, human learning, educational measurement, psychological assessment, life-span development, social psychology of the classroom and school, interpersonal and group processes, and specialized topics such as creativity, learning-to-learn strategies, and instructional computing in both formal and informal educational settings. The coordinator for this program is James Dunn.

Educational research methodology

This program focuses on basic concepts in measurement, program evaluation, statistics, and philosophy of science that underlie the design, analysis, and interpretation of investigations about educational phenomena. Current research interests include criterion-referenced testing, state and local assessment systems, evaluation models, critical appraisal of research and evaluation studies, theory of value and evaluation, attitude measurement, application of learning theory to measurement problems, and testing by computer. The coordinator for this program is Jason Millman.

Extension, continuing, and adult education The focus is on adult education as a vital component of economic and social change and on the processes of adult learning and development. The program prepares research scholars and leaders for adult and continuing education programs in colleges and universities, extension and development agencies, and other educational systems in the United States and abroad. Teaching and research interests include program design, management, evaluation, adult learning and development, community education, research use, and the indigenous culture as an educational medium. The coordinator for this program is David Deshler.

Philosophical and social foundations: educational administration Philosophy, sociology, and economics of education apply the concepts and techniques of their respective disciplines to educational phenomena. Educational administration (viewed from alternative perspectives provided by social science, philosophy, and administrative practice) prepares students to assume academic or leadership positions in higher education and public schools. Students' programs emphasize either the philosophical and social foundations or educational administration. However, students in either component of the program are expected to integrate a disciplinary perspective with the investigation of some area of educational practice. The coordinator for this program is Kenneth A. Strike.

Home economics education This program deals with the analysis of education as an instrument for effective change and studies the nature of change—describing, predicting, affecting, and measuring it. Students interested in becoming teacher educators complete a sequence of courses

and field experiences and a practicum in field experience supervision. The coordinator for this program is Marion E. Minot.

Science and mathematics education

This program focuses on teaching, curriculum development, and research in science and mathematics education. Special interests include conceptual change, teacher-student interactions, curriculum design, philosophies of science, learning, environmental studies, and use of computers in the classroom. A five-year B.S./M.A.T. program for certification for science and mathematics teaching is available to outstanding candidates. The coordinator for this program is Joseph D. Novak.

Faculty and Specializations

Njoku E. Awa: extension, continuing, and adult education
 Robert J. Babcock
 Samuel B. Bacharach
 Richard A. Baer, Jr.: science and mathematics education
 Joe P. Bail: agricultural and occupational education; extension, continuing, and adult education; philosophical and social foundations: educational administration
 Donald J. Barr: extension, continuing, and adult education
 Arthur L. Berkey: agricultural and occupational education
 George J. Broadwell: extension, continuing, and adult education
 Robert L. Bruce: extension, continuing, and adult education; curriculum and instruction; educational research methodology; philosophical and social foundations: educational administration
 Royal D. Colle: extension, continuing, and adult education
 J. Lin Compton: extension, continuing, and adult education
 Jere Confrey: science and mathematics education; curriculum and instruction
 Harold R. Cushman: agricultural and occupational education; extension, continuing, and adult education
 Richard Darlington: educational research methodology
 David J. Deshler: extension, continuing, and adult education; educational research methodology
 Robert E. Doherty
 William E. Drake: agricultural and occupational education; curriculum and instruction
 James Dunn: educational psychology and

measurement; agricultural and occupational education

Joan R. Egner: philosophical and social foundations: educational administration
 D. Bob Gowin: philosophical and social foundations: educational administration; curriculum and instruction; educational research methodology; science and mathematics education
 Jennifer C. Greene: educational psychology and measurement; educational research methodology
 Emil J. Haller: educational research methodology; philosophical and social foundations: educational administration
 Stephen F. Hamilton: curriculum and instruction
 Dalva E. Hedlund: educational psychology and measurement; extension, continuing, and adult education
 David W. Henderson: science and mathematics education; curriculum and instruction
 James B. Maas: educational psychology and measurement
 Charles McClintock: educational research methodology
 Claire A. McLennan: home economics education
 Jason Millman: educational research methodology; educational psychology and measurement; science and mathematics education
 Marion E. Minot: home economics education
 David H. Monk: philosophical and social foundations: educational administration
 Lucinda A. Noble: home economics education
 Joseph D. Novak: science and mathematics education; curriculum and instruction; educational research methodology
 George J. Posner: curriculum and instruction; educational research methodology; science and mathematics education
 Richard E. Ripple: educational psychology and measurement; curriculum and instruction; extension, continuing, and adult education
 Constance H. Shapiro
 Lloyd C. Street
 Kenneth A. Strike: philosophical and social foundations: educational administration; curriculum and instruction; educational psychology and measurement; educational research methodology; science and mathematics education
 H. Dean Sutphin: agricultural and occupational education; curriculum and instruction; extension, continuing, and adult education

William Trochim

Deborah J. Trumbull: science and mathematics education; educational psychology and measurement; curriculum and instruction

Helen L. Wardeberg: curriculum and instruction

Bettie Lee Yerka: home economics education

Jerome M. Ziegler

ELECTRICAL ENGINEERING

M.S., Ph.D., M.Eng.(Electrical)

Graduate faculty representative Paul R. McIsaac, 230 Phillips Hall

Subject Electrical engineering (electrical engineering, electrical systems, electrophysics)

Applicants should have had the equivalent of the fundamental work required by an accredited undergraduate curriculum in the area of their major subjects. The GRE general test is required for applicants to the M.S. and Ph.D. programs who want to be considered for financial aid; the subject test is optional. Applicants are urged to have these scores sent to the Graduate School as part of their application materials.

The M.S. and Ph.D. programs require submission of a thesis and are intended for students planning to engage in research as a career. Normally the M.S. is not a terminal degree, so students should enter the M.S.-Ph.D. program.

Before beginning the second semester of study as a candidate for the Ph.D., each student must take a qualifying examination administered by the student's Special Committee.

In addition to university fellowships, the following are available: the John McMullen Graduate Fellowship, the Schlumberger Foundation Fellowship, IBM Doctoral Fellowships, the RCA Electronics Research Fellowship, the General Electric Foundation Teaching Fellowship, the AT&T Bell Laboratories Doctoral Fellowship, and the Eastman Kodak Fellowship.

Professional degree The Master of Engineering (Electrical) degree program is open to persons who hold a baccalaureate (or equivalent) degree in engineering or science, which is considered appropriate as a background for professional graduate study in the field. The M.Eng. (Electrical) is a thirty-credit curricular degree requiring an engineering design project rather than a research thesis. It is intended primarily for

persons who plan to practice engineering directly, in industry or professionally. But it may also serve as the first step en route to the doctorate for those who are inclined toward the technological and design aspects of advanced engineering. For further information, contact the graduate faculty representative.

Research Opportunities

Electrical engineering This area includes electrical measurements, instrumentation, and the conversion, transmission, and control of electrical energy. Some typical research projects include a computer-managed system to control the response of an electric power network to faults, and various digital data processing and analysis systems. Other work is closely related to research in the systems or electrophysics areas.

Electrical systems Research in systems is concentrated in the areas of communications, information and decision theory, computer engineering, control theory, power systems, and signal processing. Topics studied include stochastic control, and optimization and approximation techniques; application of control theory to power systems; the simulation of systems; information coding and transmission, random signal processing, decision making, and pattern classification; the analysis, synthesis, and computer-aided design of time-varying, nonlinear, active, and distributed parameter networks; digital signal processing and digital filtering; and computer architecture, computer vision, and parallel processing.

Electrophysics This category includes all research in which the primary concern is the interaction of electromagnetic fields with materials in the solid, liquid, gaseous, or plasma state, including high-energy and geophysical plasmas such as the ionosphere and magnetosphere. Electromagnetic wave propagation and scattering, magnetohydrodynamics, electron-beam devices, quantum electronics, lasers and fiber optics, solid-state physics, microwave and optical phenomena in semiconductors, and semiconductor devices, including microfabrication and very large scale integration techniques are among the topics studied.

Faculty and Specializations

- Venkatach Anatharam: queueing theory; communication networks; stochastic processes
- Joseph M. Ballantyne: optoelectronic materials and devices; integrated optics; submicron lithography
- Toby Berger: information theory and signal processing; communication theory
- Ralph Belgiano, Jr.: tropospheric radiophysics; structures of the lower and middle atmosphere
- Robert R. Capranica: sensory communication; electrophysiological studies of neural processing; bioelectronics
- Hsiao-Dong Chiang: nonlinear control systems; electric power systems; optimization theory
- David F. Delchamps: linear and nonlinear dynamical systems, stochastic processes; estimation theory, control, and system identification
- Lester F. Eastman: microwave, optical, and high-speed optical solid-state devices; compound semiconductor growth by molecular beam epitaxy and metal organic vapor phase epitaxy
- Donald T. Farley: ionospheric physics; space plasma physics; radar techniques
- Terrence L. Fine: decision theory; estimation; foundations of probability
- Tor Hagfors: radiophysics; signal processing; ionospheric plasma; radio astronomy
- David A. Hammer: plasma physics; nuclear fusion; high-power electron and ion-beam physics and technology
- Chris Heegard: information theory; coding theory; digital communications; VLSI systems
- Lloyd W. Hillman: nonlinear and quantum optics; laser theory; optoelectronics; integrated optics
- C. Richard Johnson, Jr.: adaptive systems theory; digital signal processing; control theory
- Michael C. Kelley: space plasma physics; rocket and satellite instrumentation
- Myunghwan Kim: distributed computer systems
- Paul M. Kintner: space plasma physics and plasma diagnostic instrumentation; microprocessor controls
- J. Peter Krusius: physics and technology of submicron devices and integrated circuits
- Charles A. Lee: solid state physics and devices
- Richard L. Liboff: transport in solid state and laboratory plasmas; properties of strongly coupled plasmas and neutral fields
- Franklin T. Luk: parallel computing; signal processing
- Noel C. MacDonald: electron spectroscopy; microfabrication; integrated circuits; particle-beam instrumentation
- Paul R. McIsaac: electromagnetic theory; microwave circuits and devices
- James W. Mayer: ion implantation in semiconductors; thin-film reactions; Rutherford backscattering and channeling; silicides; ion-beam modification of materials
- John A. Nation: plasma physics; high-energy electron and ion beams; accelerator physics
- Benjamin Nichols: cable television systems; educational methods
- Thomas W. Parks: digital signal processing; seismic signal processing; circuit theory
- Clifford R. Pollock: lasers; molecular spectroscopy; quantum electronics
- Christopher Pottle: computer-aided design; power system simulation; parallel computer processing; network theory
- Anthony P. Reeves: image processing; parallel computer architecture; pattern recognition
- Charles E. Seyler: plasma physics; controlled thermonuclear fusion
- Ravindra N. Sudan: plasma physics; thermonuclear fusion; space physics; high-power electron and ion beam physics
- Chung-Liang Tang: lasers; quantum electronics; semiconductor materials and devices; ultrafast optical processes
- Robert J. Thomas: control and analysis of linear and nonlinear systems with applications to power systems
- James S. Thorp: applications of optimization and control theory to power systems; robotics
- Hwa Chung Torng: computer engineering; telecommunications; VLSI digital systems
- Norman M. Vrana: digital systems; central processor design; microprocessor systems
- Charles B. Wharton: plasma physics; plasma diagnostics; high-power microwaves
- Edward D. Wolf: microminiaturization engineering; electron and ion-beam instrumentation and processes
- George J. Wolga: lasers; applied spectroscopy; semiconductor materials and devices
- S. Siu-Weng Wong: fabrication technology; integrated circuits; optoelectronics

ENGLISH LANGUAGE AND LITERATURE

(M.A.), Ph.D., M.F.A.

Graduate faculty representative Laura S. Brown, 244 Goldwin Smith Hall

Subject English language and literature (Afro-American literature, American literature to 1865, American literature after 1865, American studies, dramatic literature, English poetry, the English Renaissance to 1660, literary criticism and theory, the nineteenth century, Old and Middle English, prose fiction, the Restoration and the eighteenth century, the twentieth century, women's literature); creative writing [M.F.A.]

Admission Requirements

Applicants may request admission to either the Master of Fine Arts program in creative writing or the doctoral program or both. The Field of English rarely accepts applicants for the terminal M.A. Except in unusual circumstances all applicants are required to submit GRE scores (general and subject tests) and should plan to take the examinations by October. Applicants for admission to the M.F.A. program must submit samples of their writing to the Committee on the Creative Writing Program, Department of English, Goldwin Smith Hall. The application and all supporting documents and materials must reach the Graduate School by January 15. Because of postal delays and the last-minute rush of transcripts and letters, it will help to guarantee full consideration if applications can be filed earlier. Since there are such a large number of applications, the field cannot assume the responsibility of notifying an applicant whose file is incomplete.

Approximately sixteen Ph.D. candidates and eight M.F.A. candidates are enrolled each year; two or three of these may be candidates for both degrees. As the ratio of accepted students to applicants is approximately one to twenty-five, competition is extremely intense and no candidate, regardless of how strong his or her credentials may be, should presume acceptance. The graduate faculty representative will be happy to meet with visiting applicants; such interviews, however, have no bearing on admission.

Financial Aid

The majority of students accepted for the Ph.D. program will be offered a financial aid package combining nonteaching fellowship and teaching assistantship support. A

number of M.F.A. candidates will also receive support. A student who has done graduate work elsewhere, or who has had professional teaching experience, may apply for a teaching assistantship for the first year in the program. An applicant who wants a teaching assistantship should check the appropriate blank on the admission and fellowship application.

The Programs

A candidate for the M.F.A. is expected to complete a workshop course in each of four semesters and a total of six or seven other courses, of which at least four should be in literature. The thesis is a piece of creative writing (a novel, for example, or a book of poems or short stories).

A candidate for the Ph.D. is normally expected to complete six or seven one-semester courses for credit in the first year of residence and a total of six or seven more in the second and third years. The program of any doctoral candidate's formal and informal study, whatever his or her particular interests, should be comprehensive enough to give some familiarity with (1) the authors and works that have been the most influential in determining the course of English and American literature; (2) the theory and criticism of literature; (3) the relations between literature and other disciplines; and (4) such basic scholarly concerns as textual criticism, analytical bibliography, and problems of attribution, authentication, genre, source, and influence. The Ph.D. student chooses a major and one or two minors. The major is selected from a list of historical and generic subjects such as the English Renaissance to 1660, the nineteenth century, or prose fiction, as well as from the areas of literary theory and Afro-American or women's literature. Minors may be selected from the same list, but students are also permitted to choose one or both minors from among the offerings of related fields. A student electing to major in American studies within the field of English will define the major to include a minor in history and will choose a second minor from some non-American subject in the area of concentration. An information sheet on American studies is available from the graduate faculty representative on request.

In both programs the Special Committee system eliminates uniform course requirements and departmental examinations, provides a close working relationship between professors and students, and

encourages freedom and flexibility in the pursuit of the graduate degree. The Special Committee directs and judges progress at a series of meetings with the student in which it reviews the course work, the individual work done with members of the committee and with others, and the student's own assessments of his or her progress. Before a doctoral candidate enters the fourth semester of graduate study, the Special Committee must decide whether he or she is qualified to proceed toward the Ph.D.

Doctoral candidates are expected to acquire some supervised teaching experience as part of their professional preparation.

Language Requirement

Foreign language proficiency and the study of the English language are so basic as to be given special emphasis. Each student and Special Committee will decide what work in these areas is most appropriate to the rest of the student's graduate program and scholarly interests.

Some doctoral programs require extensive knowledge of a single foreign language and literature; others require competent reading ability in two or more foreign languages. Programs of study for the M.F.A. normally require reading ability in one foreign language. A student may be asked to demonstrate competence in any of several ways—for example, by presenting the undergraduate record, by taking additional courses in foreign languages and literature, or by translating and discussing documents related to the student's work in English and American literature.

To pursue the study of the English language, a student may be asked to take departmental course offerings in Old English, in the history of the English language, in grammatical analysis, or in the application of linguistic study to the history of English literature, to metrics, or to literary criticism. Several other departments provide courses in such subjects as descriptive linguistics, psycholinguistics, and the philosophy of language.

Resources for Study

Graduate work at Cornell offers the opportunity for professional study in a distinguished academic community of extensive resources. The Cornell University library system includes over five million volumes; of special interest to graduate students is Olin Library, which is among the foremost university

libraries in the United States. Its special holdings include Dante and Petrarch collections unique in this country, a splendid and comprehensive Wordsworth collection, the Wyndham Lewis papers, a distinguished Icelandic collection, and one of the great Joyce collections of the world. In recent years its materials have been used for major studies of romantic thought, Joyce, John Stuart Mill, Ford Madox Ford, and other important subjects.

Faculty and Specializations

The quality of work done by graduate students in English is of course largely conditioned by the staff with whom they work and the academic environment that the staff and students together create. In addition to the distinguished graduate faculty in such related fields as comparative literature, Romance studies, Germanic studies, history, philosophy, theater arts, and classics, the members of the English faculty in the following list are normally available to direct graduate work and to serve on Special Committees. This list is illustrative rather than exhaustive, since most faculty members are available to direct work in areas other than those cited.

- Barry B. Adams: the Renaissance, dramatic literature
- Archie R. Ammons: creative writing
- Jonathan P. Bishop: American literature, the twentieth century
- Jean F. Blackall: prose fiction, the nineteenth century, women's literature
- Fredric Bogel: the Restoration and the eighteenth century, literary criticism and theory
- Laura S. Brown: the Restoration and the eighteenth century, prose fiction, women's literature
- Anthony Caputi: dramatic literature, creative writing, the Renaissance, the twentieth century
- Cynthia Chase: the nineteenth century, literary criticism and theory
- Jonathan D. Culler: literary criticism and theory, American literature, English poetry, the nineteenth century, prose fiction
- Donald D. Eddy: the Restoration and the eighteenth century
- Robert T. Farrell: Old and Middle English, American literature
- Ephim G. Fogel: the Renaissance, American literature, creative writing, dramatic literature, English poetry

Debra Fried: American literature, English poetry, literary criticism and theory, women's literature
 Henry L. Gates: Afro-American literature, American literature, literary criticism and theory, women's literature, prose fiction
 W. Lamar Herrin: creative writing, American literature, prose fiction, the twentieth century
 Thomas D. Hill: Old and Middle English
 Molly P. Hite: the twentieth century, creative writing, prose fiction, women's literature
 Mary L. Jacobus: the nineteenth century, women's literature
 Phyllis Janowitz: creative writing
 Carol V. Kaske: the Renaissance
 Robert E. Kaske: Old and Middle English
 Charles S. Levy: the Renaissance, English poetry
 Alison Lurie: creative writing, the twentieth century, prose fiction, women's literature
 Dan E. McCall: American literature, creative writing
 Kenneth A. McClane: creative writing
 James R. McConkey: creative writing, the twentieth century, prose fiction
 Harvey S. McMillin: dramatic literature, the Renaissance
 Phillip L. Marcus: the twentieth century, the nineteenth century, prose fiction, women's literature
 Dorothy M. Mermin: the nineteenth century, English poetry, women's literature
 Satya Mohanty: literary criticism and theory, the twentieth century, prose fiction
 Robert R. Morgan: creative writing, American literature, English poetry, the twentieth century
 Timothy Murray: dramatic literature, literary criticism and theory, the twentieth century, the Renaissance
 A. Reeve Parker: the nineteenth century, dramatic literature, English poetry
 Stephen M. Parrish: the nineteenth century, American literature, English poetry
 Joel Porte: American literature, prose fiction
 Mary A. Radzinowicz: the Renaissance, American literature, English poetry
 Edgar Rosenberg: prose fiction, creative writing, the twentieth century, the nineteenth century
 Shirley R. Samuels: American literature, the nineteenth century, women's literature
 Paul L. Sawyer: the nineteenth century
 Daniel R. Schwarz: prose fiction, literary criticism and theory, the twentieth century, the nineteenth century
 Mark I. Seltzer: American literature, literary criticism and theory, prose fiction

Harry Shaw: prose fiction, the nineteenth century, the Restoration and the eighteenth century, literary criticism and theory
 Sandra F. Siegel: the twentieth century, prose fiction, women's literature
 Walter J. Slatoff: American literature, creative writing, prose fiction, the twentieth century
 Jon Stallworthy: the twentieth century, English poetry, the nineteenth century
 S. Cushing Strout: American literature
 Gordon L. Teskey: the Renaissance, literary criticism and theory
 Stephanie Vaughn: creative writing
 Winthrop Wetherbee: Old and Middle English, English poetry
 The creative writing staff publishes *Epoch*, a periodical of contemporary literature.

ENTOMOLOGY

M.S., Ph.D.

Graduate faculty representative George C. Eickwort, 3124 Comstock

Subject Entomology (acarology, apiculture, aquatic entomology, biological control, economic entomology, general entomology, insect behavior, insect biochemistry, insect ecology, insect genetics, insect morphology, insect pathology, insect physiology, insect taxonomy, insect toxicology and insecticide chemistry, integrated pest management, medical entomology)

Excellent facilities for laboratory and field studies are available that include the outstanding Comstock Entomological Library and a renowned insect collection.

The Field of Entomology requires a prescriptive academic review for doctoral candidates, usually held during the first semester of work. A core curriculum is available from the graduate faculty representative.

The minimum language requirement for the Ph.D. degree is proficiency in one foreign language.

Applicants in the United States and Canada are required to submit GRE general and subject (biology) test scores.

Teaching and research assistantships and the Comstock Scholarship are available.

Faculty and Specializations

Arthur M. Agnello: integrated pest management; tree- and small-fruit insects; extension entomology*
 Edward J. Bechinski: integrated pest management; field crop insects

William L. Brown, Jr.: systematics and evolution; taxonomy of ants
 Eddie W. Cupp: medical entomology; bionomics of biting flies
 Timothy J. Dennehy: ecology and pest management of insects in vineyards*
 Charles J. Eckenrode: economic entomology; biology and management of soil and vegetable crop insects*
 George C. Eickwort: insect morphology and behavior; systematics of Hymenoptera; acarology
 Thomas Eisner: insect-plant interactions; chemical ecology; insect behavior
 Paul P. Feeny: chemical ecology; herbivorous insects
 Kean S. Goh: usage, environmental impact, and safety of pesticides
 Henry H. Hagedorn: insect physiology; reproductive physiology
 Warren T. Johnson: economic entomology; insects on ornamental plants
 Douglas C. Knipple: molecular genetics of insect-plant interactions
 John P. Kramer: insect pathology; protozoal and fungal diseases and their epidemiology
 James K. Liebherr: biosystematics of Carabidae; speciation; historical biogeography
 Roger A. Morse: apiculture; honeybee social behavior
 Arthur A. Muka: economic entomology; vegetable crop insects
 Jan P. Nyrop: insect population ecology*
 Barbara L. Peckarsky: aquatic entomology; behavior and community ecology of stream insects
 David Pimentel: insect ecology; genetic feedback mechanism; population ecology
 Edgar M. Raffensperger: economic entomology; household insects; stored product pest management
 William H. Reissig: insect biology; pest management of insects on fruit*
 Wendell L. Roelofs: organic chemistry; pheromone isolation, identification, and synthesis*
 Richard B. Root: insect ecology
 Richard T. Roush: insect population genetics; pesticide resistance; genetics of colonization
 Donald A. Rutz: veterinary entomology; livestock and poultry pest management
 John P. Sanderson: floricultural entomology; integrated pest management
 George A. Schaefer: economic entomology; ecology of small-fruit insects*

Jeffrey G. Scott: insecticide resistance and mode of action
 Maurie Semel: economic entomology; vegetable, greenhouse, and nursery crop insects
 Anthony M. Shelton: biology, ecology, and management of insect pests on vegetable crops*
 Elson J. Shields: integrated pest management; population ecology; computer applications in agriculture
 Christine A. Shoemaker: systems analysis in pest management
 David M. Soderlund: insecticide toxicology; insect biochemistry*
 Maurice J. Tauber: biological control; insect behavior; insect phenology
 Ward M. Tingey: plant resistance to insects; pest management of insects on potatoes
 Sara Via: insect population genetics
 Michael G. Villani: soil insect ecology; turf-crop insects*
 Quentin D. Wheeler: systematic theory; taxonomy of Coleoptera; fungus-insect associations
 Christopher F. Wilkinson: insect toxicology; synergists; detoxification mechanisms
 *Faculty of the New York State Agricultural Experiment Station at Geneva.

ENVIRONMENTAL QUALITY

Minor field

Graduate faculty representative John C. Thompson, Jr., C214 Schurman Hall
Minor subject Environmental quality

This *minor* field offers qualified engineers and scientists an opportunity to broaden their knowledge in physical, chemical, and biological areas related to environmental quality problems and their control. It is intended to encourage interdisciplinary study. The objective is to understand human interaction with the environment.

The student in this minor takes the combination of courses, seminars, and projects considered best for him or her. A master's candidate will ordinarily take a minimum of three courses for this minor; the courses must be in at least two areas outside the student's major field. A doctoral candidate will ordinarily take a minimum of five courses in at least two areas outside the major field.

Faculty

John G. Babish
James J. Bisogni
Bernard E. Dethier
Richard I. Dick
Leonard B. Dworsky
James M. Gossett
Douglas A. Haith
Jay S. Jacobson
William J. Jewell
Leonard W. Lion
Daniel P. Loucks
Walter R. Lynn
Ray T. Oglesby
Gerald W. Olson
David Pimental
John C. Thompson
Robert R. Zall

ENVIRONMENTAL TOXICOLOGY

M.S., Ph.D.

Graduate faculty representative June M. Fessenden-Raden, 275 Clark Hall

Subject Environmental toxicology (cellular and biochemical toxicology; ecotoxicology and environmental chemistry; risk assessment, management and public policy)

The field provides an opportunity for students to broaden their knowledge of the interactions of toxic elements and chemicals (drugs, pesticides, industrial pollutants, and natural products) with organisms and the environment. Specific disciplinary interests of the faculty members range from basic studies in environmental toxicology, including biochemistry, nutrition, genetics, environmental chemistry, epidemiology, and veterinary medicine, to societal aspects such as risk communication, public perceptions, risk management, and environmental law. Detailed information is available from the graduate faculty representative on request.

Entering students are expected to have had good basic undergraduate training in biology, chemistry, and mathematics. Previous experience or course work in toxicology is desirable but not essential. GRE general test scores are required; the subject test is suggested.

Faculty and Specializations

Martin Alexander: ecotoxicology and environmental chemistry
John G. Babish: risk assessment
Carole A. Bisogni: consumer education and risk management
Stephen E. Bloom: genetic toxicology
T. Colin Campbell: chemical carcinogenesis

Larry C. Clark: environmental and cancer epidemiology
Gerald F. Combs, Jr.: interactions of vitamins and minerals
Rodney R. Dietert: immunotoxicology
June M. Fessenden-Raden: risk communication and risk management
James W. Gillett: ecotoxicology
Steven P. Gloss: aquatic toxicology
John D. Henion: environmental toxicology
Joseph H. Hotchkiss: food-and-diet-related toxicology
Jay S. Jacobson: phytotoxicology
Sheila Jasanoff: toxic substances regulation
John M. King: toxicologic pathology
Lennart P. Krook: toxicologic pathology
Ann T. Lemley: ecotoxicology and environmental chemistry
Robert M. Lewis: environmental pathology
Leonard W. Lion: environmental engineering
Donald J. Lisk: toxicants in foods
George A. Maylin: drug testing
Neill I. Mondy: food toxicology
Mary A. Morrison: nutrition and toxicology
Robert S. Parker: xenobiotic metabolism
Daphne A. Roe: drug-nutrient interactions
Wayne S. Schwark: neurotoxicology
Ruth Schwartz: nutritional toxicology; minerals
Jeffrey G. Scott: insecticide toxicology
Geoffrey W. G. Sharp: pharmacology
David M. Soderlund: insecticide toxicology
Mary F. Sowers: nutrition and toxicology; toxicologic epidemiology
Gilbert S. Stoewsand: food toxicology
Robert J. Wagenet: soil physics and chemistry
Leonard H. Weinstein: phytotoxicology
C. F. Wilkinson: drug metabolism

EPIDEMIOLOGY

Minor field

Graduate faculty representative

Raymond H. Cypess, 209 Diagnostic Laboratory

Minor subject Epidemiology (human and animal epidemiology)

The Field of Epidemiology offers a graduate program as a *minor* field in conjunction with several areas of specialization, including biometry, environmental toxicology, nutrition, sociology, statistics, animal science, and veterinary medicine. Students may pursue an M.S., M.A., or Ph.D. degree with a minor in epidemiology. All applicants should have a sound background in mathematics and in the sciences that are consistent with the requirements of their proposed major field of interest.

Graduate students enrolled in the program will conduct their research in the departments of their major advisers.

Faculty for the Field of Epidemiology are drawn from several colleges. The list below provides a description of the varied research interests of the faculty.

Faculty and Specializations

- John J. Babish (Pharmacology): risk assessment methodology; animal modeling for risk assessment in humans; significance of *in utero* exposure to toxic substances; ambient exposure to toxic materials; factors affecting the metabolism of foreign compounds
- George Casella (Biometrics Unit): statistical decision theory; point and interval estimation; regression analysis; empirical Bayes methods
- Larry C. Clark (Biometrics Unit): nutrition and cancer epidemiology; nutritional surveillance; environmental epidemiology
- Raymond H. Cypess (Diagnostic Laboratory): parasitology; infectious diseases; diagnostic laboratory services; seroepidemiology
- Hollis N. Erb (Clinical Sciences): veterinary epidemiology; epidemiological determinants of lactational and reproductive performance in dairy herds; ovarian tumors; epidemiology in dairy cows
- Walter D. Federer (Biometrics Unit): experimental design and analysis; combinatorial construction; application of statistical theory to experiments
- Jean-Pierre Habicht (Division of Nutritional Sciences): nutritional surveillance; nutritional epidemiology of mother and child; international nutrition
- Donald J. Lisk (Toxic Chemicals Laboratory): toxicologic markers in occupationally exposed human populations
- Charles E. McCulloch (Biometrics Unit): linear statistical models; ecological statistics; selection and ranking
- Douglas S. Robson (Biometrics Unit): sampling theory; biological sampling and estimation; statistical models for bioassay
- Daphne A. Roe (Division of Nutritional Sciences): geriatric nutrition; photobiology and nutrition; drug and nutrient interactions
- Thomas J. Santner (Operations Research): biomedical statistics; selection theory; reliability
- Janet M. Scarlett-Kranz (Clinical Sciences): veterinary epidemiology; zoonoses;

- occupational epidemiology; epidemiology of disabilities among the elderly
- Steven J. Schwager (Biometrics Unit): multivariate analysis; experimental design; clustering; outlier detection
- Mary F. Sowers (Division of Nutritional Sciences): chronic disease epidemiology; nutrition assessment of population; nutritional surveillance; environmental epidemiology
- Bruce W. Turnbull (Operations Research): statistical methods for health studies; survival analysis; statistical methods for reliability and life testing

FLORICULTURE AND ORNAMENTAL HORTICULTURE

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Robert W. Lanhans, 20 Plant Science Building

Subject Floriculture and ornamental horticulture

Admission to the field is based on the quality and nature of the applicant's prior training as well as on letters of recommendation. Applicants should have strong backgrounds in biological, horticultural, and agricultural sciences and strong interests in floriculture and ornamental horticulture. Applicants are required to submit GRE test scores. For the Ph.D. the field requires a qualifying examination taken early in the program, preferably no later than the second term of residence, in addition to the other examinations required by the Graduate School.

The field has no foreign language requirement. All students receive experience in resident teaching and cooperative extension programs.

For the Master of Professional Studies (Agriculture) degree, the field requires completion of thirty credits of courses related to the student's professional interests, successful completion of a problem-solving project, and a minimum grade point average of 2.5.

Research Opportunities

Excellent opportunities for graduate study and research are offered in all phases of floriculture and ornamental horticulture. Areas of specialization include greenhouse floriculture crops, nursery crops, turfgrass science, horticultural physiology, taxonomy of ornamental plants, landscape horticulture, and urban horticulture. Studies relating to physiology, growth and development,

propagation, physiology, postharvest physiology, nutrition, weed science, horticultural marketing, production management, and culture of floriculture and nursery crops and turfgrass may be undertaken as research for an advanced degree and should be approached from the standpoint of the basic sciences. It is appropriate to select minor areas of study from such areas as plant physiology, plant pathology, biochemistry, botany, entomology, plant anatomy, plant morphology, taxonomy, plant ecology, genetics, education, agricultural economics, agricultural engineering, and landscape architecture.

Outstanding facilities include laboratories specifically equipped for studies on growth regulators, foliar and soil analysis, tissue culture, postharvest physiology, rhizosphere analysis, and various other physiological and anatomical topics. Controlled-environment rooms, greenhouses, an outdoor nursery, and turfgrass production areas are also available.

Landscape architecture, although a program in the Department of Floriculture and Ornamental Horticulture, operates as a separate graduate field.

Faculty and Specializations

- Nina L. Bassuk: physiology of horticultural crops, especially in the urban environment
 Raymond T. Fox: retail florist shop management; merchandising, layout, and shop efficiency
 George L. Good: nursery crop production management; nutrition
 Carl F. Gortzig: floriculture crop production management; floriculture extension programming
 Norman W. Hummel: turfgrass science and nutrition; soil fertility
 Robert W. Langhans: culture of greenhouse crops; controlled environments
 Robert G. Mower: taxonomy of ornamental plants; plant evaluation
 Kenneth W. Mudge: physiology of nursery crops; mycorrhizae; propagation and micropropagation
 Joseph C. Neal: horticultural weed science
 Fayek B. Negm: physiology of horticultural crops; carbohydrate metabolism; postharvest physiology
 A. Martin Petrovic: turfgrass science; soil fertility; root physiology
 Thomas C. Weiler: florist cut-, pot-, and bedding-crop culture; cropping systems

FOOD SCIENCE AND TECHNOLOGY

M.S., Ph.D., M.F.S., M.P.S.(Agr.)

Graduate faculty representative Dennis D. Miller, 119 Stocking Hall

Subjects Food science and technology (dairy science, food chemistry, food engineering, food microbiology, food processing waste technology, food science [general], international food science); food science [M.F.S.]

Candidates for the M.S. are required to register for one major in the field and one minor outside the field. Candidates for the Ph.D. are required to register for one major in the field and two minors outside the field. There are no course credit requirements for the M.S. or Ph.D. All graduate students must register for the seminar (NS 600) each term and must make at least one seminar presentation prior to graduation. In addition to the examinations required by the Graduate School, a qualifying examination is required of Ph.D. candidates before the start of their second semester of residence.

Applicants should have good training in biology, chemistry, microbiology, and biochemistry; prior training in food science is desirable. Applicants must submit GRE general test scores. Foreign students are required to take the Test of English as a Foreign Language (TOEFL) in addition to the GRE.

The field offers excellent opportunities for graduate study in both basic and applied research. All course work is taken on the Ithaca campus, but students may conduct their research at the New York State Agricultural Experiment Station at Geneva as well as on the Ithaca campus.

Faculty and Specializations

- Terry E. Acree: food chemistry*
 Gertrude D. Armbruster: food chemistry; food science (general)
 John G. Babish: food science (general)
 Robert C. Baker: food science (general)
 David M. Barbano: dairy science; food chemistry; food microbiology; food science (general)
 Carl A. Batt: food microbiology
 Donald H. Beermann: food science (general)
 Carole A. Bisogni: food science (general)
 John B. Bourke: food chemistry*
 Malcolm C. Bourne: food chemistry; food science (general); international food science*
 John W. Brady: food chemistry

Marjorie M. Devine: food science (general)
 Terence R. Dockerty: food science (general)
 Donald L. Downing: food science (general)*
 Donald C. Graham: food microbiology; food science (general); international food science
 Robert B. Gravani: food microbiology; food science (general)
 Yong D. Hang: food microbiology; food processing waste technology; food science (general); international food science*
 James R. Hicks: food chemistry
 Joseph H. Hotchkiss: food chemistry
 Geza Hrazdina: food chemistry*
 William K. Jordan: dairy science; food engineering; food processing waste technology; food science (general); international food science
 John E. Kinsella: dairy science; food chemistry; food science (general); international food science
 Richard A. Ledford: dairy science; food microbiology; food science (general)
 Chang Y. Lee: food chemistry; food science (general); international food science*
 B. A. Lewis: food chemistry; food science (general)
 Donald J. Lisk: food science (general)
 Frank Liu: food science (general)
 Mark McLellan: food engineering; food processing waste technology*
 Dennis D. Miller: food chemistry; food science (general)
 Nell I. Mondy: food chemistry; food science (general); international food science
 Mary A. Morrison: food chemistry
 Robert S. Parker: food science (general)
 Norman N. Potter: dairy science; food microbiology; food science (general)
 M. Anandha Rao: food engineering*
 Joe M. Regenstein: food chemistry; food microbiology; food science (general)
 Gerald E. Rehkugler: food engineering
 Syed S. H. Rizvi: food engineering
 R. S. Shallenberger: food chemistry*
 John W. Sherbon: dairy science; food chemistry; food engineering; food science (general)
 William F. Shipe, Jr.: dairy science; food chemistry; food science (general); international food science
 Michael L. Shuler: food engineering
 Don F. Splittstoesser: food microbiology*
 Keith H. Steinkraus: food microbiology; food science (general); international food science*
 Gilbert S. Stoewsand: food chemistry*

J. R. Stouffer: food science (general)
 Jerome P. Van Buren: food chemistry*
 Reginald H. Walter: food chemistry; food science (general); international food science*

Robert R. Zall: dairy science; food engineering; food processing waste technology; food science (general)

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

GENETICS

(See also Graduate School of Medical Sciences.)

(M.S.), Ph.D.

Graduate faculty representative Thomas D. Fox, 202 Bradfield Hall

Subject Genetics (developmental biology, genetics)

Only students intending to take a Ph.D. degree are admitted. Applicants should submit scores for the GRE general test, and, if appropriate, for the subject test (biology). Evidence of previous successful research experience will greatly strengthen an application.

Graduate students are required to pass an oral qualifying examination before the beginning of their fifth semester and must obtain at least two semesters of teaching experience during their course of study.

Faculty members in the Field of Genetics have widely different research interests ranging from molecular genetics through developmental and evolutionary genetics. Entering students are encouraged to work for brief periods (laboratory rotations) with several faculty members during their first year before choosing a major adviser.

Faculty and Specializations

Charles F. Aquadro: population genetics and evolution
 Antonie W. Blackler: vertebrate development
 Stephen E. Bloom: avian cytogenetics
 Peter J. Bruns: gene regulation and organization in ciliates
 Joseph M. Calvo: control of gene expression
 Rodney R. Dietert: regulation of avian gene expression
 Gary M. Dunny: genetics of bacterial cell surfaces
 Thomas D. Fox: control of mitochondrial and nuclear genes in yeast
 Michael L. Goldberg: control of gene expression in *Drosophila*
 Maureen R. Hanson: mitochondrial and somatic cell genetics in plants

Richard G. Harrison: evolution
 Kenneth J. Kemphues: developmental genetics of the nematode *Caenorhabditis*
 John T. Lis: gene regulation and chromatin structure
 Ross J. MacIntyre: gene structure and function in *Drosophila*
 Martha A. Mutschler: genetics of *Brassica* and *Lycopersicon*
 June B. Nasrallah: molecular genetics of self-incompatibility in plants
 Jeffrey W. Roberts: regulation of gene expression in phage lambda
 Valley J. Stewart: gene regulation in bacteria
 Steven D. Tanksley: genome organization and evolution in plants
 Bik K. Tye: genome structure and DNA replication in yeast
 Volker M. Vogt: structure and assembly of retroviruses
 Mariana F. Wolfner: gene regulation in development of *Drosophila*
 Olen C. Yoder: molecular genetics of fungal plant pathogens
 Stanley A. Zahler: molecular genetics of *Bacillus*

GEOLOGICAL SCIENCES

M.S., Ph.D.

Graduate faculty representative William A. Bassett, 4140 Snee Hall

Subject Geological sciences (economic geology, engineering geology, general geology, geobiology, geochemistry and isotope geology, geomorphology, geophysics, geotectonics, mineralogy, paleontology, petroleum geology, petrology, planetary geology, Precambrian geology, Quaternary geology, rock mechanics, sedimentology, seismology, stratigraphy, structural geology, marine geology [minor only])

Students with undergraduate majors in subjects such as engineering, physics, chemistry, biology, and mathematics, as well as in geology, are encouraged to apply. Prior study of geology is not a requirement for admission. Applicants are required to submit scores from the GRE general test.

The program is designed to give students the opportunity for broad and formal training in the basic sciences as well as in the field and to provide extensive practical experience through research in their specialty. Students have a wide variety of options in the selection of programs that will best suit their interests and talents. At least one minor subject outside the field is required for the doctoral degree.

Proficiency must be established in French, German, or Russian for the doctoral degree. A qualifying examination is required in addition to the examinations required by the Graduate School. The qualifying examination will determine the candidate's fitness for undertaking advanced studies and will enable the Special Committee to plan programs that will make the student familiar with the requisite knowledge in the chosen areas. It must be taken before the end of the second semester in residence.

There are a number of graduate teaching assistantships available in the field. Teaching assistants who are doctoral candidates are eligible for special summer awards.

There are several departmental fellowships that have various restrictions. The department has several special endowments that may be used to assist graduate students in their research and fieldwork, and research assistantships are available.

Research and Study Opportunities

The department conducts a number of research programs in various parts of the world, covering a variety of research topics. The list is ever changing but includes such diverse items as the study of seafloor spreading and plate tectonics on a global scale; observation of current seismic activity in the South Pacific; investigation of igneous rocks in arc systems; experimental deformation of sediments; tectonics, seismology, sedimentation, and geomorphology of the central Andes; the study of rocks and minerals from the earth's deep interior; the properties of minerals at high pressures and temperatures; the nature and movement of fluids in the earth's crust; measurement of sea-level changes and recent crustal movement in the eastern United States, the Southwest Pacific, and elsewhere; seismic reflection profiling of the deep crust and upper mantle; dynamics and mechanics of the lithosphere and asthenosphere; paleontological problems of New York State and elsewhere; engineering geology of selected localities; field geology in Indonesia; and marine studies of areas available to current cruises. Through the resources of the department and the cooperating faculty of other departments a wide variety of special and advanced equipment is available.

The Institute for the Study of Continents (INSTOC) shares quarters and facilities with the Department of Geological Sciences. A number of graduate students in the Field of

Geological Sciences conduct their research and write their theses based on INSTOC projects.

Some students carry out their thesis projects in the interdisciplinary area of planetology with members of the Department of Astronomy. Others work on projects with members of the Department of Civil Engineering, the Department of Materials Science and Engineering, and the Department of Theoretical and Applied Mechanics. Each of these four departments have faculty who are members of the Field of Geological Sciences.

Working agreements with institutions in other parts of the world are maintained by the department to facilitate research projects in those areas or to work on materials especially accessible at those bases.

The Paleontological Research Institution, a private research organization, is located near the campus, and its facilities are available to the specialized investigator.

The Ithaca region is particularly suited for research in stratigraphy, paleontology, geomorphology, and glacial geology. The nearby Adirondack area is a classic one for studies of igneous and metamorphic petrology, and much of the Appalachian orogenic belt is readily accessible. Geology is seen as a global science by the department, however, and interests are not limited to the immediate vicinity of the Ithaca campus.

Interdisciplinary Studies

The exceptional flexibility of the graduate program at Cornell provides ample opportunity for students of the geological sciences to do work in interdisciplinary areas. For example, special arrangements already exist for study of oceanography, marine ecology, water resources, and various branches of applied geological science. Faculty in other departments or divisions offer many interdisciplinary courses, such as paleobotany, ecology and systematics, biogeochemistry, limnology, soil genesis, soil mineralogy, soil and rock mechanics, aerial photo analysis, fluid dynamics, elasticity, regional planning, hydraulics and hydrology, and materials science and engineering.

Faculty

Richard W. Allmendinger
William A. Bassett
John M. Bird
Arthur L. Bloom
Larry D. Brown
Lawrence M. Cathles III

John L. Cisne
Bryan L. Isacks
Teresa E. Jordan
Daniel E. Karig
Robert W. Kay
David L. Kohlstedt
Arthur F. Kuckes
Fred H. Kulhawy
George H. Morrison
Jack E. Oliver
Thomas D. O'Rourke
Frank H. T. Rhodes
Andy L. Ruina
Arthur L. Ruoff
Carl E. Sagan
William B. Travers
Donald L. Turcotte
Joseph F. Veverka
William M. White

GERMANIC STUDIES

M.A., Ph.D.

Graduate faculty representative Sander L. Gilman, 173 Goldwin Smith Hall

Subject Germanic studies (German area studies, German intellectual history, Germanic linguistics, Germanic literature, Old Norse [minor only])

Applicants are expected to have a good background in German literature and to be fluent in German. The field asks all United States applicants to submit GRE scores. Since proficiency in French is required for the Ph.D., students are encouraged to begin their study of this language as early as possible.

The program in German literature at Cornell is uniquely flexible. In general, requirements are defined in terms of competence, not in terms of credits or specific courses. All students are expected to acquire a general knowledge of German literature and to become familiar with the tools and methods necessary for research and analysis. In addition, students are expected to acquire a more-detailed knowledge of one of the following periods: medieval; Renaissance, Reformation, baroque; Enlightenment, *Sturm und Drang*, Schiller, Goethe; romanticism, *Biedermeier*, *Restauration* through *Vormärz*; realism, naturalism; twentieth century.

The program in Germanic linguistics aims at ensuring familiarity with the basic tools of research in linguistics and philology and at providing the student with a thorough knowledge of selected areas of specialization. Students may focus on one or more of

the following: the structure of modern German, the history of German, comparative Germanic linguistics, the older Germanic languages, and the contrastive analysis of German and English. Opportunities for studying Old Norse are exceptional; the university's collection of Old Norse materials (the Fiske Icelandic Collection) is probably the most important of its kind in the world.

A concentration in intellectual history draws on the German-oriented faculty of other departments such as philosophy, history, government, psychology, and music. A student with a major in German intellectual history may concentrate on a theme or in a historical period from the Middle Ages to the present. The focus of the major is generally on the history of ideas as reflected in German written documents. A concentration in German area studies combines relevant courses in history, international relations, and comparative economics with courses in German literature, culture, and language.

The qualifying examination is required of all students at the beginning of their second semester. A comprehensive examination will be administered at the end of the sixth semester of residence, after which work on the dissertation will begin. Details are contained in the *Guide for Graduate Students*, which may be requested by writing to the graduate faculty representative.

Faculty and Specializations

Anne G. Adams: Dutch Creole dialectology
Ciriaco M. Arroyo: comparative literature
David Bathrick: literary theory; modern drama and literature; film theory; history of German social thought
Eric A. Blackall (emeritus): eighteenth- and nineteenth-century literature; comparative literature
Susan Buck-Morss: government
Herbert Deinert: seventeenth-, nineteenth-, and twentieth-century literature
Inta M. Ezergailis: nineteenth- and twentieth-century literature; women's studies
Sander L. Gilman: literature from the Reformation to the present; Jewish studies; history of psychiatry
Arthur B. Groos, Jr.: medieval and eighteenth-century literature
Wayne Harbert: Germanic linguistics; syntactic theory
Peter U. Hohendahl: seventeenth-, eighteenth-, nineteenth-, and twentieth-century literature; literary theory; comparative literature
William W. Holdheim: comparative literature

Ronnie P.-C. Hsia: history
Isabel Hull: history
Jay H. Jasanoff: Indo-European linguistics; historical Germanic linguistics
Peter J. Katzenstein: government
Herbert L. Kufner: German dialectology; contrastive and applied linguistics; German language pedagogy
Carolyn A. Martin: nineteenth- and twentieth-century literature; women's studies
P. M. Mitchell: Danish literature; eighteenth-century German literature; bibliography
Leonard M. Olschner: lyric poetry; twentieth-century literature
Frans van Coetsem: Germanic linguistics; historical linguistics
Allen W. Wood: philosophy

GOVERNMENT

(M.A.), Ph.D.

Graduate faculty representative Milton J. Esman, 132 McGraw Hall

Subject Government (American politics, comparative politics, international relations, political thought, political methodology [minor only], public policy [minor only])

The field asks applicants to submit scores of the GRE general test. Students are admitted only at the beginning of the academic year.

Students are asked (1) to acquire a thorough knowledge of the discipline, including substantial theoretical, conceptual, and substantive competence in a major subject; (2) to provide a clear demonstration of the methodological, linguistic, and other skills needed to conduct original scholarly research; and (3) to acquire at least one term's experience as a teaching assistant. If students have not taken equivalent courses previously, they are expected to take three of the four field seminars in the major subjects.

Early in the first semester the new graduate student meets with the director of graduate studies and several faculty members to discuss the first year's program. At the end of the first year the student should form a Special Committee that guides and supervises the student's subsequent academic preparation and dissertation research.

By the end of the third year of residence, or sooner if possible, the student is expected to have taken the admission to candidacy examination. The examination is given in three parts: (1) a written examination in the student's major and minor subjects; (2) an extended research paper in the student's

specialized field of interest; and (3) an oral examination conducted by the Special Committee. The written examinations are normally taken before the end of the student's second year; the oral examination, at the beginning of the third. At the oral examination the student presents a thesis proposal outlining the hypothesis, data, methods, and resources needed to carry out his or her dissertation research.

The graduate Field of Government also accepts a limited number of candidates for the M.A. degree who are interested in careers in politics or public service. Preference is given to applicants who want to combine the study of political science with a specialized minor in which Cornell has distinctive strengths, such as Southeast Asian studies, peace studies, rural development, or an Asian language. The M.A. degree requires two full years of full-time study plus successful completion of a master's thesis.

Interdisciplinary Programs

Students are encouraged to take advantage of the numerous interdisciplinary programs, which include the Program on Science, Technology, and Society; the Cornell Institute for Social and Economic Research; the Rural Development Committee; the Peace Studies Program of the Center for International Studies; and the foreign areas programs for Latin America, South Asia, Southeast Asia, China, Japan, the Soviet Union, and Western Europe.

Faculty and Specializations

Benedict R. Anderson: comparative government; nationalism; militarism; Southeast Asian studies
 Martin G. Bernal: comparative government; Chinese politics; modern Chinese history
 Susan Buck-Morss: political and social theory
 Werner J. Dannhauser: political thought
 Arch T. Dotson: American government; public policy
 Milton J. Esman: comparative government; comparative ethnic politics; politics, public administration, and rural development in third world countries
 Benjamin Ginsberg: American government and politics; elections; public opinion
 Michael Goldfield: American politics; labor and American politics; Marxist theory;

philosophy of social science; political methodology
 George McT. Kahin: international relations; comparative politics; Southeast Asian studies
 Mary F. Katzenstein: comparative government; South Asia; women's studies; feminist movements; public policy
 Peter J. Katzenstein: comparative government; Europe; international relations; international and comparative political economy; comparative public policy; state theory
 Estel W. Kelley: American government; political methodology; comparative public policy
 Eldon G. Kenworthy: comparative government; Latin America; United States policy toward Latin America
 Ronald F. King: American government and politics; welfare policy; economic policy
 Isaac Kramnick: political thought
 Richard N. Lebow: international relations
 Theodore J. Lowi: American government and politics; public policy and administration
 T. John Pempel: comparative politics; Japan; public policy; modern industrial societies; political economy
 Jonas G. Pontusson: comparative politics; Western Europe; political economy; comparative labor movements
 Jeremy A. Rabkin: American government; constitutional law; administrative procedure; bureaucratic politics
 Richard Rosecrance: international relations
 Myron Rush: international politics; comparative politics; Soviet domestic and foreign policy; esoteric communications; politics of succession
 Lawrence Scheinman: international relations; international law and regime development; international energy and technology; nuclear nonproliferation
 Martin A. Shefter: American politics; urban politics; national political institutions
 Vivienne B. Shue: comparative politics; China; peasant politics; socialism; revolution
 Sidney G. Tarrow: comparative politics; Western Europe; social movements and political parties; comparative communism
 Norman T. Uphoff: comparative politics; third world development; local institutions and participation; South Asia; political economy; public policy

HISTORY

M.A., Ph.D.

Graduate faculty representative J. Victor Koschmann, 327 McGraw Hall

Subject History (American history, American studies, ancient history, early modern European history, English history, French history, German history, history of science, Latin American history, medieval Chinese history, medieval history, modern Chinese history, modern European history, modern Japanese history, Russian history, Southeast Asian history)

Applications for admission must include the scores of the GRE general test. Applications are normally accepted for the fall term, but spring admission is possible.

All new graduate students must enroll in History 709, Introduction to the Graduate Study of History, in the fall semester. Students whose major area of concentration is American history must enroll in History 710, Graduate Colloquium in American History, in the spring.

All entering doctoral students must take a proficiency examination in an appropriate foreign language at the beginning of the first term of residence. Those who do not pass the examination must enroll in a suitable language course until proficiency is acquired. Proficiency in two foreign languages (or in one language and statistics) must be demonstrated before a Ph.D. candidate is eligible for the admission to candidacy examination. The admission to candidacy examination must cover one major and two minor concentrations and is partly oral and partly written. It is usually taken in the third year of study. History graduate students are permitted to choose one of their two minor concentrations from other fields of the Graduate School.

Candidates for the Ph.D. in history are required to do classroom teaching as part of the doctoral program. Most graduate students will serve for at least one year as teaching assistants in undergraduate courses. For some, however, especially those with financial support from foundations or special agencies, voluntary teaching under the supervision of a member of their graduate committee will be an acceptable alternative.

The field does not usually give teaching assistantships to first-year students. However, second- through fifth-year students are frequently employed as assistants in undergraduate history courses. First-year students are eligible for university-wide competitive fellowships.

Faculty and Specializations

- Daniel A. Baugh: modern English history, 1688–1914—political, social, economic, and administrative; maritime history of Western Europe, 1600–1800
- Stuart M. Blumin: American history—social, cultural, economic, and demographic; American urban history
- Joan J. Brumberg: history of women in the United States—nineteenth and twentieth century; social history of religion and medicine; history of the family and adolescence
- Sherman G. Cochran: modern Chinese history, 1644 to the present—political, social, economic, and intellectual
- Peter R. Dear: history of science; early modern science and philosophy
- Robert L. Harris: Afro-American history; Afro-American historiography; thought and culture; leaders and movements
- Thomas H. Holloway: Latin American history; Brazil—social, economic, and political history in the national period
- Clive A. Holmes: early modern English history, 1450–1688—political, legal, social, and economic
- Ronnie P. Hsia: Reformation and Counter-Reformation
- Isabel V. Hull: modern German history; history of women in Germany
- James J. John: medieval intellectual history; historiography; universities; Latin paleography
- Michael G. Kammen: early American history; historical thought and American culture; New York history
- Steven L. Kaplan: France, 1500–1848; comparative European social history; historical demography; quantitative approaches
- J. Victor Koschmann: modern Japanese history; Japanese intellectual history
- Dominick LaCapra: modern European intellectual history
- Walter F. LaFeber: American history; United States foreign policy, 1750 to the present
- Robert L. Moore: American history, intellectual and cultural
- John M. Najemy: late medieval and Renaissance history; Italy, 1250–1559; Florence—political, socioeconomic, constitutional, and cultural history; intellectual history of Western Europe, 1300–1600
- Mary Beth Norton: American history, 1760–1850—social, political, and constitutional; history of women in America

- Charles A. Peterson: Chinese history in the period T'ang-Sung—political, military, administrative, and foreign relations, especially late T'ang and late southern Sung
- Walter M. Pintner: modern Russian history, 1700 to the present, especially social, economic, military, and administrative history of the imperial period
- Richard Polenberg: modern American political and social history, 1930 to the present
- William B. Provine: history of science; history of biology
- Nick Salvatore: American history; social history in the nineteenth and twentieth centuries, with emphasis on labor history; radicalism and dissent
- Takashi Shiraishi: modern Southeast Asian history; twentieth-century Indonesian history
- Joel H. Silbey: American history; political behavior, especially in the nineteenth century; the Age of Jackson; the sectional controversy; Civil War and Reconstruction; quantitative methods in history
- Fred Somkin: American cultural and intellectual history
- Barry Strauss: ancient history, Greek and Roman; classical and Hellenistic Greece; the Greek city; late antiquity and early Byzantine
- Brian Tierney: medieval church history; law; political theory
- Daniel Usner: Native American history
- John Weiss: modern European history, social and political; social history of technology
- L. Pearce Williams: history of science; nineteenth-century physical sciences
- David K. Wyatt: modern Southeast Asian history; history of Thailand and Laos

HISTORY AND PHILOSOPHY OF SCIENCE AND TECHNOLOGY

M.A., Ph.D.

Graduate faculty representative Tom F. Peters, 425 Caldwell Hall

Subject History and philosophy of science and technology

The history and philosophy of science and technology constitutes a complex interdisciplinary field that requires rigorous training in at least one branch of science or engineering and a thorough grounding in the humanistic traditions. Applicants to the field should have a strong background in the basic sciences or in a branch of engineering

but have prior schooling also in history or philosophy and preferably in both of those areas. The faculty of the field is reluctant to overburden a student with required course work and finds it neither realistic nor desirable to attempt to provide detailed training in all aspects of the field. The breadth and depth of training obtained will depend on the student's particular degree program and on his or her level of commitment to the field—as a major or minor.

In accordance with the general guidelines for graduate education at Cornell, the Field of History and Philosophy of Science and Technology will have no specific course work requirements except that each student working toward the Ph.D. in the field will be expected to show proficiency equivalent to (1) four graduate-level courses in the branch of science or engineering of prime importance to subsequent thesis work, (2) four courses in history, and (3) four courses in philosophy.

History and philosophy courses in various specialties are frequently offered by other departments in addition to those of History and Philosophy. Courses in the individual branches of science and engineering are listed in the catalog *Courses of Study* under the individual specialties.

Students minoring in the history and philosophy of science will be expected to take a series of three courses in this area.

The Graduate School requires two examinations. The admission to candidacy examination in the history and philosophy of science and technology is an oral examination on the students's integrative understanding, thesis prospectus, and relevant literature, taken usually in the fifth semester of residence. The final examination for Ph.D. candidates is an oral examination on the student's dissertation.

All students are required to serve one year as teaching assistants.

A student's Special Committee may recommend or require study of languages needed for research and teaching in one of the student's areas of specialization or may suggest or require course work in a field other than the history or philosophy of science and technology.

Collaborative Work with the Medical College in New York City

A year in residence for historical research at the Cornell Medical College can be arranged, particularly in the area of psychiatry, where the prospective candidate would work

with members of the faculty of the Section on the History of the Behavioral Sciences in the Department of Psychiatry.

Weekly Colloquium

Graduate students working toward the Ph.D. in the history and philosophy of science and technology will be expected to attend a weekly colloquium held each semester. Scholars from Cornell or other institutions make a formal hour-long presentation followed by discussion in which all present may participate. There are no course requirements, nor is there any course credit offered. The purpose of the colloquia is to acquaint students with work in the field going on at Cornell and at other institutions and to bring the students into contact with scholars active in the field.

Faculty and Specializations

Richard N. Boyd: philosophy of science, psychology, epistemology, language, and mind; ethics; social and political philosophy, especially Marxism
 Urie Bronfenbrenner: psychology; human development and education; family studies
 Joan J. Brumberg: history of American women; history of childhood, youth, and the family; social history of American religion; history of American education; American cultural and intellectual history
 Margaret L. Cook: fifth- and fourth-century B.C. Greek political history; Greek historiography, rhetoric, science, and medicine
 Peter R. Dear: scientific revolution; Jesuit science in the early seventeenth century
 Terrence L. Fine: comparative probability; inference and decision theory; modeling of chance and uncertainty
 Sander L. Gilman: insanity in literature and art; treatments in literature of the Blacks, of the Jews, and of sexual stereotypes
 Carl A. Ginet: philosophy of psychology and of linguistics
 Arthur B. Groos, Jr.: medieval and eighteenth-century German literature
 Keith E. Gubbins: molecular thermodynamics of liquid mixtures; phase equilibria; computer simulation studies of liquids; interfacial properties
 Martin O. Harwit: astrophysics; optical transform techniques; history of science and science policy
 Harold T. Hodes: philosophy of science and mind; aesthetics; the history of twentieth-century philosophy

Roald Hoffmann: electronic structure of stable and unstable molecules and of transition states in reactions
 Kenneth A. R. Kennedy: biological and forensic anthropology; historical development of biological anthropology; paleoecology and paleodemography
 Norman Kretzmann: medieval science
 Richard L. Liboff: kinetic theory; quantum mechanics
 Richard W. Miller: philosophy of the natural and social sciences
 Dorothy W. Nelkin: social factors influencing the conduct of science; the impact of science on modern society
 Anil Nerode: recursion theory; model theory; logic and computer science; history of mathematics
 Tom F. Peters: nineteenth-century development of the modern building process; suspension bridges; industrial development
 William B. Provine: history of population genetics; evolutionary theory
 Frank H. T. Rhodes: paleontology; evolution; education
 Sydney Shoemaker: philosophy and psychology
 Robert C. Stalnaker: philosophy of language; epistemology; formal semantics; foundations of probability; philosophy of psychology
 Yervant Terzian: radioastronomy; large-scale structure in the universe
 John H. Weiss: modern European history; social history of technology
 L. Pearce Williams: origins of field theory in physics; the work of Faraday, Ampere, and Oersted

HISTORY OF ART AND ARCHAEOLOGY

(M.A.), Ph.D.

Graduate faculty representative Robert G. Calkins, 35 Goldwin Smith Hall

Subject History of art and archaeology (American art, ancient art and archaeology, medieval art, modern art, oriental art, Renaissance and baroque art)

An undergraduate major in the history of art is recommended but not required. All applicants are required to take the GRE general test. Applicants should already have begun to study the language appropriate to their intended program; they must demonstrate reading proficiency in the language before becoming candidates for a degree. Each Ph.D. candidate must participate in teaching during at least two terms.

The department awards several teaching assistantships. The Franklin and Gretel Goldring Memorial Fellowship provides summer travel support in Europe for several advanced students.

Research and Study Opportunities

Major study facilities are provided by the collections of Olin Library, which contain resources of primary materials for this field, and by the Fine Arts Library in Sibley Hall, which has extensive holdings in art and architectural history. The Herbert F. Johnson Museum of Art, which has in its permanent collection significant study material, offers opportunities to gain experience in the operations of the museum. In addition to the major collections in New York City, Ithaca is within reasonable distance of the Albright-Knox Art Gallery in Buffalo, the Memorial Art Gallery in Rochester, and the Munson-Williams-Proctor Institute in Utica. The Department of History of Art has a study collection of photographs of works of art and a collection of over 175,000 slides.

Interdepartmental programs are available in archaeology and in medieval studies; descriptive pamphlets will be sent on request. The Department of Asian Studies also issues a publication describing facilities in Far Eastern studies. A study archive of Chinese art is being developed.

Faculty and Specializations

Judith E. Bernstock: modern and contemporary art
 Theodore M. Brown: American art and architecture
 Robert G. Calkins: medieval art and architecture; illuminated manuscripts
 John E. Coleman: classical art and archaeology; Aegean Bronze Age
 Esther G. Dotson: Renaissance art; seventeenth- and eighteenth-century art
 Patricia J. Graham: Japanese art and architecture
 Claudia Lazzaro: Italian Renaissance art, architecture, and gardens
 Thomas W. Leavitt: American art; museum studies
 Sheila McTighe: seventeenth- and eighteenth-century art
 Laura L. Meixner: nineteenth- and twentieth-century American and European art
 Stanley J. O'Connor: Indian and Southeast Asian art; art criticism
 Andrew Ramage: Greek and Roman art and archaeology; Lydia and Asia Minor; ceramics and metallurgy
 M. W. Young: Chinese art

HOTEL ADMINISTRATION

M.S., Ph.D., M.P.S.(H.Ad.)

Graduate faculty representative Michael H. Redlin, W107 Statler Hall

Major subject Hotel administration (hotel administration)

Minor subject Hotel administration (financial management, food and beverage management, hotel accounting, human resources management, marketing, properties management)

The field offers the following degrees: Ph.D., M.S., and Master of Professional Studies (Hotel Administration). The Ph.D. degree program is specifically aimed at preparing those exceptional students who plan to teach at the college level or to do research in the field. The M.S. is also aimed at preparing teachers and researchers. The M.P.S. program leads to a professional terminal degree. It is designed to help individuals who have had significant work experience in the hospitality industry to prepare for successful management careers in the field at the corporate and operational levels.

Candidates for the Ph.D. must have completed a master's or bachelor's degree in hotel administration or related areas. Candidates for the M.S. must have completed the B.S. in hotel administration at Cornell. The Graduate Management Admission Test (GMAT) is required of all applicants to the M.P.S., M.S., and Ph.D. programs.

There are four different approaches to the M.P.S. (H.Ad.) degree, depending on the applicant's prior study: (1) for those with a bachelor's in a field other than hotel administration, sixty-four credits (a minimum of two years residence) will be required; (2) for those with a B.S. in hotel administration from a school other than Cornell, forty-eight to sixty-four credits (a year and a half to two years) will be required; (3) for those with a B.S. in hotel administration from Cornell, thirty-two credits (one year minimum) will be required; and (4) for those who already hold a master's degree in another field, forty-eight to sixty-four credits (a year and a half to two years) will be required. A master's monograph must be presented during the last term of work for this degree.

Each applicant must show evidence of significant experience in the hospitality industry or in a related area. Further, it is required that each candidate arrange for a personal interview with a representative of

the School of Hotel Administration. Not all prospective students can readily come to Ithaca; therefore, arrangements have been made with graduates and others active in the hotel and restaurant business to serve as interviewers for M.P.S. applicants in most of the principal cities of the world. A time and place for this interview should be requested from the Graduate Office, School of Hotel Administration, Statler Hall. Ph.D. and M.S. applicants must come to Cornell for their interviews.

Admission to the M.P.S. program is granted for fall only. Applicants and all supporting documents must be filed by February 15. M.S. and Ph.D. degree applicants may apply for either the fall or spring semester. Applications for the spring semester must be filed by September 1, and all supporting documents must be submitted by October 1. Fall-semester deadlines are February 1 and March 1.

Faculty and Specializations

Avner Arbel: accounting and financial management
 Florence C. Berger: human resources
 John J. Clark: properties management
 Thomas P. Cullen: management
 David C. Dunn: accounting and financial management
 James J. Eyster: accounting and financial management
 Dennis Ferguson: accounting and financial management
 A. Neal Geller: accounting and financial management
 Daphne A. Jameson: communications
 William H. Kaven: marketing
 Craig C. Lundberg: management
 Stephen A. Mutkoski: food and beverage management
 Michael H. Redlin: properties management
 Leo M. Renaghan: marketing
 John E. H. Sherry: law
 Mary H. Tabacchi: food chemistry

HUMAN DEVELOPMENT AND FAMILY STUDIES

M.A., Ph.D., M.P.S.(Hu.Ec.)

Graduate faculty representative Barbara M. Koslowski, NG29A Martha Van Rensselaer Hall

Subjects Developmental psychology (cognitive development, developmental psychopathology, ecology of human development, social and personality development); human development and

family studies (ecology of human development, family studies and the life course)

Students enrolled in this program may choose to organize their courses of study so as to major formally in one or two broad areas: (a) developmental psychology or (b) human development and family studies. Within those broad majors (which have some common requirements), students focus their studies by choosing a specific area of concentration. Students may also, if they wish, organize their program to include special emphasis on a particular age span in the life cycle or on a particular context of development.

The program prepares graduates for careers in academic life—for example, in departments of psychology, sociology, or human development; in research programs of governmental agencies at various levels; and in a range of programs in community agencies and private enterprise. It does not prepare students to be clinical psychologists, school psychologists, or family life counselors.

All students are expected to acquire a basic background in the behavioral sciences and to master a broad base of knowledge of human development in the context of family and society.

One semester of graduate-level training in statistics is required of all master's degree candidates, and two semesters of all Ph.D. candidates. The master's as well as the Ph.D. requires a research thesis. The field requires a predoctoral research project to be completed at the end of the second year of study. Some teaching experience is required for degree candidates. Master's programs ordinarily require two years for completion; doctoral programs, four years. The policy of the field is to attempt, whenever possible, to provide financial support for master's degree candidates during their first two years of study and for Ph.D. candidates during their first four years of study provided that their work is satisfactory. New and continuing students are supported in roughly the same proportions.

Most successful applicants have undergraduate majors in psychology, sociology, child development, or family relationships, but students of high ability may be admitted regardless of undergraduate background. All applicants are required to submit their scores on the GRE general test.

Special Facilities and Programs

About half of the research in the Field of Human Development and Family Studies is conducted in the departmental laboratories and nursery school; the other half is done off campus. The departmental nursery school maintains half-day programs for children from diverse backgrounds. Several small experimental rooms and two large rooms are equipped with one-way vision screens and modern sound recording equipment. In addition, closed-circuit television facilities are available for teaching and research. The Family Life Development Center is a resource and demonstration center concerned with child abuse and maltreatment. It is possible for students to become involved in research or public service in connection with the center.

The department maintains close relationships off campus with many of the public schools, nursery schools, day-care centers, youth service agencies, and counseling services in Tompkins County. A great deal of departmental research is conducted in these settings.

The field maintains close relationships with the Fields of African and Afro-American Studies, Psychology, Sociology, and Women's Studies.

Faculty

Helen T. M. Bayer
Franklin Becker
Daryl J. Bem
Sandra L. Bem
Dale A. Blyth
W. L. Brittain
Urie Bronfenbrenner
Joan J. Brumberg
Stephen J. Ceci
Moncrieff M. Cochran
John C. Condry
Steven W. Cornelius
William E. Cross
Richard B. Darlington
John L. Doris
John J. Eckenrode
Eleanor J. Gibson
Stephen F. Hamilton
John S. Harding
Francis C. Keil
Barbara M. Koslowski
William W. Lambert
Lee C. Lee
Harry Levin
Barbara C. Lust
Phyllis Moen
Marion H. Potts

H. N. Ricciuti
Bernard C. Rosen
Ritch C. Savin-Williams
Phil Schoggen
Elizabeth S. Spelke
George J. Suci
Michael C. Thornton
William M. K. Trochim

HUMAN SERVICE STUDIES

M.S., Ph.D., M.P.S.(Hu.Ec.)

Graduate faculty representative Robert J. Babcock, N132 Martha Van Rensselaer Hall

Subjects Human service studies (human service administration, policy analysis and program planning, program evaluation studies); health services administration [M.P.S.]

The Field of Human Service Studies offers two types of degrees: the general M.S. and Ph.D., offered through the Graduate School, and the professional Master of Professional Studies (Human Ecology), offered through the College of Human Ecology and the Graduate School. Applicants must submit either GRE general or Miller Analogies Test (MAT) scores.

The field recruits individuals aspiring to, or experienced in, providing direct services to people. Typically students have had volunteer or paid experience in social work, health and mental health programs, and community agencies at local or state levels. Graduates are working in federal, state, regional, and local agencies as executives, program planners, evaluators, and policy and budget analysts and as university faculty in professional education programs.

Another program of study is the accredited Sloan Program in Health Services Administration, a two-year curriculum leading to an M.P.S.(Hu.Ec.). It is designed to prepare individuals for administrative careers in health care in such settings as hospitals, management consulting firms, private industry, government regulatory and planning agencies, and long-term care, mental health, and social welfare agencies. Applicants must submit either GRE, GMAT, or MAT scores.

The research and public service programs engaged in by faculty and student members of the field reflect this same range of interests and relationships to public agencies. Faculty members continue to conduct research of concern to state and federal legislative bodies, local community

agencies, federal and state agencies, and foundations concerned with human services and the quality of life.

Additionally, faculty and students are engaged in programs of continuing education for practicing professionals and staff in public agencies. These programs include in-service training for staffs of county departments of social service and for other county government and extension offices.

Graduate Study

Since graduate work at Cornell is organized around common-interest fields rather than departments or colleges, field members may come from any department or unit of the university. The Field of Human Service Studies is located in the Department of Human Service Studies of the New York State College of Human Ecology, one of the four statutory colleges of the State University of New York that are part of Cornell University and are located on its Ithaca campus.

The field has no fixed course or credit requirements for a graduate degree. The candidate's program, mapped out with his or her Special Committee, is based on the student's goals and background. It will often consist of a combination of courses from any appropriate source, independent study and research, participation in ongoing research, educational and public service programs, and field experience. When the student has satisfied the plan of study and has passed a qualifying examination, he or she then writes a thesis (a problem-solving project for the M.P.S.) and, on its acceptance by the Special Committee, will receive a degree.

Faculty and Specializations

Josephine Allen: social welfare policy and services
 Robert J. Babcock: organizational behavior and career development
 Donald J. Barr: community mental health; group processes; leadership
 Roger M. Battistella: public policy issues involving health planning
 Robert L. Bruce: adult and community education; international education
 J. Lin Compton: extension; community and adult education
 J. David Deshler: adult and community education; group and community processes and change
 Joan R. Egner: educational policy and administration

Ronald G. Ehrenberg: evaluation methods, economics of public services
 John L. Ford: health policy and health systems planning
 Jennifer L. Gerner: welfare economics and public policy
 Jennifer C. Greene: program evaluation; measurement; motivational processes in learning; research methodology
 Alan Hahn: community decision making; intergovernmental relationships
 Dalva E. Hedlund: group development; organizational behavior
 Irving Lazar: design and evaluation of human service programs; infant and preschool services
 John O. McClain: operations research; decision theory; statistics; computer technology
 Charles C. McClintock: evaluation and survey methodology; organizational behavior
 Jason Millman: educational measurement and evaluation
 Marion Minot: home economics education; higher education; instructional design program
 Phyllis E. Moen: family; social policy and family impact; work-family linkages
 B. Jeanne Mueller: social work education; adult development service systems design
 Lucinda Noble: adult learning and development; public services systems
 Robert F. Risley: manpower studies; organizational development and behavior; intergroup relations
 Ernest F. Roberts: legal and institutional aspects of planning and development
 Diva M. Sanjur: studies of human nutrition; community and international nutrition education
 Constance H. Shapiro: social work education
 Lloyd C. Street: intergroup relations; criminology; social policy; ethnographic methods
 William Trochim: methodology and evaluation research
 Bettie L. Yerka: organization and evaluation of informal adult and community educational programs
 Jerome M. Ziegler: urban social policy; intergovernmental systems

IMMUNOLOGY

M.S., Ph.D.

Graduate faculty representative Robin G. Bell, Baker Institute

Subject Immunology (cellular immunology, immunochemistry, immunogenetics, immunopathology, infection and immunity)

The Field of Immunology has a substantial cadre of members and students working in the areas of infection and immunity, cellular immunology, immunogenetics, and immunopathology. There are also members currently carrying out studies in the areas of immunochemistry, membrane biochemistry, developmental immunology, immunoparasitology, and related fields.

There are no tests or language requirements for admission; rather, each student is assessed by the members of the field.

Faculty and Specializations

Douglas F. Antczak: the major histocompatibility complex

Judith A. Appleton: immunoparasitology; viral immunology

Barbara Ann Baird: molecular immunology; membrane biochemistry

Robin G. Bell: immunity to parasitic infections; mucosal immunity

Bruce W. Calnek: pathogenesis and immunity in avian viral infections

Raymond H. Cypess: resistance to gastrointestinal helminths

Rodney R. Dietert: genetic regulation of cell surface antigens

Clare M. Fewtrell: cell biology; molecular immunology

Richard H. Jacobson: immunobiology of host-helminth relationships

Robert M. Lewis: immunologic mechanisms of tissue injury

Douglas D. McGregor: host resistance to intracellular bacteria

James A. Marsh: developmental immunology

Neil L. Norcross: secretory immunity to bacterial infection in cattle

Fernando M. Noronha: oncovirus immunology

Fred W. Quimby: the pathogenesis of autoimmune diseases

Efraim Racker: role of oncogenes, transforming growth factors, and protein kinases in neoplastic transformation

Karel A. Schat: immune responses to Marek's disease virus

David O. Slauson: the inflammatory response; immunopathology

John F. Timoney: pathogenesis and immunology of equine streptococcal infections

Virginia L. Utermohlen: nutrition and immune function

Watt W. Webb: biophysics of cells

Alexander J. Winter: secretory immunity; microbial chemistry

INDUSTRIAL AND LABOR RELATIONS

M.S., Ph.D., M.I.L.R., M.S.I.L.R.

Graduate faculty representative

Lawrence K. Williams, 367 Ives Hall

Subject Industrial and labor relations (collective bargaining, labor law and labor history; economic and social statistics; international and comparative labor relations; labor economics; organizational behavior; personnel and human-resource studies; industrial and labor relations problems [minor restricted to students in other fields])

Applicants whose native language is English are required to take the GRE general test. For admission to the Ph.D. program, a master's degree or its equivalent is usually required; direct admission is possible in cases of exceptional promise.

The Master of Industrial and Labor Relations program is designed to provide broad coverage in the field and some opportunity for advanced specialized work. It requires a minimum of two semesters and thirteen courses, nine of which are required. The requirements for this degree are fulfilled by satisfactory performance in these courses.

The final examination for the M.S. includes a test of subject matter competence in the major and minor subjects and a defense of the master's thesis. The examination is both written and oral.

The field may administer a preliminary examination prior to admitting students to the doctoral program. Teaching experience during study for the doctorate is required.

Collective bargaining, labor law, and labor history In this area faculty members specialize in (1) the study of the legal framework within which labor-management relations systems in the United States have developed; (2) the study of the history and structure of various components of the American trade union movement at the local, national, and confederation levels; and (3) the study of institutions, practices, and

principles relevant to understanding how interested parties resolve conflicts over the conditions of the labor contract. The chairperson for this area is A. Gerd Korman.

Economic and social statistics Faculty members in this area are mathematical statisticians interested in the application of their area of expertise to the social studies. They offer students an opportunity to study how the tools of mathematical statistics help in describing and analyzing socioeconomic phenomena and how various hypotheses can be tested quantitatively. The chairperson for this area is Philip J. McCarthy.

International and comparative labor relations This area deals with two major problems: a comparative analysis of the ways in which industrial societies other than the United States handle labor market problems, and the study of social institutions and economic conditions that facilitate or impede development in developing countries. The chairperson for this area is Gary Fields.

Labor economics Scholarly interests of students in labor economics lie primarily in two areas. Some seek to generalize about the ways in which movements of prices, wages, and workers are related and to study the mechanisms of various labor markets. Others examine private and public programs designed to insure the working population against those risks of living in an industrial society that can be expressed in money terms. The chairperson for labor economics is Gary Fields.

Organizational behavior This department is staffed by behavioral scientists, including psychologists, social psychologists, sociologists, and cultural anthropologists. Opportunity is offered for the study of the nature of industrial society as a context for complex work organizations, the study of such organizations *per se*, or the study of the behavior of small groups and individuals that are components of such organizations. The chairperson for this department is Robert N. Stern.

Personnel and human-resource studies Personnel and human-resource management has two main facets. First, the conventional study of the personnel function is directed at understanding how the single employing organization deals with its human resources. Second, the study of manpower supply and training problems at the community and national levels is increasingly a matter of critical public policy. The chairperson for this area is Robert F. Risley.

Faculty and Specializations

Samuel B. Bacharach: organizational behavior
 Stephen R. Barley: organizational behavior
 John H. Bishop: personnel and human-resource studies
 Isadore Blumen: economic and social statistics
 John W. Boudreau: personnel and human-resource studies
 George R. Boyer: labor economics
 Vernon Briggs: personnel and human-resource studies
 John Burton: collective bargaining, labor law, and labor history; labor economics
 Donald E. Cullen: collective bargaining, labor law, and labor history
 Cletus E. Daniel: collective bargaining, labor law, and labor history
 Ileen DeVault: collective bargaining, labor law, and labor history
 Robert E. Doherty: collective bargaining, labor law, and labor history; extension
 Lee D. Dyer: personnel and human-resource studies
 Ronald G. Ehrenberg: labor economics
 Jennie Farley: extension
 Gary Fields: international and comparative labor relations; labor economics
 William W. Frank: personnel and human-resource studies; extension
 Barry A. Gerhart: personnel and human-resource studies
 Michael Gold: collective bargaining, labor law, and labor history
 Cynthia L. Gramm: collective bargaining, labor law, and labor history
 James A. Gross: collective bargaining, labor law, and labor history
 Leo W. Gruenfeld: organizational behavior
 Ali S. Hadi: economic and social statistics
 Tove H. Hammer: organizational behavior
 Robert M. Hutchens: labor economics
 George Jakubson: labor economics
 Harry C. Katz: collective bargaining, labor law, and labor history
 A. Gerd Korman: collective bargaining, labor law, and labor history
 Risa L. Lieberwitz: collective bargaining, labor law, and labor history
 David B. Lipsky: collective bargaining, labor law, and labor history
 Philip J. McCarthy: economic and social statistics
 George T. Milkovich: personnel and human-resource studies
 Olivia Mitchell: labor economics
 Robert F. Risley: personnel and human-resource studies; extension

Philip Ross: collective bargaining, labor law, and labor history
 Sara L. Rynes: personnel and human-resource studies
 Nick Salvatore: collective bargaining, labor law, and labor history
 Ronald L. Seeber: extension
 Robert S. Smith: labor economics
 Robert N. Stern: organizational behavior
 Pamela S. Tolbert: organizational behavior
 Harrison M. Trice: organizational behavior
 Paul F. Velleman: economic and social statistics
 William J. Wasmuth: personnel and human-resource studies; extension
 Lawrence K. Williams: organizational behavior

INTERNATIONAL AGRICULTURAL AND RURAL DEVELOPMENT

M.P.S.(Agr.)

Graduate faculty representative Edwin B. Oyer, 350 Caldwell Hall

Subject International agricultural and rural development

The field offers a Master of Professional Studies (Agriculture) degree for students interested in the broader, more interdisciplinary aspects of agricultural and rural development. The field is intended primarily for the student preparing for service in international agriculture and draws from several disciplines to assist the student in understanding the special conditions and problems of newly developing economies. The program provides an opportunity for study of development strategies, a broad perspective on practices and trends in world agriculture, and up-to-date training in a discipline. The curriculum is especially relevant to mature and experienced practitioners in development activities abroad.

Students majoring in one of the graduate fields in agriculture and life sciences, and other qualified students, are welcome to take this field as a minor. For those who minor in this field, proficiency in the language most likely be useful in their intended area of service is encouraged. In addition, those who take this field as a minor may not minor in fields such as Asian studies or Latin American studies, and they may not select a professor for this minor who also serves on the graduate faculty in their major field.

Faculty and Specializations

George S. Abawi: plant pathology*
 Martin Alexander: agronomy
 Njoku Awa: communication
 Randolph Barker: agricultural economics
 Robert W. Blake: animal science
 David R. Bouldin: agronomy
 Malcolm C. Bourne: food science and technology*
 Frederick H. Buttel: rural sociology
 T. Colin Campbell: nutrition
 William R. Coffman: plant breeding
 Royal D. Colle: communication
 J. Lin Compton: education
 E. Walter Coward, Jr.: rural sociology
 Eddie W. Cupp: entomology
 Harold R. Cushman: education
 Eugene C. Erickson: rural sociology
 Milton J. Esman: international studies
 Robert W. Everett: animal science
 Elmer E. Ewing: botany
 Shelley Feldman: rural sociology
 Davydd J. Greenwood: anthropology
 Jean-Pierre Habicht: nutrition
 Douglas E. Hogue: animal science
 Michael C. Latham: nutrition
 Douglas J. Lathwell: agronomy
 David R. Lee: agricultural economics
 William H. Lesser: agricultural economics
 Edward W. McLaughlin: agricultural economics
 Roger A. Morse: entomology
 Gerald W. Olson: agronomy
 Edwin B. Oyer: international agriculture
 Warren R. Philipson: agronomy
 Robert L. Plaisted: plant breeding
 Thomas T. Poleman: agriculture economics
 Alison G. Power: ecology
 Syed S. H. Rizvi: food science
 Thomas W. Scott: agronomy
 Daniel G. Sisler: agricultural economics
 Tamme S. Steenhuis: agricultural engineering
 Keith H. Steinkraus: food science and technology*
 Erik Thorbecke: nutrition; economics
 H. David Thurston: plant pathology
 Ward M. Tingey: entomology
 Norman T. Uphoff: international studies
 Peter J. Van Soest: animal science
 Armand Van Wambeke: agronomy
 Robert J. Wagenet: agronomy
 Donald H. Wallace: plant breeding
 Michael F. Walter: agricultural engineering
 H. C. Wien: vegetable crops
 Madison J. Wright: agronomy
 Frank W. Young: rural sociology

**Faculty of the New York State Agricultural Station at Geneva.*

INTERNATIONAL DEVELOPMENT

M.P.S.(I.D.)

Graduate faculty representative Norman T. Uphoff, 170 Uris Hall

Subject International development (international nutrition, international planning, international population, science and technology policy)

The field offers graduate training leading to the degree of Master of Professional Studies (International Development). It provides an interdisciplinary course of study for persons experienced in international development who seek to upgrade or update their educational qualifications in areas of direct relevance to their professional careers. The program offers training both in a substantive specialization—such as population, regional planning, science and technology policy, or nutrition—and in areas of analysis for implementing objectives—development administration and planning, development economics, development politics, development sociology, or international communication. A specialized concentration in some area of development policy (such as women in development) may serve as the student's concentration with the approval of the graduate faculty representative and the student's adviser. Although applicants should have a strong academic background, excellent professional performance will be given a large weight in evaluating the applicant's admissibility. The field will normally consider only applicants who have at least two years experience in development work. Most applicants will be expected to have complete funding from outside sources. TOEFL (for applicants whose native language is not English) and GRE scores should be included with the application.

The degree program consists of at least thirty credits of course work satisfying a residence requirement of two units. Normally six credits are earned for an applied research project. Approximately half of this work will be in one of the four substantive specializations and half in one or more of the areas of analysis. Candidates can expect to complete their degree requirements in eleven to eighteen months. If more work in the substantive specialization is desired, the candidate is expected to do it in a summer of work before or after the academic year or in an additional term of work.

Faculty and Specializations

Roger C. Avery: population
 Randolph Barker: methods of analysis
 T. Colin Campbell: nutrition
 Peter S. K. Chi: population
 Royal D. Colle: population
 J. Lin Compton: methods of analysis
 E. Walter Coward, Jr.: methods of analysis
 Eugene C. Erickson: methods of analysis
 Milton J. Esman: science and technology policy
 Gary Fields: methods of analysis
 William W. Goldsmith: regional planning
 Jere D. Haas: nutrition
 Jean-Pierre Habicht: nutrition
 Charles Hirschman: population
 Barclay G. Jones: regional planning
 Michael C. Latham: nutrition
 David B. Lewis: regional planning
 Walter R. Lynn: science and technology policy
 Richard J. McNeil: methods of analysis
 Kathryn S. March: methods of analysis
 Malden C. Nesheim: nutrition
 Porus Olpadwala: regional planning; science and technology policy
 Daphne A. Roe: nutrition
 Sidney Saltzman: regional planning
 Diva M. Sanjur: nutrition
 Ruth Schwartz: nutrition
 Daniel G. Sisler: nutrition
 Stuart W. Stein: regional planning
 Lani S. Stephenson: nutrition
 J. Mayone Stycos: population
 Jan Svejnar: science and technology policy
 Erik Thorbecke: science and technology policy
 Norman T. Uphoff: methods of analysis
 Frank W. Young: methods of analysis

LANDSCAPE ARCHITECTURE

M.L.A.

Graduate faculty representative Leonard J. Mirin, 114 West Sibley Hall

Subject Landscape architecture

Two-Year Graduate Program

The two-year Master of Landscape Architecture (M.L.A.) program serves to broaden and enrich undergraduate education in design by providing an expanded educational experience to those who are technically skilled. Applicants are therefore expected to hold a bachelor's degree in architecture or in landscape architecture from a recognized institution.

The objectives of the two-year program are to permit students to conduct research in

the multidisciplinary areas relating to landscape architecture and to provide advanced education and training to individuals who decide, on graduation, to teach, to practice, or to conduct applied research in landscape architecture. To further these objectives, students are permitted considerable flexibility in establishing programs that take full advantage of the teaching and research resources of the university.

Three-Year Graduate Program

Students with bachelor's degrees in areas other than architecture or landscape architecture may enroll in the three-year M.L.A. program. Through an initial curriculum sequence intended to develop basic landscape architecture skills and concepts, the three-year program provides opportunities for students from diverse educational backgrounds to become proficient in landscape design, site construction, graphic communication, plant materials, and other related subject areas necessary to enter the profession fully qualified at the master's level. To provide advanced education and training for those who decide to conduct applied research, to practice, or to teach in landscape architecture, multidisciplinary studies based on an individualized curriculum can be developed under the guidance of an adviser in the Field of Landscape Architecture.

Admission

Applicants should include transcripts of all previous academic performance, two letters of recommendation, and a statement describing the applicant's background and objectives. Portfolios are required for applicants to the two-year program. Examples of work that illustrate potential for achievement at the graduate level are desirable for applicants to the three-year program. All applicants are strongly encouraged to submit GRE scores. For further information prospective students should write to the graduate faculty representative.

Curriculum and Requirements

Sixty credits of course work are required for students enrolled in the two-year program. Two academic years constitute the minimum residence requirement. A student may petition the Graduate School for a maximum of one semester's advanced standing based on previous education or experience.

Ninety credits, including those for satisfactory completion of the core curriculum courses, fulfill the course work requirement of the three-year M.L.A. program.

Two-year and three-year M.L.A. program students are required to choose a minor area of concentration. This requires a minimum of fifteen credits of course work and may be chosen from any of the relevant fields in the Graduate School or from subject areas such as the ecological, economic, social, historical, or legal determinants of landscape architectural design.

In addition to satisfactory completion of course work, requirements for the M.L.A. degree include an approved summer internship and completion of a thesis or final project.

Faculty and Specializations

Marvin I. Adleman: landscape architecture
David J. Allee: resource economics
Richard Booth: environmental law
Thomas H. Johnson: landscape architecture
Barclay G. Jones: urban and regional quantitative analysis and environmental health planning
Daniel W. Krall: landscape architecture
Arthur S. Lieberman: physical environmental quality
Leonard J. Mirin: landscape architecture
Robert G. Mower: ornamental horticulture
Charles W. Pearman: architectural design
Warren R. Philipson: remote sensing
Mario L. Schack: architectural design and urban design
John P. Shaw: architectural design
Stuart W. Stein: land-use planning and urban design
Roger T. Trancik: landscape architecture and urban design
Peter J. Trowbridge: landscape architecture

LATIN AMERICAN STUDIES

Minor field

Graduate faculty representative Billie Jean Isbell, 206 McGraw Hall

Minor subject Latin American studies

Latin American Studies is a *minor* field of concentration at Cornell; consequently a prospective student must first be admitted to a *major* field of the Graduate School before selecting this field as a minor. Subsequent to admission a student elects a minor in Latin American studies by inviting a member of the graduate faculty who represents this area to sit on the Special Committee.

Direct field research experience provides opportunity to investigate a problem in Latin

America by using tools of the major discipline and usually generates the data on which the Ph.D. or master's thesis is based. Faculty members from various academic fields are currently engaged in research in many Latin American countries and will counsel students who have an interest in this field of study.

Faculty

Lourdes Beneria
Robert Blake
Tom E. Davis
Gary Fields
William W. Goldsmith
Carol J. Greenhouse
Jere D. Haas
John S. Henderson
Thomas H. Holloway
Billie Jean Isbell
Steven I. Jackson
Eldon G. Kenworthy
Thomas F. Lynch
Olivia S. Mitchell
Thomas T. Poleman
Bernard C. Rosen
Diva M. Sanjur
Enrico M. Santi
Donald F. Sola
J. Mayone Stycos
Marguerita A. Suner
H. David Thurston
Jonathan P. Tittler
Armand R. Van Wambeke
Kathleen M. Vernon
Lawrence K. Williams
Frank W. Young

LAW

LL.M., J.S.D.

Graduate faculty representative John Barcelo III, 309 Myron Taylor Hall

Subject Law

The Master of Laws and the Doctor of Science of Law degrees are conferred. The former is intended for students who want to increase their knowledge of law by work in a specialized field. The latter is intended for students who want to become legal scholars and to pursue original investigations into the function, administration, history, and progress of law.

The minimum residence requirement for the LL.M. or the J.S.D. is two full terms. But the J.S.D. program normally requires three to four terms. Longer periods may be required. Candidates for either degree are ordinarily expected to concentrate on one legal field and do a substantial amount of work in at least one other field.

Students who meet the requirements for admission to the Graduate School's Division of Law but who do not want to become candidates for a degree may, at the discretion of the faculty, be admitted as non-degree candidates.

Applicants for admission for an LL.M. or J.S.D. degree are expected to hold both a baccalaureate degree and a degree of Doctor of Law (J.D.) or a degree of equivalent rank from an approved law school. An applicant for admission for a J.S.D. degree must also have had professional practice or experience in teaching or advanced research. Applicants should state in as much detail as possible why they want to do advanced graduate work and the particular fields of study they want to pursue.

Applicants from other countries can be considered for degree candidacy only if they have completed with distinction all the studies necessary for admission or licensing for the practice of law in their own country.

For further details, see the catalog of the Law School. Each candidate must pass examinations in courses taken for credit and any other examinations required by the Special Committee.

Special research and study opportunities exist at Cornell in city and regional planning, comparative law, commercial law, copyright and trademark law, corporation law, criminal law, environmental law, industrial and labor relations, international legal studies, legislation, and property law. See also the description of the International Legal Studies Program in the catalog of the Law School.

Division Faculty

Gregory S. Alexander
Alfred C. Aman, Jr.
John J. Barcelo III
Kevin M. Clermont
Roger C. Cramton
Theodore Eisenberg
Cynthia R. Farina
Alan Gunn
Jane L. Hammond
George A. Hay
James A. Henderson
Robert A. Hillman
Sheri L. Johnson
Robert B. Kent
David L. Lyons
Jonathan R. Macey
Peter W. Martin
Dale A. Oesterle
Russell K. Osgood
Larry I. Palmer

Ernest F. Roberts, Jr.
 Faust F. Rossi
 Stewart J. Schwab
 Steven H. Shiffrin
 John A. Siliciano
 Gary J. Simon
 Gary J. Summers
 David Williams
 Susan Williams
 Charles W. Wolfram
 Charles W. Zacharias

LINGUISTICS

M.A., Ph.D.

Graduate faculty representative Wayne E. Harbert, 213 Morrill Hall

Major subject Linguistics (general linguistics)

Minor subject Linguistics (applied linguistics, East Asian linguistics, English linguistics, Germanic linguistics, Indo-European linguistics, phonological theory, Romance linguistics, semantics, Slavic linguistics, sociolinguistics, South Asian linguistics, Southeast Asian linguistics, syntactic theory)

GRE scores are required of all applicants to the Field of Linguistics.

To assure that all M.A. and Ph.D. students receive a firm grounding in current linguistic theory, the field has a set of required courses. Exemptions are granted on an individual basis.

Candidates for the M.A. are required to demonstrate a reading knowledge of one language other than their native language. Ph.D. candidates are required to demonstrate a reading knowledge of one language other than their native language, one of either French, German, or Russian. The requirement may be satisfied by taking the College Entrance Examination Board test and achieving a score acceptable to the linguistics faculty. In other languages the requirement may be satisfied by special examination administered by an appropriate member of the faculty. There is also a two-semester "non-Western" language requirement for Ph.D. candidates that may be satisfied in a number of different ways (language courses, structure courses, and field methods courses).

For the Ph.D. a qualifying examination in the spring of the first year is required in addition to the examinations required by the Graduate School.

The field offers a wide variety of courses in theoretical and applied linguistics, as well

as an exceptionally broad spectrum of courses dealing with the history and structure of particular languages.

Specialization in linguistics is provided by several other fields of the Graduate School. Relevant minor subjects are offered by the Fields of Asian Studies, Classics, Germanic Studies, Near Eastern Studies, Psychology, Romance Studies, and Slavic Studies. All of those offerings are found in this catalog under the various fields.

Faculty and Specializations

Leonard H. Babby: Slavic linguistics; syntactic theory; Turkish
 John S. Bowers: syntax; linguistic theory; semantics
 E. Wayles Browne: Slavic linguistics; Serbo-Croatian; linguistic theory
 Gennaro Chierchia: semantics; linguistic theory; Italian language and linguistics
 G. Nick Clements: phonology; phonetics; West African and Bantu languages and linguistics
 Gerard Diffloth: Southeast Asian linguistics; historical linguistics
 James W. Gair: South Asian linguistics; general linguistics; Sinhala; syntax
 Joseph E. Grimes: discourse; phonetics; computational linguistics; lexicography
 Gregory R. Guy: sociolinguistics; Spanish and Portuguese linguistics; language change
 Wayne E. Harbert: Germanic linguistics; linguistic theory; syntax
 C. T. James Huang: syntax; linguistic theory; Chinese language and linguistics
 Jay Jasanoff: Indo-European, Germanic, and historical linguistics
 Francis C. Keil: conceptual change; language acquisition; cognitive development
 John Kingston: phonetics; phonology; general linguistics
 Herbert L. Kufner: Germanic linguistics; German; applied linguistics
 Richard L. Leed: Russian language and linguistics; language pedagogy
 Barbara C. Lust: language acquisition; psycholinguistics
 Sally McConnell-Ginet: semantic theory; pragmatics; English linguistics; language and gender
 James S. Noblitt: French language and linguistics; applied linguistics
 Alan Nussbaum: historical and comparative grammar of Greek and Latin; Indo-European; historical linguistics
 Carol G. Rosen: syntax; Romance linguistics; Italian

Chilin Shih: Chinese language and linguistics; phonology; East Asian linguistics
 Donald F. Sola: language planning; Quechua
 George J. Suci: psycholinguistics
 Marguerita A. Suner: Hispanic linguistics; syntax; Spanish
 Frans van Coetsem: Germanic linguistics; Dutch; language contact
 Linda R. Waugh: French linguistics; morphology; semiotics; semantics; phonology; linguistic theory
 John Whitman: syntax; East Asian linguistics; historical linguistics
 John U. Wolff: Indonesian; sociolinguistics; Southeast Asian linguistics; Austronesian linguistics

MANAGEMENT

Ph.D.

Graduate faculty representative Dick R. Wittink, 506 Malott Hall

Subjects Business administration (business and public policy, finance, managerial economics, marketing, organizational theory and behavior, production and operations management, quantitative analysis for administration); accounting

The most desirable preparation is strong undergraduate work in such relevant fields as economics, engineering, mathematics, operations research, psychology, sociology, or one of the other physical or social sciences. Students are admitted directly from a bachelor's degree program or after a distinguished record in an M.B.A. or other master's program. A knowledge of mathematics at least through calculus is essential. Scores from the GRE or the GMAT are required. Students may not register for an M.A. or M.S. degree in this field; those desiring a master's degree should examine the catalog of the Graduate School of Management.

Subject Descriptions

Accounting deals with the theory and practice of developing financial data for two purposes: to enable management to control and plan the development of the enterprise and to enable others to appraise its condition.

Business and public policy involves the study of the three-way relationship among individuals, business firms, and government. Emphasis is placed on the impact of public policies and regulations on business and of business policies on government.

Finance focuses on the financial structures and requirements of corporations of various types, the problems of maintaining sound financial condition, the organization and behavior of financial markets of different types, and the influence of public policies on these markets and on corporate finance. A knowledge of accounting is essential.

Managerial economics concentrates on economic analysis for decision making. A candidate may study the problems of the total economy, of industries, or of the firm and may do so within the context of any particular study area, such as industrial organization, economic theory, econometrics, public finance, or behavioral decision theory.

Marketing adapts analytical and behavioral theories commonly used in disciplines such as economics, operations research, psychology, and sociology. The topics addressed include models for new products, pricing theories, theories about advertising effects, advertising and promotion response models, market research techniques, and theories about marketing decisions.

Organizational theory and behavior focuses on social and behavioral science approaches to the study of human activity in organizational settings. The major concern is with regularities, differences, and relationships in purposive behavior. A fundamental grounding in at least one of the basic behavioral disciplines is essential.

Production and operations management emphasizes the study of quantitative methods of analysis, including the use of the computer, in the solution of major economic decision problems of production and operations management.

Quantitative analysis for administration stresses the modern developments in the uses of mathematical and statistical tools and computer technology for the solution of managerial problems.

Faculty and Specializations

Mitchel Y. Abolafia: organizational theory; economic and political sociology; regulation of markets

Barry L. Bayus: marketing; planning; market research; decision models; microcomputer applications

David J. BenDaniel: entrepreneurship

Fredrick T. Bierman: corporate finance; corporate investment decisions

Richard W. Conway: information systems; production management

- Thomas R. Dyckman: accounting; quantitative methods
- John A. Elliott: accounting
- Jerome E. Hass: managerial finance; regulatory economics; business strategy and policy
- Richard A. Highfield: econometrics; forecasting; applied economics
- Ronald Hilton: accounting; decision theory; information economics
- Robert A. Jarrow: finance; mathematical economics; game theory; applied mathematics; microeconomic theory
- David M. Krackhardt: organizational behavior; network analysis
- Robert C. Lind: economics; public policy analysis; government-business relations
- Alan K. McAdams: economics
- John O. McClain: operations research; production management; statistics; computer applications
- Dale Morse: financial accounting; investments
- Maureen P. O'Hara: finance; money and banking; economics
- Levent Orman: information systems; database management; decision support systems
- Vithala R. Rao: marketing and quantitative methods; marketing research and models; multivariate models
- Lawrence W. Robinson: production management; operations research
- J. Edward Russo: marketing; decision making and decision aiding; consumer behavior; advertising; behavioral science in management
- Wayne H. Shaw: financial accounting; corporate income taxation
- Seymour Smidt: capital budgeting; financial market microstructure; corporate finance
- Robert H. Smiley: applied microeconomics; industrial organization; regulation; energy policy
- Curtis W. Tarr: management; business history; leadership
- Richard H. Thaler: microeconomics; behavioral and experimental economics
- L. Joseph Thomas: production and operations management; operations research; distribution systems
- James B. Wiggins: options pricing; financial markets and institutions
- Dick R. Wittink: marketing models; market research; applied econometrics and statistics

MATERIALS SCIENCE AND ENGINEERING

M.S., Ph.D., M.Eng.(Materials)

Graduate faculty representative Rishi Raj, 229 Bard Hall

Subject Materials science and engineering (materials engineering, materials science)

Students from any undergraduate engineering or physical science program may be accepted. Applicants from outside the United States or Canada must submit GRE scores. On request the graduate faculty representative can waive this requirement.

Research and Study Opportunities

Current areas of advanced research focus on the molecular structure and the mechanical, electrical, and optical properties of materials that are constructed from ceramics, electronic materials, polymers, and metals. The synthesis of these materials is emphasized, and interaction with other fields at Cornell, for example chemistry, physics, mechanical engineering, electrical engineering, and chemical engineering, is strongly encouraged. Central research facilities supported by the Cornell Materials Science Center provide an arena for such interactions. The study of layered materials, which are synthesized from dissimilar materials, is an area of general interest. More specific areas of current interest are given in the following list:

- development of advanced experimental techniques: high-resolution electron microscopy, X ray, high pressure, crystal growing, purification methods
- electrical and magnetic behavior: semiconductors, conduction in oxides and amorphous materials, magnetic domain wall motion, properties of layered structures, fast-ion conductors
- geological materials: mechanical properties, effects of pressure and environment on diffusion
- helium back scattering: electron-beam-induced current microscopy, scanning transmission electron microscopy, deep level transient capacitance spectrometry
- high-pressure studies: creep, diffusion, elastic constants, equation of state, synthesis, electrical properties, metallic hydrogen
- high-temperature materials: composite materials, refractory metals and alloys, sintering of ceramics
- imperfections in solids: point defects, dislocation mechanics, planar defects in

silicon, defect interactions, radiation damage, grain boundaries, structural studies of polymers, diffraction studies with synchrotron radiation

- mechanical behavior: plastic deformation and the strength of solids, fracture, embrittlement phenomena, anelasticity, crazing and fracture of polymers, mechanical behavior of metallic glasses
- microprocessing: submicron particle production, submicron grain polycrystalline production, submicron lamellar structures, very thin films, ion implantation
- nuclear materials: reactor materials, radiation damage, mechanical properties
- optical materials: electrooptic and ferroelectric materials, such as lithium niobate, in thin film configurations; composites for far infrared transmitting applications
- phase transformations: solidification, precipitation, martensite, phase decomposition during sintering, nonstoichiometry in ceramic systems, silicide formation, pulsed-beam-induced phase transformation in semiconductors
- solid-state reactions: reactions in oxides and silicates, internal oxidation and reduction
- surface structure and reactions: solid-liquid and solid-gas interfaces, surface diffusion, low-energy electron diffraction, oxidation, segregation, catalysis, secondary electron spectroscopy, electron tunneling spectroscopy and synchrotron radiation photoelectron spectroscopy, reduction of oxides by gases
- synthesis: chemical routes to the synthesis of inorganic (ceramics) and organic (polymers) materials, including vapor phase (e.g., CVD) and wet techniques
- transition metal oxides: defect chemistry and diffusion kinetics in mixed transition metal oxides

Further information about course programs and research areas is available on request.

A strong catalyst for the materials research activities at Cornell has been provided by the Materials Science Center, which provides substantial financial assistance to graduate students and maintains central research facilities.

M.Eng.(Materials) The program leading to the professional degree of Master of Engineering (Materials) provides advanced courses designed to prepare the student for a career in professional engineering. There is less emphasis on research. For further information, see *Graduate Study in Engineering and Applied Science at Cornell*.

Faculty

Dieter G. Ast
William A. Bassett
Boris W. Batterman
John M. Blakely
Clive B. Carter
Claude Cohen
Rudiger Dieckmann
Emmanuel P. Giannelis
David T. Grubb
Edward W. Hart
Herbert H. Johnson
David L. Kohlstedt
Edward J. Kramer
Che-yu Li
James W. Mayer
Robert Merrill
Christopher K. Ober
S. Leigh Phoenix
Rishi Raj
Thor N. Rhodin
Arthur L. Ruoff
Stephen L. Sass
Benjamin M. Siegel
John Silcox
Michael O. Thompson
Watt W. Webb
Edward D. Wolf

MATHEMATICS

M.A., M.S., Ph.D.

Graduate faculty representative Stephen Lichtenbaum, B-4 White Hall

Subject Mathematics

Prerequisites for admission are a knowledge of advanced calculus (including both theoretical and applied points of view) and modern algebra.

The field requires a reading knowledge of German or Russian for the Ph.D. degree. There is no formal French requirement, but books and papers in that language will be freely used in all graduate courses, and students can expect to be called on to read French mathematical texts.

The field requires teaching experience of all graduate students. Candidates for the master's degree are expected to obtain some understanding of mathematical thought, ordinarily by taking twenty-four credits of courses at the graduate level. Qualifications for the Ph.D. degree include a broad acquaintance with the basic subjects of present-day mathematics and a demonstration of ability to do research in one or more branches of mathematics.

It is strongly recommended that applicants take the GRE (the general test and the

subject test in mathematics) in time for the scores to be reported by February 1.

All of the three major subdivisions of mathematics (algebra, analysis, and geometry) are well represented at Cornell. The department is also very strong in logic, probability, and statistics.

Additional information about the courses, thesis and examination requirements, and research in mathematics is contained in a booklet entitled *Graduate Work in Mathematics at Cornell*, which may be obtained by writing to the graduate faculty representative. A detailed list of the research interests of the faculty will be sent with the booklet.

Special minor in mathematics The Field of Mathematics has instituted a special minor. For details, contact the graduate faculty representative.

Special master's There is a course-work master's degree in computer science available to students in the Ph.D. program in mathematics. For details, contact the graduate faculty representative.

Faculty and Specializations

Israel Berstein: algebraic and differential topology
 James H. Bramble: numerical solutions of partial differential equations
 Kenneth S. Brown: algebra; topology; homological algebra
 Lawrence D. Brown: statistics
 Stephen U. Chase: homological algebra; group schemes; algebraic number theory
 Marshall M. Cohen: topology
 Robert Connelly: geometry; rigidity; topology
 R. Keith Dennis: commutative and noncommutative algebra; algebraic K-theory
 Richard T. Durrett: probability
 Eugene B. Dynkin: probability theory
 Clifford J. Earle: complex variables; Teichmüller spaces
 Roger H. Farrell: mathematical statistics; measure theory
 Leonard Gross: functional analysis; classical analysis on Hilbert space; constructive quantum field theory
 John Guckenheimer: dynamical systems
 Allen E. Hatcher: algebraic topology
 David W. Henderson: geometry; geometric topology; mathematics education
 John H. Hubbard: analysis, differential equations, differential geometry
 Jiunn T. Hwang: statistics
 Peter J. Kahn: algebraic and differential topology; co-bordism and homotopy type of manifolds
 Harry Kesten: probability theory; limit theorems

Anthony W. Knap: lie groups; Fourier analysis
 Stephen Lichtenbaum: algebraic number theory; algebraic geometry
 G. Roger Livesay: differential topology; group actions
 Robert S. Lubarsky: mathematical logic; recursive function theory
 Michael D. Morley: mathematical logic; model theory
 Anil Nerode: mathematical logic; recursive functions, automata
 Lawrence E. Payne: partial differential equations; approximation methods; non-well-posed and nonstandard problems
 Richard A. Platek: mathematical logic; recursion theory; set theory; computer science
 Dinaka Ramakrishnan: algebra
 Alex Rosenberg: algebra; homological algebra; commutative algebra; quadratic forms
 Oscar S. Rothaus: several complex variables; combinatorics
 Alfred H. Schatz: numerical solutions of partial differential equations
 Shankar Sen: algebraic number theory
 Richard A. Shore: mathematical logic; recursion theory; set theory
 Birgit Speh: lie groups
 Frank L. Spitzer: probability theory and statistical mechanics
 Robert S. Strichartz: harmonic analysis; partial differential equations
 Moss E. Sweedler: co-algebra; field extensions; algebraic groups; inseparability phenomena; algebraic cohomologies
 Karen L. Vogtmann: topology; cohomology of groups
 Lars B. Wahlbin: numerical solutions of partial differential equations
 James E. West: geometric topology; infinite-dimensional topology

MECHANICAL ENGINEERING

M.S., Ph.D., M.Eng.(Mechanical)

Graduate faculty representative Stephen B. Pope, 106 Upson Hall

Subject Mechanical engineering (bio-mechanical engineering, combustion, energy and power systems, fluid mechanics, heat transfer, materials and manufacturing engineering, mechanical systems and design)

Applicants should have the equivalent of an accredited undergraduate curriculum in the area of their major work. Promising applicants with deficiencies may be required to

make up the deficiencies. All domestic applicants are strongly urged to submit the results of the GRE general and subject tests. Other applicants are required to submit GRE general and subject test results.

The M.S. and Ph.D. programs require submission of a thesis. These programs provide an advanced level of training suitable for pursuing careers in research and development, education, or advanced engineering analysis and design. A reading knowledge of French, German, or Russian is required of Ph.D. candidates whose native language is English. Ph.D. candidates are required to take a qualifying examination in addition to the examinations required by the Graduate School. Teaching experience of one semester for M.S. students and two semesters for Ph.D. students is required. This is normally satisfied by the student's being a teaching assistant.

M.Eng.(Mechanical) The Field of Mechanical Engineering offers the professional degree of Master of Engineering (Mechanical). The M.Eng. (Mechanical) degree program has a thirty-credit curriculum and requires an engineering design course rather than a research thesis. The program is intended primarily for persons who seek a high level of competence in current technology and engineering design and who plan to practice engineering in industry or professionally. Students concentrate in one of the areas in the field. The program may also serve as the first step toward the doctorate for persons who are inclined toward the technological aspects of advanced engineering.

Further information is contained in the booklet *Graduate Study in Mechanical and Aerospace Engineering at Cornell*, which can be obtained by writing to the graduate faculty representative.

Areas of Specialization

Biomechanical engineering Biomechanics, emphasizing structural analysis, computer-aided design, lubrication of joints, and the dynamics of the musculoskeletal system.

Combustion Research is concentrated on turbulent combustion, advanced diagnostic techniques, chemical kinetics, spectroscopy, fuel pyrolysis, fluidized-bed combustion, droplet combustion, generation of air pollutants, gas turbine combustors, engine combustion, and alternative fuels.

Energy and power systems This category includes studies of the transformation, transport, and use of energy, and associated environmental interactions. Specific topics include energy policy studies, power-plant cycles and siting, dry-cooling technology, geothermal energy, and energy-efficient propulsion systems.

Fluid mechanics Topics included in this area are computational fluid mechanics, turbulence and turbulent flows, fluid-particle interactions, meteorological fluid dynamics, rotating fluids, physical oceanography, cooling-tower aerodynamics, geological and geothermal flows, and noise generation.

Heat transfer Topics of current interest include freezing, evaporation, boiling, fluid-particle heat transfer, conduction, free convection, and mixed convection. Applications include heat rejection to the environment, geophysical heat transfer, air-cooled heat exchangers, cooling of electronic components, and enhanced heat transfer.

Materials and manufacturing engineering Research is concerned with the analysis and selection of materials and manufacturing operations. Studies include failure in composite materials, injection molding processes, computer-aided design of systems, numerical control of machine processes, materials forming, and friction welding.

Mechanical systems and design This area is concerned with the design, analysis, and manufacture of devices, machines, and systems. Topics under study are reliability, optimization, finite element analysis, computer-aided design, vehicle dynamics, vibrations, control systems, robotics, lubrication, and dynamic analysis of bearings.

Faculty and Specializations

Charles T. Avedisian: combustion; heat transfer

Peter L. Auer: energy and power systems

Donald L. Bartel: biomechanical engineering; mechanical systems and design

John F. Booker: biomechanical engineering; mechanical systems and design

David A. Caughey: fluid mechanics

Bart J. Conta: energy and power systems

Paul R. Dawson: biomechanical engineering; materials and manufacturing engineering

P. C. Tobias de Boer: combustion; heat transfer

Albert R. George: fluid mechanics

Frederick C. Gouldin: combustion; fluid mechanics

Sidney Leibovich: fluid mechanics
 Michel Y. Louge: fluid mechanics; heat transfer
 John L. Lumley: fluid mechanics
 Franklin K. Moore: energy and power systems; fluid mechanics; heat transfer
 Richard M. Phelan: mechanical systems and design
 S. Leigh Phoenix: materials and manufacturing engineering; mechanical systems and design
 Stephen B. Pope: combustion; fluid mechanics
 E. L. Resler, Jr.: combustion; energy and power systems
 Peter Schwartz: materials and manufacturing engineering
 Shan-fu Shen: fluid mechanics
 Dennis G. Shepherd: energy and power systems; fluid mechanics
 Dean L. Taylor: biomechanical engineering; materials and manufacturing engineering; mechanical systems and design
 Kenneth E. Torrance: fluid mechanics; heat transfer
 Herbert B. Voelcker: materials and manufacturing engineering
 Kuo-King Wang: materials and manufacturing engineering
 Zellman Warhaft: fluid mechanics
 Robert L. Wehe: mechanical systems and design

MEDIEVAL STUDIES

M.A., Ph.D.

Graduate faculty representative Norman Kretzman, 77 Goldwin Smith Hall

Subject Medieval studies (medieval art, medieval history, medieval literature, medieval music, medieval philology, medieval philosophy)

The aim of this field is to allow the student to concentrate more fully on medieval studies than is possible within the programs of traditional fields.

Medieval literature and philology may be studied in the following languages: Celtic, English, Germanic, Latin, Old Norse, Romance, Semitic, or Slavic.

Although certain requirements are absolute (such as reading knowledge of

Latin and a course in paleography and research methods), emphasis is on the formulation of individual programs to fit individual interests and needs. Teaching experience is a requirement for all Ph.D. candidates.

Ideally a broad undergraduate major in one of the participating disciplines should precede graduate concentration in this field. All applicants are strongly urged to take the GRE general test and an appropriate subject test if such exists.

For the M.A., proficiency in Latin and either French or German is required; for the Ph.D., proficiency in Latin, French, and German.

Further information concerning the Field of Medieval Studies is given in the field's brochure, which can be obtained by writing to the graduate faculty representative, 77 Goldwin Smith Hall.

Faculty and Specializations

Barry B. Adams: medieval drama
 Frederick M. Ahl: Latin epic
 Ciriaco M. Arroyo: medieval Spanish language and literature
 Robert G. Calkins: medieval art and architecture
 Alice M. Colby-Hall: Old French language and literature
 Robert T. Farrell: Old English language and literature; English philology; medieval architecture
 Arthur B. Groos, Jr.: medieval German language and literature
 Thomas D. Hill: Old English language and literature
 Jay Jasanoff: Germanic, Celtic, and Indo-European philology
 James J. John: Latin paleography; medieval history
 Robert E. Kaske: Middle English language and literature
 Norman Kretzmann: medieval philosophy
 Gordon M. Messing: medieval Latin language and literature
 John M. Najemy: late medieval Italian and Renaissance history
 David S. Powers: Islamic studies
 Don M. Randel: medieval music
 Brian Tierney: medieval history; canon law
 Frans van Coetsem: Germanic philology
 Winthrop Wetherbee: medieval Latin and English literature

MICROBIOLOGY

M.S., Ph.D.

Graduate faculty representative Robert P. Mortlock, 310 Stocking Hall

Subject Microbiology (see also veterinary medicine)

Applicants should have preparation in general chemistry at an intermediate level, organic chemistry, physics, and introductory courses in the biological sciences. In addition, training in physical chemistry and calculus is desirable. Although deficiency in the subjects listed does not preclude admission, it may increase the time necessary to earn a degree. Applicants are required to submit scores for the GRE general test.

One semester or more of teaching is required of all graduate students. Well-equipped laboratories are available. Staff research interests include virology, genetics, physiology, biochemistry, molecular biology, systematic and environmental microbiology, and microbial ecology.

Faculty and Specializations

Martin Alexander: aquatic microbiology; microbial ecology; soil microbiology
 Carl A. Batt: biotechnology
 Steven V. Beer: plant pathology
 Leland Carmichael: animal virology; pathogenic microbiology
 Edward J. Dubovi: animal virology; pathogenic microbiology
 Gary M. Dunny: biotechnology; microbial genetics; pathogenic microbiology
 Robert K. Finn: biotechnology
 William C. Ghiorse: aquatic microbiology; microbial ecology; microbial physiology; prokaryotic cytology; subsurface microbiology
 A. Jane Gibson: microbial biochemistry; microbial ecology; microbial physiology
 E. Peter Greenberg: microbial biochemistry; microbial ecology; microbial genetics; microbial physiology; prokaryotic cytology
 Yong D. Hang: biotechnology
 Robert P. Mortlock: microbial biochemistry; microbial genetics; microbial physiology
 James B. Russell: microbial ecology; rumen microbiology; microbial physiology
 Michael L. Shuler: biotechnology
 Keith H. Steinkraus: biotechnology
 Valley J. Stewart: microbial genetics; microbial physiology
 Paul J. VanDemark: microbial physiology
 David B. Wilson: microbial biochemistry
 Stanley A. Zahler: microbial genetics
 Stephen H. Zinder: microbial biochemistry; microbial ecology

MUSIC

M.A., Ph.D., M.F.A., D.M.A.

Graduate faculty representative Don M. Randel, 211 Lincoln Hall

Subjects M.A., Ph.D.: Musicology; musical composition [minor only]; musical performance [minor only]; theory of music [M.A. major only]. M.F.A., D.M.A: Music (composition, eighteenth-century performance practice)

All applicants must take a test of musicianship as well as a written music history and analysis examination. Further information may be obtained from the office of the Department of Music. Applicants must also submit scores of the GRE general test (the GRE subject test in music is optional) and a term paper or musical composition.

For the Master of Fine Arts and the Doctor of Musical Arts, the field requires a reading knowledge of French or German. For the M.A. and the Ph.D. in musicology a reading knowledge of both is required.

Programs and Facilities

The graduate program at Cornell coordinates musical composition, scholarship, and performance. Under the supervision of their Special Committees students create individual programs of study in accordance with their interests and abilities. While mastering a professional discipline, they are expected to continue to develop broad interests in music and related fields. Doctoral studies in musicology may emphasize music theory or ethnomusicology. The performers in the field specialize in historically authentic performance practice.

The Music Library, housed in Lincoln Hall, has an excellent collection of the standard research tools: its holdings consist of approximately eighty thousand books and scores and thirty thousand sound recordings. Particularly noteworthy are the collection of opera scores from all periods, twentieth-century scores and recordings, and a large microfilm collection of Renaissance sources, both theoretical and musical. In addition, the Department of Rare books in Olin Library contains an important collection of early printed books on music and musical manuscripts.

The Verne S. Swan collection of about thirty musical instruments is especially rich in old stringed instruments. A small Challis harpsichord and clavichord and a two-manual Hubbard harpsichord are available for practice. A Dowd harpsichord, a replica of

a Stein 1784 fortepiano, a replica of an 1820 Graf fortepiano, and a Bosendorfer concert grand piano are reserved for advanced students and concerts. There is an Aeolian-Skinner organ in Sage Chapel, a Schlicker organ at Barnes Hall, and a Hellmuth Wolff organ in Anabel Taylor Chapel. A studio for electronic music was built in 1970, and its equipment is steadily increasing.

The Department of Music and the Faculty Committee on Music sponsor more than eighty concerts each year by world-renowned musicians, faculty members, and students.

A brochure more fully describing the graduate programs in music can be obtained on request to the graduate faculty representative.

Faculty and Specializations

William W. Austin: history of twentieth-century music; nineteenth-century music in Russia and America; philosophy of music

Malcolm Bilson: the fortepiano of the eighteenth and early nineteenth centuries; piano literature

Lenore F. Coral: music bibliography; seventeenth- and eighteenth-century studies

Martin F. Hatch: ethnomusicology; history and theory of Indonesian music; gamelan orchestra

Charlotte A. Heth: ethnomusicology; American Indian music

John T. Hsu: literature and technique of the viols and violincello

Karel Husa: composition; orchestration; conducting

Sonya Monosoff: violin; baroque violin; chamber music; performance practice

Edward Murray: theory; twentieth-century music

Roger L. Parker: nineteenth-century opera and instrumental music

Don M. Randel: medieval and Renaissance music

Thomas Sokol: choral music; conducting; performance style

Steven Stucky: composition; twentieth-century music; tonal and atonal theory

James Webster: eighteenth- and nineteenth-century music; theory of tonal music; history of theory

Neal A. Zaslaw: seventeenth- and eighteenth-century music; performance practice

NATURAL RESOURCES

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative John W. Kelley, 8C Fernow Hall

Subject Natural resources (aquatic science, fishery science, forest science, resource policy and planning, wildlife science)

Applicants should be well prepared in biological sciences; a strong background in physical sciences and a working knowledge of statistical methods are highly desirable. The GRE general test is typically required.

To concentrate in resource policy and planning, a student should have previous training in a discipline that can be used in focusing on natural resources problems. Professional job experience is normally expected.

An oral qualifying examination is given to Ph.D. candidates early in residence.

Research Facilities

A variety of terrestrial and aquatic environments are available for research. Within sixty miles of the campus are reforested areas, mature hardwood forests, extensive agricultural lands, wetlands, lakes, streams, and ponds.

Several forested or partially wooded areas are available for research, demonstration, and management purposes. Cornell's Arnot Teaching and Research Forest, eighteen miles from the campus, consists of four thousand acres of second-growth beech, birch, maple, hemlock, and associated native forest trees. The forest has populations of grouse, deer, and other wildlife and contains ten ponds. Facilities are available for short-term housing, teaching, and research.

The Department of Natural Resources operates the Cornell University Biological Field Station, which has a mile and a half of shoreline and four hundred acres of land at Shackelton Point on Oneida Lake, a shallow, eighty-square-mile eutrophic lake with about sixty warmwater fish species. The station has a permanent research and maintenance staff. Facilities are available for short-term housing, teaching, and research.

The Fishery Laboratory, located a half mile from the campus, contains facilities for instruction and research in fishery and aquatic science. The laboratory includes wet labs, an aquarium room and facilities for processing and holding fish, a larval-fish building, and a workshop. There are ten

ponds on the laboratory grounds for research on warmwater fish in seminatural conditions. Boats are available for use in aquatic ecology and fishery studies on the Finger Lakes. Two well-equipped laboratories are available for limnological studies.

Wildlife research facilities are located one mile from the campus at the Richard E. Reynolds Game Farm of the New York State Department of Environmental Conservation. The Wildlife Ecology Laboratory houses equipment for physiological and nutritional studies and provides laboratory-office space for faculty and graduate students interested in the study of ecology, behavior, and genetics of vertebrates.

In addition, there are other nearby areas that the administering agencies have generously made available for special research, graduate study, and class demonstration. The twelve-thousand-acre Connecticut Hill Game Management Area of the New York State Department of Environmental Conservation, twelve miles from Ithaca, is an outstanding grouse, deer, and woodcock area. A thirty-two-hundred-acre state refuge at Howland's Island has been managed for waterfowl and other game since 1931; it is a useful study and demonstration area forty-five miles from the campus. The Montezuma National Wildlife Refuge of the U.S. Fish and Wildlife Service, forty miles away, is an outstanding waterfowl and muskrat management area.

Cooperative Research Unit

The New York Cooperative Fish and Wildlife Unit combines federal, state, and university assets to facilitate advanced training and research. The research unit staff participates in the department's teaching and advising program and conducts research on a variety of aquatic and terrestrial subjects. The unit leader and two assistant leaders are members of the graduate faculty and devote most of their efforts to graduate research and training.

Faculty and Specializations

David J. Allee: resource economics; resource policy and planning
 Richard A. Baer, Jr.: environmental values; land ethics
 Harlan B. Brumsted: community and regional problems; environmental education, outdoor recreation; wildlife value, use, policies
 Tom J. Cade: behavior and ecology of birds

Timothy J. Fahey: dynamics of forest ecosystems
 John L. Forney: ecology and dynamics of fish communities
 Thomas A. Gavin: population biology of birds and mammals; conservation biology
 James W. Gillett: ecotoxicology; microcosm technology; risk assessment; fate and effects of toxic chemicals
 Steven P. Gloss: fisheries biology; aquatic ecology
 John W. Kelly: woodlot management; maple syrup production
 Barbara A. Knuth: natural resources policies, planning, and evaluation; fisheries programs and institutions; wildlife and agricultural policy interactions
 Marianne E. Krasny: forest regeneration; clonal biology of trees and shrubs; riparian ecology
 Charles C. Krueger: fisheries management; population genetics; stream ecology
 James P. Lassoie: nonindustrial uses of forest lands; woodlot management; forest ecology; tree physiology; air pollution
 Richard J. McNeil: international resource problems; national parks and wildlands management; resource policy; values, life-styles, and development; big-game ecology
 Richard A. Malecki: waterfowl biology and wetland ecosystems
 Aaron N. Moen: physiology, nutrition, and behavior of free-ranging animals; range evaluation, population dynamics, and management
 Ray T. Oglesby: comparative limnology and management of lakes; trophic-level interactions in aquatic systems
 David Pimentel: environmental policies; energy and land resources; ecosystem management
 Milo E. Richmond: reproduction and population biology of mammals and birds; terrestrial ecology
 Leonard H. Weinstein: environmental biology
 Bruce T. Wilkins: natural resource policies; outdoor recreation; management of marine resources
 William D. Youngs: fishery science; aquaculture

NEAR EASTERN STUDIES

M.A., Ph.D.

Graduate faculty representative David I. Owen, 372 Rockefeller Hall

Subjects Near Eastern studies (Arabic and Islamic history and literature, Assyriology, biblical history and archaeology, Hebrew Bible, Judaic studies, Near Eastern history and archaeology, Semitic languages and literatures)

Near Eastern studies at Cornell is concerned especially with those Semitic languages and literatures in the orbit of whose users, molders, and creators there emerged the three world religions of Judaism, Christianity, and Islam.

The program is designed to help students acquaint themselves with the most fundamental elements of these languages and literatures and also to acquire a high degree of specialization in one or more areas of (1) ancient Near Eastern and biblical studies; (2) ancient, medieval, and modern Jewish history; (3) classical and modern Arabic literature; and (4) Hebrew language and literature.

Candidates for the Ph.D. degree will be expected to demonstrate mastery in the language or languages of the main texts that will be directly related to the topic of their dissertations. Students are advised to determine early in their training the special field of their concentration and to consult their advisers about linguistic requirements. All applicants to the field will be expected to have at least three years of undergraduate study in one Semitic language or the equivalent and to have taken the GRE general test.

Before the end of the fourth term of graduate study each Ph.D. candidate must demonstrate competence in reading scholarly materials in any two of the following languages: French, German, Italian, Latin, Russian, and Spanish. Candidates for the master's degree must demonstrate competence in one of these languages or in Greek by at least one term before the degree is awarded.

Faculty and Specializations

Ross Brann: Hebrew literature and poetics; Judeo-Arabic literature; Muslim Spain; medieval Arabic literature

Steven T. Katz: Jewish history and religion

Samia E. Mehrez: Arabic language; classical and modern Arabic literature

David I. Owen: ancient Near Eastern history and archaeology; Assyriology; biblical history and archaeology; maritime history and archaeology

David S. Powers: Arabic language; Qur'anic studies; Islamic history; Islamic law

Gary Rendsburg: biblical studies

NEUROBIOLOGY AND BEHAVIOR

(See also Graduate School of Medical Sciences.)

M.S., Ph.D.

Graduate faculty representative Paul Sherman, W309 Seeley Mudd Hall

Subjects Behavioral biology (behavioral ecology, chemical ecology, ethology, neuroethology, sociobiology); neurobiology (cellular and molecular neurobiology, neuroanatomy, neurochemistry, neuropharmacology, neurophysiology, sensory physiology)

Applicants must present scores from the GRE general test and one of the subject tests in science. Students can be considered for Cornell fellowships, and for teaching and research assistantships and traineeships in cellular and molecular neurobiology. The deadline for application to the field is February 1. Early application is recommended; to be eligible for a Cornell fellowship, applications are due by January 15. The field discourages the application of Cornell graduates and accepts students from Cornell only under special circumstances. Cornell graduates should consult with the graduate faculty representative.

The field has no language requirement, but such a requirement is frequently imposed by the student's Special Committee.

In addition to the normal requirements of the Graduate School, the field requires for the Ph.D. degree one year of teaching experience, a written qualifying examination at the end of the first year of study, and an orientation meeting with the Special Committee within the first three semesters at Cornell. The field also requires each student to give a publicly announced seminar as part of the thesis defense for the Ph.D. degree.

Members of the faculty will be especially interested in directing research in the areas mentioned below. Prospective students may want to correspond with staff members whose interests are most closely related to their own before they apply.

Faculty and Specializations

Kraig Adler: photoreception and orientation of vertebrates; behavior of amphibians and reptiles.

Andrew H. Bass: evolution of the nervous system; neuroanatomy; sexual differentiation of the brain

Robert R. Capranica: animal communication; sensory neurobiology

Timothy DeVoogd: steroid actions in the brain; development of the brain and behavior

George C. Eickwort: arthropod behavior; evolution of social and nest-building behavior

Thomas Eisner: chemical communication; chemical ecology; insect behavior and physiology

Stephen T. Emlen: animal orientation systems; adaptive strategies of vertebrate social behavior

Barbara Finlay: sensory physiology; visually guided behavior; neuroembryology

Bruce P. Halpern: sensory physiology; chemoreception

Owen P. Hamill: membrane ion channels in mammalian central neurons

Rona Harris-Warrick: neurochemistry; neurophysiology

Carl D. Hopkins: animal communication; neuroethology; mechanisms of species recognition in electric communication

Howard C. Howland: sensory physiology; mathematical biology

Ronald R. Hoy: animal communication; behavior genetics of invertebrates; regeneration and development in invertebrate nervous systems

Robert E. Johnston: vertebrate social behavior; olfaction and chemical communication in mammals; hormones and behavior; human ethology

Ellis Loew: visual ecology of vertebrates and invertebrates; retinal electrophysiology; microspectrophotometry of visual pigment

William N. McFarland: sensory ecology; vertebrate visual systems

Linda M. Nowak: cellular neuropharmacology and synaptic physiology—neurotransmitter receptors, ion channels and neuronal response mechanisms in synaptic transmission

Robert E. Oswald: neurotransmitter receptors; ion channels

Thomas R. Podleski: neurochemistry; membrane physiology

Elizabeth Regan: vertebrate social behavior; hormonal bases of reproductive and aggressive behavior

Wendell Roelofs: insect pheromones; identification and behavioral responses in the field and in the laboratory

Miriam Salpeter: neurocytology; synaptic mechanisms; developmental neurobiology; neurotropic phenomena; electron microscopy and EM autoradiography

Thomas D. Seeley: insect social behavior: physiology, ecology, and evolution

Paul W. Sherman: behavioral ecology

Charles Walcott: animal orientation and navigation; animal communication; magnetic orientation in homing pigeons

Gregory A. Weiland: neuropharmacology; receptor mechanisms

NUCLEAR SCIENCE AND ENGINEERING

M.S., Ph.D., M.Eng.(Nuclear)

Graduate faculty representative David D. Clark, 105 Ward Laboratory

Subject Nuclear science and engineering (nuclear engineering, nuclear science)

Nuclear science and engineering is concerned with the understanding, development, and application of the science of nuclear reactions and radiations. Atomic phenomena such as those that occur in conjunction with nuclear processes in laboratory and astrophysical plasmas also come within its scope. The graduate programs at Cornell allow specialization in basic science, in engineering (including non-power applications), or in a combination of the two. Concentrations on various topics in those areas are possible (see examples under Research Opportunities below).

Three graduate degree programs are offered. The Master of Engineering (Nuclear) is a professional degree; the M.S. and Ph.D. degrees are intended for those who plan to pursue research or teaching careers.

A bachelor's degree in science or engineering, including courses in advanced calculus, thermodynamics, and atomic and nuclear physics, is required. Students with less preparation may be admitted but should expect to take longer to complete degree requirements. Applicants are urged, but not required, to submit GRE general test scores.

For the Ph.D., a reading knowledge of one language other than English is required.

Financial aid, including teaching or research assistantships, traineeships, fellowships, and loans, is available to graduate students. For applications to the M.S. or Ph.D. program, no special fellowship forms are required. Applications for admis-

sion received by January 15 are reviewed for Cornell graduate fellowship awards. Other forms of award are generally considered at this time but may also be awarded as they become available at any time during the year.

Prospective students in the Master of Engineering (Nuclear) degree program who want to apply for scholarship aid should obtain the appropriate form from the chairperson of the Graduate Professional Engineering Programs.

Research Opportunities

The M.S. and Ph.D. programs are oriented toward research and require completion of a thesis as well as course work. Candidates for one of these degrees choose either nuclear science or nuclear engineering as their major subject; because each student plans an individual program in consultation with the faculty members of his or her Special Committee, there are no detailed degree requirements. This approach, long a tradition of graduate study at Cornell, is well suited to interdisciplinary fields such as nuclear science and engineering. Areas of concentration may be in any related engineering or science field. Independent thesis research and formal and informal interactions with staff members and other students are vital parts of the program.

The programs permit emphasizing a variety of specializations, such as nuclear structure physics, analytical applications, atomic processes, nuclear engineering, and controlled fusion and plasma physics.

Current examples of nuclear structure research are experimental investigations of short-lived nuclear isomeric states—in particular the "shape isomers" associated with the fission barrier—using instrumentation invented and developed at Ward Laboratory.

Analytical applications include neutron activation analysis, prompt gamma analysis (using neutron capture gamma rays), and neutron radiography. The latter two are being actively pursued at Cornell using newly constructed facilities expressly designed for the purpose.

Studies of relevant atomic processes are being carried out using an electron-beam ion source (EBIS) capable of producing low-energy, very highly charged ions, including bare nuclei, in collision and spectroscopy experiments to investigate fundamental atomic properties and ion-surface interactions.

A current example in nuclear engineering is computer modeling of reactor systems for investigation of operational, anticipated, and accident transients in liquid-metal-cooled fast breeder reactors and light-water-moderated reactors.

Controlled fusion and plasma physics include several areas. Cornell is recognized as the leading university in the production and application of relativistic electron beams and intense ion beams to controlled fusion. Specific projects concern the production of magnetic field configurations for plasma confinement by electron and ion beams, and the use of ion beams for inertial confinement fusion. Fusion technology combines conventional nuclear engineering with plasma physics and other technologies that may be required for the development of fusion reactors.

Previously pursued research areas that are not at present active but could be reactivated on demand include nuclear instrumentation, reactor physics, radiation chemistry, and radiation damage.

Students in nuclear science and engineering can use the facilities of two laboratories: the Ward Laboratory of Nuclear Engineering and the Laboratory of Plasma Studies. Experimental facilities of Ward Laboratory include (1) the TRIGA reactor, with steady-state power of 500 kilowatts and pulsing capability of up to 1,000 megawatts, for nuclear physics, activation analysis, neutron radiography, and, with a unique neutron-beam facility combining a cold source and a curved neutron guide, low-background experiments, including prompt gamma analysis; (2) the Cornell Critical Facility, a "zero-power reactor" of very versatile design for basic studies in reactor physics and dynamics; (3) the Gamma Cell, a shielded cell with a nominal 10,000-curie cobalt-60 gamma-ray source for radiation chemistry and radiation damage studies; and (4) a conventional solenoid EBIS and a cryogenic, superconducting solenoid EBIS with a Jt of 200 coulomb/cm² at 9.0 keV.

The Laboratory of Plasma Studies coordinates and facilitates the work of faculty members from several graduate fields. Facilities include a variety of magnetic confinement systems and intense particle beam generators. The latter includes pulsed-power generators with powers from 1010 to 8×10^{11} watts for pulse durations of 0.05 to 1.0 microseconds. Electron beams of 1011 watts and proton beams in excess of 1010 watts are routinely produced by these generators.

M.Eng.(Nuclear)

The two-term curricular program leading to the degree of Master of Engineering (Nuclear) provides a professional degree for persons entering the nuclear industry, but it may also serve as preparation for doctoral study in nuclear science and engineering.

Further information may be obtained by writing to the nuclear science and engineering graduate faculty representative.

Faculty and Specializations

- K. Bingham Cady: nuclear engineering; nuclear reactor safety
 Alison P. Casarett: radiation biology
 David D. Clark: nuclear structure; radiation detection and measurement; analytical applications
 Hans H. Fleischmann: thermonuclear power; plasma physics
 David A. Hammer: plasma physics and controlled fusion
 Bryan L. Isacks: seismological aspects of nuclear-plant siting
 Vaclav O. Kostroun: interaction of radiation and matter; nuclear and atomic structure
 Che-Yu Li: fast-neutron damage; nuclear materials
 Franklin K. Moore: thermal engineering; energy conversion
 George H. Morrison: activation analysis
 Mark Nelkin: neutron scattering; transport and kinetic theory
 James S. Thorp: systems engineering; controls
 Robert L. VonBerg: radiation chemistry; chemical engineering
 Charles B. Wharton: plasma physics

NUTRITION

M.S., Ph.D., M.N.S., M.P.S.(Hu.Ec.)

Graduate faculty representative B. A. Lewis, 145 Savage Hall

Subject Nutrition (animal nutrition, clinical nutrition, foods, general nutrition, human nutrition, international nutrition, nutritional biochemistry)

An adequate background in chemistry, biology, physics, and mathematics is essential for advanced study in nutrition, particularly in areas involving laboratory experimentation. Additional training in nutrition, food science, physiology, and microbiology is recommended. For study relating to community aspects of nutrition, courses in the social sciences are important. Entering students with background deficiencies can correct some deficiencies after they

have been admitted to the graduate program. However, organic chemistry and biochemistry are required for admission. GRE general test scores are required by the field; subject test scores in chemistry or biology are recommended.

Candidates for the M.S. must satisfy requirements in the major subject and one area of concentration outside the field. Candidates for the Ph.D. must satisfy requirements in the major subject and two areas of concentration. Only one of the areas of concentration may be selected from within the field. Candidates for the Master of Nutritional Science (M.N.S.) degree must complete a two-year program consisting of study at the university and affiliated clinical sites. To complete the M.N.S. in two years, the applicant should take the undergraduate courses required for ADA registration before matriculating. All degree programs require a thesis; the specific requirements are determined by the each candidate's Special Committee.

Members of the faculty in various colleges and divisions of the university with interests in nutrition constitute the graduate faculty in the field. Graduate students may study with faculty in the Division of Nutritional Sciences, the College of Veterinary Medicine, and the Departments of Animal Science, Food Science, and Poultry and Avian Science in the College of Agriculture and Life Sciences or in the Department of Food Science and Technology of the Geneva Experiment Station.

Research and Study Opportunities

Depending on his or her interests, a student may obtain training in many aspects of nutrition and in the biological or social sciences related to nutrition. Several combinations of majors and minors selected from colleges or divisions of the university are possible, and both human and animal nutrition interests are accommodated in the field. For those preparing for laboratory experimentation in nutrition, minors in physiology and biochemistry are usually recommended, although other minors may be chosen. Students interested in community and international nutrition have access to active programs that provide opportunity for field experience in the United States or abroad. The specialization in food applies the chemical, biological, and physical sciences to the study of human foods. As part of their training graduate students may be required to assist in teaching.

Research of the faculty encompasses many aspects of nutrition: metabolism of proteins and amino acids, vitamins, minerals, lipids, energy metabolism, gastrointestinal physiology, nutritional pathology, nutrition and cancer, nutrition and behavior, community nutrition, international nutrition, food habits, epidemiology, and nutritional education. Research is conducted with humans, lower animals, and microorganisms as experimental models. The studies may involve the whole organism or isolated systems.

Faculty and Specializations

B. Jean Apgar: zinc deficiency in animal models

William J. Arion: energy metabolism; molecular and cell biology

Gertrude Armbruster: food science; food chemistry; food preservation; food quality

Richard E. Austic: nutritional biochemistry

Dale E. Bauman: metabolic regulation;

lactation; pregnancy; growth

Alan W. Bell: nutritional physiology;

pregnancy; growth of farm animals

Andre Bensadoun: lipid transport and biochemistry

Carole Bisogni: community nutrition; nutrition education

Raymond D. Boyd: monogastric nutrition

T. Colin Campbell: nutrition and cancer

Larry E. Chase: dairy cattle nutrition; ruminant nutrition

Gerald F. Combs: selenium and vitamin E; influence of nonnutritive factors

Marjorie M. Devine: nutrition education

J. Murray Elliot: ruminant nutrition

Danny G. Fox: nutrition of cattle

Ardyth H. Gillespie: communication nutrition; nutrition education; community nutrition

Jere D. Haas: human nutrition and growth; international nutrition

Jean-Pierre Habicht: nutritional epidemiology

Harold F. Hintz: equine nutrition

Douglas E. Hogue: animal nutrition

Francis A. Kallfelz: mineral metabolism; veterinary clinical nutrition

Michael N. Kazarinoff: nutritional biochemistry; molecular and cell biology; protein metabolism; polyamines

Lennart P. Krook: pathology of nutritional diseases

Michael C. Latham: international nutrition and tropical public health

David Levitsky: nutrition and behavior; regulation of energy balance

B. A. Lewis: food chemistry; complex carbohydrates; proteins; dietary fiber

Charles C. McCormick: trace element metabolism; zinc; cadmium and copper; metallothionein; chick

Dennis D. Miller: mineral bioavailability

Nell I. Mondy: plant biochemistry; enzymes; phenols; lipids; minerals; glycoalkaloids

Mary A. Morrison: use of amino acids from plant proteins

Malden C. Nesheim: nutrition and infection; international nutrition

Christine M. Olson: nutrition education; maternal and child nutrition

Robert S. Parker: nutritional biochemistry; nutrition and cancer

Kathleen M. Rasmussen: human nutrition; experimental nutrition; nutritional physiology and metabolism

Daphne A. Roe: drug-nutrient interactions; public health and clinical nutrition

Diva M. Sanjur: international and community nutrition

Ruth Schwartz: mineral metabolism; role of magnesium

Charles J. Sniffen: dairy cattle nutrition

Mary F. Sowers: community nutrition and epidemiology

Lani S. Stephenson: international nutrition; nutrition and infection; protein-energy malnutrition; anemias

Martha H. Stipanuk: metabolism of sulfur-containing amino acids in mammals

Michael L. Thonney: growth and development; ruminant nutrition; skeletal growth

Virginia Utermohlen: clinical nutrition; immunology; maternal and child nutrition

Darrell G. Van Campen: absorption of trace elements

Peter J. Van Soest: ruminant nutrition; dietary fiber

Richard G. Warner: animal nutrition

Robert H. Wasserman: membrane transport; calcium metabolism; vitamin D

Malcolm Watford: biochemistry; hormonal regulation of gene expression; glutamine metabolism; gluconeogenesis; urea

Donald B. Zilversmit: lipid metabolism; lipoproteins; atherosclerosis

OPERATIONS RESEARCH

M.S., Ph.D., M.Eng.(Operations Research and Industrial Engineering)

Graduate faculty representative David C. Heath, 318 Upson Hall

Subjects Operations research (applied probability and statistics, manufacturing systems engineering, mathematical programming); operations research and industrial engineering [M.Eng.]

In addition to choosing a major subject, a candidate selects one minor for the M.S. and two for the Ph.D. degree. A minor may be in operations research or in a subject offered by another field of the Graduate School. Appropriate minor areas of concentration that have been chosen most frequently in recent years (listed with the departments or schools that offer these courses of study) are computer science (Department of Computer Science), econometrics and economic statistics (Department of Economics), environmental systems engineering (School of Civil and Environmental Engineering), managerial economics (Graduate School of Management), mathematics (Department of Mathematics), and planning theory and systems analysis (Department of City and Regional Planning).

Applicants must hold a bachelor's degree in engineering, mathematics, economics, or the physical sciences. All applicants are required to take at least the general test of the GRE. An appropriate GRE subject test is also desirable, especially for applicants for financial aid.

A student in a Ph.D. program must demonstrate reading ability in French, German, Russian, Chinese, or a language approved by petition to the field.

In addition to the examinations required by the Graduate School, the field requires a qualifying examination for Ph.D. candidates. This examination is normally taken at the end of the third term of graduate study at Cornell.

The field requires teaching experience of all graduate students.

The John McMullen Graduate Fellowship is specifically designated for incoming candidates to this field.

M.Eng.(Operations Research and Industrial Engineering)

The main objectives of the program leading to the professional degree of Master of Engineering (Operations Research and Industrial Engineering) are to give each student greater breadth and depth of technical knowledge and to provide an environment in which he or she can synthesize the material studied in the course work. The emphasis is on mathematical modeling and on the application of quantitative techniques associated with optimization, probability, and statistics to the design and operation of systems.

Students are required to complete an engineering project in which they have the

opportunity to work closely with practicing engineers or analysts as well as with Cornell faculty members. The projects are usually provided and sponsored by industrial or government organizations. Students are expected to perform all aspects of the project work from problem formulation to communication of the results.

Subject Descriptions

Applied probability and statistics This area of study and research is appropriate for students whose primary interest is in the techniques and associated underlying theory of probability and statistics, particularly as applied to problems arising in science and engineering. The techniques emphasized are those associated with applied stochastic processes (e.g., queuing theory, traffic theory, and inventory theory) and statistics (including statistical decision theory; the statistical aspects of the design, analysis, and interpretation of experiments and of ranking and selection theory; reliability theory; and analysis of life data).

Those who elect to work in this area are expected to acquire considerable knowledge of the theory of probability and statistics. All students who major in applied probability and statistics are required to have the equivalent of a minor in mathematics.

Industrial and systems engineering

Analysis and design of the complex operation systems found in modern society are included in this area. Problems found in mathematics, such as the design of integrated production, inventory and distribution systems, plant design, and various engineering-economic analyses, as well as those problems found in government, banking, and health delivery systems, are some of the major topics considered.

Research activity in this area may involve the development of new methodology or the synthesis of existing knowledge. The goal is to improve the understanding and design of a system's operation.

Students who specialize in this area are expected to have the ability to use modern techniques in the design and analysis of systems; they need to acquire an understanding of inventory theory, scheduling theory, queuing theory, mathematical programming, computer science, and computer simulation. Research activity may involve the development of new methodology or the synthesis of existing knowledge.

Mathematical programming Work in mathematical programming traditionally consists of linear, nonlinear, integer, and combinatorial programming (including network flows and scheduling theory). Research in these areas ranges from the development and application of computational algorithms (exact and approximate) to the associated studies of duality theory, convex analysis, fixed-point techniques, polyhedra, combinatorics, and graph theory. Another aspect is game theory—the general study of conflict and cooperation—which includes considerations of the properties of solutions and applications in economic market theory, bidding and auctions, cost-allocation schemes, and voting procedures.

Faculty and Specializations

Robert E. Bechhofer: ranking and selection procedures; design of experiments; medical statistics
 Louis J. Billera: game theory; combinatorics
 Robert Bland: network flows; graph theory; mathematical programming
 Lawrence D. Brown: statistics
 Thomas T. Coleman: numerical optimization
 Eugene B. Dynkin: probability theory; mathematical economics
 David C. Heath: applied probability
 Peter L. Jackson: stochastic models; finance
 Walter R. Lynn: environmental systems
 William L. Maxwell: scheduling; materials handling; simulation
 Joseph Mitchell: computational geometry
 John A. Muckstadt: inventory and logistics control
 Narahari U. Prabhu: stochastic processes; queuing and storage theory
 James Renegar: optimization
 Robin O. Roundy: analytical management of production and inventory systems
 Thomas J. Santner: statistics
 Lee W. Schruben: applied operations research; health systems
 Christina Shoemaker: environmental systems
 Frank L. Spitzer: probability theory
 Joseph L. Thomas: production and distribution systems
 Michael J. Todd: mathematical programming
 Leslie E. Trotter, Jr.: mathematical programming
 Bruce W. Turnbull: biomedical statistics; quality control; reliability theory
 Lionel I. Weiss: statistical decision theory; nonparametric statistics

PEACE STUDIES AND PEACE SCIENCE

Minor field

Graduate faculty representative Walter Isard, 476 Uris Hall

Minor subjects Peace science; peace studies

Peace studies and peace science are both interdisciplinary *minor* subjects that provide opportunity for graduate students to deepen their knowledge of (a) international security, (b) the structure and function of multinational systems, and (c) the general area of conflict analysis, conflict management, and conflict resolution. The peace science minor emphasizes mathematical modeling and game-theoretic models, while the peace studies minor emphasizes historical, institutional, and policy-oriented approaches. These minors are intended to complement basic study in such areas as government; economics; sociology; civil, environmental, and transportation engineering; operations research; city and regional planning; industrial and labor relations; psychology; and agricultural economics.

Faculty and Specializations

Steven B. Caldwell: sociology and policy analysis
 Walter Isard: economics and cooperative procedures
 Judith V. Reppy: defense economics
 Sidney Saltzman: planning and information processing systems
 Lawrence Scheinman: government and international organization and law
 Richard E. Schuler: economics and environmental engineering
 Henry Y. Wan, Jr.: economics and game theory
 Robin M. Williams, Jr.: sociology and conflict analysis

PHILOSOPHY

(M.A.), Ph.D.

Graduate faculty representative David B. Lyons, 227 Goldwin Smith Hall

Subject Philosophy

The Susan Linn Sage School of Philosophy, which comprises the Field of Philosophy in the Graduate School, was founded through the generosity of Henry W. Sage. There are at present fifteen faculty members engaged in full-time instruction. The faculty manages and edits *The Philosophical Review*.

A background in philosophy equivalent to a Cornell undergraduate major is presupposed, and deficiencies must be made up in addition to graduate work. The Field of Philosophy has no terminal M.A. program, but under exceptional circumstances the field has accepted M.A. students. It is recommended but not required that applicants to the program submit GRE general test scores. *In addition to other application materials required by the Graduate School, the Field of Philosophy requires from every applicant a sample of his or her written work in philosophy.* A student whose major interest is in philosophy is required (a) to gain a general knowledge of the whole subject, including its history, and (b) to select some aspect or subdivision of it for intensive study and research.

A doctoral candidate normally spends two years taking courses (usually three courses or seminars each semester) and preparing for the admission to candidacy examination, after which work on the thesis begins. There are no field-wide course requirements. Each student's program of study is worked out individually in regular meetings each semester with his or her three-person Special Committee. There are no written comprehensive examinations. The admission to candidacy examination is an oral examination on the student's thesis proposal and related subjects. The field requires teaching experience for all Ph.D. candidates.

The meetings of the Philosophy Discussion Club are among the significant features of the program. Every fortnight the club meets to hear and discuss a paper by one of its members or a visiting scholar. A number of distinguished philosophers visit the club each year.

Joint Program in Ancient Philosophy with the Field of Classics

The joint program aims at training productive scholars and effective teachers of ancient philosophy who will also be well-rounded classicists or philosophers. All students must demonstrate adequate basic knowledge of pre-Socratic philosophy, Plato, Aristotle, and ancient philosophy after Aristotle. Normally students applying to the program in the Department of Philosophy should know enough Greek to read philosophical texts; knowledge of Latin is not a requirement for admission for philosophy candidates. Further work in both languages will be expected. For further information, write to one of the faculty members listed below who teach ancient philosophy.

J.D. and Ph.D. (or M.A.) in Philosophy

This program is of special interest to students who want to concentrate in jurisprudence or legal philosophy. It enables students to coordinate their studies toward the J.D. degree and a graduate degree in philosophy, completing both degrees approximately a year sooner than otherwise would be possible. A student in the program may begin law study in the first year or after a year of course work in philosophy. Once law study is begun, it is continued until completion of the J.D. degree. Students who want to enter this joint program must make separate applications to the Law School and to the Field of Philosophy in the Graduate School. A student may apply to the program before matriculating in either law or philosophy and, if admitted, may then decide in which discipline to spend the first year. Alternatively a student may apply and be admitted to the program after having already begun the first year of study in either philosophy or law.

For further information, write to the Department of Philosophy, 227 Goldwin Smith Hall.

Faculty and Specializations

- Kwame A. Appiah: probabilistic semantics; philosophy of language; African philosophy
- Richard N. Boyd: philosophy of science; philosophy of psychology; epistemology; philosophy of language; philosophy of mind
- Gail J. Fine: ancient philosophy; the history of modern philosophy; epistemology and metaphysics
- Carl A. Ginet: metaphysics; epistemology; philosophy of mind; philosophy of language; Wittgenstein; Descartes; Leibniz
- Harold Hodes: logic; philosophy of language; philosophy of mathematics
- Terence H. Irwin: ancient philosophy; moral and political philosophy; Kant
- Jon P. Jarrett: philosophy of science; foundations of physics
- Norman Kretzmann: history of philosophy and logic; medieval philosophy; ancient philosophy; philosophy of religion
- David B. Lyons: moral, political, and legal philosophy
- Richard W. Miller: social and political philosophy; Marx; epistemology; aesthetics; philosophy of natural and social science; ethics

Phillip T. Mitsis: ancient philosophy
 Sydney Shoemaker: metaphysics; philosophy of mind; history of modern philosophy; epistemology
 Henry Shue: ethics and foreign policy
 Robert C. Stalnaker: philosophy of language; metaphysics; philosophy of logic
 Nicholas Sturgeon: history of modern philosophy; ethics
 Milton W. Wachsbarg: ethics; philosophy of mind; political philosophy
 Allen W. Wood: modern Continental philosophy; history of modern philosophy; social and political philosophy; philosophy of religion

PHYSICS

M.S., Ph.D.

Graduate faculty representative David M. Lee, 528 Clark Hall

Subject Physics (experimental physics, physics, theoretical physics)

The graduate physics program at Cornell is designed to give students an adequate background in the concepts and techniques of both theoretical and experimental physics to prepare them for careers at the most advanced level in research or teaching. Although the program focuses on the Ph.D. degree, there is a wide variety of options available to students during their work at Cornell, both in the final level of achievement and in the area of concentration.

The large majority of entering students have completed an undergraduate physics major program, including such courses as analytical mechanics, electricity and magnetism, optics and wave motion, electronics, and atomic physics; some advanced undergraduate laboratory work in physics is also expected. Knowledge of differential equations and vector calculus is essential.

In the selection of new students, emphasis is on the quality of the undergraduate work and on the promise for graduate work rather than on the extent of undergraduate study in physics and related subjects. Many entering students enroll in one or more undergraduate courses to make up deficiencies.

Although taking the GREs, including the subject test in physics, is not formally required for admission, it is strongly recommended that prospective graduate students take this set of examinations no later than December.

No foreign language is required either for admission or for a master's or a Ph.D., but proficiency in at least one foreign language is very desirable.

A copy of the brochure *Graduate Study in Physics at Cornell*, containing a more detailed description of the program, may be obtained by writing to Physics Graduate Admissions, 117 Clark Hall.

Research and Study Opportunities

Theoretical physics Strongly interacting fermion systems; electronic properties of homogeneous and inhomogeneous systems; matter under extreme conditions; defects; classical and quantum liquids; superconductivity; statistical and phase transition; computer simulation of classical and quantum many-particle systems; amorphous materials; liquid crystals; dynamical systems; turbulence; application of renormalization group to field theory and critical phenomena; phenomenology of heavy quarks; quantum chromodynamics; lattice gauge theories; computer simulation of relativistic quantum field theories; internal symmetries and their connection with strong interaction dynamics; quantum electrodynamics; unified strong, weak, and electromagnetic interaction; high-energy electromagnetic interaction, astrophysics; and stellar structure and general relativity

Experimental high-energy physics

Students have the opportunity to study experimental elementary particle physics at CESR, the Cornell Electron Storage Ring, located on the Cornell campus. CESR is an electron-positron colliding beam facility that is uniquely suited for studies of the "b" quark in the Upsilon energy region. A sophisticated detector, CLEO, is being used to search for and to examine new particles composed of heavy quarks and to study the energy levels and decays of the Upsilon particles. Presently a major upgrade of the CLEO detector is under way. Graduate students working in this program have an excellent opportunity to learn the art of experimental elementary particle physics research while taking part in work at a very basic and exciting frontier of the field.

The program of storage-ring development provides a unique opportunity for graduate students interested in accelerator physics. In addition, there is an active program to develop the superconducting radio-frequency cavities that will be needed for the next generation of electron-positron storage rings.

Cornell is a member of University Research Associates, which operates the Fermi National Accelerator Laboratory at Batavia, Illinois, where a 500-GeV proton synchrotron is in operation and 2 TeV proton-antiproton collider will soon be commissioned. A group of Cornell physicists is participating in the first experiment to measure proton-antiproton scattering in the collider. This experiment will continue to provide opportunities for graduate students who work at Fermilab.

Experimental condensed matter physics Liquid and solid ^3He and ^4He (particularly superfluid phases); spin-polarized hydrogen; near and far infrared studies of surfaces, solids, and heterogeneous media; laser spectroscopy; submicron physics; spin resonance in metals and semiconductors; properties of amorphous and highly disordered crystalline solids; thin films and interfaces; time-resolved studies of surface phenomena; atom and ion scattering from solid surfaces; boundary effects of phase transitions in liquid mixtures; metal-insulator transitions; atomic diffusion in metals and insulators; and inelastic X-ray scattering from atoms and solids

Faculty

Vinay Ambegaokar
Neil W. Ashcroft
Karl Berkelman
David G. Cassel
Geoffrey V. Chester
Barbara H. Cooper
Robert M. Cotts
Mitchell Feigenbaum
Michael E. Fisher
Douglas B. Fitch
Carl P. Franck
Richard S. Galik
Murdoch G. Gilchriese
Bernard Gittelman
Kurt Gottfried
Louis N. Hand
Donald L. Hartill
Wilson Ho
Donald F. Holcomb
Hikaru Kawai
Toichiro Kinoshita
James A. Krumhansl
David M. Lee
G. Peter Lepage
Raphael M. Littauer
N. David Mermin
Nariman B. Mistry
Mark S. Nelkin
Jay Orear

Robert O. Pohl
John D. Reppy
Robert C. Richardson
David L. Rubin
Edwin E. Salpeter
James Sethna
Stuart L. Shapiro
Robert H. Siemann
Albert J. Sievers
Eric D. Siggia
Robert H. Silsbee
Albert Silverman
Peter C. Stein
Richard M. Talman
Saul A. Teukolsky
Maury Tigner
Watt W. Webb
John W. Wilkins
Kenneth G. Wilson
Tung-Mow Yan
Donald R. Yennie

Closely associated with the graduate program in physics are a number of faculty members in related fields who teach graduate courses in physics or serve as thesis advisers to physics students. There are also typically several visiting professors and about forty Ph.D. instructors and research associates who rarely serve on Special Committees but with whom graduate students often work informally.

PHYSIOLOGY

(See also Graduate School of Medical Sciences.)

M.S., Ph.D.

Graduate faculty representative Howard C. Howland, W-201 Seeley Mudd Hall

Subject Physiology (behavioral physiology, cellular physiology, comparative physiology, endocrinology, gastrointestinal and metabolic physiology, neurophysiology, reproductive physiology, vertebrate physiology). See also the list of faculty and specializations below for major subjects.

Minors may be selected from biochemistry, biometry, chemistry, ecology, electrical engineering, genetics, histology, microbiology, nutrition, pathology, pharmacology, physics, psychology, and other suitable areas.

All applicants should submit the results of the GRE general test and subject test in biology. Applicants should have obtained a good knowledge of biology, chemistry, biochemistry, and physics. Calculus, statistics, and genetics are also advisable.

The field requires that the Ph.D. candidate form his or her Special Committee with one field-appointed member by the end of the second semester. At this time, or at some time before the end of the second semester, the entire committee meets to discuss and formulate the academic program of the candidate. It is also required by the field that each Ph.D. candidate teach for at least one semester.

The field has instituted specific course requirements for graduate students in order to provide basic information and breadth in the physiological sciences. The student's Special Committee and the field brochure should be consulted regarding these requirements.

Each Ph.D. student will be required to present a seminar, open to the faculty and graduate students of the field, on the thesis work after all laboratory work is essentially complete but before the written thesis is in final form.

A doctoral candidate in physiology must have two minor subjects. At least one of the minor committee members must not be a member of the Field of Physiology.

Information and a brochure describing requirements, faculty, and research programs in the Field of Physiology may be obtained from the field assistant, New York State College of Veterinary Medicine, 226 Veterinary Research Tower (telephone: 607/253-3276).

Faculty and Specializations

Prospective students are urged to correspond with professors whose interests are nearest their own.

Andre Bensadoun: cellular physiology; gastrointestinal physiology; lipid transport and metabolism

Emmett N. Bergman: metabolism; ruminant physiology

Klaus Beyenbach: comparative and environmental physiology; renal physiology

Walter R. Butler: endocrinology; reproduction

Alison P. Casarett: reproduction

Robert A. Corradino: cellular physiology; endocrinology; gastrointestinal physiology

W. Bruce Currie: endocrinology; reproduction

Alan Dobson: gastrointestinal physiology;

respiration; ruminant physiology

Clare M. S. Fewtrell: cellular physiology

R. H. Foote: reproduction

Joanne E. Fortune: endocrinology; reproduction

Ronald C. Gorewit: lactation

Henry H. Hagedorn: endocrinology;

invertebrate physiology; reproduction

Bruce P. Halpern: neurophysiology; sensory physiology

William Hansel: endocrinology; reproduction

Katherine A. Houpt: behavioral physiology; sensory physiology

T. Richard Houpt: behavioral physiology; gastrointestinal physiology; metabolism; vertebrate physiology

Howard C. Howland: behavioral physiology; sensory physiology; vertebrate physiology

Francis A. Kallfelz: gastrointestinal physiology; metabolism; pathological physiology

Fred W. Lengemann: lactation; metabolism

Ellis Loew: neurophysiology; sensory physiology

George Lust: biochemistry of connective tissue; pathological physiology

William N. McFarland: comparative and environmental physiology; sensory physiology

James A. Marsh: cellular physiology; developmental immunology; endocrinology

Peter W. Nathanielsz: endocrinology; reproduction

Linda M. Nowak: cellular physiology

F. Harvey Pough: comparative and environmental physiology; herpetology

Andrea Quaroni: cellular physiology

Elizabeth Adkins Regan: behavioral physiology; endocrinology; reproduction

Thomas J. Reimers: endocrinology; reproduction

Miriam M. Salpeter: neurocytology

Herbert F. Schryver: metabolism; pathological physiology

Geoffrey G. W. Sharp: cellular physiology; endocrinology; gastrointestinal physiology

Daniel N. Tapper: neurophysiology; sensory physiology

Robert H. Wasserman: cellular physiology; gastrointestinal physiology

John F. Wootton: cellular physiology; enzymology; gastrointestinal physiology

PLANT BREEDING

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative W. R. Coffman, 252 Emerson Hall

Subject Plant breeding (plant breeding, plant genetics)

Plant breeding and plant genetics cannot be a major-minor combination; however, genetics (Field of Genetics) may be a minor.

Applicants should be well grounded in the fundamentals of the natural sciences. It is strongly recommended that applicants submit GRE test results.

Students interested in crop improvement through breeding and the genetics of higher plants may choose plant breeding or plant genetics as an area of concentration. Research may involve studies of breeding methods, application of genetic principles to breeding, and correlation of knowledge from other areas, such as physiology, biochemistry, and statistics, in attacks on problems of yield, quality, adaptability, and disease and insect resistance. Students may also select research problems involving cell and tissue culture or molecular genetics. Plant genetics generally involves research more specifically aimed toward the analysis of hereditary and evolutionary phenomena.

Students majoring in plant breeding or plant genetics will find it necessary to remain in Ithaca during the summer or to make arrangements elsewhere for growing and studying the material used in connection with their research problems. Special provisions are made for students interested in international or extension experience.

Members of the staff are especially interested in directing research in the areas listed below, although research will not be limited to those areas. Plant breeding staff direct thesis research on the crop plants with which they are primarily concerned.

Faculty and Specializations

Ronald E. Anderson: golden nematode resistance in potatoes
 W. R. Coffman: plant breeding; international agriculture
 Michael H. Dickson: vegetable breeding*
 Elizabeth D. Earle: tissue and cell culture
 R. C. Lamb: fruit breeding*
 Gerald A. Marx: vegetable breeding*
 Martha A. Mutschler: vegetable crops
 William D. Pardee: extension and seed production
 Robert L. Plaisted: potatoes
 Bruce I. Reisch: grape breeding*
 Richard W. Robinson: vegetable breeding*
 John C. Sanford: small fruit breeding*
 Michael E. Smith: corn breeding and genetics; disease and insect resistance
 Mark E. Sorrells: small grains
 John C. Steffens: biochemistry of plant breeding
 Steven D. Tanksley: molecular genetics of crop plants

Donald R. Viands: forage crops
 Donald H. Wallace: vegetable crops
 Norman F. Weeden: genetics and biochemistry of crop species*
 Richard W. Zobel: crop ecology; crop physiology

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

PLANT PATHOLOGY

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Steven V. Beer, 410 Plant Science Building

Subject Plant pathology (molecular plant pathology, mycology, plant pathology)

Admission

Applicants should have introductory-level knowledge of biochemistry, botany, calculus, chemistry, genetics, microbiology, mycology, organic chemistry, physics, plant pathology, plant physiology, soil science, statistics, and computers. A deficiency in any of those subjects will not preclude admission, but it will likely increase the time needed to complete a graduate degree program. Course work or experience in plant pathology is desirable but not required.

Applicants from the United States must present scores from the GRE general test. Successful applicants usually achieve combined verbal-quantitative scores of at least 1,200. GRE scores from the biology subject test are strongly encouraged. Applicants from other countries are encouraged, but not required, to present scores from the same tests. Early application is strongly encouraged, especially if fellowship or assistantship support is requested.

Program and Facilities

Excellent opportunities for study and research are offered for the M.S., the M.P.S., and the Ph.D. degrees. Summer field trips with staff members give students an appreciation of agriculture and the importance of plant diseases and the opportunity to observe applied research and extension programs. Students are required to obtain teaching experience in plant pathology by assisting in courses and by presenting both formal and informal seminars on their research.

Students majoring in plant pathology may specialize in a particular branch of plant pathology, such as disease cytology, disease management, epidemiology, molecular plant pathology, physiology, phytochemistry,

phytonematology, phytoviology, soilborne pathogens, or tropical plant pathology, or in a crop-oriented area, such as diseases of field crops, forage, fruits, ornamentals, potatoes, shade trees and shrubs, turfgrasses, or vegetables. Students electing a major in mycology may develop research programs in cytology, genetics, morphology, molecular biology, physiology, or taxonomy of fungi.

All students take oral or oral and written qualifying examinations within six months after their first registration, in addition to the examinations required by the Graduate School.

Cornell has two departments of plant pathology. All courses are given in the Ithaca department, and most students conduct their research there. The department at Geneva (fifty miles from Ithaca) emphasizes basic and applied research on diseases of fruits and vegetables and provides opportunities (including some assistantships) for students to conduct research. An outstanding mycological and plant pathological herbarium, superior library facilities, and modern laboratory equipment are available at Ithaca. Excellent laboratories with modern equipment, a library, a greenhouse, and field facilities are available at Geneva. Provisions can be made for students to carry out research at outlying field stations and, in special circumstances, in other countries.

Further information is given in the brochure *Graduate Study in Plant Pathology at Cornell*, which may be obtained from the graduate faculty representative.

Faculty and Specializations

George S. Abawi: research—soilborne pathogens; plant-disease control; root diseases of vegetables*

James R. Aist: research—disease and fungal cytology

Herbert S. Aldwinckle: administration; research—breeding; genetics; disease resistance of fruits*

Phil A. Arneson: teaching—plant protection; research—epidemiology; computer simulation modeling

Steven V. Beer: research—bacterial diseases; disease physiology and molecular plant pathology

Gary C. Bergstrom: extension and research—diseases of field crops; integrated pest management

Bill B. Brodie: research—nematology; biology; ecology; pest management; breeding for resistance

Thomas J. Burr: research and extension—fruit diseases caused by fungi and bacteria*

Helene R. Dillard: extension and research—diseases of vegetables*

William E. Fry: administration; research—plant disease epidemiology and control

Dennis Gonsalves: research—virus diseases of fruits and vegetables; biological control of virus diseases*

Gary F. Harman: administration; research—seed pathology; physiology of parasitism; resistance mechanisms; biological control*

Harvey C. Hoch: research—cell biology of fungi, especially host recognition and infection structure development; biological control of vegetable diseases*

Ralph K. Horst: research and extension—diseases of florist and ornamental crops

George W. Hudler: research, teaching, and extension—diseases of woody ornamentals

James E. Hunter: research—fungal and bacterial diseases of vegetables; integrated pest management*

Herbert W. Israel: research and teaching—cytology of pathogens and diseased plants

Edward D. Jones: extension and research—diseases of potatoes; potato certification; foundation seed programs

Mann P. Ko: research and teaching—ecology, physiology, molecular biology, and biocontrol of plant parasitic nematodes

Wolfram Koeller: research—biochemistry, mode of action, mechanisms of resistance, and design of fungicides*

Richard P. Korf: teaching and research—mycology; taxonomy, morphology, biology, and phytogeography of fungi

John A. Laurence: research—effects of air pollutants on plants and on plant disease

James W. Lorbeer: research—diseases of vegetables; soilborne pathogens; fungal genetics; epidemiology; teaching—mycology

Rosemary Loria: research and extension—diseases of vegetables; integrated pest management

Vladimir Macko: research—biochemistry of host-pathogen interactions

E. B. Nelson: research and extension—diseases of turfgrasses; soilborne pathogens

Paul E. Nelson: research—disease of ornamental crops; pathological histology; biology and taxonomy of *Fusarium*

- Peter F. Palukaitis: research—molecular plant pathology; virus diseases
 Roger C. Pearson: research—epidemiology and control of grape diseases*
 Rosario Provvidenti: research—virus diseases of vegetables; genetics of resistance*
 David A. Rosenberger: research and extension—epidemiology and control of fruit diseases*
 Robert C. Seem: research—quantitative epidemiology of fruit and vegetable diseases; pathosystem analysis and modeling*
 Wayne A. Sinclair: teaching—plant pathology; research—dendropathology
 Richard C. Staples: research—biology of fungal spore germination and infection structure development
 H. David Thurston: teaching and research—potato diseases; breeding for disease resistance; tropical plant diseases and their control
 Hans D. VanEtten: research and teaching—fungal diseases and pathogen physiology; molecular plant pathology
 Wayne F. Wilcox: extension and research—diseases of fruit; soilborne pathogens of fruit*
 Olen C. Yoder: research and teaching—molecular biology and genetics of fungal plant pathogens; molecular plant pathology
 Milton Zaitlin: research—plant virus replication; molecular biology of virus diseases; teaching—plant virology; administration—biotechnology
 Thomas A. Zitter: extension and research—diseases of vegetable crops; virus diseases of vegetables

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

PLANT PROTECTION

M.P.S.(Agr.)

Graduate faculty representative Phil A. Arneson, 412 Plant Science Building

Subject Plant protection

Plant protection is a major field for the M.P.S. (Agriculture) degree only. Admission to the field is based on a strong background in the basic biological and physical sciences and substantial preparation in agricultural and plant protection subjects. Applications are encouraged from agricultural graduates who have been working for several years

and want to pursue an advanced degree, as well as from students just completing a bachelor's degree.

The field requires a minimum of thirty credits (of which twenty-four must be for courses numbered 400 or above) plus an approved internship consisting of one growing season's experience in an extension pest-management program. The internship requirement may be waived for candidates already having appropriate experience. A problem-solving project is also required, a report of which must be submitted to the M.P.S. (Agriculture) Committee. On completion of the above requirements each candidate must take a final examination, which may be written, oral, or a combination of both, at the discretion of the Special Committee.

The suggested course of study stresses statistics and farm business management and develops depth in ecology, entomology, plant pathology, and weed science. The program is sufficiently flexible to accommodate the varying career objectives of the students as well as a wide range of crop interests.

Faculty and Specializations

Phil A. Arneson: plant pathology
 Charles J. Eckenrode: entomology*
 William E. Fry: plant pathology
 Robert C. Seem: plant pathology*
 Wayne A. Sinclair: plant pathology
 Gerald B. White: agricultural economics

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

POMOLOGY

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative F. W. Liu, 125 Plant Science Building

Subject Pomology

Applicants to this field should have a sound background in the basic sciences and an interest in fruit plants but need not have done their undergraduate work in horticulture. A knowledge of botanical and chemical subjects is necessary. Scores from the GRE general test are required.

During their graduate work students are expected to become well acquainted with the Field of Pomology and with other fields closely allied to their thesis problems. Students who want to obtain a Ph.D. degree are normally expected to obtain a master's first. Students registered in the Ph.D.

program must take a qualifying examination in addition to the examinations required by the Graduate School.

Faculty members in the field include members of the Department of Pomology on the Ithaca campus and members of the Department of Horticultural Sciences of the New York State Agricultural Station. The station is located in Geneva, fifty miles northwest of Ithaca. Both departments have excellent facilities for research. Faculty members are currently engaged in a variety of research projects concerning management and culture, breeding, genetics and biotechnology, nutrition, anatomy and morphology, growth regulators and hormones, postharvest physiology and storage, biochemistry, and development and stress physiology of tree fruits, grapes, and small fruits. Students take their courses at Ithaca but may conduct thesis research in the above-mentioned areas at either Ithaca or Geneva. A limited number of fellowships and assistantships are often available to qualified applicants.

Faculty and Specializations

- Robert L. Andersen: breeding and production of fruit crops*
- G. D. Blanpied: postharvest physiology
- Susan K. Brown: breeding of stone fruits*
- Leroy L. Creasy: physiology and biochemistry of plant phenolics
- James N. Cummins: rootstock breeding, propagation and testing; virus diseases—fruit crops*
- C. G. Forshey: mineral nutrition; growth regulators; tree fruit management and physiology*
- Alan N. Lakso: growth, development, and environmental physiology of apples and grapes*
- R. C. Lamb: breeding for disease resistance in apples and for improved pears, peaches, and apricots*
- Frank W. Liu: postharvest physiology; tropical and subtropical fruits
- Gene H. Oberly: mineral nutrition; soils; tree fruit production
- Robert M. Pool: general viticulture; vine physiology*
- Lloyd E. Powell, Jr.: plant hormones; dormancy; hormonal aspects of fruit development; analytical techniques for hormones
- Marvin P. Pritts: cultural practices and physiology with small-fruit crops
- Bruce I. Reisch: grape breeding; genetics and tissue culture*

Terence L. Robinson: orchard management and production systems; tree fruit physiology*

John C. Sanford: biotechnology; small-fruit breeding*

Warren C. Stiles: orchard management; tree fruits

Norman F. Weeden: plant genetics; biochemistry and evolution*

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

PSYCHOLOGY

(M.A.), Ph.D.

Graduate faculty representative James Cutting, 220 Uris Hall

Subject Psychology (biopsychology, general psychology, human experimental psychology, personality and social psychology)

In addition to transcripts of their undergraduate record, two or three letters of recommendation, and a personal statement of interests, applicants must submit scores on the GRE general test. Foreign applicants must submit TOEFL scores. The GRE subject test in psychology and an undergraduate major in psychology are not required. Prior research experience is highly desirable. Applicants may submit research reports or work if they wish. Only applicants for a Ph.D. are accepted. The normal closing date for applications is January 15. Persons whose primary interests lie in clinical, counseling, industrial, or school psychology should not apply.

Each student develops an independent program of study in consultation with his or her Special Committee. The three primary members of the Special Committee must be chosen by the end of the first year; students are encouraged to select at least one member (not the chairperson) from a field other than psychology. The graduate faculty representative will appoint a fourth member, whose function is to ensure that the student obtains adequate breadth of training.

Certain requirements are established by the field. These are enforced by the Special Committees. The present requirements include (1) a first-year review and annual meetings of the Special Committee to review the student's progress; (2) a research paper completed by the end of the first year and an oral report of the research made to a meeting of students and faculty; (3) a one-year course in statistics and experimental design; (4) at least ten hours a week of

supervised teaching experience for at least two semesters; (5) the examination for admission to candidacy, which should be taken by the end of the third year (a Graduate School requirement); (6) a written dissertation proposal, which must be accepted at a meeting of the Special Committee called for that purpose; (7) the doctoral dissertation itself and a final examination on the dissertation (Graduate School requirements).

Financial support for students is available in the form of teaching assistantships, research assistantships, predoctoral traineeships, and fellowships. The John Wallace Dallenbach Fellowship in Experimental Psychology is intended specifically for students in the Field of Psychology.

Research facilities include special rooms for research in problems of perception and cognition; a social psychology laboratory equipped for experimental and observational studies; electrophysiological, histological, and chemical laboratories; surgery facilities; facilities for the maintenance and behavioral study of vertebrate and invertebrate laboratory animals; darkrooms and shops; an audiovisual studio equipped for the study of teaching; facilities for research with a variety of laboratory animals; laboratory computers and interacting terminals with the capacity to control equipment in experiments and to do on-line processing and complex data analyses; a mobile laboratory for the study of children near their schools; and other specialized facilities, both on campus and at various off-campus locations.

Faculty and Specializations

Daryl Bem: personality theory; self-perception; attitude change
 Sandra L. Bem: sex roles; gender-schematic information processing
 James E. Cutting: visual perception; stimulus information; event perception
 Richard Darlington: psychometric theory; statistics; conflict and war
 Timothy DeVoogd: neural anatomical plasticity; sex differences in neuroanatomy
 David A. Dunning: social judgment and decision making; psychology and law
 Barbara Finlay: neural and behavioral embryology; neuroethology and vision
 Lorna K. Fitzgerald: social cognition; feelings and judgment
 Jennifer J. Freyd: cognition and perception; mental representation

Eleanor J. Gibson (emeritus): perceptual development in infants
 Thomas D. Gilovich: social judgment and attribution; gambling
 Bruce P. Halpern: taste-dependent decisions and adaptive behavior
 Robert E. Johnston: animal communication and social behavior; pheromones
 Francis C. Keil: concepts, categories, and word meanings; conceptual change
 Carol L. Krumhansl: perception and cognition; music perception; mathematical models
 Howard S. Kurtzman: psycholinguistics; parsing; higher-level visual cognition
 William W. Lambert: cross-cultural psychology; stress and cognition
 Harry Levin: social psychology of language; speech styles; reading
 David Levitsky: nutrition and behavior; obesity; weight regulation
 James B. Maas: communication; media-based educational programs
 Ronald D. Mack: psychotherapy and psychopathology
 Dennis T. Regan: experimental social psychology; interpersonal influence
 Elizabeth Adkins Regan: animal social behavior; neural and neuroendocrine mechanisms in reproduction
 Elizabeth S. Spelke: perception and cognition in infancy

PUBLIC POLICY

Minor field

Graduate faculty representative Norman T. Uphoff, 170 Uris Hall

Minor subject Public policy

Questions of public choice and policy applications are very real concerns in many disciplines, reflecting changes in our society. The complexities and interdependencies of more-industrialized societies and the inequities and immobilities in less-developed countries pose more-difficult and urgent problems than ever before. They require multidisciplinary analysis, for which existing graduate education does not necessarily prepare a graduate student. The *minor* Field of Public Policy is designed to complement study in major fields such as government, economics, administration, anthropology, sociology, planning, ecology, engineering, industrial relations, or a physical science. The field contributes to a linking of analytical skills and substantive knowledge to deal with problems of public choice and public action.

Students choosing this area as a minor field will usually write a dissertation bearing on some aspect of public policy. Seminars and course work, as well as directed and independent reading, will be organized to give multidisciplinary depth to the students' theses and to their subsequent teaching, research, and practice.

Faculty

David J. Allee
Josephine A. V. Allen
Roger M. Battistella
Fredrick T. Bent
Frederick H. Buttell
L. Duane Chapman
Pierre Clavel
Tom E. Davis
Arch T. Dotson
Paul R. Eberts
Eugene C. Erickson
Milton J. Esman
John L. Ford
John F. Forester
William W. Goldsmith
Davydd J. Greenwood
Alan J. Hahn
Sheila S. Jasanoff
Barclay G. Jones
Robert J. Kalter
Estel W. Kelley
Irving Lazar
David B. Lewis
Robert C. Lind
Daniel P. Loucks
Theodore J. Lowi
Walter R. Lynn
Alan K. McAdams
E. Scott Maynes
B. Jeanne Mueller
Dorothy W. Nelkin
Neil Orloff
T. John Pempel
James D. Reschevsky
Richard N. Rosecrance
Sidney. Saltzman
Richard E. Schuler
Stuart W. Stein
Robert S. Summers
Norman T. Uphoff
Jaroslav Vanek
Jerome M. Ziegler

REGIONAL SCIENCE

M.A., M.S., Ph.D.

Graduate faculty representative Sidney Saltzman, 215 West Sibley Hall

Subject Regional science (environmental and energy systems, international spatial problems, location theory, multiregional economic analysis, peace science, planning methods, transportation, urban and regional economics)

The Ph.D program is designed to provide the student with (1) a thorough understanding of regional, interregional, and location and conflict theory in the context of physical and policy spaces and the framework of existing economic, social, and political systems; and (2) a mastery of techniques of analysis of urban-regional systems as they relate to public and private decision making. Heavy emphasis is placed on mathematical models and quantitative methods. The student is fully exposed to the existing and newly developing social science theory that directly relates to the multidisciplinary approach of regional science.

The course offerings focus on the socioeconomic aspects of the physical environment and on the spatial and conflict aspects of socioeconomic systems. Since work for the Ph.D. is considered preparatory to making creative contributions to the discipline, competence in basic analytical and research methods will be required. Applicants are expected to have substantial preparation prior to entrance, which may be supplemented by work at Cornell.

There are no fixed admission requirements, but grades, class standing, GRE scores, and letters of recommendation must collectively indicate superior ability for creative research.

Students may ask any member of the Graduate Faculty to serve on their Special Committee. The chairperson must be a member of the Field of Regional Science.

The primary objective of the postdoctoral program is to deepen the understanding of complex urban, regional, spatial, and conflict phenomena by (1) bringing together within the regional science groups scholars with diverse backgrounds in the social sciences, design, engineering, and related fields; (2) encouraging each scholar to probe areas of interest and challenge in unprogrammed and independent ways; (3) establishing active working relationships with one or more research teams at Cornell; and (4) exchanging ideas in informal regional science and

peace science seminars. It is expected that each postdoctoral scholar will undertake research of high quality that will lead to publication in scholarly journals such as the *Journal of Regional Science* and *Conflict Management and Peace Science*.

Faculty and Specializations

David J. Allee: resource economics; regional economics; regional development planning

Richard N. Boisvert: economic development; employment and income distribution

Steven B. Caldwell: research methods; policy analysis; microsimulation

Stan Czamanski: regional industrial development; industrial complex analysis; optimization and econometric techniques in planning

Gordon P. Fisher: urban transportation planning; public transportation; operations analysis; human factors in transportation

William W. Goldsmith: political economy; international urbanization; development and underdevelopment

Walter Isard: location theory; conflict management procedures; peace science; general social science theory and methods; environmental management

Barclay G. Jones: urban and regional theory; quantitative analysis; urbanization theory; planning theory; environmental health planning

Robert J. Kalter: economic evaluation of public investment; water projects; recreation; environmental quality; energy

David B. Lewis: international development; science and technology policy in developing nations; quantitative methods for policy evaluation

Daniel P. Loucks: mathematical modeling of water resources and environmental quality management systems; urban noise control; regional development; multi-objective evaluation methods; interactive computer graphics

Walter R. Lynn: environmental systems; planning and public policy issues

Arnim H. Meyburg: urban transportation planning; travel-demand modeling; urban goods movement; transportation-communications relationships; transit systems operations

Timothy D. Mount: applied econometrics and quantitative analysis; resource economics

Sidney Saltzman: quantitative analysis; regional modeling; public policy research; information processing systems

Richard E. Schuler: urban and spatial economics; public economics; utility regulation

Erik Thorbecke: development planning; theory of quantitative economic policy; international trade

Henry Y. Wan, Jr: dynamic economic models; international trade; resource economics

ROMANCE STUDIES

M.A., Ph.D.

Graduate faculty representative Edward P. Morris, 291 Goldwin Smith Hall

Subject Romance studies (French linguistics, French literature, Italian linguistics, Italian literature, Romance linguistics, Spanish linguistics, Spanish literature)

The Field of Romance Studies includes faculty from four departments (Romance Studies, Africana Studies and Research Center, Comparative Literature, Modern Languages and Linguistics) and offers a diverse interdisciplinary program of research and instruction in the Romance languages and literatures. Language courses in French, Italian, Portuguese, Romanian, and Spanish are given in the broad cultural and linguistic setting of a department providing instruction in general and applied linguistics as well as in some thirty-five major languages and regional tongues. Romance studies seeks to maintain and transmit the traditional philological discipline and to that end offers a full complement of courses in French, Italian, and Hispanic literatures. It seeks also to incorporate the speculative, theoretical view of literature current in Europe today and reflected in the review *Diacritics*, which since 1971 has been edited and published by members of the field.

Students in the Field of Romance Studies may choose to work in either of two major subfields: Romance linguistics or Romance literature. Many students of Romance studies take some courses in both literature and linguistics. Appropriate minors may be drawn from such diverse areas as Afro-American studies, anthropology, applied linguistics, classics, comparative literature, English language and literature, general linguistics, Germanic studies, history, history of art, history of science, Latin American studies, medieval studies, musicology, Near Eastern studies, Old Icelandic literature, philosophy, psycholinguistics, Romance linguistics, Slavic studies, sociology, theater arts (including cinema and dance), and women's studies.

In practice most graduate students in Romance literature now elect only one minor area of concentration; in Romance linguistics, two—one or both of which usually lie in the Field of Romance Studies (such as French or Spanish literature) or the Field of Linguistics (such as applied linguistics or general linguistics).

Romance linguistics In Romance linguistics the student is given training in four types of study and research: (1) general principles of linguistic analysis; (2) the description of the structure of the Romance language of major interest; (3) the external and internal history of that language; and (4) the genetic and typological relationships of the Romance family of languages. Special emphasis is placed on the relation between linguistic history and cultural factors (literary, political, and social). A concomitant aim of this area is to afford instruction and practice in the application of linguistics to the teaching of one or more Romance languages.

A candidate may choose as the major area of concentration either the linguistics (descriptive and historical) of a specific Romance language or the comparative study of the Romance languages. Normally one of the minor areas will be the literature of the language in which the student's major interest lies.

For the M.A. in the concentration of Romance linguistics a candidate is expected to have command of two Romance languages (including the language of the major concentration) and the equivalent of a first-year course in Latin. For the Ph.D., a command of French and German is expected and the equivalent of a second-year course in Latin.

Romance literature In Romance literature students choose one national literature as their major concentration. They are expected to acquire a basic working knowledge of the general history of that literature along with the history of the national language and to become conversant with social and intellectual history. They are expected to speak and write their major language fluently and correctly. They are trained in those bibliographical, linguistic, and analytical skills basic to teaching and research in the interpretation of literature.

In the concentration of Romance literature students are encouraged to study foreign languages other than the language of the major concentration, but such study is not required unless special linguistic

competence is necessary for the student's research. The need for such competence is determined by the student's Special Committee.

The program in Romance literature does not ordinarily admit students seeking a terminal M.A. degree. Ph.D. candidates are granted the M.A. after successful completion of course work and the general field examinations. These examinations take slightly different forms in French, Italian, and Spanish, but all are based on the major works of the national literature. The last part of the examination involves the writing of a substantial essay setting forth the topic of the eventual dissertation, and an oral examination based on that essay. All examinations are normally completed by the beginning of the student's seventh semester.

Each year a certain number of graduate students in Romance studies obtain support from fellowships available in the Graduate School. Relatively large undergraduate enrollments in French, Italian, and Spanish courses (both in language and literature) require the employment of numerous teaching assistants. Every attempt is made to provide new teachers with careful guidance and support. A special summer course on the teaching of language allows beginning assistants to observe and participate in the classroom teaching of French or Spanish and to attend lectures and discussions on theory and practice. Graduate students in Romance literature are usually expected to teach at least one year of literature and one of language as part of their professional training.

The field does not have a formal program for study in Europe, but students are encouraged to spend a term or a year abroad whenever study in another country seems appropriate—either for improvement of language skills or for the advancement of their research. Close ties of professional acquaintance make it possible for students in French or Italian to attend seminars at such institutions as the *École Normale Supérieure* and the *École Pratique des Hautes Études* in Paris or the University of Bologna. Students in Spanish often conduct thesis research in archives or libraries in such cities as Madrid, Seville, Mexico City, and Lima. A special endowment allows the Department of Romance Studies to provide some of its students with small subsidies for study abroad.

The Field of Romance Studies has at its disposal Cornell's excellent research library

with renowned collections of books pertaining to Dante and Petrarch, to the French Revolution, and to turn-of-the-century Spain, among others. The field also benefits from the presence of strong departments in all branches of the humanities and from the widely known interdisciplinary program in Medieval Studies. There is an active Renaissance Colloquium with more than twelve faculty member participating. The Society for the Humanities, the Andrew D. White Professors-at-Large program, and visiting appointments in the Department of Romance Studies bring distinguished scholars and writers to Cornell for extended visits. Cornell is a National Resource Center for Latin American studies and research and study in Western (European) societies.

Applicants are strongly urged to include scores of the general and subject tests of the GREs with their other credentials and are urged to take those examinations by mid-December. Applicants are also encouraged to include course papers (or other samples of written work) with their applications.

For course offerings, please see the catalog *Courses of Study* under the headings "Comparative Literature" and "Modern Languages, Literatures, and Linguistics."

Faculty and Specializations

- Anne Adams: Francophone literature of Africa and the Caribbean
 Ciriaco M. Arroyo: Spanish intellectual history; medieval and modern Spanish literature; philosophy
 Anne E. Berger: eighteenth-century French literature and philosophy; modern poetry and poetics; feminist and psychoanalytic criticism
 Jacques Bereaud: stylistics; French civilization
 Debra A. Castillo: modern Hispanic literature; comparative literature; literary theory
 Gennaro Chierchia: Italian linguistics; semiotics
 Alice M. Colby-Hall: French philology; medieval French language and literature; stylistics
 Jonathan Culler: literary theory; nineteenth- and twentieth-century French literature
 Nelly Furman: nineteenth-century French literature; feminist criticism
 Anita Grossvogel: nineteenth- and twentieth-century Italian literature
 David I. Grossvogel: twentieth-century French literature; comparative literature; theater and cinema

- Gregory R. Guy: Hispanic linguistics; Brazilian linguistics; sociolinguistics
 William W. Holdheim: history of ideas; contemporary French literature
 William J. Kennedy: Italian and French Renaissance literature
 Richard J. Klein: nineteenth- and twentieth-century French literature; literary criticism
 John W. Kronik: nineteenth- and twentieth-century Spanish literature; Spanish American drama
 Philip E. Lewis: seventeenth- and nineteenth-century French literature; literary criticism
 Marilyn Migiel: Dante; Italian literature of the Renaissance
 Edward P. Morris: sixteenth-century French literature; literature and the visual arts; literary history and musicology
 James S. Noblitt: French linguistics; applied linguistics; Old Provençal
 Mary G. Randel: Spanish literature of the Golden Age
 Carol G. Rosen: Italian linguistics; comparative Romance linguistics
 Enrico M. Santi: Hispanic American literature
 Marguerita A. Suner: Spanish linguistics; general syntax
 Jonathan P. Tittler: Hispanic American literature
 Kathleen Vernon: modern Hispanic literature; comparative literature
 Linda R. Waugh: French linguistics; general linguistics; semiotics

SLAVIC STUDIES

M.A., Ph.D.

Graduate faculty representative

E. Wayles Browne, 308 Morrill Hall

Subject Slavic studies (Russian literature, Slavic linguistics)

Applicants should have a minimum of two years' previous study of Russian or equivalent knowledge of one of the Slavic languages. GRE test results, although not required, are useful in the objective evaluation of credentials and in financial aid decisions. Additional information can be obtained by writing to the graduate faculty representative.

The student in Slavic studies plans an individual program in consultation with the Special Committee chairperson and other members of that committee representing the minor areas of concentration. A student who chooses either Russian literature or Slavic linguistics as a major may choose the other for a minor or may choose minor areas of

concentration from other fields in the university, such as other literatures, linguistics, history, art, government, economics, psychology, mathematics, computer sciences, philosophy, and music. A Ph.D. candidate will normally have two minor areas of concentration, although it is possible to plan with the Special Committee chairperson a program of studies with only one. In the latter case the student is still required to select a total of three professors to serve on the Special Committee.

The progress toward the degree is determined by oral and written comprehensive examinations given at three points in the student's career: at the end of the first year of work to assess the student's capacity for Ph.D. work and to assist in planning the student's program of study; at the end of the third year of study (or sooner if the student is prepared) to assess the student's mastery of the materials of study; and after completion of the dissertation (defense of the dissertation).

Candidates receiving the M.A. are required to demonstrate a reading knowledge of either French or German before continuing into the Ph.D. program. Candidates for the Ph.D. are required to demonstrate a reading knowledge of both languages.

Candidates for the Ph.D. are normally required to spend two semesters as teaching apprentices as part of their training toward the degree.

Faculty and Specializations

- Leonard H. Babby: Slavic linguistics; history and structure of Russian; theory of syntax and morphology; Turkish
- E. Wayles Browne: Slavic linguistics; Serbo-Croatian; Balkan languages; linguistic theory; language pedagogy
- Patricia Carden: nineteenth- and twentieth-century prose; modernism and the avant-garde; critical theory
- George Gibian: nineteenth-century prose; the 1920s; contemporary literature
- Richard L. Leed: historic Slavic linguistics; language pedagogy
- Michael Scammell: twentieth-century Russian literature (Soviet and émigré)
- Savely Senderovich: Old Russian literature; eighteenth- and nineteenth-century literature; structural and phenomenological poetics

SOCIOLOGY

M.A., Ph.D.

Graduate faculty representative Michael T. Hannan, 323 Uris Hall

Subject Sociology (policy analysis, population studies, research methods, social organization and change, social psychology)

All inquiries about the graduate program in sociology should be made directly to the graduate faculty representative. Applicants are required to submit GRE general test scores.

M.A. candidates major in general sociology, which covers the four subjects of social organization and change, research methods, social psychology, and population studies.

Students in the Ph.D. program may register in general sociology initially but must select one of the five areas of concentration before taking the admission to candidacy examination. Two minors are also chosen either in sociology or from related fields.

All students in the Ph.D. program are required to have one year of directed teaching experience at Cornell unless specifically exempted. In addition, students in M.A. and Ph.D. programs are expected to prepare themselves to undertake research both through formal course work and through apprenticeships in the ongoing research activities of the faculty.

Candidates in full-time residence are normally expected to complete the Ph.D. degree within four years of the bachelor's degree. A written and oral admission to candidacy examination is usually taken early in the third year, followed by the dissertation and oral defense. Students normally take a sequence of core courses in theory and methods but may substitute a general examination in these subjects. Additional details are in pamphlets available from the graduate faculty representative.

Concentrations

Social organization and change This major requires (1) a thorough knowledge of theories and research in social organization and change, (2) a working knowledge of research methods, and (3) a detailed knowledge of one or two subfields in social organization.

Social psychology This major requires (1) a thorough knowledge of social psychological theory and research; (2) a working knowledge of the methodology of social psychological research; (3) a working

knowledge of psychology, sociology, and relevant aspects of other related disciplines; and (4) a detailed knowledge of some specialized aspect of social psychology.

Policy analysis This major requires (1) a thorough knowledge of both experimental and nonexperimental research designs and analytical techniques as used in applied settings, (2) a working knowledge of the policy research literature, and (3) a detailed knowledge of some specialized aspect of policy research.

Population studies This major requires (1) a thorough knowledge of demographic and ecological theory and substantive research, (2) a thorough knowledge of the techniques of demographic and ecological data collection and analysis, and (3) a working knowledge of the theory and methods of social organization and change.

Research methods This major requires (1) a detailed knowledge of the logic of science; (2) a general knowledge of research design, data collection techniques, and analytical procedures; (3) a working knowledge of the theory of social organization and change; and (4) a concentration of study in one of the areas listed in (1) and (2).

Research Opportunities

The Cornell Institute for Social and Economic Research (CISER), founded in May 1981, currently includes several hundred social science faculty members from twenty-seven academic departments at Cornell. CISER's mandate is to strengthen the links among basic social science research, public policy, and public service applications.

Many faculty members in the field conduct research in cross-national settings: Africa, Asia, Europe, and Latin America. Staff members participate in the International Population Program and in area study programs affiliated with the Center for International Studies.

Faculty and Specializations

Mitchel Y. Abolafia: social organization and change

Samuel B. Bacharach: policy analysis

Daryl Bem: social psychology

Sandra L. Bem: social psychology

Ronald L. Breiger: research methods; social organization and change

Frederick H. Buttel: policy analysis; social organization and change

Steven B. Caldwell: policy analysis; research methods

Peter S. K. Chi: population studies

Paul R. Eberts: policy analysis; social organization and change

John H. Freeman: social organization and change

Michael T. Hannan: research methods; social organization and change

Donald P. Hayes: research methods; social psychology

Charles Hirschman: population studies; social organization and change

William W. Lambert: social psychology

Robert McGinnis: policy analysis; research methods

Leo Meltzer: social psychology

Phyllis Moen: policy analysis; social organization and change

Victor Nee: social organization and change

Dorothy Nelkin: policy analysis

Susan M. Olzak: social organization and change

Bernard C. Rosen: social psychology

Beth Rubin: social organization and change

Robert N. Stern: policy analysis; social organization and change

J. Mayone Stycos: policy analysis; population studies

Pamela S. Tolbert: social organization and change

Harrison M. Trice: policy analysis

William F. Whyte (emeritus): policy analysis

Robin M. Williams, Jr., (emeritus): policy analysis; social organization and change

James J. Zuckes

STATISTICS

M.S., Ph.D.

Graduate faculty representative

Lawrence D. Brown, 250A Caldwell Hall

Subject Statistics (biometry, decision theory, economic and social statistics, engineering statistics, experimental design, mathematical statistics, probability, sampling, statistical computing, stochastic processes)

Applicants must have evidence in their bachelor's or master's transcript of strength in the mathematical sciences, and they must demonstrate strong motivation for advanced study in statistics. Applicants are urged to present scores from the GRE general test.

In addition to examinations required by the Graduate School, students in the Ph.D. program will be given a qualifying examination shortly after the first year of graduate study.

Each Ph.D. candidate will have either one or two minor areas of concentration and, before the Ph.D. dissertation oral examination, demonstrate to the chairperson of his or

her Special Committee a level of proficiency in one of the following languages: French, German, Russian, Chinese, Japanese, or Spanish.

Faculty and Specializations

Robert E. Bechhofer: design of experiments; selection and ranking

Toby Berger: information theory; detection and estimation

Isadore Blumen: nonparametrics; multivariate analysis

Lawrence D. Brown: statistical decision theory; sequential analysis

George Casella: decision theory; regression

Eugene B. Dynkin: stochastic processes

Roger H. Farrell: decision theory; multivariate analysis

Walter T. Federer: statistical design; estimation and analysis

Terrence L. Fine: foundations of probability; statistical signal processing

Ali S. Hadi: regression diagnostics

David C. Heath: applied probability; finitely additive probability

Jiunn Hwang: estimation; decision theory

Harry Kesten: limit laws; random walks

Nicholas M. Kiefer: econometrics

Philip J. McCarthy: sample survey theory; sample survey practice

Charles E. McCulloch: linear models; ecological statistics

Douglas S. Robson: biological statistics; sampling theory

Thomas J. Santner: applied statistics; selection and ranking

Steven J. Schwager: multivariate analysis; data analysis

Shayle R. Searle: linear models; variance components

Frank L. Spitzer: probability theory

Bruce W. Turnbull: biomedical statistics; reliability and life testing

Paul F. Velleman: statistical computing; robust exploratory methods

Lionel Weiss: nonparametric statistics; large-sample theory

apparel, as engineering structures such as composite materials, in biomedical applications, and in home furnishings. The Field of Textiles is applied and multidisciplinary; its faculty members are drawn from the New York State College of Human Ecology and the College of Engineering.

Students in the field are expected to develop strength in the base discipline, as well as appropriate breadth to support the area of specialization. Active research programs exist in the areas of high-performance fibers and fiber-reinforced composites, detergency and surface chemistry, international trade in textiles and apparel, textile materials in biomedical applications, polymers for electronics, liquid crystal polymers, textile-dye chemistry, crystal morphology of fibers, and functional apparel design.

Admission to the field is based on evidence of potential for advanced study. The Field of Textiles requires all applicants to take the GRE general test. Students applying directly to the Ph.D. program in fiber science should have an M.S. degree in textile chemistry, textile science, polymer science, engineering, chemistry, physics, applied mathematics, or a similar discipline. Ph.D. applicants without an appropriate M.S. should apply for the M.S.-Ph.D. program. Applicants who want to pursue studies in functional apparel design must submit a portfolio as part of their application materials. The portfolio should be sent directly to the graduate faculty representative.

Approximately two-thirds of the graduate students in the field hold teaching or research assistantships. General fellowships, as well as two college fellowships specifically designated for students in the field, are available. Summer support from research grants is available to qualified students as funds are available from the research of individual faculty members. A few summer graduate research assistantships are available from the Graduate School.

The Special Committee for M.A. and M.S. candidates will consist of at least two graduate faculty members, one representing the student's major subject area and the other representing the student's minor subject area. For Ph.D. students a minimum of four committee members are required; one faculty member representing the major, one for each of the two minor areas, and a fourth member appointed by the graduate faculty representative to act for the field. Two oral examinations, the admission to

TEXTILES

M.A., M.S., Ph.D., M.P.S.(Hu.Ec.)

Graduate faculty representative Peter Schwartz, 201 Martha Van Rensselaer Hall

Subjects Fiber science (fiber science, polymer science, textile science); textiles [M.A.](apparel design, clothing, textiles); textiles [M.P.S.]

The common focus of the field is the study of fibrous materials and their use as

candidacy examination and the final examination, are required for the Ph.D. The field does not require a foreign language.

Outstanding research facilities for graduate study are available in the New York State College of Human Ecology and the College of Engineering. Martha Van Rensselaer Hall houses one of the general-access computer facilities with both remote terminals and microcomputers available for use by faculty and students. Textile and polymer science laboratories are equipped with modern instrumentation for chemical, physical, and mechanical analysis; microscopy facilities, including a scanning electron microscope; and a controlled-temperature and humidity room. Apparel design studios are also available.

Faculty and Specializations

- Chih-Chang Chu: design of textile materials for medical use; degradation and stabilization of fibers; thermal and crystallization properties
- David T. Grubb: structure-property relationships in crystalline polymers; crystal morphology of fibers; electron microscopy
- Susan B. Hester: international trade of textiles and apparel; identification of competitive advantages of the American textile and apparel industries; impact of federal policies on the textile and apparel sector
- Edward J. Kramer: diffusion and molecular rheology of polymer melts; diffusion in polymer glasses; fracture and crazing of polymers
- Ann T. Lemley: textile dyes; toxic substances in water
- Sharon Kay Obendorf: fiber microscopy and spectroscopy; textile chemistry; detergency and surface analysis
- Christopher K. Ober: polymer synthesis; macromolecules with unusual optical and mechanical properties; liquid crystal polymers; dispersion polymerization
- S. Leigh Phoenix: statistical models of fiber bundles; fiber-reinforced composites
- Ferdinand Rodriguez: polymerization; properties of polymer systems; polymers for electronics
- Nancy C. Saltford: textile legislation and marketing; clothing consumption practices
- Peter Schwartz: mechanics of fiber structures; high-performance fibers; fiber-reinforced composites
- Susan M. Watkins: functional apparel design

THEATRE ARTS

M.A., Ph.D.

Graduate faculty representative Stephen R. Cole, 212 Lincoln Hall

Subject Theater arts (drama and the theater, theater history, theater theory and aesthetics, cinema [minor only], design for the theater [minor only], directing [minor only])

For the M.A. and Ph.D., GRE general test scores are required. Direct admission to the doctoral program is restricted to those with M.A. degrees.

The normal language requirement for the Ph.D. is proficiency in two foreign languages, but the Special Committee may approve a single language at a higher proficiency. For the Ph.D. a qualifying examination is given in the third term of residence; it may be combined with the final examination for the M.A.

Research and Study Opportunities

The chief aim of the Ph.D. program in theater arts is to develop competent scholars, teachers, and directors for the educational theater. Research, teaching, and production are therefore included to a meaningful extent in each Ph.D. program.

Opportunities are offered for study and research in many phases of the discipline, including dramatic literature; history, criticism, and aesthetics of the theater; and most aspects of theatrical production.

Faculty and Specializations

- Frederick M. Ahl: classics
- Richard Archer: theater technology
- Robert Ascher: anthropology
- David Bathrick: theater theory; dramatic literature; cinema theory
- Karen W. Brazell: Asian theater
- Anthony Caputi: comparative literature
- Holly Cole: design
- Stephen R. Cole: acting; directing; theater aesthetics
- Ralph Dressler: design
- David M. Feldshuh: directing; acting
- Donald Fredericksen: cinema theory and history
- Robert F. Gross: theater theory and history; dramatic literature; playwriting
- Michael D. Hays: dramatic literature; theater theory and history
- Margaret Lawler: dance
- Bruce Levitt: directing; dramatic literature
- H. Scott McMillin: English language and literature
- Tim Murray: dramatic theory; comparative drama; Renaissance

THEORETICAL AND APPLIED MECHANICS

M.S., Ph.D.

Graduate faculty representative Subrata Mukherjee, 223 Kimball Hall

Subject Theoretical and applied mechanics (dynamics and space mechanics, fluid mechanics, mechanics of materials, solid mechanics)

The program emphasizes the fundamental principles of engineering science and a strong foundation in applied mathematics coupled with an appreciation of the newest developments in engineering. Graduate students may pursue in-depth studies in the mechanics of particles, rigid and deformable solids, dynamics of liquids and gases, mechanical properties of materials, and other related subjects in engineering, physics, and mathematics. Current research topics include (1) biodynamics, mathematical modeling of biological systems; (2) dynamics and space mechanics—stability and nonlinear oscillations of particles, dynamical systems, bifurcation, planetary dynamics, celestial mechanics; (3) fluid mechanics—Newtonian and non-Newtonian fluids, liquid crystals; and (4) mechanics of materials—failure and fracture of solids, nondestructive testing, ultrasonics, static and dynamic properties of solids and fluids; and (5) solid mechanics—wave propagation in solids, geomechanics, static and dynamic response of structures, contact problems, computational mechanics, elasticity, plasticity, creep, magnetosolid mechanics, continuum mechanics, and modeling of manufacturing processes.

The field admits students with backgrounds in physics, mathematics, and any branch of engineering. Students applying for financial aid are expected to submit GRE scores.

Students enrolled in the Ph.D. program must take a qualifying examination before the start of their fourth term of graduate studies. Each doctoral candidate must demonstrate reading ability in one language other than the native language. The field also requires teaching experience of all doctoral candidates.

Fellowships, teaching assistantships, and a limited number of research assistantships are available. Applications for assistantships are considered along with admission to the field; no separate form is needed.

Faculty

Joseph A. Burns
Harry D. Conway
Edward W. Hart
Timothy J. Healey
Philip J. Holmes
Chung Yuen Hui
James T. Jenkins
Richard H. Lance
Francis C. Moon
Subrata Mukherjee
Yih-Hsing Pao
Richard H. Rand
Andy Lee Ruina
Wolfgang H. Sachse

URBAN STUDIES

Minor field

Graduate faculty representative Barclay G. Jones, 111 West Sibley Hall

Minor subject Urban studies

Urban studies is an interdisciplinary *minor* field that provides students an opportunity to develop knowledge and understanding of urban society. It is intended to complement basic studies in such major fields as city and regional planning, economics, government, history, human development and family studies, management, and sociology, as well as various fields in engineering. It should develop the student's competence in such subject areas as processes of urban change, public policy and administration, theories of urbanization, urban ecology, urban economics, urban planning, urban political processes, and urban social structure. Because of the field's interdisciplinary character students may not for this minor select a professor who also serves on the Graduate Faculty in the student's major field.

The student's dissertation research must show a close integration between the major field and the particular aspect of urban studies that has been selected. There are opportunities for research support through the Program in Urban and Regional Studies and through other university facilities.

Faculty and Specializations

Peter S. K. Chi: sociology
Pierre Clavel: city and regional planning
Arch T. Dotson: government
Paul R. Eberts: rural sociology
William W. Goldsmith: city and regional planning
Barclay G. Jones: city and regional planning
Peter W. Martin: law

Sidney Saltzman: city and regional planning
 Richard E. Schuler: economics
 Stuart W. Stein: urban planning and design
 James E. Turner: Africana studies
 Henry Y. Wan, Jr.: economics

VEGETABLE CROPS

M.S., Ph.D., M.P.S.(Agr.)

Graduate faculty representative Pamela M. Ludford, 163 Plant Science Building
Subject Vegetable crops

A good background in biological and agricultural sciences, together with an interest in economic plants, is desirable, and farm experience is an advantage. It is strongly recommended that applicants submit scores from the GRE general test.

Students who want to obtain a Ph.D. degree are expected to obtain a master's first.

Study in this field may deal with the fundamental processes of growth, yield, and quality of vegetable crops or involve finding solutions to problems in production, postharvest handling, or marketing of vegetables, including potatoes and dry beans. The ecology of vegetable production systems, including weed control and maintenance of productivity, are other possible thesis topics. The research might focus on problems of New York State or other regions of the world. Depending on the student's interests, it is possible to prepare for careers in such diverse areas as university teaching, international agriculture, applied or basic biological research, agricultural extension, or commercial work with producers of seeds, agricultural chemicals, and food processors.

Facilities include ample greenhouse space; a bioclimatic laboratory complex, including cold-storage rooms; a pilot plant at Geneva; research farms at Ithaca, Geneva, and Riverhead, Long Island; and laboratories well equipped for physiological, anatomical, genetic, and biochemical investigations. A limited number of assistantships are available to qualified applicants for training in research, teaching, or extension.

In addition to the examinations required by the Graduate School for the Ph.D., the field requires a qualifying examination, which is taken early in the program, preferably no later than the second term of residence.

All M.S. and Ph.D. candidates are encouraged to obtain teaching experience.

Faculty and Specializations

Robin R. Bellinder: weed science
 Michael H. Dickson: vegetable breeding*
 Leroy A. Ellerbrock: vegetable production
 Elmer E. Ewing: potato physiology
 James R. Hicks: postharvest physiology; marketing
 Pamela M. Ludford: postharvest physiology
 Gerald A. Marx: vegetable breeding*
 Peter L. Minotti: mineral nutrition
 Martha A. Mutschler: vegetable breeding
 Edwin B. Oyer: international agriculture
 Nathan H. Peck: nutrition and cultural practices*

Richard W. Robinson: vegetable breeding*
 Alan George Taylor: seed and vegetable science*

Leonard D. Topoleski: greenhouse production

Donald H. Wallace: vegetable breeding
 H. C. Wien: physiology and cultural practices
 Darlene A. Wilcox-Lee: cultural practices
 David W. Wolfe: production and varieties

**Faculty of the New York State Agricultural Experiment Station at Geneva.*

VETERINARY MEDICINE

M.S., Ph.D.

Graduate faculty representative John F. Timoney, C324 Schurman Hall

Subject Veterinary medicine (anatomy, bacteriology, epidemiology, immunology, parasitology, pathology, pharmacology, physiology, surgery, theriogenology, veterinary medicine, virology)

At the time of writing the areas of concentration listed above were under revision. Questions concerning those areas should be directed to the Graduate Faculty Office.

Applicants should submit results of the GRE general test; scores of a subject test are also desirable. The D.V.M. degree is required of applicants for admission in clinical areas of study.

A student who holds the D.V.M. from a recognized college in the United States or Canada may transfer one year's residence credit for that work toward the Ph.D.

Facilities for graduate study and research in all areas of basic and applied veterinary medicine offer many unique opportunities. In addition to the excellent university libraries, the college has a specialized collection of more than seventy-five thousand volumes and twelve hundred current serials. A large and varied clinic representing all domestic animals offers opportunities for the study of

spontaneous diseases. In addition to the animal quarters, pastures, and laboratories on the main campus, the college operates several farm and equine research facilities nearby. These include isolation facilities for infectious disease research.

Further information can be obtained from the Graduate Faculty Office, Veterinary Research Tower, New York State College of Veterinary Medicine, Cornell University, Ithaca NY 14853-6401, (telephone: 607/253-3276).

Faculty and Specializations

Douglas F. Antczak: immunogenetics and infectious diseases

Max J. G. Appel: pathogenesis of canine viral diseases

Roger J. Avery: molecular virology; lenti and tumor viruses

John G. Babish: xenobiotic metabolism and pharmacokinetics

Robin G. Bell: immunoparasitology; mucosal immunity

Emmett N. Bergman: ruminant metabolism

Paul R. Bowser: diseases of finfish

Bruce W. Calnek: avian diseases

S. Gordon Campbell: immunity to facultative intracellular bacteria and viruses

Leland E. Carmichael: canine infectious diseases

Alison P. Casarett: biological effects of radiation

Richard A. Cerione: pharmacology; biochemistry

Barry J. Cooper: neuromuscular pathology

Robert A. Corradino: molecular endocrinology; cellular physiology

John F. Cummings: comparative neurology; histology

Raymond H. Cypess: immunoparasitology; epidemiology

Alexander deLahunta: applied anatomy; clinical neurology

Alan Dobson: gastrointestinal and respiratory physiology

Edward J. Dubovi: virology; viral pathogenesis

Gary M. Dunny: pathogenic bacteriology and molecular biology

Hollis N. Erb: epidemiology

Cornelia E. Farnum: functional anatomy of cartilage and bone

Clare M. S. Fewtrell: cellular pharmacology; immunopharmacology

Joanne E. Fortune: reproductive physiology and endocrinology

Francis H. Fox: internal medicine; diseases of large animals

Jay R. Georgi: parasitic diseases and parasite systems

David L. Graham: avian pathology and histopathology

Charles L. Guard: clinical pharmacology; comparative gastroenterology

William Hansel: reproductive physiology and endocrinology

John D. Henion: analytical chemistry and toxicology

Harold F. Hintz: equine nutrition

Katherine A. Houpt: behavioral and sensory physiology

T. Richard Houpt: gastrointestinal physiology

Richard H. Jacobson: immunoparasitology; diagnostic serology

Francis A. Kallfelz: clinical nutrition; nuclear medicine

John M. King: diagnostic pathology; wildlife pathology

Lennart P. Krook: nutritional pathology; bone diseases

Louis Leibovitz: diseases of aquatic animals

Donald H. Lein: reproductive pathology; theriogenology

Fred W. Lengemann: mineral metabolism; lactational physiology

Robert M. Lewis: immunopathology

John E. Lowe: surgery; biomechanics

George Lust: biochemistry; osteoarthritis

Douglas D. McGregor: cellular resistance to infection

George A. Maylin: toxicology; drug testing

Ronald R. Minor: developmental biology and pathology of connective tissues

Peter W. Nathanielsz: reproductive physiology and fetal development

Drew M. Noden: developmental biology and embryology

Neil L. Norcross: bovine mammary gland immunity

Fernando M. Noronha: viral oncology

Linda M. Nowak: neuropharmacology; membrane biophysics

Robert E. Oswald: pharmacology; biophysics

Robert D. Phemister: developmental pathology; renal pathology

George C. Poppensiek: infectious diseases; comparative medicine

Fred W. Quimby: immunopathology; immunogenetics

Thomas J. Reimers: endocrinology

Victor T. Rendano: radiology and radiation therapy

Wolfgang O. Sack: functional anatomy of the digestive system; embryology

Karel A. Schat: avian virology and immunology

Donald H. Schlafer: reproductive pathology; infectious diseases
 Herbert F. Schryver: equine nutrition; digestive physiology
 Wayne S. Schwark: neuropharmacology; clinical pharmacology
 Fredric W. Scott: feline and bovine viral diseases
 Geoffrey W. G. Sharp: insulin secretion; gastrointestinal physiology
 David O. Slauson: immunopathology; inflammatory response
 Brian A. Summers: neuropathology
 Daniel N. Tapper: neurophysiology
 Bud C. Tennant: internal medicine; comparative gastroenterology
 John D. Thompson: environmental contamination; veterinary economics
 John F. Timoney: pathogenic bacteriology and molecular biology
 Alfons Torres: viral enteric diseases
 Eric J. Trotter: small animal orthopedic surgery and neurosurgery
 Virginia L. Utermohlen: nutrition; cell-mediated immunity
 Robert H. Wasserman: mineral metabolism; intestinal absorption mechanisms
 Gregory A. Weiland: neuropharmacology and receptor mechanisms
 Alexander J. Winter: infection and mucosal immunity; bovine brucellosis
 John F. Wootton: macromolecular interactions; cellular regulation

WATER RESOURCES

Minor field

Graduate faculty representative Douglas A. Haith, 214 Riley-Robb Hall

Minor subject

Water resources is a *minor* field of concentration at Cornell; consequently, a prospective graduate student must first be admitted to a *major* field of the Graduate School.

The field offers qualified engineers and biological, physical, and social scientists an opportunity to gain breadth of knowledge in water resources planning and management through an interdisciplinary program of study intended to complement their major subject. The minor will represent for each candidate the combination of courses, seminars, and projects outside the major field that the Special Committee considers most appropriate to the interdisciplinary aspects of the degree program.

Students interested in a minor in water resources usually major in one of the following fields (subjects in parentheses): agricultural economics (resource economics), agricultural engineering (soil and water management), agronomy (soil science), chemical engineering, city and regional planning, civil and environmental engineering (remote sensing, environmental systems engineering, hydraulics and hydrology, water resource systems), ecology and evolutionary biology, economics (economic theory), geological sciences (engineering geology), management, natural resources (aquatic science, fishery science), and operations research.

Faculty

David J. Allee
 Leonard B. Dworsky
 Douglas A. Haith
 Daniel P. Loucks
 Walter R. Lynn
 Bruce T. Wilkins

WOMEN'S STUDIES

Minor field

Graduate faculty representative Sandra L. Bem, 332 Uris Hall

Minor subject

Women's studies is a *minor* field of concentration at Cornell; a prospective student must first be admitted to a *major* field of the Graduate School and may then elect a minor in women's studies. The minor is interdisciplinary, representing a focus within general humanistic and social science scholarship. Women's studies includes not only the study of women but also the general investigation of sex roles and their significance. There are five core areas: history, literature, and the arts; psychology and human development; ideology and culture; institutions and society; and natural sciences.

Faculty and Specializations

Daryl J. Bem: personality theory and assessment; social influence and attitude change
 Sandra L. Bem: psychology of sex roles; social psychology; personality
 Lourdes Beneria: women in international development; economics
 Jean F. Blackall: nineteenth-century English and American prose fiction; major nineteenth-century women novelists

- Laura S. Brown: restoration and eighteenth-century literature; the female literary tradition and the development of Gothic fiction; feminist criticism
- Joan J. Brumberg: social history of medicine; history of the American family; women and adolescence; nineteenth-century religion; popular culture
- W. Keith Bryant: economic behavior of households; impact of public programs and policies on the household and individual members of the household
- Susan Buck-Morss: political and social theory
- Royal D. Colle: communication with women in rural development programs
- John J. Condry: development of sex role identity; role of various aspects of identity in life choices and personality; effect of other people on the development of identity
- William E. Cross: Black identity and self-esteem; Black family
- Joan R. Egner: organizational studies; educational governance and policy
- Inta M. Ezergailis: nineteenth- and twentieth-century German literature; recent German-language women authors
- Jennie Farley: effect of public policy on personnel practices; analysis of problems at work; education for employment; problems at re-entry; communications at work
- Joanne E. Fortune: hormonal control of ovarian development and function in vertebrates
- Nelly Furman: French romantic period; women in France; French feminist literary criticism
- Jennifer L. Gerner: female labor-force supply and fertility; economic implications of legislation; affirmative action
- David H. Holmberg: anthropology of women and gender; cultural anthropology; religion and society; spirit possession, curing, witchcraft, and women; ethnology of South Asia, Himalayas, and Tibet
- Robert M. Hutchens: impact of welfare programs on female-headed families
- Billie J. Isbell: symbolism; acquisition of culture and language; sex role socialization; South America
- Mary L. Jacobus: feminist literary criticism; feminism and psychoanalysis; women and writing
- Mary F. Katzenstein: women and politics; population policy; South Asia
- Isaac Kramnick: women in social theory
- William W. Lambert: social personality and developmental psychology
- Alison Lurie: nineteenth- and twentieth-century British and American fiction; children's literature; folklore
- Sally A. McConnell-Ginet: general linguistics; theoretical semantics and pragmatics; language and gender; philosophy of language
- Kathryn S. March: anthropology of sex and gender; gender symbolism; life histories; women in development; social and cultural anthropology; South Asia and the Himalayas
- Carolyn A. Martin: feminist criticism; literary criticism
- Frank B. Miller: gender as a factor in occupational choice; occupational information in career planning; determinants of occupational "status" of the married woman worker
- Mary Beth Norton: American Revolution; women in early America; American intellectual, social, constitutional, and legal history; women in revolutionary and republican America
- Elizabeth K. Regan: hormones and sexual behavior
- Sandra F. Siegel: British literature and social thought, 1800–1940; poetry and poetics of modernism; Anglo-Irish drama, fiction, and poetry; traditional controversy over reading, writing, and gender; historiography
- Lawrence K. Williams: women in work organizations; special interests in studies of the new manager

ZOOLOGY

(M.S.), Ph.D.

Graduate faculty representative

F. Harvey Pough, E211 Corson Hall

Subject Zoology (animal cytology, comparative and functional anatomy, developmental biology, ecology, histology)

The field prefers that students apply for the M.S.-Ph.D. sequence, but qualified students may be accepted directly into the Ph.D. program. Terminal M.S. degree candidates are not usually accepted.

The deadline for application to the field is February 1. However, if an applicant wishes to be considered for Cornell fellowships, the application must be received by January 15. Applicants must submit scores of the GRE general test and subject test in biology. All applicants should have completed the equivalent of a college major in zoology, with

some foundation in the particular phase of zoology they desire to pursue, and should have taken courses in calculus, elementary physics, and organic chemistry.

The Field of Zoology does not have a language requirement, but proficiency in one or more foreign language may be required by the student's Special Committee.

All Ph.D. candidates are expected to perform in a teaching capacity for a minimum of two semesters.

There are excellent opportunities for study and research in many phases of zoology, particularly in the descriptive and experimental aspects of the following special subjects: comparative and vertebrate anatomy with emphasis on the functional approach, cytology, developmental biology, histology and descriptive embryology, invertebrate zoology, and vertebrate zoology.

Faculty and Specializations

Antonie W. Blackler: origin of sex cells and nucleocytoplasmic interaction in development

Stephen E. Bloom: cytology and cytogenetics of avian species; applications of

cytochemistry and cytophotometry in the animal and plant sciences

T. J. Cade: environmental biology of vertebrates; ornithology; biology of raptorial birds

Rodney R. Dietert: gene regulation for oncodevelopmental antigens; environmental and genetic factors influencing immune function

Kenneth A. R. Kennedy: human functional morphology; paleontology; evolution

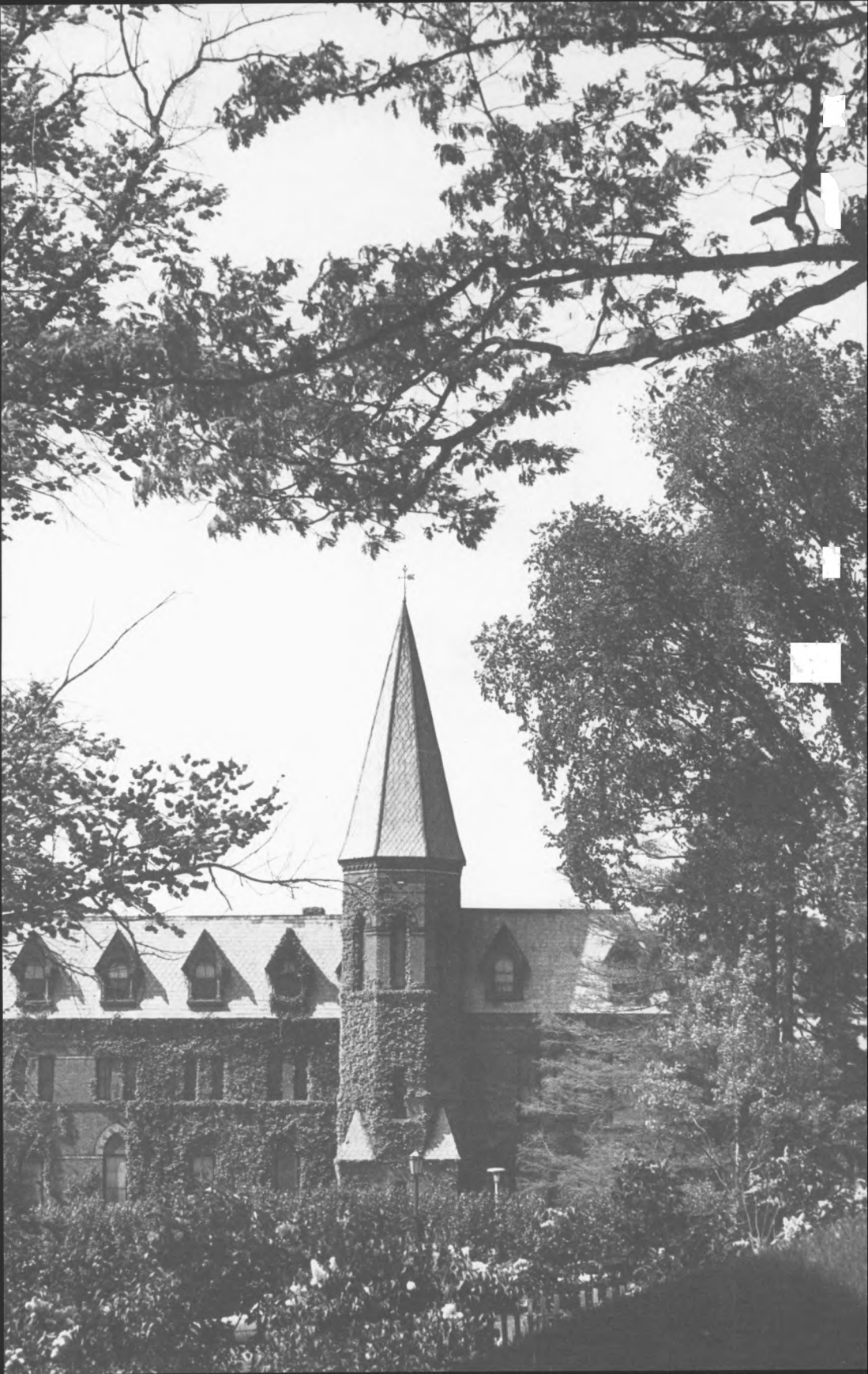
Amy R. McCune: ichthyology; morphology; systematics; development; evolution; paleontology

James A. Marsh: developmental immunology; physiological parameters regulating immune-system development and function

Drew N. Noden: mechanisms of craniofacial development; neuroembryology

F. Harvey Pough: environmental physiology, especially of lower vertebrates; herpetology

Milo E. Richmond: mammalogy; terrestrial ecology; reproductive biology



ADMISSION

An applicant for admission to the Graduate School should (1) hold a baccalaureate degree or the equivalent first degree or diploma granted by a faculty or university of recognized standing; (2) have adequate preparation for graduate study in the chosen field of instruction; (3) have fluent command of English; and (4) present evidence of promise in advanced study and research. Applicants from United States colleges and universities should be in the top third of their graduating class. Individual fields of study may have additional requirements (for example, Graduate Record Examinations test scores). For details consult the section "Fields of Study," starting on page 17.

Most students matriculate in the fall. As some fields will not accept new students for the spring term, applicants should check with the proposed field of study before applying for spring admission.

It is the policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age, or handicap. The university is committed to the maintenance of affirmative action programs that will assure the continuation of such equality of opportunity.

Categories of Admission

Degree candidates It is expected that most applicants for admission will pursue a program for an advanced degree. Applicants may specify candidacy for the Doctor of Philosophy degree, the Master of Arts degree, the Master of Science degree, or one of the professional degrees. Since Cornell has a strong commitment to doctoral work, most students are encouraged to enroll in a doctoral program. In some fields students interested in a doctoral program may be required to earn a master's degree first. In many fields students may also choose to enroll in a combined master's-doctorate program.

Provisional status An applicant whose academic background is difficult to evaluate may be admitted as a provisional candidate. Ordinarily only one semester of study in that status is permitted. The progress of a student with provisional status is automatically evaluated at the end of the first semester.

Nondegree status When staff and facilities are available, the Graduate School will admit some applicants who do not intend to work toward an advanced degree at Cornell but who have special objectives for formal study or scholarly work at the graduate level. Applicants for nondegree status must satisfy all the entrance requirements that apply to degree candidates. Registration as a nondegree student is restricted to two semesters.

Change of status It is possible for a student to change from one degree program or field to another or to change from nondegree status to degree status. To apply for a change of status, a petition giving reasons for the proposed change must be submitted to the dean of the Graduate School.

Application Procedures

Applications for admission should be requested from the Graduate School, Cornell University, Sage Graduate Center, Ithaca, New York 14853-6201. The following supporting documentation is required: two letters of recommendation; official transcripts from all the institutions of higher learning attended; and, where required, the appropriate test scores.

A student may apply to only one field at a time, although an alternate field of interest may be indicated on the application. The application of a student rejected in the first-choice field will then be automatically transferred to the alternative field.

All applications must be accompanied by payment of a \$40 nonrefundable fee.

TESTS

Graduate Record Examinations The Graduate Record Examinations (GRE) general test and the appropriate subject test are required by many fields. For information on field requirements, see the section on fields of study beginning on page 17. Applicants who want to be considered for Cornell fellowships are strongly urged to take the GRE general test. Applicants for fall admission and for fellowship consideration should take the test(s) no later than November.

The GREs are administered by the Educational Testing Service. Further information may be obtained by writing to the Graduate Record Examinations, Box 955, Princeton, New Jersey 08541.

Graduate Management Aptitude Test Some fields require that applicants submit scores from the Graduate Management Aptitude Test (GMAT). It is the applicant's responsibility to ascertain whether the field of interest has that requirement.

FINANCIAL SUPPORT

The application for admission to the Graduate School is also an application for a fellowship, assistantship, and tuition award; no additional form is needed. Applicants indicate the types of support for which they want to be considered by answering the pertinent questions on the form. All applicants are eligible to be considered for those awards.

All applicants who are United States citizens or permanent residents are requested to submit a Graduate and Professional School Financial Aid Service (GAPSFAS) form. See p. 125 for information.

APPLICATION DEADLINE

Although applications for admission to the Graduate School may be submitted at any time, many fields require that completed applications be received by a specific date, in most cases by January 15. Applicants should check with the field(s) of interest. Foreign students should complete their applications as early as possible to allow time for the admissions office to evaluate credentials, financial support, and English proficiency and to issue certificates of eligibility for visas.

Applicants for fall admission who are also applying for Cornell fellowships awarded by the Graduate School must submit their applications and all supporting documents by January 15.

NOTIFICATION OF ADMISSION AND FINANCIAL AID

If application is made for the fall term and supporting documents are received by January 15, every effort will be made to notify the applicant of admission action no later than May 1. Applicants who have been accepted for admission should inform the Graduate School as early as possible whether they intend to accept the admission offer.

As agreed on by some of the members of the Council of Graduate Schools in the United States, *successful* fellowship applicants will be notified of their award by April 1. It is not possible to inform other applicants of the outcome of the fellowship competition. Applicants awarded assistantships will hear directly from the fields to which they have been admitted.

Additional Application Procedures for Foreign Applicants

COMPETENCY IN ENGLISH

All applicants whose native language is not English must provide proof of competency in English. Acceptable proof is (1) a Test of English as a Foreign Language (TOEFL) score of 550 or higher, (2) a degree from a college or university in a country where the native language is English, or (3) two or more years of study in an undergraduate or graduate program in a country where the native language is English. Because of heavy reading requirements, some fields may require a minimum TOEFL score of 600.

The TOEFL is offered worldwide six times a year. Information about the time and place of each of the test administrations, as well as a test application form, may be obtained by writing to the Educational Testing Service, Princeton, New Jersey 08540. The test score must be reported directly to the Graduate School by the testing organization.

It may be possible for a student receiving a TOEFL score between 500 and 550 to be accepted for the fall

semester on the condition that he or she attend an intensive English course in the summer session *at Cornell* and continue English instruction in the fall if necessary. Similarly, a student whose TOEFL score is between 500 and 550 may be accepted for the spring semester on the condition that he or she enroll in the Intensive English Program in the preceding fall semester. Applicants who attend English language programs elsewhere must submit a minimum TOEFL score of 550 to be admitted to Cornell's Graduate School.

Until the English language requirement is met, a student who is offered admission will receive conditional admission only.

FINANCIAL REQUIREMENT

Foreign students who are offered admission must submit evidence of adequate financial support for the duration of their study here. The Graduate School informs applicants of procedures for financial support certification at the appropriate time in the admission process. Students awarded a fellowship or assistantship from Cornell do not need to provide evidence of financial support.



FINANCES

Tuition and Expenses

TUITION

Students pay either endowed or statutory tuition depending primarily on the college affiliation of the chairperson of the Special Committee or of the adviser. Most graduate students in the humanities and in the physical and social sciences pay endowed tuition; most of those in the biological sciences pay statutory tuition. Graduate students who have major advisers on the faculty of the College of Veterinary Medicine pay veterinary tuition.

Tuition 1987-88

Statutory colleges	\$ 5,670
Endowed colleges	12,300
Veterinary college	8,000

Tuition increases are anticipated for subsequent academic years. Payment of tuition or proof of financial support is required before a student may register. The amount, time, and manner of payment of tuition, fees, and other charges may be changed at any time without notice.

Reduced tuition Doctoral candidates who have completed at least six semesters of graduate study at Cornell, who have passed the admission to candidacy examination, and who will not be enrolled in formal course work are eligible to apply for reduced tuition. For the 1987-88 academic year the reduced tuition rate for all graduate students is \$2,200.

In absentia tuition Graduate students who are approved to register in absentia, either to pursue their studies or to conduct their research off campus, pay in absentia tuition, which is currently \$200 a semester.

EXPENSES

For the 1987-88 academic year (nine months) it is estimated that living expenses (cost of books, room and board, personal expenses) for a single graduate student will be about \$7,950; for a single parent, about \$11,410; and for a married couple, about \$11,400. The expense for dependent children is \$1,820 per child. Tuition and travel should be added to those figures to arrive at the cost of attendance for the academic year.

Financial Support

Extensive financial resources are available to help Cornell graduate students with education costs. In 1986-87 over 85 percent of the graduate students received financial assistance, either from Cornell or from outside sources. Students are discouraged from trying to support themselves by employment unrelated to their studies.

All applicants who are United States citizens or permanent residents are requested to submit a Graduate and Professional School Financial Aid Service (GAPSFAS) form, whether or not they are applying for need-based aid. Those applying for need-based aid *must* file a GAPSFAS form.

GAPSFAS forms are available at college and university financial aid offices and from the Educational Testing Service. When completing the GAPSFAS financial statement, applicants should enter the correct code number for Cornell—Graduate School (2165). The form should be filed by March 15 with the Educational Testing Service, Box 2614, Princeton, New Jersey 08541.

CORNELL FELLOWSHIPS

Fellowships for graduate study are available from the Graduate School, from academic departments and divisions, and from some fields of study. Fellowships are typically awarded to full-time candidates for a higher degree (usually Ph.D.), on the basis of scholastic ability and promise of achievement.

Graduate School fellowships

More than three hundred fellowships are awarded by the Graduate School and academic units at Cornell. The following fellowships are available to first-year students and include a full tuition fellowship and a stipend (1987-88 stipends are indicated in parentheses): two-year Andrew D. White Fellowships (\$10,000), Sage Graduate Fellowships (\$8,500), Cornell Graduate Fellowships (\$8,500), and Cornell fellowships from special endowments (\$7,000-\$8,500). Candidates for these fellowships are nominated by their fields. Selection is made by the Graduate Fellowship Board and is based on a university-wide competition.

Cornell has made fellowships available to applicants from under-represented ethnic groups who are not offered support through other channels. The Graduate School offers J. Saunders Redding Fellowships (\$10,000), two-year awards for incoming students, and Cornell Graduate Fellowships (\$8,500). Cornell is also a participant in the Patricia Roberts Harris Fellowship Program (formerly G*POP) under grants from the U.S. Department of Education. Candidates for the above fellowships are nominated by their fields.

All applicants are eligible for Graduate School fellowship consideration. To apply, applicants must submit the completed application for admission, which includes an application for fellowship consideration, and all required application materials by January 15. Fellowship applicants are urged to submit Graduate Record Examination general test scores regardless of field requirements. The GRE test

should be taken no later than November. Successful applicants are notified of their award by April 1. Recipients must notify the Graduate School by April 15 if they plan to accept the award.

Students currently enrolled in the Graduate School apply annually for university fellowships; information on these awards is available at graduate field offices and the Graduate Fellowship Office.

Field-administered fellowships

Applicants are urged to write to their proposed field of study for information about possible field- or department-administered fellowships. Fellowships administered by the fields do not necessarily subscribe to the deadlines for application and notification mentioned above.

Foreign Language and Area Studies Fellowship Program (FLAS) The FLAS program offers fellowships to students in various disciplines and professional fields who are pursuing advanced training in most foreign languages and area studies (some Western European languages are excluded). Competition is open to United States citizens or permanent residents only. Awards provide a nine-month stipend of \$5,000 (1987-88) and a tuition fellowship. Applications are available in December and may be obtained from the Graduate Fellowship Office; the deadline for application for 1988-89 is January 22, 1988.

ASSISTANTSHIPS

Applicants interested in applying for assistantships should indicate that fact on the Graduate School application form. Assistantships are awarded by departments and fields, and recipients are generally notified before April 1.

Most teaching and research assistants receive a stipend and usually a tuition fellowship. Summer appointments are made in many fields. The 1987-88 basic assistantship stipend for incoming graduate students is \$6,400 for nine months. The stipend may be supplemented in some fields under certain conditions.

Teaching assistantships An appointment as a teaching assistant is usually made in the student's major field or in a closely related one. The duties ordinarily require about fifteen hours a week but not more than twenty.

Research assistantships The duties of the research assistant involve work on a research project. The student is usually required to work about fifteen hours a week but not more than twenty.

Graduate assistantships Graduate assistants perform services—teaching, grading, research, etc.—for the department. They may work up to twenty hours a week but usually work ten hours a week or less.

Graduate research assistantships A student whose research interest coincides with a supported research project may receive a graduate research assistantship with the understanding that thesis research will contribute to the project. Since a student devotes considerable time to thesis research, the time spent on research connected with the project is expected to be significant.

NEED-BASED FINANCIAL AID

The following programs are open to United States citizens and permanent residents only: College Work-Study, Perkins Loans (formerly NDSL), Guaranteed Student Loans (GSL), and Supplemental Loans for Students (SLS, formerly ALAS). Graduate students must be enrolled in a degree program and must file a GAPSFA form by mid-March.

Applicants can find further information on need-based aid in the application for admission; students currently enrolled in the Graduate School should contact the Graduate Financial Aid Office for information and application procedures.

Tuition Assistance Program (TAP) Legal residents of New York State may be eligible for a TAP award. Based on need, the awards range from \$100 to \$1,200 per academic year. Students who receive tuition awards from Cornell must apply for a TAP award if they are eligible. If they receive the TAP award, their Cornell award is decreased by the amount of the TAP

award. Information and application forms may be obtained from the New York State Higher Education Services Corporation, Student Financial Aid Section, Tower Building, Empire State Plaza, Albany, New York 12255. Applications are usually available in May for the next academic year.

OTHER SUPPORT

All graduate students are urged to apply for financial support for graduate study from national, international, industrial, foundation, and government sources. Because Cornell's funding is limited, not all qualified students can be offered financial aid from Cornell. Support from outside sources, therefore, is an important source of funding for many graduate students.

The application for admission includes a list of selected fellowships available to incoming graduate students. Prospective students can also find information on financial support for graduate study in local, college, and university libraries and in career libraries at many schools.

A student receiving a Cornell fellowship and an outside award may be permitted to hold them concurrently, although an adjustment may be made in the Cornell award.

Employment for spouses There is some opportunity for employment in local businesses and in nonacademic positions at the university. Because of the high number of well-educated men and women in the university community, however, it is not easy to find employment in the Ithaca area. As a result, many highly qualified people accept positions in semiskilled jobs outside their professions. In most cases *spouses of foreign students are not permitted to be employed in the United States.*

The Graduate School will send employment applications on request to applicants whose spouses hope to work. Completed applications, returned to the Graduate School, will be forwarded to the university's Office of Human Resources and other employment agencies.



ACADEMIC RESOURCES

Libraries

The Cornell University Libraries system is one of the largest academic research libraries in the country. An integrated system with sixteen separate libraries on the Ithaca campus, the libraries contain more than five million printed volumes and more than four million microform units. Approximately 125,000 volumes and 400,000 microform units are added each year. The extensive holdings of periodicals and newspapers include nearly 60,000 serials, most of which are in complete runs. An unusually rich collection of reference works, both modern and antiquarian, also facilitates daily study and dissertation research. Special services are maintained for computer software, government documents, manuscripts, maps, microtexts, and rare books. Computer-assisted search services providing on-line access to numerous data bases, and interlibrary loan services providing access to research materials not included in the libraries' collections, are also available to all graduate students.

All Cornell libraries, with the exception of the Uris Undergraduate Library, contain resources supportive of graduate study and research. The largest and most comprehensive collections in the humanities and social sciences are housed in the John M. Olin Research Library. Opened in 1961, Olin was designed to support the research of faculty and graduate students in these fields and contains 350 carrels assigned on an annual basis to graduate students working on dissertations. In addition to its general collections, Olin also contains a number of special collections likely to be of particular interest to advanced students in the social sciences and humanities. The Department of Rare Books houses numerous distinguished collections of books and manuscripts,

including world-renowned ones relating to Dante, Petrarch, Wordsworth, Joyce, Shaw, and other literary figures.

Students in the social sciences will also find here outstanding collections of books and manuscripts relating to the French Revolution, slavery and abolition, and witchcraft, among others. Other special collections in Olin include the History of Science Collections, with outstanding holdings of rare materials from the sixteenth through the nineteenth centuries, and the Fiske Icelandic Collection, which is unexcelled in North America. The Echols Collection on Southeast Asia is the premier collection of its kind in the world, and the Wason Collection on East Asia, in addition to its extensive vernacular holdings, is also nationally known for its extensive holdings of Western language materials. The Department of Manuscripts and University Archives contains total holdings of more than seventy-five million items. Although the department's collections focus on the economic and cultural history of upstate New York, the geographical range of subject matter is international.

In addition to Olin Library, extensive research collections in the humanities will also be found in the Fine Arts and Music libraries. Research materials on the various social sciences will also be found in the specialized collections of the Africana Studies and Research Center, Hotel Administration, Industrial and Labor Relations, Law, Johnson Graduate School of Management, and Mann libraries. The Industrial and Labor Relations Library in particular contains the foremost university research collection in the United States in the field of labor relations, and the Hotel Administration Library is also one of the finest of its kind in the country.

Graduate students in the physical and biological sciences will find

outstanding research collections in the Engineering, Entomology, Mathematics, Physical Sciences, and Veterinary Medicine libraries, as well as in the Albert R. Mann Library. Mann is the nation's premier academic library in the field of agriculture and related subjects. It also supports the research of faculty and graduate students in the College of Human Ecology and in the Divisions of Biological Sciences and Nutritional Sciences. In addition to its outstanding collection of monographs and serials, Mann also includes a major microcomputer center providing an extensive software collection and instructional assistance designed to support the research needs of its faculty and students.

Programs

AFRICANA STUDIES AND RESEARCH CENTER

The Africana Studies and Research Center offers instruction in African and Afro-American studies and sponsors special lectures, seminars, and presentations during the academic year to inform students about issues and methods for studying different aspects of Africa and the African diaspora, especially in the New World. The center also maintains a library of more than ten thousand volumes.

Additional information may be obtained from the Africana Studies and Research Center, 310 Triphammer Road, Ithaca, New York 14850-2599 (telephone: 607/255-4625).

AMERICAN STUDIES

Although there is no formal program leading to a degree in American studies, candidates for the doctorate in English or history will find ample opportunity to do interdisciplinary work in conjunction with a concentration in American studies within the field. There are members of the staff in both fields who are professionally trained and currently active in the study of the interrelationships of American intellectual, literary, and social history. A student concentrat-

ing in American literature or American history may take advantage of the freedom permitted by the Graduate School regulations and, in collaboration with his or her Special Committee, readily build an individual doctoral program that systematically embraces more than a single discipline. The thesis work typically draws on both literary and historical analysis more systematically than is usually the case in either English or historical theses.

Inquiries concerning opportunities in this area should be addressed to Professor Cushing Strout, American Studies Committee, Department of English, Rockefeller Hall, or to Professor Richard Polenber, Department of History, McGraw Hall.

DIVISION OF BIOLOGICAL SCIENCES

Established in 1964, the Division of Biological Sciences brings together investigators and teachers representing a broad spectrum of interests in basic biology. The division has the primary responsibility for research and undergraduate education in basic biology. Its faculty members, as members of various graduate fields, provide opportunities for graduate study in biochemistry, molecular and cell biology; botany; ecology and evolutionary biology; genetics; neurobiology and behavior; physiology; or zoology. The division is organized into the Sections of Biochemistry, Molecular and Cell Biology; Ecology and Systematics; Genetics and Development; Neurobiology and Behavior; Physiology; and Plant Biology. A number of fellowships, assistantships, and traineeships are available.

Further information may be obtained by writing to the graduate faculty representative of the appropriate field.

BIOPHYSICS PROGRAM

The Biophysics Program sponsors a variety of joint activities and provides prospective students with information on graduate study in biophysics. The wide range of biophysics interests among faculty makes study and

research of biophysics possible in many fields, including agronomy; applied mathematics; applied physics; biochemistry; molecular and cell biology; botany; chemical engineering; chemistry; electrical engineering; immunology; neurobiology and behavior; physics; physiology; plant pathology; theoretical and applied mechanics; and veterinary medicine. The Special Committee system of supervision of graduate study, which encourages interdisciplinary study, is particularly amenable to the study of biophysics, since choice of the thesis research subject and thesis adviser may transcend field membership. Because there is such diversity, prospective graduate students should choose carefully the field to which they apply according to interests and background preparation. The Biophysics Advisory Committee can provide interested students with information and guidance in selection of the graduate field.

A brochure containing available courses and program descriptions can be obtained from the Program in Biophysics, 210 Clark Hall.

BIOTECHNOLOGY PROGRAM

The Cornell University Biotechnology Program pursues basic research and development in biotechnology with the collaboration and support of government and industry. This multidisciplinary effort draws on the faculties and facilities of numerous departments and divisions in four Cornell colleges: arts and sciences, agriculture and life sciences, veterinary medicine, and engineering.

The program consists of three components, the New York State Center for Advanced Technology in Biotechnology, the U.S. Army Center of Excellence in Biotechnology, and the Biotechnology Institute. The New York State Science and Technology Foundation has designated Cornell as the New York State Center for Advanced Technology in Biotechnology (Agriculture). The center fosters research and its application for economic development in areas related to agriculture and food and

chemical production. The U.S. Army Research Office has designated Cornell as the National Center for Excellence in Biotechnology. The center carries out basic research on animal cell surface receptors and protein and enzyme structure and function. It also serves as a resource for U.S. Army scientists. The Biotechnology Institute embodies a new approach to university-industry relationships through a long-term cooperative program of basic research and information transfer. Eastman Kodak, General Foods, and Union Carbide/Rhône Poulenc have pledged substantial funds over a six year period; Corning Glass Works has also made a significant contribution to the institute. The research program focuses on molecular genetics, cell biology, and cell production.

The Biotechnology Program provides predoctoral and postdoctoral awards, including tuition, stipends, and supplies, to Cornell researchers in four program areas: plant molecular biology, bioprocess engineering, protein and enzyme structure and function, and animal surface receptors. In addition, more than fifty graduate students and post-doctoral associates currently participate in research projects.

For further information, contact Gordon G. Hammes, Director, Biotechnology Program, Box 547, Baker Laboratory (telephone: 607/255-2300).

CHINA-JAPAN PROGRAM

This program provides comprehensive graduate-level training and sponsors a wide range of research. Graduate students in the program take a major in such fields as agricultural economics, Asian studies, anthropology, development sociology, economics, government, history, history of art, linguistics, or literature. Early mastery of the Chinese or Japanese language that is sufficient to permit use of Chinese or Japanese sources in courses and seminars and in research is expected. Fellowships are available to some students in the program.

The focus of much of the research and teaching in the program is the culture, economy, history, and society of traditional and contemporary China and Japan. Recent research supported by the China-Japan Program includes ancient and contemporary Chinese relations with Southeast Asia, center-regional relationships in traditional and modern China, Chinese agriculture, Chinese and Japanese economic relations, classical and early modern Chinese and Japanese literature, contemporary Japanese international relations, cultural-religious practices of the China-Southeast Asia border regions, Japanese and Chinese linguistics, Japanese performing arts, and the religions and societies of Japan and China.

Additional information may be obtained by writing to the director of the China-Japan Program, 140 Uris Hall.

PROGRAM OF COMPUTER GRAPHICS

The Program of Computer Graphics is an interdisciplinary graphics center dedicated to the development of interactive graphics techniques and the uses of techniques in a variety of applications. The computer graphics facility is one of the most advanced in the United States and provides a unique opportunity for interdisciplinary research in computer-aided design. Projects undertaken in the program have included the areas of architecture, computer science, cartoon animation, graphics research, energy conservation, medicine, and structural engineering.

There are two appropriate ways to study and to conduct research in computer graphics. The first is to apply for a Ph.D. degree through the Department of Computer Science and to identify an interest in specializing in computer graphics. The second, for those students who want to study the application of computer graphics to fields such as architecture and engineering, is to apply to the Field of Architecture's M.S. program with a major in architectural science and a

minor in computer science. The course work for the master's consists primarily of courses in the computer science department and is determined jointly by the student and his or her minor adviser. The research and thesis for either degree consist entirely of work performed in the computer graphics laboratory.

Additional information may be obtained from Donald Greenberg, Director, Program of Computer Graphics, 120 Rand Hall (telephone: 607/255-4880).

EXCHANGE SCHOLAR PROGRAM

The Exchange Scholar Program enables students enrolled in a doctoral program at Cornell to study for one or two terms in the graduate school of one of the other participating institutions. The academic experience, including courses taken or research conducted with particular faculty at the visited institution, is registered on the academic record maintained by the student's home institution. Participating institutions comprise the following: University of California at Berkeley, Brown University, University of Chicago, Columbia University, Cornell University, Harvard University, Massachusetts Institute of Technology, Princeton University, Stanford University, and Yale University.

The Graduate School also sponsors several programs for graduate studies in universities overseas. For information on these programs contact the dean's office of the Graduate School.

CENTER FOR INTERNATIONAL STUDIES

The Center for International Studies (CIS) facilitates cooperation in international work among the independent academic units at Cornell. It encourages and supports international comparative and interdisciplinary research through area studies programs and supports research in developing countries through its International Agriculture, Rural Development, International Nutrition, and Institute for African Development programs. CIS is also

responsible for expanding study-abroad options for Cornellians and for establishing preprofessional internships overseas. Many other international initiatives are nurtured by the center, bringing the total that the center supports to eighteen different international programs.

CIS Area Programs and Topical Programs

China-Japan Program, 140 Uris Hall
Committee on Soviet Studies,

185 Goldwin Smith Hall

Comparative Economic Development,
486 Uris Hall

Cornell Abroad, 474 Uris Hall
Institute for African Development,
207 West Sibley Hall

International Agriculture Program,
384 Caldwell Hall

International Legal Studies, 309 Myron
Taylor Hall

International Political Economy,
170 Uris Hall

International Population Program,
372 Uris Hall

International Studies in Planning,
200 West Sibley Hall

Latin American Studies Program,
190 Uris Hall

Peace Studies Program, 180 Uris Hall
Program on International Development
and Women, 334 Uris Hall

Program in International Competitive-
ness, 170 Uris Hall

Program in International Nutrition,
127 Savage Hall

Rural Development Committee,
170 Uris Hall

South Asia Program, 170 Uris Hall

Southeast Asia Program, 120 Uris Hall
Western Societies Program, 130 Uris
Hall

Further information can be obtained
from the Center for International
Studies, 170 Uris Hall, 607/255-6370.

LATIN AMERICAN STUDIES PROGRAM

Resources in Latin American studies include formal course work, ample library facilities, and widely based research networks developed by the faculty. Research tends to be problem-oriented, and relevant data are applied

from various fields. The focus of much of the research is the Andean region and Brazil. In addition to those specific areas, research is also under way on the processes and consequences of rapid agricultural development, urbanization, population problems, science and technology policies, and the presence of the United States in Latin America.

Graduate students are encouraged to do independent research and to join faculty members on current projects. Students have received funding for dissertation field research from sources such as the Social Science Research Council, the Fletcher School of Law and Diplomacy, Fulbright-Hays awards, the Doherty Foundation, the Inter-American Foundation, and the Organization of American Studies.

Additional information can be obtained from the director of the Latin American Studies Program, 190 Uris Hall (telephone: 607/255-3345).

CORNELL MANUFACTURING ENGINEERING AND PRODUCTIVITY PROGRAM

COMEPP—the Cornell Manufacturing Engineering and Productivity Program—was founded in 1982 to provide a focus for research and education pertinent to industrial production, design, and management. Today COMEPP is best thought of as a set of collaborating, semi-autonomous projects involving about thirty faculty members and staff and almost one hundred graduate students, plus a growing set of cross-disciplinary courses and industrial collaborators. The current roster of projects and their directors is as follows: world modeling and robotics (J. E. Hopcroft, computer science); program-mable automation (H. B. Voelcker, mechanical and aerospace engineering); integrated mechanical analysis (D. L. Taylor, mechanical and aerospace engineering); manufacturing and operations modeling (J. M. Muckstadt, operations research and industrial engineering); injection molding (K. K. Wang, mechanical and aerospace

engineering); deformation processes (P. R. Dawson, mechanical and aerospace engineering); microelectronics manufacturing (teaching laboratory: N. C. MacDonald, electrical engineering); process control (teaching laboratory: P. Clancy, chemical engineering).

Each of the six research projects has both federal and industrial funding, supports graduate students through research assistantships, and has appropriate laboratory and computing facilities. One or two new projects are likely to be formed in 1988-90, and a "metaproject" spanning several of the existing projects may be launched.

Prospective Ph.D. candidates interested in particular areas can contact the project directors directly. Students interested in the Master of Engineering degree with a manufacturing specialization should contact both COMEPP and the appropriate field(s) of study. Further information may be obtained from COMEPP, 104A Kimball Hall (telephone: 607/255-8084).

INTERNATIONAL NUTRITION PROGRAM

This program provides graduate-level training for those concerned about nutrition problems in low-income countries. International nutrition is one of the concentrations available to students working toward a Ph.D. or M.S. degree in the Field of Nutrition. It is also one of the concentrations available for the Master of Professional Studies (International Development) degree. A number of students from fields such as food science or agricultural economics minor in international nutrition. Others spend time in the program as postdoctoral fellows, as special or non-degree students, or as visiting fellows.

The International Nutrition Program is intended for foreign students who will be undertaking nutrition work in their own countries and American students who are interested in careers in international nutrition. There is an increased recognition of world food and

nutrition problems, the complexity of their etiology, and the multidisciplinary approach needed for their solution. The Cornell approach is perhaps unique in its attempt to address these issues in a program that includes broad training, research in several parts of the world, and service to international agencies and to Third World countries.

Further information may be obtained from Professor Michael C. Latham, director of the International Nutrition Program, Division of Nutritional Sciences, 127 Savage Hall (telephone: 607/255-3041).

DIVISION OF NUTRITIONAL SCIENCES

The Division of Nutritional Sciences is an academic unit on the Cornell campus with responsibilities for various aspects of human nutrition. Master's and doctoral degrees and the professional degrees of Master of Nutritional Science and Master of Professional Studies (Human Ecology) are awarded through the Field of Nutrition. Professors from many disciplines provide Cornell with a strong, diversified sphere of nutritional science. Interests include community nutrition, dietetics, human nutrition, international nutrition, nutritional biochemistry, nutrition and behavior, nutrition education, and public health. A number of assistantships are available through the division.

Further information may be obtained from the graduate faculty representative, B. A. Lewis, 145 Savage Hall, (telephone: 607/255-4410).

PEACE STUDIES PROGRAM

The Peace Studies Program sponsors teaching, research, and conferences on the moderation or avoidance of war and on the political, economic, technical, and social implications of progress toward peace. The program emphasizes an interdisciplinary approach involving social scientists, natural scientists, engineers, and lawyers. There is a graduate minor field of peace studies and peace science for students who want to establish competence in these fields. Students are encouraged to

participate in the colloquia, research, and publication activity sponsored by the program. Student fellowship and research resources are available.

Further information may be obtained from R. Ned Lebow, the director of the Peace Studies Program, 180 Uris Hall.

RENAISSANCE STUDIES

Cornell's Graduate School offers no formal degree in Renaissance studies, but because of Cornell's distinctive field system there is ample opportunity to pursue interdisciplinary work in this area. A student who wants to concentrate on various aspects of Renaissance culture may enter one of the Graduate School's major fields of study and, with the advice of his or her Special Committee, may construct an individual doctoral program that accommodates work in different disciplines. Fields with especially strong resources in Renaissance areas include architecture, classics, comparative literature, English language and literature, Germanic studies, history, history of art and archaeology, music, and Romance studies. Olin Library possesses internationally famous collections in Dante, Petrarch, Erasmus, the history of science, and witchcraft. Each candidate must meet the specific requirements of the field that he or she enters.

Programs such as the A. D. White Professors-at-Large and the Society for the Humanities have brought to campus for extended seminars such distinguished Renaissance scholars as M. Baxandall (London), B. Bono (Michigan), E. M. Gombrich (London), S. Greenblatt (Berkeley), L. Jardine (Cambridge), R. Lanham (UCLA), J. Murdoch (Harvard), W. Ong (St. Louis), A. Patterson (Maryland), Q. Skinner (Cambridge), and D. P. Walker (London).

Additional information may be obtained from the graduate faculty representatives of the appropriate fields.

RURAL DEVELOPMENT

Although there is no formal major or minor in rural development, students can select faculty interested in rural development to serve on their Special Committees. Interested students may choose to work on rural development issues by selecting the Fields of Public Policy or International Agriculture and Rural Development as minors complementing their major fields. Students who want to do professional studies on particular aspects of rural development can work for a Master of Professional Studies degree in Agriculture or International Development. The Rural Development Committee brings together Cornell's strengths in this interdisciplinary area by supporting a program of research, publication, guest speakers, and scholars in residence.

Further information may be obtained from Professor Norman Uphoff, Rural Development Committee, 170 Uris Hall.

PROGRAM ON SCIENCE, TECHNOLOGY, AND SOCIETY

The Program on Science, Technology, and Society (STS) is an interdisciplinary unit of Cornell University. STS engages in undergraduate and graduate teaching and research coordinated with other departments, specialized centers, and related programs. At present STS activities can be divided into four areas: social and political studies of science and technology; science, technology, and public policy; biology and society; and the humanistic interplay between science, technology, and society.

The STS program does not enroll students for advanced degrees. Rather, it cooperates with the various colleges to facilitate curriculum development and research of graduate students and faculty on the interrelations of science, technology, and society. The field of History and Philosophy of Science and Technology offers a doctoral program in

the history and philosophy of science and technology, and a specialization in science and technology policy is available within the field of International Development. Faculty members in the program also include members of the fields of City and Regional Planning, Ecology and Evolutionary Biology, Environmental Toxicology, Government, Philosophy, Sociology, and the various engineering fields.

Additional information may be obtained by contacting the Program on Science, Technology, and Society, 632 Clark Hall, 607/255-3810.

SOCIETY FOR THE HUMANITIES

The Society for the Humanities awards senior fellowships, faculty fellowships, and junior postdoctoral fellowships for research in the humanities. Fellows represent different disciplines, but their research is related to a common theme selected each year. They offer informal seminars on their current work. Details are circulated to interested departments and are listed in the Cornell *Courses of Study* catalog.

The society's seminars are open to graduate students and suitably qualified undergraduates. There are no examinations, and other requirements are at the discretion of the Fellow. Faculty members and others who are interested may attend as visitors with the permission of the instructor.

All seminars are held in the society's quarters, the Andrew D. White House, 27 East Avenue.

SOUTH ASIA PROGRAM

The South Asia Program encompasses the study of Bangladesh, India, Nepal, Pakistan, the Maldive Islands, and Sri Lanka. Graduate students and supervising faculty are drawn from colleges across the university, including agriculture and life sciences; architecture, art, and planning; arts and sciences; and human ecology. The main objective of the program is to offer the student broad exposure to area studies material

and rigorous training in a specific discipline.

Graduate students participate in Cornell-sponsored research in South Asia or carry on independent research abroad. Current research includes long-term projects concerned with planning irrigation and agricultural development in India, Sri Lanka, and Nepal. Another study involves developing a communication research project in Pune, India. Several studies are also being conducted in folklore and religion and on languages of the area, including numerous studies of the Sinhala language in Sri Lanka.

Foreign Language and Area Studies Fellowships are open to incoming students. Opportunities for field research and advanced language study are available through the American Institute of Indian Studies, of which Cornell is a class A member. Since degrees are granted to majors in disciplines rather than regional studies, students should apply directly to the graduate fields of their interest. Prospective students seeking admission or financial aid should contact the program office and the Graduate School.

Additional information may be obtained from the director of the South Asia Program, 170 Uris Hall.

SOUTHEAST ASIA PROGRAM

The Southeast Asia Program offers substantial facilities for graduate study and research and provides exceptional opportunities for the study of all Southeast Asia in various disciplines of the humanities, social sciences, and some natural sciences. Although there is no field in Southeast Asian studies, graduate students may study in the Field of Asian Studies with a concentration in Southeast Asian studies and/or Southeast Asian linguistics and in the Field of History with a concentration in Southeast Asian history. Study opportunities are also available in Southeast Asian art history. Instruction in the major languages of the region is an integral part of the graduate training of the program, which is also strengthened by exceptional library resources, regular

interdisciplinary courses on the countries of the region, and an extensive program of informal seminars and visiting lecturers.

Possible sources of financial aid include Southeast Asia Program Fellowships; Foreign Language and Area Studies Fellowships; and, for advanced Ph.D. candidates, Fulbright-Hays Doctoral Dissertation Research Fellowships and International Dissertation Research Fellowships administered by the Social Science Research Council.

Additional information on the program and the various fellowships and awards may be obtained by writing to the director of the Southeast Asia Program, 120 Uris Hall.

SOVIET STUDIES

The university offers many courses and seminars on the Soviet Union as well as pre-1917 Russia. Instead of a separate area program, graduate students have a choice of majors and minors in the established fields of the Graduate School, including government, history, and Slavic studies. Some of the area specializations are Russian history, Russian literature, and Slavic linguistics. Other subjects combine area specializations in a wider framework: comparative government, economic planning, history of architecture, music, regional planning, and social psychology. Graduate students pursuing Soviet studies in any of these subjects are expected to attain proficiency in Russian either before or soon after entering the Graduate School.

The Committee on Soviet Studies coordinates the university's academic activities related to Russia and sponsors a colloquium for faculty members and graduate students in Soviet studies. In the Soviet studies graduate study room in Olin Library major reference works and key current periodicals from and about the USSR are brought together.

Inquiries about fellowships and other aspects of Soviet studies should be addressed to the Chairperson, Committee on Soviet Studies, 185 Goldwin Smith Hall.

WESTERN SOCIETIES PROGRAM

The Western Societies Program coordinates and promotes interaction between the faculty and students from the thirty-one departments and divisions that deal with European or Canadian subjects. Its broad objectives are to sponsor interdisciplinary courses, seminars, workshops, and conferences on European topics; support undergraduate, graduate, and faculty research; advise students concentrating in European studies; and expand and update European library holdings.

In 1985 the program was designated one of four National Resource Centers on Western Europe. As such, the program receives funds to strengthen the area of European studies at the university and has implemented the creation of new courses and associated faculty positions, library acquisitions, a visiting scholar program, a regional institute for outreach, and fellowships for graduate students.

The program hosts visiting fellows from Europe, who give occasional lectures and seminars on their current research. In addition, a visiting scholar teaches at least one course on a subject relating to the center's focal theme, European public culture since World War II. Policy studies and social history remain a high priority of the program.

The Western Societies Program maintains two programs supporting graduate student research in Europe: the Sicca Fellowship Fund offers support for predissertation and other travel to Europe, and the federally funded Foreign Language and Area Studies fellowship is awarded annually to students who want to study a European language.

Additional information may be obtained from John Weiss, the director of the Western Societies Program, 130 Uris Hall.

Research Centers and Facilities

AGRICULTURAL EXPERIMENT STATIONS

Initiated through the Hatch Act of 1887, which established federal funding for agricultural research, the agricultural experiment stations in Ithaca and Geneva are among the oldest and most prestigious in the United States. They provide a research base and fundamental knowledge for sustaining agriculture and food production throughout New York State and contribute the state's share to the national agricultural research program.

Total research support at both the Ithaca and Geneva stations exceeds \$54 million from New York State, Federal Formula Funds, USDA Special and Competitive grants, federal agencies, private industry, foundations, and gifts. The equivalent of approximately 275 full-time researchers work on over 750 active projects in diverse areas of soils, water, and forestry; crops; animals; economics and agricultural policy; people and social institutions; food and human nutrition; and biotechnology.

At the Cornell University Agricultural Experiment Station on the Ithaca campus, research ranges from the basic sciences represented by modern biotechnology to more-applied agricultural research areas in plant, animal, physical, and social sciences.

The mission of the New York State Agricultural Experiment Station in Geneva, New York, is to research the production and processing of fruits and vegetables. It contains the most all-inclusive apple orchard in the United States with over a thousand varieties. In addition to developing sixty-five new apple varieties, researchers have produced experimental wines from grapes grown in the station's own vineyards, which are now widely grown for New York State's farm wineries. The station's work also extends to growing techniques, plant diseases, pests and pesticides, and many other areas. The mechanical grape harvester, for ex-

ample, which can pick 95 percent of all grapes, was designed here in cooperation with agricultural engineers.

On the Geneva campus there are sixty-six faculty members in four academic departments: Horticultural Sciences, Entomology, Plant Pathology, and Food Science and Technology. Most are also members of the Graduate Faculty and are eligible to serve on Special Committees and to supervise the research of graduate students. Course work and research are done on the Ithaca and Geneva campuses respectively. Transportation is provided for those who want to commute, and housing for single and married students is available on the Geneva campus. Excellent facilities are also available for graduate research under laboratory, greenhouse, pilot-plant, insectary, orchard, and other field conditions.

Further information about Cornell's agricultural experiment stations can be obtained from the Office for Research in the New York State College of Agriculture and Life Sciences, 292 Roberts Hall (telephone: 607/255-5420). The Geneva experiment station can be reached by writing to the director of the New York State Agricultural Experiment Station, Geneva, New York 14456, or by calling 315/787-2211.

JAMES A. BAKER INSTITUTE FOR ANIMAL HEALTH

The institute conducts research on agents that cause disease in domestic and companion animals. Its aims are to increase knowledge about the nature of diseases and the means by which they are spread and to develop methods of controlling their transmission. The staff includes specialists in molecular biology, virology, bacteriology, parasitology, immunology, biochemistry, and genetics. The institute is superbly equipped for research on infectious diseases and osteoarthritis in dogs, reproductive disorders in horses, and research using laboratory animal models of disease. Opportunities for the training of graduate students are available through the Fields of Immunology and Veterinary Medicine.

Additional information can be obtained from the James A. Baker Institute for Animal Health, Snyder Hill Road (telephone: 607/277-3044).

CENTER FOR APPLIED MATHEMATICS

The Center for Applied Mathematics (CAM) administers a broadly based interdepartmental graduate program that provides opportunities for study and research over a wide range of the mathematical sciences. This program is based on a solid foundation in analysis, algebra, and methods of applied mathematics.

Further information may be obtained from the Center for Applied Mathematics, Sage Hall (telephone: 607/255-4335).

Mathematical Sciences Institute A new subunit under CAM is the Mathematical Sciences Institute, a national focal point for comprehensive and integrated fundamental research. Graduate students and postdoctoral associates will conduct research and provide technical and educational assistance to the U.S. Army in the areas of applied analysis, physical mathematics, numerical methods, computing, statistics, and applied probability.

Further information may be obtained from the Mathematical Sciences Institute, 294 Caldwell Hall (telephone: 607/255-8005).

LABORATORY OF ATOMIC AND SOLID STATE PHYSICS

The laboratory is part of the Department of Physics and consists of twenty-four professorial members of the department whose research lies in the general field of condensed-matter physics. At any given time there are about seventy-five full-time graduate students, fifteen postdoctoral associates, and ten senior visitors in the laboratory. Activities range over the entire field of condensed-matter physics, from theoretical studies of dynamic systems to experimental studies of new phenomena at the lowest temperatures ever obtained.

Research is conducted primarily in the Clark Hall of Science. Because of the breadth of condensed-matter physics,

there is frequent interaction between research scientists in LASSP and in chemistry and engineering. Such interdisciplinary work is encouraged through the participation of LASSP physicists in, for example, the Cornell Materials Science Center, the Center for Theory and Simulation in Science and Engineering, and the National Nanofabrication Facility.

Most of the graduate students involved in research at LASSP are enrolled in the Field of Physics.

Further information may be obtained from the director, Clark Hall, (telephone: 607/255-6053).

BROOKHAVEN NATIONAL LABORATORY AND FERMI NATIONAL ACCELERATOR LABORATORY

Cornell is one of nine eastern universities participating in Associated Universities, Inc. (AUI). Operating under contract with the Department of Energy, this corporation has the responsibility for the management of Brookhaven National Laboratory. The laboratory provides unusual research facilities for studies in biology, chemistry, applied mathematics, medicine, physics, high-energy particle physics, and reactor and nuclear engineering.

Cornell is also a member of Universities Research Association, which operates the Fermi National Accelerator Laboratory at Batavia, Illinois, where a 1,000-GeV proton synchrotron and a 1,000 GeV proton on 1,000 GeV antiproton collider are in operation. Several groups of Cornell physics staff are participating in work on this new frontier of elementary particle physics.

Graduate students may participate in research at the Brookhaven or Fermi laboratory by association with Cornell staff members who are engaged in research at these laboratories. Both laboratories also offer temporary summer appointments to a limited number of selected graduate and undergraduate students in science or engineering.

INSTITUTE FOR THE STUDY OF CONTINENTS

As an interdisciplinary organization centered in Cornell's Engineering College, INSTOC seeks to improve scientific understanding of the structure, composition, and evolution of the earth's continents. One of INSTOC's major projects, the Consortium for Continental Reflection Profiling (COCORP), uses the powerful seismic reflection profiling technique, developed by the petroleum industry, for the study of the continental crust's entire thickness. Another large project is the Cornell Andes Project (CAP), a multidisciplinary approach to the study of the shallow and deep structure of the Andes in western South America. Graduate students are involved in INSTOC's different research projects through the Field of Geological Sciences. Many students are supported by graduate research assistantships and some by fellowships. State-of-the-art computing and image-processing facilities are shared with the Department of Geological Sciences and are available to students, research staff, and faculty members.

Further information about the institute may be obtained from the director, 3122 Snee Hall (telephone: 607/255-3474).

CENTER FOR ENVIRONMENTAL RESEARCH

The Center for Environmental Research (CER) supports a comprehensive program of interdisciplinary research, teaching, and public service activities involving major environmental issues. Over the past several years these activities have been carried on under four programs. The Ecosystems Research Center, funded by Cornell, the Environmental Protection Agency (EPA), and other funders, conducts ecosystems research and supports the EPA's regulatory activities. The Cornell Laboratory for Environmental Applications of Remote Sensing (CLEARS) conducts teaching, research, and extension activities involving remote

sensing techniques. The Water Resources Institute's research and extension efforts focus on problems of surface- and groundwater contamination. The Environmental Law and Policy program focuses on risk perception and management and regulation of toxic substances.

All of the center's programs conduct activities, such as seminars, research projects, and conferences, that are geared to the interests of graduate students.

For further information write to the director of the Center for Environmental Research, Hollister Hall (telephone: 607/255-7535).

INSTITUTE FOR COMPARATIVE AND ENVIRONMENTAL TOXICOLOGY

The Institute for Comparative and Environmental Toxicology (ICET) is a university-wide program that promotes collaborative research in environmental toxicology; fosters the academic activities of the graduate field of Environmental Toxicology through administrative support; and maintains a program of outreach, public education, and service. It facilitates the flow of information among researchers conducting independent investigations in toxicology and between Cornell and various governmental, industrial, and scientific organizations. Through these efforts it stimulates development of research and identification of resources for its support, thus aiding students directly and indirectly through activities such as the training grants from the National Institute of Environmental Health Sciences.

Research, teaching, and outreach are carried out in three major areas: biochemical and organismic toxicology; ecotoxicology and environmental chemistry; and risk assessment and policy development. Graduate students in toxicology have access to a wide variety of unique and sophisticated facilities across the university through participating faculty and departments. In addition, students may interact with various state and federal agencies and international programs.

Further information is available from James W. Gillett, the director of ICET, Fernow Hall (telephone: 607/255-8112 or 255-2163).

CORNELL HIGH ENERGY SYNCHROTRON SOURCE

CHES, the Cornell High Energy Synchrotron Source, is a national laboratory supported by the National Science Foundation to provide high-energy X-radiation for studies in the physical and biological sciences. CHES uses synchrotron radiation from the Cornell Electron Storage Ring (CESR), which is used for studies in high-energy particle physics. Radiation from the storage ring is channeled through three beam lines that are then split to provide for six experimental stations. Users of the facility range through all fields of science; approximately one hundred user groups come to CHES for studies. About a third of these are from the Cornell community, and the rest are from other universities, industries, and national laboratories. Graduate students have access to CHES through the research programs of faculty members.

Further information may be obtained from B. W. Batterman, the director of CHES, Clark Hall.

MATERIALS SCIENCE CENTER

The Materials Science Center (MSC) sponsors an interdisciplinary program to promote research and graduate student training in all phases of the science of materials. The subjects of MSC program research are mechanical properties, optical phenomena, phase transitions, low-temperature phenomena, and surfaces and interfaces.

The center can help provide funds for new equipment, laboratory supplies, and research assistantship support to students who choose to specialize in one of the areas represented in the MSC program. In addition, fifteen central technical facilities operated by the center are available to provide access to sophisticated major equipment such as crystal-growing furnaces, electron microscopes, computers, and X-ray apparatus. The technical staff in each

facility give advice on the use of equipment, assist with routine measurements, and are continually developing the technology of their particular area.

Further information may be obtained from the director of the Materials Science Center, 627 Clark Hall (telephone: 607/255-4272).

NATIONAL NANOFABRICATION FACILITY

The National Nanofabrication Facility (NNF) is a national research center for the fabrication of structures at dimensions less than one-tenth of a micrometer. The facility at Cornell is used by researchers from universities and industrial and federal laboratories across the country. There are currently more than one hundred research projects using the NNF. These projects represent ten different scientific disciplines from astronomy to plant pathology.

The NNF was established at Cornell under the name the National Research and Resource Facility for Submicron Structures by the National Science Foundation (NSF) in 1977. The name was changed to the National Nanofabrication Facility in 1987 to reflect a new emphasis at the facility on dimensions below one-tenth of a micrometer. The NNF continues to be supported by NSF as well as by industrial affiliates and Cornell University.

In addition to the NNF's role as a national research center, the facility is a valuable resource for graduate students at Cornell. More than 10 percent of all engineering graduate students use the advanced equipment available at the NNF at some time during their thesis research. The facility also offers an excellent opportunity for students to interact with students from other universities and scientists and engineers from industrial laboratories in a multidisciplinary environment.

Faculty and students from the fields of aerospace, electrical, chemical, and mechanical engineering and applied physics, architecture, astronomy and space sciences, computer science, materials science and engineering,

physics, plant pathology, and textiles have projects at the NNF in such areas as electronic devices, condensed-matter physics, thin-film materials, plant pathology, chemical sensors, and lithography.

Further information may be obtained from the National Nanofabrication Facility, Knight Laboratory (telephone: 607/255-2329).

FLOYD R. NEWMAN LABORATORY OF NUCLEAR STUDIES

One of six major laboratories in the world that are active in experimental high-energy physics, LNS is Cornell's center for research in elementary particle and accelerator physics. It is the home of CESR, an electron-positron storage ring designed and built by members of the laboratory. About one hundred physicists from ten universities are involved with experiments at CESR. The accelerator group is unique in regularly training graduate students not only in experimental and theoretical particle physics but also in accelerator physics. LNS has led the development of superconducting radio frequency accelerating cavities, which are expected to play a decisive role in the next generation of accelerators. Prospective students who want to participate in graduate research with LNS should apply to the Field of Physics.

Further information can be obtained from the director of the Newman Laboratory (telephone: 607/255-4951).

LABORATORY OF ORNITHOLOGY

The Laboratory of Ornithology is a nonacademic department of the university. It has three program areas: education, bird population studies, and the bioacoustics research facility. In education the laboratory manages home-study courses, prepares educational materials, and publishes an award-winning magazine, the *Living Bird Quarterly*, for its thirteen thousand members. Bird population studies puts information gathered from thousands of

birders on the Cornell mainframe computer and analyzes it to detect changes in bird populations. The bioacoustic research facility conducts research on animal and human sounds and manages the Library of Natural Sounds, the world's largest and busiest collection of animal sound recordings.

Graduate students are involved in all these programs, and funding for particular projects is often available through the laboratory. For information write to the director, Charles Walcott, Laboratory of Ornithology, Sapsucker Woods Road, Ithaca, New York 14850.

BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH

This private, independent, nonprofit corporation—established in 1924—combines molecular, cellular, and organismal biology with socioeconomic research on plant protection, plant growth and development, plant utilization, and environmental biology to generate new knowledge for improved agriculture and forestry. Interdisciplinary approaches to solve key problems are emphasized. Plant transformation, regulation of gene expression, atmospheric pollutants and forest decline, biological control of pests, fungal pathogenesis, seed-root-microbe biology, and nonfood uses of plants are current programs.

The institute's new facilities include a unique complex of laboratories, controlled greenhouses, growth rooms, and environmental chambers with approved DNA facilities as well as a twenty-acre experimental farm on the outskirts of Cornell's Ithaca campus.

Approximately a dozen graduate students are conducting their thesis research in the laboratories of Boyce Thompson Institute scientists, who are usually adjunct professors in the pertinent graduate field. Financial support varies from research assistantships funded by the institute and research and training assistantships funded by Cornell departments to support obtained by graduate students from foundations, the government, and other sources.

Further information can be obtained from the Boyce Thompson Institute, Tower Road, Ithaca, New York 14853 (telephone: 607/257-2030, extension 211).

LABORATORY OF PLASMA STUDIES

Cornell's Laboratory of Plasma Studies enables students and faculty members to investigate the physics of laboratory and space plasmas, and to study intense electron and ion-beam physics, on a unique interdisciplinary basis. The experimental speciality of LPS has been the development of the technology of high-powered electron and ion beams and their applications to fusion research, to collective acceleration of electrons or ions to high energy, and to high-power microwave generation. The facilities include several pulsed-power generators ranging from about 100kV and 50kA to 2MV and 500kA. In addition, experimental studies of ionospheric and magnetospheric phenomena that can be understood in terms of plasma physics are in progress by members of LPS. Theoretical research is conducted in support of experiments in progress in LPS and elsewhere as well as on fundamental problems in plasma physics, such as turbulence and other nonlinear phenomena. The laboratory has its own computer system and also has access to excellent large-scale computer facilities at Cornell's Center for Theory and Simulation in Science and Engineering and by dedicated telephone links to the Lawrence Livermore National Laboratory's Magnetic Fusion Energy Computing Center (MFECC) and the computing center of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado.

Graduate study in plasma physics is offered to students in the graduate fields of aerospace engineering, applied physics, astronomy and space sciences, chemistry, electrical engineering, and

physics. Graduate research assistantships and positions at the postdoctoral level are available through the laboratory.

Further information may be obtained from the director of the Laboratory of Plasma Studies, Upson Hall (telephone: 607/255-4127).

CENTER FOR RADIOPHYSICS AND SPACE RESEARCH

The Center for Radiophysics and Space Research (CRSR) furnishes administrative support and provides facilities for faculty members and graduate assistants who are engaged in space research in one of several academic departments. The center offers opportunities for graduate students to undertake theoretical or experimental thesis work in astronomy and astrophysics, atmospheric and ionospheric radio investigation, lunar and planetary studies, radar and radio astronomy, or space vehicle instrumentation. A student's major professor can be chosen from the following fields in the Graduate School: aerospace engineering, applied physics, astronomy and space sciences, chemistry, electrical engineering, and physics.

The center's facilities include a laboratory for infrared astronomy and the Laboratory for Planetary Studies on the Cornell campus; close to Ithaca are the Radio Astronomy and Ionospheric laboratories. CRSR has one of the six major facilities established by the National Aeronautics and Space Administration for the study of planetary photography (the Spacecraft Planetary Imaging Facility—SPIF). Extensive collections of photographs of Mars, the moon, Venus, and Jupiter and its satellites are available, together with facilities for analysis. The collection is being augmented as new missions supply further data.

National Astronomy and Ionosphere Center Students may also be associated with the Cornell-operated National Astronomy and Ionosphere

Center (NAIC), which operates the world's largest radar-radio telescope at Arecibo, Puerto Rico. At Arecibo an extremely sensitive radio telescope and an unusually powerful space radar are available for use by qualified graduate students, who may conduct thesis research while resident there. CRSR also has close ties to the Cornell Theory Center (Center for Theory and Simulation in Science and Engineering), including its supercomputing facilities.

Further information may be obtained from CRSR, Space Sciences Building (telephone: 607/255-3910).

CORNELL INSTITUTE FOR SOCIAL AND ECONOMIC RESEARCH

The Cornell Institute for Social and Economic Research (CISER) is a cross-disciplinary organization of more than 270 Cornell social science faculty members that seeks to enhance the environment for social science research at the university and to provide a focus and a voice for Cornell social science researchers. CISER develops and maintains programs of research, and the institute's staff are available to assist researchers with their projects.

The institute's research support services include an extensive data archive that contains demographic, economic, and international statistics, social surveys, and small-area socioeconomic data; the Survey Research Facility, offering services including questionnaire design, sampling, data collection, data coding, and data entry and analysis; and the New York State Information System, a program of research assistance and data-base development specializing in social, demographic, and economic data of New York State.

Further information may be obtained from the director of CISER, 391 Uris Hall (telephone: 607/255-4801).

CENTER FOR THEORY AND SIMULATION IN SCIENCE AND ENGINEERING

The Center for Theory and Simulation in Science and Engineering—the Theory Center—is one of the five National Science Foundation-sponsored National Advanced Scientific Computing Centers. The Theory Center was created to enhance the position of United States science and technology by increasing the availability of the most highly advanced computers to researchers. As part of this effort the Theory Center is committed to educating students, scientists, and engineers in the use of supercomputers.

The Theory Center offers a wide range of programs, including the Cornell National Supercomputing Facility (CNSF); the Advanced Computing Facility, a highly parallel hardware and software development effort for computational science; Interdisciplinary Research Groups supporting collaboration across technical fields; and a cooperative Research Institute program to involve industrial users. In addition, there are ongoing workshops and training programs; specialized, immediate consulting for users; an advanced communication network; and advanced computer graphics.

Graduate students gain hands-on experience in the use of supercomputers, algorithms, software, graphics, and the analysis of results by working with principal investigators in the CNSF on a variety of projects. Current research spans a wide range of disciplines, including physics, medicine, biology, sociology, engineering, chemistry, modern languages, mathematics, animal science, geology, economics, and materials science. Most research projects involve graduate students.

Further information can be obtained from the Cornell Theory Center, 265 Olin Hall (telephone: 607/255-8686).

Cornell Computer Services

Cornell Computer Services (CCS) supplies and maintains computer hardware operating systems and programs to meet a broad spectrum of user needs. To make those resources readily accessible, CCS operates several clusters of public terminals, provides some free consulting services, produces informative documentation, and offers or cosponsors a variety of user education programs. To facilitate computer literacy, CCS is working with faculty and teaching assistants to develop areas in which computing will enhance instruction and study.

Cornell's main computers consist of two large-scale IBM computers, a VAX 8500, two MicroVAX IIs, and two VAX 11/750s. Public terminal clusters in seventeen areas on campus house about 360 workstations, including more than 250 microcomputers. A wide variety of microcomputer software programs may be borrowed, and several facilities and services are devoted to word processing and letter-quality printing.

Of particular significance to graduate students is Cornell's expanding role in supercomputing. Cornell is one of five federally designated national centers for advanced scientific computing (supercomputing) and was the first to become fully operational. The current configuration at the Cornell National Supercomputer Facility consists of an IBM 3090-400 mainframe, a smaller IBM 4381 mainframe, four Floating Point Systems FPS 264 scientific processors, two FPS 164s, and an FPS/MAS. The four-processor mainframe has both scalar and vector capabilities, and, with seven attached FPS processors, the facility also can be used as a parallel system.

A \$1.2 million grant from the National Science Foundation has enabled the university to undertake the first phase of a data communication network linking academic research institutions to national and industrial laboratories in New York State. The New York State Educational Research Network (NYSERNet) is among the first regional networks in a growing system

of links to supercomputer centers across the United States.

CCS will soon begin supporting local areas networks (LANs) suitable for clusters of microcomputers. An experimental project is underway to provide LANs in student housing. Currently Cornell is connected to numerous data communications networks, including Telenet and TYMNET, which provide access to computing facilities in almost every state as well as in Mexico, Canada, and parts of Europe. As a member-supplier of EDUNET, Cornell shares computer research with other institutions of higher learning. Cornell is also a member of BITNET and MAILNET, providing two-way electronic mail service between Cornell and other universities throughout the world.

For further information, contact Cornell Computer Services, User Support Office, Communications and Computing Center.

Art Museum

The Herbert F. Johnson Museum of Art is one of the country's leading university art museums. Designed by the world-renowned architect I. M. Pei, the building's upper galleries afford sweeping views of the Cornell campus, Ithaca, Cayuga Lake, and the surrounding countryside. Its collections include paintings, drawings, sculpture, photographs, prints, textiles, and crafts spanning thirty centuries and six continents. They are particularly strong in Asian, nineteenth-century American, graphic, and contemporary art. The museum presents about fifteen special exhibitions each year as well as lectures, art demonstrations, film screenings, workshops, music and dance performances, and other programs.

Other campus locations for art displays include the Art Room in Willard Straight Hall, the John Hartell Gallery in Sibley Hall, and the galleries in Goldwin Smith Hall, Martha Van Rensselaer Hall, and Olive Tjaden Hall.



GENERAL INFORMATION

Housing

Applicants interested in university housing should write to the appropriate housing office as early as possible. Addresses are listed in the directory on page 160.

There are several small residence facilities for single graduate students near campus. Information and application forms may be obtained from the Housing Assignment Office.

Unfurnished apartments for families of up to four members are available in Cornell Quarters, Pleasant Grove Apartments, and Hasbrouck Apartments. Information and application forms may be obtained from the Family Housing Office.

The Off-Campus Housing Office maintains a board with listings of off-campus accommodations. A booklet on off-campus housing is available from Off-Campus Housing, Dean of Students Office.

Health Services and Health Insurance

A number of health care services are provided at Gannett Health Center. The costs of most of those services are covered by tuition. For information contact the Department of University Health Services, Gannett Health Center.

Students are automatically enrolled in the university's accident and sickness insurance plan. Coverage may be waived, however, by completing the waiver card accompanying the bursar's bill.

Spouses of regularly enrolled students may use the university health services on a prepaid or fee-for-service basis. Spouses and dependents may also be enrolled in the accident and sickness insurance plan.

Before registration each entering graduate student must submit a health history and proof of inoculation against measles, rubella, tetanus, and polio on a form supplied by the university.

Student Services and Facilities

Students benefit from a wide variety of resources, both academic and nonacademic, that contribute significantly to their Cornell education. The following section is a selected list of services and facilities available to graduate students.

Information and Referral The Information and Referral Center in the main lobby of Day Hall is the central source of information on any aspect of the university for visitors to the campus and for the entire Cornell community. Free guided walking tours of the campus leave the center daily through most of the year. The center is open Monday through Friday from 9:00 a.m. to 5:00 p.m. (telephone: 607/255-6200).

Dean of Students Office The primary aim of the Dean of Students Office is the personal, social, and intellectual development of students and the enhancement of the quality of the educational environment for the benefit of the entire community.

Specific responsibilities of the office include graduate student orientation week; training and development of peer counseling groups such as EARS (Empathy, Assistance, and Referral Service); and off-campus housing. Various publications are prepared by this office, including *Cornell Calendar*, *Off-Campus Housing in the Ithaca Area*, and *Life at Cornell*. The Dean of Students Office is located in 103 Barnes Hall.

International Students and Scholars Office Cornell, since its founding, has welcomed students from around the

world. Currently over eighteen hundred international students, representing more than one hundred countries, study at Cornell; about fourteen hundred of these students are enrolled in the Graduate School. To assist students from abroad, the International Students and Scholars Office (ISSO) provides services in a variety of areas, including arrival assistance, housing information, orientation workshops, personal and academic advising, and financial planning assistance. The ISSO is located in 200 Barnes Hall.

Minority affairs The Graduate School actively encourages applicants from minority groups that are under-represented in American higher education and the professions: American Blacks, Puerto Ricans, Chicanos, and American Indians. Although Cornell has no special admission program for minority students, it does give special consideration to individual capability and to the need for a diverse group of students. Fellowships are available to qualified applicants. For information, contact the assistant dean for minority affairs, Graduate School, Sage Graduate Center (telephone: 607/255-5235).

Disabled students Cornell is committed to ensuring that all qualified disabled persons have the opportunity to participate in its educational and employment programs and services on an equal basis. A brochure describing services for the disabled student is available. Questions and requests for special assistance and brochures should be directed to the Office of Equal Opportunity, 234 Day Hall (telephone: 607/255-3976).

Child care The child-care facilities in the Ithaca area and at Cornell are limited. In Ithaca there are thirteen licensed day-care centers for toddlers (some also care for infants) and 220 registered private providers. The demand, however, exceeds the supply, so there are waiting lists. The Cornell Community Infant Center offers full-time care for twenty-four infants aged eight weeks to eighteen months; there is usually a waiting list. In addition, Cornell cosponsors some limited child-care programs.

Career Center The Career Center, an academic support service, works in conjunction with college career-planning and placement offices to help students discover, explore, and choose careers. The Sage Hall office, 14 East Avenue, houses an extensive career library, aids students in job hunting through on-campus interviews with employers, and provides special programs and advice for minority students. The Barnes Hall office, 203 Barnes Hall, provides academic and career counseling to individuals and groups, conducts academic and vocational testing, gives language placement tests for students enrolling in foreign language courses, and provides information for students interested in careers in health fields. It also maintains a credential service for letters of recommendation, transcripts, and other personal documents retained and distributed by request to employers.

Recreation and Athletics

Recreational facilities on the Cornell campus and in the Ithaca area are abundant and accessible. Cayuga Lake and the many streams flowing into it provide opportunities for all forms of water sports, including swimming, sailing, water-skiing, canoeing, and fishing. The gently rolling hills of the Finger Lakes Region are ideal for hiking, bicycling, and long-distance running during the warmer months and for cross-country skiing during the winter. Downhill ski facilities include the Greek Peak center, less than an hour from Ithaca.

Facilities for on-campus sports include two indoor swimming pools, tennis and squash courts, an ice-skating rink, a polo arena, and a golf course. Opportunities to participate in competitive sports are available through one of the most varied intramural sports programs in the country. About seventeen hundred teams participate annually in 180 leagues, competing in more than twenty sports. Of interest to spectators are the many intercollegiate teams fielded by Cornell in the Ivy League.

REGISTER

UNIVERSITY ADMINISTRATION

Frank H. T. Rhodes, president of the university
Robert Barker, provost

GRADUATE SCHOOL ADMINISTRATION

Alison P. Casarett, dean
Eleanor M. Cox, assistant dean
Richard M. Levy, assistant dean
Benjamin Ginsburg, secretary of the graduate faculty

GENERAL COMMITTEE

Karen W. Brazell, Asian studies (1989)
Laura S. Brown, English language and literature (1991)
S. Gordon Campbell, veterinary microbiology (1991)
Robert L. Harris, Jr., Africana studies (1991)
Peter L. Marks, ecology and evolutionary biology (1991)
Douglas D. McGregor, veterinary microbiology (1989)
Mark S. Nelkin, applied engineering physics (1989)
S. Leigh Phoenix, engineering (1991)
Henry N. Ricciuti, human development and family studies (1989)
Benjamin Widom, chemistry (1991)

ANDREW D. WHITE PROFESSORS-AT-LARGE

Professors-at-large are distinguished nonresident members of the University Faculty. During short visits to the campus of up to a month's duration, made at irregular intervals, they hold seminars, give public lectures, and consult informally with students and faculty.

Michael Baxandall, art historian
Norman E. Borlaug, plant scientist
Françoise Choay, historian of architecture and city planning
Sir David Cox, statistician
Jacques Derrida, philosopher, literary critic
Sir Kenneth Dover, classicist
Richard L. Garwin, physicist
John L. Heilbron, historian of science
Bernard Lewis, Islamicist
Geoffrey Marshall, political theorist
Ali. A. Mazrui, Africanist, political scientist
Michael L. Rutter, psychiatrist
Margery W. Shaw, geneticist, physician, lawyer
Sir Richard Southwood, biologist
John Szarkowski, curator and historian of photography
Kip S. Thorne, astrophysicist
Eudora Welty, novelist and short-story writer
Harold W. Woolhouse, biologist

INDEX OF FIELDS, SUBJECTS, AND CONCENTRATIONS

For specific programs, consult the General Index.

- Acarology, 57
- Accounting, 81; hotel, 70
- Administration: business, 81; educational, 50; health services, 72; hotel, 70; human service, 72; quantitative analysis for, 81
- Adult education: extension, continuing, and, 50
- Aerodynamics, 17
- Aerospace engineering, 17
- Aesthetics, theater theory and, 113
- African and Afro-American studies, 18
- Africana studies, 18
- Afro-American: literature, 55; studies, African and, 18
- Agricultural: development, international, 20; economics, 18; engineering, 20; finance, 18; international, and rural development, 76; and natural resource sociology, 46; and occupational education, 50
- Agronomy, 21
- American: art, 69; history, 67; literature, 55; politics, 65; studies, 55, 67
- Analysis: environmental, design and, 45; multiregional economic, 106; numerical, 44; planning theory and systems, 37; policy, 110; policy, and program planning, 72; public policy, 18; quantitative, for administration, 81; quantitative, applied econometrics and, 18
- Analytical: chemistry, 36; economics, basic, 50
- Anatomy: comparative and functional, 118; plant morphology and, 34; veterinary, 115
- Ancient: art and archaeology, 69; history, 40, 67; philosophy, 40
- Animal: breeding, 22; cytology, 118; ecology, 48; epidemiology, 59; genetics, 22; nutrition, 22, 93; science, 22
- Anthropology, 23; applied, 23; historical, 23; physical, 23; psychological, 23; social, 23
- Apiculture, 57
- Apparel design, 112
- Applied: anthropology, 23; ecology, 48; econometrics and quantitative analysis, 18; economics, 49; linguistics, 80; mathematics, 24; mathematics and computational methods, 35; mechanics, theoretical and, 114; physics, 26; probability and statistics, 94
- Aquatic: entomology, 57; science, 88
- Arabic and Islamic history and literature, 90
- Archaeology, 23; ancient art and, 69; biblical history and, 90; classical, 40; history of art and, 69; Near Eastern history and, 90
- Architectural: design, 27; science, 27
- Architecture, 27; history of, 27; landscape, 77; theory and criticism of, 27
- Artificial intelligence, 44
- Art(s), 29; American, 69; ancient, and archaeology, 69; creative visual, 29; graphic, 29; history of, and archaeology, 69; medieval, 69, 86; modern, 69; oriental, 69; Renaissance and baroque, 69; theater, 113
- Asian: history, Southeast, 67; linguistics, East, 29, 80; linguistics, South, 29, 80; linguistics, Southeast, 29, 80; literature, East, 48; religions, 48; studies, 29; studies, East, 29; studies, Southeast, 29
- Assyriology, 90
- Astronomy, 31; infrared, 31; radio, 31; and space sciences, 31
- Astrophysics, 31
- Atmospheric sciences, 21
- Bacteriology, 115
- Baroque art, Renaissance and, 69
- Behavior: insect, 57; neurobiology and, 90; organizational, 74; organizational theory and, 81. *See also* Graduate School of Medical Sciences *in General Index*
- Behavioral: biology, 90; ecology, 90; physiology, 99
- Bible, Hebrew, 90
- Biblical history and archaeology, 90
- Biochemical: engineering, 35; toxicology, cellular and, 59
- Biochemistry, 32; insect, 57; molecular and cell biology, 32; nutritional, 93. *See also* Graduate School of Medical Sciences *in General Index*
- Biological: control, 57; engineering, food and, 20
- Biology: behavioral, 90; biochemistry, molecular and cell, 32; cell, 32; developmental, 62, 118; ecology and evolutionary, 48; evolutionary, 48; molecular, 32; molecular and cell, 32; plant molecular,

- 34; population, 48. *See also* Graduate School of Medical Sciences in *General Index*
- Biomechanical engineering, 84
- Biometry, 33, 111
- Bioorganic chemistry, 36
- Biophysical chemistry, 36
- Biophysics, 32. *See also* Graduate School of Medical Sciences and Biophysics program in *General Index*
- Biopsychology, 104
- Biorheology, fluid dynamics, rheology, and, 35
- Botany, 34; systematic, 34
- Breeding, animal, 22; plant, 100
- Building technologies and environmental science, 27
- Business: administration, 81; and public policy, 81
- Catalysis, kinetics and, 35
- Cell biology, 32; biochemistry, molecular and, 32; plant, 34. *See also* Graduate School of Medical Sciences in *General Index*
- Cellular: and biochemical toxicology, 59; immunology, 74; and molecular neurobiology, 90; physiology, 99
- Chemical: ecology, 90; engineering, 35; reaction engineering, 36
- Chemistry, 36; analytical, 36; bioorganic, 36; biophysical, 36; ecotoxicology and environmental, 59; food, 61; inorganic, 36; insect toxicology and insecticide, 57; organic, 36; physical, 36; theoretical, 36
- Chinese: history, 67; linguistics, 48; literature, 48; philology, 48; studies, 29
- Cinema, 113
- City and regional planning, 37
- Civil and environmental engineering, 39
- Classical: archaeology, 40; mythology, 40; rhetoric, 41
- Classics, 40
- Clinical nutrition, 93
- Clothing, 112
- Cognitive: development, 71; studies, 41
- Collective bargaining, labor law, and labor history, 74
- Combustion, 84
- Communication, 42
- Community: and ecosystem ecology, 48; and regional sociology, 46
- Comparative: and functional anatomy, 118; labor relations, international and, 74; literature, 43; physiology, 99; politics, 65
- Composition, musical, 87
- Computation: distributed, 44; theory of, 44
- Computational methods, applied mathematics and, 35
- Computer: graphics, 27; science, 44
- Computing: statistical, 111
- Consumer: economics, 45; and household economics, 45; and housing, 45
- Continuing education, extension, adult, and, 50
- Creative: visual arts, 29; writing, 55
- Criticism: of architecture, theory and, 27; and theory, literary (English language and literature), 55
- Crop(s): science, field, 21; vegetable, 115
- Culture and meaning, 23
- Curriculum and instruction, 50
- Cytology, 34; animal, 118
- Dairy science, 61
- Decision theory, 111
- Design, 27, 45; apparel, 112; architectural, 27; and environmental analysis, 45; environmental planning and, 37; experimental, 111; interior, 45; mechanical systems and, 84; for the theater, 113; urban, 27
- Development: cognitive, 71; ecology of human, 71; economics of, 18; human, and family studies, 71; international, 77; international agricultural, 20; international agricultural and rural, 76; and planning, economic, 49; planning, international, 37; planning, and regional economics, 37; population and, 46; social and personality, 71; sociology, 46; urban, history of, 27; urban, history of architecture, 27
- Developmental: biology, 62, 118; psychology, 71; psychopathology, 71
- Directing, 113
- Distributed computation, 44
- Drama and the theater, 113
- Dramatic literature, 55
- Dynamics: fluid, rheology, and biorheology, 35; and space mechanics, 114
- East Asian: linguistics, 29, 80; literature, 48; studies, 29
- Ecological genetics, 48
- Ecology, 48, 118; animal, 48; applied, 48; behavioral, 90; chemical, 90; community and ecosystem, 48; and evolutionary biology, 48; of human development, 71; insect, 57; physiological, 48; plant, 34, 48; population, 48; theoretical, 48
- Econometrics: and economic statistics, 49; and quantitative analysis, applied, 18
- Economic: analysis, multiregional, 106; development and planning, 49; entomology, 57; geology, 63; history, 49; and social statistics, 74, 111; statistics, econometrics and, 49; systems, 49; theory, 49
- Economics, 49; agricultural, 18; applied, 49; basic analytical, 50; consumer, and housing, 45; consumer and household, 45; of development, 18; farm manage-

- ment and production, 18; home, education, 50; international, 49; labor, 50, 74; managerial, 81; of participation in labor-managed systems, 49; regional, and development planning, 37; resource, 18; urban and regional, 106
- Ecosystem ecology, community and, 48
- Ecotoxicology and environmental chemistry, 59
- Education, 50; agricultural and occupational, 50; extension, continuing, and adult, 50; home economics, 50; science and mathematics, 50
- Educational: administration, philosophical and social foundations:, 50; psychology and measurement, 50; research methodology, 50
- Eighteenth century: performance practice (music), 87; Restoration and the, (English language and literature), 55
- Electrical: engineering, 53; systems, 53
- Electrophysics, 53
- Endocrinology, 99
- Energy, 20; and power systems, 84; systems, environmental and, 106
- Engineering: aerospace, 17; agricultural, 20; biochemical, 35; biomechanical, 84; chemical, 35; chemical reaction, 35; civil and environmental, 39; electrical, 53; environmental, 39; environmental, and waste management, 20; environmental systems, 39; food, 61; food and biological, 20; geology, 62; geotechnical, 39; industrial, operations research and, 94; manufacturing systems, 94; materials, 82; materials and manufacturing, 84; materials science and, 82; mechanical, 84; nuclear, 91; nuclear science and, 91; physics, 26; soil and water, 20; statistics, 111; structural, 39; transportation, 39
- English: history, 67; language and literature, 55; linguistics, 80; Old and Middle, 55; poetry, 55; Renaissance, 55
- Entomology, 57; aquatic, 57; economic, 57; general, 57; medical, 57
- Environmental: analysis, design and, 45; chemistry, ecotoxicology and, 59; and energy systems, 106; engineering, 39; engineering, civil and, 39; engineering and waste management, 20; planning and design, 37; quality, 58; science, building technologies and, 27; systems engineering, 39; toxicology, 59
- Environments, structures and their, 20
- Epidemiology: human and animal, 59; veterinary, 115
- Ethology, 90
- European history, 67
- Evolutionary biology, 48; ecology and, 48
- Experimental: design, 111; physics, 98; psychology, human, 104
- Extension, continuing, and adult education, 50
- Facilities planning and management, 45
- Family resource management, 45
- Family studies: human development and, 71; and the life course, 71
- Farm management and production economics, 18
- Fiber science, 112
- Fiction, prose, 55
- Field crop science, 21
- Finance, 81; agricultural, 18; public, 50
- Financial management, 70
- Fishery science, 88
- Floriculture and ornamental horticulture, 60
- Fluid: dynamics, rheology, and biorheology, 35; mechanics, 84, 114
- Food: and beverage management, 70; and biological engineering, 20; chemistry, 61; distribution, marketing and, 18; engineering, 61; microbiology, 61; processing waste technology, 61; science, 61; science and technology, 61; science, international, 61
- Foods, 93
- Forest science, 88
- French: history, 67; linguistics, 107; literature, 107
- Functional anatomy, comparative and, 118
- Gastrointestinal and metabolic physiology, 99
- Genetics, 62; animal, 22; ecological, 48; insect, 57; plant, 100
- Geobiology, 63
- Geochemistry and isotope geology, 63
- Geological sciences, 63
- Geology, 63; economic, 63; engineering, 63; isotope, geochemistry, and, 63; marine, 63; petroleum, 63; planetary, 63; Precambrian, 63; Quaternary, 63; structural, 63
- Geomorphology, 63
- Geophysics, 63
- Geotechnical engineering, 39
- Geotectonics, 63
- German: area studies, 64; history, 67; intellectual history, 64
- Germanic: linguistics, 64, 80; literature, 64; studies, 64
- Government, 65
- Graphic arts, 29
- Graphics, computer, 27
- Greek: language and literature, 40; and Latin language and linguistics, 40
- Handling and processing materials, 20
- Health services administration, 72
- Health systems planning, social and, 37
- Heat: and mass transfer, 35; transfer, 84
- Hebrew Bible, 90

- Histology, 118
 Historic preservation planning, 37
 Historical anthropology, 23
 History, 67; American, 67; ancient, 40, 67;
 Arabic and Islamic, and literature, 90; of
 architecture, 27; of architecture and
 urban development, 27; of art and
 archaeology, 69; biblical, and archaeol-
 ogy, 90; Chinese, medieval, 67; Chinese,
 modern, 67; economic, 49; English, 67;
 European, early modern, 67; European,
 modern, 67; French, 67; German, 67;
 German intellectual, 64; Japanese,
 modern, 67; labor, 74; Latin American,
 67; medieval, 67, 86; Near Eastern, and
 archaeology, 90; and philosophy of
 science and technology, 68; Russian, 67;
 of science, 67; Southeast Asian, 67;
 theater, 113; of urban development, 27;
 urban planning, 37
 Home economics education, 50, 51
 Horticulture, floriculture and ornamental, 60
 Hotel: accounting, 70; administration, 70
 Household economics, consumer and, 45
 Housing, 45; consumer economics and, 45
 Human: development, ecology of, 71;
 development, and family studies, 71;
 epidemiology, 59; experimental psychol-
 ogy, 104; nutrition, 93; resources
 management, 70; service administration,
 72; service studies, 72
 Human-environment relations, 45
 Human-resource studies, personnel and, 74
 Hydraulics and hydrology, 39

 Immunity, infection and, 74
 Immunochemistry, 74
 Immunogenetics, 74
 Immunology, 74; cellular, 74; veterinary,
 115. *See also* Graduate School of
 Medical Sciences in *General Index*
 Immunopathology, 74
 Indo-European linguistics, 41, 80
 Industrial: engineering, operations research
 and, 94; and labor relations, 74; and
 labor relations problems, 74; organization
 and control, 49
 Infection and immunity, 74
 Information processing, 44
 Infrared astronomy, 31
 Inorganic chemistry, 36
 Insect: behavior, 57; biochemistry, 57;
 ecology, 57; genetics, 57; morphology,
 57; pathology, 57; physiology, 57;
 taxonomy, 57; toxicology and insecticide
 chemistry, 57
 Instruction, curriculum and, 50
 Integrated pest management, 57
 Interior design, 45
 International: agricultural development, 20;
 agricultural and rural development, 76;
 and comparative labor relations, 74;
 development, 77; development planning,
 37; economics, 49; food science, 61;
 nutrition, 77, 93; planning, 77; population,
 77; relations, 65; spatial problems, 106
 Islamic, Arabic and, history and literature, 90
 Isotope geology, geochemistry and, 63
 Italian: linguistics, 107; literature, 107

 Japanese: history, modern, 67; linguistics,
 48; literature, classical, 48; literature,
 modern, 48; studies, 29
 Judaic studies, 90

 Kinetics and catalysis, 35

 Labor: economics, 50, 74; history, collective
 bargaining, labor law, and, 74
 Labor-managed systems, economics of
 participation in, 49
 Labor relations: industrial and, 74; interna-
 tional and comparative, 74; problems,
 industrial and, 74
 Landscape architecture, 77
 Language and linguistics: Greek and Latin,
 40
 Language and literature: English, 55; Greek,
 40; Latin, 40
 Languages: and literatures, Semitic, 90;
 programming, 44. *See also* Languages in
 General Index
 Latin: language and linguistics, Greek and,
 40; language and literature, 40; literature,
 medieval and Renaissance, 40
 Latin American: history, 67; studies, 78
 Law, 79; labor, 74
 Life course, family studies and the, 71
 Limnology, 48
 Linguistics, 80; applied, 80; Chinese, 48;
 East Asian, 29, 80; English, 80; French,
 107; general, 80; Germanic, 64, 80;
 Greek and Latin language and, 40; Indo-
 European, 41, 80; Italian, 107; Japanese,
 48; Romance, 80, 107; Slavic, 80, 109;
 South Asian, 29, 80; Southeast Asian, 29,
 80; Spanish, 107
 Literary criticism and theory, 55
 Literature(s): Afro-American, 55; American,
 55; Arabic and Islamic, history and, 90;
 Chinese, classical, 48; Chinese, modern,
 48; comparative, 43; dramatic, 55; East
 Asian, 48; English language and, 55;
 French, 107; Germanic, 64; Greek
 language and, 40; Italian, 107; Japanese,
 classical, 48; Japanese, modern, 48;
 Latin language and, 40; medieval, 86;
 medieval and Renaissance Latin, 40;
 Russian, 109; Semitic languages and, 90;
 Spanish, 107; women's, 55
 Local roads, 20
 Location theory, 106
 Machinery, power and, 20

- Macroeconomics, monetary and, 50
- Management, 81; environmental engineering and waste, 20; facilities planning and, 45; family resource, 45; farm, and production economics, 18; financial, 70; food and beverage, 70; human resources, 70; integrated pest, 57; production and operations, 81; properties, 70; risk assessment, and public policy, 59
- Managerial economics, 81
- Manufacturing: engineering, materials and, 84; systems engineering, 94
- Marine geology, 63
- Marketing, 70, 81; and food distribution, 18
- Mass transfer, heat and, 35
- Materials: engineering, 82; handling and processing, 20; and manufacturing engineering, 84; mechanics of, 114; science, 82; science, polymers and, 35; science and engineering, 82
- Mathematical: programming, 94; statistics, 111
- Mathematics, 83; applied, 24; applied and computational methods, 35; education, science and, 50; 7-12, 51
- Mechanical: engineering, 84; systems and design, 84
- Mechanics: dynamics and space, 114; fluid, 84, 114; of materials, 114; rock, 63; solid, 114; structural, 39; theoretical and applied, 114
- Medical entomology, 57
- Medical Sciences, Graduate School of. *See* Graduate School of Medical Sciences in *General Index*
- Medicine, veterinary, 115
- Medieval: art, 69, 86; Chinese history, 67; history, 67, 86; literature, 86; music, 86; philology, 86; philosophy, 86; and Renaissance Latin literature, 40; studies, 86
- Metabolic and gastrointestinal physiology, 99
- Methodology: educational research, 50; political, 65
- Methods: applied mathematics and computational, 36; planning, 106; research, 110; of social research, 46
- Microbiology, 87; food, 61. *See also* Graduate School of Medical Sciences in *General Index*
- Middle English, Old and, 55
- Mineralogy, 63
- Molecular: biology, 32; biology, plant, 34; and cell biology, biochemistry, 32; neurobiology, cellular and, 90; plant pathology, 101
- Monetary and macroeconomics, 50
- Morphology: insect, 57; plant, and anatomy, 34
- Multiregional economic analysis, 106
- Music, 87; medieval, 86; theory of, 87
- Musical composition, 87; performance, 87
- Musicology, 87
- Mycology, 34, 101
- Mythology, classical, 40
- Natural resource(s), 88; sociology, agriculture and, 46
- Near Eastern: history and archaeology, 90; studies, 90
- Neuroanatomy, 90
- Neurobiology, 90; and behavior, 90; cellular and molecular, 90. *See also* Graduate School of Medical Sciences in *General Index*
- Neurochemistry, 90
- Neuroethology, 90
- Neuropharmacology, 90
- Neurophysiology, 90, 99
- Nineteenth century (English language and literature), 55
- Norse, Old, 64
- Nuclear: engineering, 91; science, 91; science and engineering, 91
- Numerical analysis, 44
- Nutrition, 93; animal, 22, 93; clinical, 93; general, 93; human, 93; international, 77, 93
- Nutritional biochemistry, 93
- Occupational education, agricultural and, 50
- Oceanography, 48
- Old: and Middle English, 55; Norse, 64
- Operations: management, production and, 81; research, 94; research and industrial engineering, 94
- Organic chemistry, 36
- Organization: and change, social, 110; and control, industrial, 49
- Organizational: behavior, 74; theory and behavior, 81
- Oriental art, 69
- Ornamental horticulture, floriculture and, 60
- Painting, 29
- Paleobotany, 34
- Paleontology, 63
- Parasitology, 115
- Pathology: insect, 57; plant, 101; plant, molecular, 101; veterinary, 115. *See also* Graduate School of Medical Sciences in *General Index*
- Peace: science, 50, 96, 106; studies, 96
- Performance, music, 87; practice, eighteenth-century, 87
- Personality and social: development, 71; psychology, 104
- Personnel and human-resource studies, 74
- Pest management, integrated, 57
- Petroleum geology, 63
- Petrology, 63
- Pharmacology, veterinary, 115. *See also*

- Graduate School of Medical Sciences in
General Index
- Philology: Chinese, 48; medieval, 86
- Philosophical and social foundations:
educational administration, 50
- Philosophy, 96; ancient, 40; medieval, 86; of
science and technology, history and, 68
- Phonological theory, 80
- Photography, 29
- Physical: anthropology, 23; chemistry, 36
- Physics, 98; applied, 26; engineering, 26;
experimental, 98; theoretical, 98
- Physiological ecology, 48
- Physiology, 99; behavioral, 99; cellular, 99;
comparative, 99; gastrointestinal and
metabolic, 99; insect, 57; plant, 34; of
reproduction, 22; reproductive, 99;
sensory, 90; vertebrate, 99; veterinary,
115. *See also* Graduate School of
Medical Sciences in *General Index*
- Planetary: geology, 63; studies, 31
- Planning: city and regional, 37; and design,
environmental, 37; economic develop-
ment and, 49; historic preservation, 37;
history, urban, 37; international, 77;
international development, 37; and
management, facilities, 45; methods, 106;
program, policy analysis and, 72; regional
economics and development, 37;
resource policy and, 88; social and health
systems, 37; theory and systems
analysis, 37
- Plant: breeding, 100; cell biology, 34;
ecology, 34, 48; genetics, 100; molecular
biology, 34; morphology and anatomy,
34; pathology, 101; pathology, molecular,
101; physiology, 34; protection, 103
- Poetry: English, 55
- Policy: analysis, 110; analysis and program
planning, 72; analysis, public, 18;
business and public, 81; and planning,
resource, 88; public, 65, 105; public, risk
assessment, management and, 59;
science and technology, 77
- Political: methodology, 65; thought, 65
- Politics: American, 65; comparative, 65
- Polymer(s): and materials science, 35;
science, 112
- Pomology, 103
- Population: biology, 48; and development,
46; ecology, 48; international, 77; studies,
110
- Power: and machinery, 20; systems, energy
and, 84
- Precambrian geology, 63
- Preservation planning, historic, 37
- Probability, 111; and statistics, applied, 94
- Processing: information, 44; materials,
handling and, 20
- Production: economics, farm management
and, 18; and operations management, 81
- Program: evaluation studies, 72; planning,
policy analysis and, 72
- Programming: languages, 44; mathematical,
94
- Properties management, 70
- Prose fiction, 55
- Psychological anthropology, 23
- Psychology, 104; developmental, 71;
educational, and measurement, 50;
general, 104; human experimental, 104;
personality and social, 104; social, 110
- Psychopathology, developmental, 71
- Public: finance, 50; policy, 65, 105; policy
analysis, 18; policy, business and, 81;
risk assessment, management, and, 59
- Quantitative analysis: for administration, 81;
applied econometrics, and, 18
- Quaternary geology, 63
- Radio astronomy, 31
- Radiophysics, 31
- Regional: economics and development
planning, 37; economics, urban and, 106;
planning, city and, 37; science, 37, 106;
sociology, community and, 46; theory,
urban and, 37
- Religions, Asian, 48
- Remote sensing, 21, 39
- Renaissance: and baroque art, 69; English,
55; medieval and Latin literature, 40
- Reproduction, physiology of, 22
- Reproductive physiology, 99
- Research: methodology, educational, 50;
methods, 110; operations, 94; social,
methods of, 46
- Resource(s): economics, 18; management,
family, 45; management, human, 70;
natural, 88; policy and planning, 88;
sociology, agricultural and natural, 46;
systems, water, 39; water, 117
- Restoration and the eighteenth century
(English language and literature), 55
- Rheology: fluid dynamics, and biorheology,
35
- Rhetoric, classical, 41
- Risk assessment, management and public
policy, 59
- Roads, local, 20
- Robotics, 44
- Rock mechanics, 63
- Romance: linguistics, 80, 107; studies, 107
- Rural development, international agricultural
and, 76
- Russian: history, 67; literature, 109
- Sampling, 111
- Science(s): animal, 22; aquatic, 88; architec-
tural, 27; atmospheric, 21; building
technologies and environmental, 27;
computer, 44; dairy, 61; fiber, 112; field
crop, 21; fishery, 88; food, 61; food, and
technology, 61; forest, 88; geological, 63;

- history of, 67; international food, 61; materials, 82; materials, and engineering, 82; and mathematics education, 50; nuclear, 91; nuclear, and engineering, 91; peace, 50, 96, 106; polymer, 112; polymers and materials, 35; regional, 37, 106; soil, 21; space, 31; surface, 35; and technology, history and philosophy of, 68; and technology policy, 77; textile, 112; wildlife, 88
- Sculpture, 29
- Sedimentology, 63
- Seed technology, 21
- Seismology, 63
- Semantics, 80
- Semitic: languages and literatures, 90
- Sensory physiology, 90
- Slavic: linguistics, 80, 109; studies, 109
- Social: anthropology, 23; and health systems planning, 37; organization and change, 110; and personality development, 71; psychology, 110; psychology, personality and, 104; research, methods of, 46; statistics, economic and, 74, 111
- Sociobiology, 90
- Sociolinguistics, 80
- Sociology, 110; agricultural and natural resource, 46; community and regional, 46; development, 46
- Soil: science, 21; and water engineering, 20
- Solid mechanics, 114
- South Asian linguistics, 29, 80
- Southeast Asian: history, 67; linguistics, 29, 80; studies, 29
- Space: mechanics, dynamics and, 114; sciences, 31
- Spanish: linguistics, 107; literature, 107
- Spatial problems, international, 106
- Statistical: computing, 111; thermodynamics, classical and, 35
- Statistics, 111; applied probability and, 94; biological (biometry), 111; econometrics and economic, 49; economic and social, 74, 111; engineering, 111; mathematical, 111
- Stochastic processes, 111
- Stratigraphy, 63
- Structural: engineering, 39; geology, 63; mechanics, 39
- Structures and their environments, 20
- Surface science, 35
- Surgery, veterinary, 115
- Syntactic theory, 80
- Systematic botany, 34
- Systematics, 48
- Systems: analysis, planning theory and, 37; economic, 49; economics of participation in labor-managed, 49; electrical, 53; environmental and energy, 106; mechanical, and design, 84; planning, social and health, 37; power, energy and, 84; water resource, 39
- Systems engineering: environmental, 39; manufacturing, 94
- Taxonomy, insect, 57
- Technologies, building, and environmental science, 27
- Technology: food processing waste, 61; food science and, 61; history and philosophy of science and, 68; policy, science and, 77; seed, 21
- Textile(s), 112; science, 112
- Theatre: arts, 113; design for the, 113; drama and the, 113; history, 113; theory and aesthetics, 113
- Theoretical: and applied mechanics, 114; chemistry, 36; ecology, 48; physics, 98
- Theory: and behavior, organizational, 81; of computation, 44; and criticism of architecture, 27; decision, 111; economic, 49; literary criticism and, 55; location, 106; of music, 87; phonological, 80; planning, and systems analysis, 37; syntactic, 80; theater, and aesthetics, 113; urban and regional, 37
- Therigenology, 115
- Thermodynamics, classical and statistical, 35
- Toxicology: cellular and biochemical, 59; environmental, 59; insect, and insecticide chemistry, 57
- Transfer, heat: 84; mass and, 35
- Transportation, 106; engineering, 39
- Twentieth century (English language and literature), 55
- Urban: design, 27; development, history of, 27; development, history of architecture and, 27; planning history, 37; and regional economics, 106; and regional theory, 37; studies, 114
- Vegetable crops, 115
- Vertebrate: physiology, 99; zoology, 48
- Veterinary medicine, 115
- Virology, veterinary, 115
- Visual arts, creative, 29
- Waste: in management, environmental engineering and, 20; technology, food processing, 61
- Water: engineering, soil and, 20; resources, 117; resource systems, 39
- Wildlife science, 88
- Women's: literature, 55; studies, 117
- Writing, creative, 55
- Zoology, 118; vertebrate, 48

GENERAL INDEX

See page 150 for Index of Fields, Subjects, and Concentrations.

- Academic resources, 129
- Activities, recreation, and athletics, 148
- Administration: of the Graduate School, 149; of the university, 149
- Admission, 121: to Candidacy Examination, 7. *See also individual fields of study*
- Advisers, 6
- Africana Studies and Research Center, 130
- Agricultural Experiment Station (Geneva, N.Y.), 138
- Agriculture Program, International, 133
- American studies, 130. *See also American studies in Index of Fields, Subjects, and Concentrations*
- Animal Health, James A. Baker Institute for, 138
- Application, 121. *See also individual fields of study*
- Applied Mathematics, Center for, 139
- Art, Herbert F. Johnson Museum of, 145
- Assistantships, 126, 127
- Athletics, 148
- Atomic and Solid State Physics, Laboratory of, 139

- Baker Institute for Animal Health, James A., 130
- Biological Sciences, Division of, 130
- Biophysics Program, 130
- Biotechnology Program, 131
- Boyce Thompson Institute for Plant Research, 142
- Brookhaven National Laboratory, 139

- Career center, 148
- Child care, 148
- China-Japan Program, 131
- College Work-Study, 127
- Comparative and Environmental Toxicology (CET), Institute for, 140
- Computer Graphics, Program of, 132
- Computer Services (CCS), Cornell, 145
- Continents, Institute for the Study of (INSTOC), 140
- Cornell High Energy Synchrotron Source (CHESS), 141
- Cornell Manufacturing Engineering and Productivity Program (COMEPP), 133

- Course(s): and degree requirements, 6; catalog, 161

- Dean of Students Office, 147
- Degree(s): candidates, 121; offered, 7; other, 9; professional, 8, 9; requirements, 6. *See also individual fields of study*
- Development, rural, 135
- Directory, 160
- Disabled students, 148

- Economic Research (CISER), Cornell Institute for Social and, 144
- Educational Testing Service, 122
- Employment: effect on residence credit, 7; for spouses of students, 127
- English: competency in, 123; placement examination, 123; Program, Intensive, 123
- Environmental: Research, Center for, 140; Toxicology, Institute for Comparative and, 140
- Examination(s): Admission to Candidacy, 7; final, 7; Graduate Record, 122; qualifying, 7. *See also individual fields of study*
- Exchange Scholar Program, 132
- Expenses, tuition and, 125
- Extramural Study, Division of, 7

- Faculty, 5
- FALCON Program for Chinese, Indonesian, and Japanese, 14, 30
- Family housing, 147
- Fees, application, 122. *See also Tuition.*
- Fellowships: application for, 122, 126; notification, date of, 123, 126. *See also individual fields of study*
- Fermi National Accelerator Laboratory, 139
- Fields of study, 11, 17. *See also individual fields of study and Index of Fields, Subjects, and Concentrations*
- Final examinations, 7
- Financial: requirement for foreign applicants, 123; support, 122, 125, 127. *See also individual fields of study*
- Foreign applicants: additional application procedures for, 123; financial requirements for, 123
- Foreign language: instruction, 7, 13; requirements, 7. *See also individuals fields of study*

- Gannett Health Center, 147
 General Committee of the Graduate School, 149
 General information, 147
 Grades and degree requirements, 6
 Graduate: assistantships, 127; Management Aptitude Test (GMAT), 122; and Professional School Financial Aid Service (GAPSFAS), 122, 125; Record Examinations (GRE), 122; research assistantships, 127; students, 3
 Graduate School: administration, 149; of Management, Johnson, 9, 160; of Medical Sciences, 160; organization of, 5
 Health: insurance, 147; requirements, 147; services, 147
 Health Center, Gannett, 147
 Housing, 147
 Humanities, Society for the, 136
 In absentia tuition, 125
 Information and referral, 147
 Insurance, health, 147
 International: Nutrition Program, 134; Students and Scholars Office, 147; Studies, Center for, 132; programs, 132
 Japan, China-, Program, 131
 Laboratory: of Atomic and Solid State Physics, 139; Brookhaven National, 139; Fermi National Accelerator, 139; of Nuclear Studies, Floyd R. Newman, 142; of Ornithology, 142; of Plasma Studies, 143
 Language(s): instruction in, 7, 13; requirements, 7, 123. *See also individual fields of study*
 Latin American Studies Program, 133
 Law School, 9, 160
 Legal Studies Program, International, 133
 Libraries, 129
 Loans, 127
 Major subjects, 5, 6, 17. *See also individual fields of study*
 Management, Johnson Graduate School of, 9, 160
 Manufacturing Engineering and Productivity Program, Cornell (COMEPP), 133
 Materials Science Center (MSC), 131
 Mathematical Sciences Institute, 139
 Medical College, Cornell, 9, 160
 Minor subjects, 5, 17. *See also individual fields of study*
 Minority: affairs, 148; fellowships, 126, 148
 Museum of Art, Herbert F. Johnson, 145
 National: Accelerator Laboratory, Fermi, 139; Laboratory, Brookhaven, 139; Nanofabrication Facility, 141
 Newman Laboratory of Nuclear Studies, Floyd R., 142
 New York State Agricultural Experiment Station at Geneva, 138
 Nondegree status, 121
 Nuclear Studies, Floyd R. Newman Laboratory of, 142
 Nutritional Sciences, Division of, 134
 Nutrition Program, International, 134
 Ornithology, Laboratory of, 142
 Part-time studies, 7
 Peace Studies Program, 134
 Plant Research, Boyce Thompson Institute for, 142
 Plasma Studies, Laboratory of, 143
 Population Program, International, 133
 Professional degrees, 8, 9. *See also individual fields of study*
 Professors-at-large, 149
 Provisional status, 121
 Qualifying examination, 7
 Radiophysics and Space Research, Center for, 143
 Recreation and athletics, 148

- Reduced tuition, 125
- Register, 149
- Renaissance studies, 135
- Research: assistantships, 127; centers and facilities, 138
- Residence: facilities, 147; units (credit), 6, 7
- Rural development, 135
- Science: and Engineering, Center for Theory and Simulation in, 144; Technology, and Society (STS), Program on, 135
- Social and Economic Research (CISER), Cornell Institute for, 144
- Society for the Humanities, 136
- South Asia Program, 136
- Southeast Asia Program, 136
- Soviet Studies, 137
- Space Research, Center for Radiophysics and, 143
- Special Committee, 5, 6, 7. *See also individual fields of study*
- Status, change of, 121
- Student services and facilities, 147
- Subjects, 5, 6, 17. *See also individual fields of study and Index of Fields, Subjects, and Concentrations*
- Summer study and residence credit, 6
- Synchrotron Source, Cornell High Energy, (CHESS), 141
- Teaching, 7: assistantships, 127
- Test(s), 122: of English as a Foreign Language (TOEFL), 123
- Theory Center, 144
- Thesis, 7
- Toxicology, Institute for Comparative and Environmental, 140
- Transfer of residence credit, 6
- Tuition, 125: in absentia, 125; reduced, 125
- Tuition Assistance Program (TAP), 127
- University administration, 149
- Veterinary Medicine, College of, 9, 160
- Western Societies Program, 137
- Work-study aid, 127

DIRECTORY

INFORMATION

Cornell telephone numbers may be obtained by calling 607/255-2000 Monday through Friday from 8:00 a.m. to 6:00 p.m.

GRADUATE SCHOOL

The Graduate School offices are open Monday through Friday from 8:15 a.m. to 4:15 p.m.

Main office: 607/255-4884

Dean's office: 607/255-5812

Minority affairs: 607/255-5235

The address is:

Graduate School

Cornell University

Sage Graduate Center

Ithaca, New York 14853-6201

FIELDS OF STUDY

Requests for information about a specific field should be directed to the address indicated in each field of study (pages 17-120) as follows:

Graduate Faculty Representative

Field of [*supply name of Field*]

Cornell University

[*Supply building address*]

Ithaca, New York 14853

CAMPUS OFFICES

Housing Assignment Office

Cornell University

Department of Residence Life

Balch Hall

Ithaca, New York 14853-1401

Family Housing Office

Cornell University

Department of Residence Life

Building 40, Hasbrouck Apartments

Ithaca, New York 14850-2662

University Health Services

Cornell University

Gannett Health Center

Ithaca, New York 14853-3101

Dean of Students Office

Cornell University

Barnes Hall

Ithaca, New York 14853-1601

Services for Disabled Students

Cornell University

Office of Equal Opportunity

Day Hall

Ithaca, New York 14853-2801

International Students and Scholars Office

Cornell University

Barnes Hall

Ithaca, New York 14853-1601

OTHER CORNELL SCHOOLS

Cornell Law School

Myron Taylor Hall

Ithaca, New York 14853-4901

Johnson Graduate School of Management

Cornell University

Malott Hall

Ithaca, New York 14853-4201

Cornell Medical College

York Avenue

New York, New York 10021

Graduate School of Medical Sciences:

•Medical College Division

Graduate School of Medical Sciences

York Avenue

New York, New York 10021

•Sloan-Kettering Division

Graduate School of Medical Sciences

York Avenue

New York, New York 10021

New York State College of Veterinary Medicine

Cornell University

Schurman Hall

Ithaca, New York 14853-6401

PUBLICATIONS

Cornell University publishes the following graduate catalogs to provide information on graduate programs, faculty, facilities, curricula, and courses of various academic units:

- Engineering and Applied Science
Graduate School
- Industrial and Labor Relations
Law School
- Graduate School of Management
- Veterinary Medicine

The master course catalog, *Courses of Study*, contains pertinent information about all aspects and academic units of the university.

Requests for these publications should be addressed to:

Cornell University Catalogs
Building 7, Research Park
Ithaca, New York, 14850-1247

Cornell University
USPS 132-860
Graduate School
Cornell University
Sage Graduate Center
Ithaca, NY 14853-6201

Second-class postage
paid at Ithaca, New York