Cornell University Announcements Graduate School of Medical Sciences 1971-72

Cornell University

Graduate School of Medical Sciences 1971-72

1300 York Avenue
New York, New York 10021
Telephone 212/879–7379 or 212/879–9000

Cornell University Announcements

The Cornell *Announcements* are designed to give prospective students and others information about the University. The prospective student should have a copy of the *Announcement of General Information;* after consulting that, he may wish to write for one or more of the following *Announcements:*

New York State College of Agriculture
College of Architecture, Art, and Planning
College of Arts and Sciences
Department of Asian Studies
Education
College of Engineering
School of Hotel Administration
New York State College of Human Ecology
New York State School of Industrial and Labor Relations
Officer Education (ROTC)
Summer Session

Undergraduate preparation in a recognized college or university is required for admission to certain Cornell divisions, for which the following *Announcements* are available:

Graduate School
Graduate School: Course Descriptions
Law School
New York State Veterinary College
Graduate School of Business and Public Administration
Graduate School of Nutrition
Medical College (New York City)
Cornell University—New York Hospital School of Nursing (New York City)
Graduate School of Medical Sciences (New York City)

Requests for the publications listed above may be addressed to

CORNELL UNIVERSITY ANNOUNCEMENTS
Edmund Ezra Day Hall
Ithaca, New York 14850

(The writer should include his zip code.)

Contents

The courses and curricula described in this *Announcement,* and the teaching personnel listed herein, are subject to change at any time by official action of Cornell University.

Calendar*

1971–72

Fall Semester	
Registration	Wednesday, September 8–Friday September 10
Opening Exercises, 3:00 p.m.	Friday, September 10
Instruction begins for first trimester and fall semester	Monday, September 13
End of first trimester	Wednesday, November 24
Thanksgiving recess	Thursday, November 25–Friday, November 26
Examinations for first trimester	Monday, November 29–Saturday, December 4
Instruction begins for second trimester	Monday, December 6
Christmas recess:	
Instruction suspended, 5:00 p.m.	Friday, December 17
Instruction resumed, 9:00 a.m.	Monday, January 3
Last day for completing all requirements for January degrees	Friday, January 7
Fall semester ends	Friday, January 28
Spring Semester	
Registration	Monday, January 31
Instruction begins for spring semester	Monday, January 31
End of second trimester	Friday, March 3
Examinations for second trimester	Monday, March 6–Saturday, March 18
Instruction begins for third trimester	Monday, March 20
Spring recess:	
Instruction suspended, 5:00 p.m.	Friday, April 7
Instruction resumed, 9:00 a.m.	Monday, April 17
Last day for completing all requirements for June degrees	Monday, May 22
Memorial Day, holiday	Monday, May 29
Commencement, 3:00 p.m.	Wednesday, May 31
End of third trimester and spring semester	Friday, June 9
Examinations for third trimester	Monday, June 12–Wednesday, June 14
Summer	
Summer research period begins	Monday, June 19
Registration for summer research	Monday, June 19
Last day for completing all requirements for September degrees	Monday, August 28
Labor Day, holiday	Monday, September 4
Summer research period ends	Friday, September 8

* Courses in the Graduate School of Medical Sciences are either semestral or trimestral. The calendar for this School is based primarily on the academic semester but is coordinated as well with the trimestral calendar of the Medical College.

Cornell University

Graduate School of Medical Sciences

Purpose and Nature of Graduate Study

The Graduate School of Medical Sciences, a semiautonomous component of the Graduate School of Cornell University, provides an environment for advanced study and research in specific areas of the basic biomedical sciences. Graduate programs leading to the degree of Doctor of Philosophy are currently offered in the Fields of Biochemistry, Biological Structure and Cell Biology, Biology, Biomathematics, Biophysics, Genetics, Microbiology, Neurobiology and Behavior, Pathology, Pharmacology, and Physiology. Certain of these Fields also offer programs leading to the degree of Master of Science. The Faculty recommends the award of advanced general degrees not only as the result of the fulfillment of certain formal academic requirements but also as evidence of the development and possession of a critical and creative ability in science. Proof of this ability is embodied in a dissertation which the candidate presents to the Faculty as an original research contribution in his area of study.

Freedom and independence are key qualities of scholarship, and graduate education at Cornell attempts to preserve them for teacher and student. Each graduate student is supervised by his own Special Committee, a small group of faculty members selected by the student. Within the broad framework provided by requirements for residence, examinations and thesis, and additional regulations of individual Fields, the Cornell graduate student and his Special Committee are completely free to plan a program of study. The Graduate School of Medical Sciences sets no overall course, credit-hour, or grade requirements. The Special Committee has extraordinary independence in guiding the student's program, and the student will be recommended for his degree whenever his Committee judges him qualified.

History

The opportunity for graduate study leading to advanced general degrees in the biomedical sciences was first offered at the Cornell University Medical College in 1912 in cooperation with the Graduate School of Cornell University. In June of 1950, Cornell University, in association with the Sloan-Kettering Institute for Cancer Research, established a new division of the Medical College, the Sloan-Kettering Division, for the purpose of providing additional opportunities for graduate study in the biomedical sciences. The resultant expansion of the Graduate Faculty and facilities on the New York City campus prompted the organization in January 1952 of the Graduate School of Medical Sciences which, with the annual approval of the Graduate Faculty of Cornell University, has full responsibility for advanced general degrees granted for study in residence at the New York City campus.

Facilities

The Medical College Division. The buildings of the Medical College extend along York Avenue from 68th to 70th Streets and contain the main library, lecture rooms and study laboratories for the basic science departments, and extensive research facilities for faculty and students.

The Sloan-Kettering Division. The facilities of the Sloan-Kettering Division consist of the Howard Laboratory and the Kettering Laboratory on East 68th Street in New York City and the Walker Laboratory in Rye, New York. These facilities of the Sloan-Kettering Institute for Cancer Research provide lecture and seminar rooms and well-equipped laboratories for biomedical research.

Organization of the Graduate School

Faculty

The Graduate School of Medical Sciences is composed of two relatively separate divisions, the Medical College Division, consisting principally of the professorial staff of the basic science departments of the Cornell University Medical College, and the Sloan-Kettering Division, consisting of the professorial staff of the Sloan-Kettering Institute for Cancer Research. Within each of these divisions are Fields or Units of graduate instruction formed by faculty members with similar research and teaching interests. An individual faculty member may elect to affiliate with the one

or two Fields or Units in which he agrees to sponsor graduate students.

General Committee

The General Committee of the Graduate School of Medical Sciences is an administrative board whose membership has responsibility for the academic affairs of the School. The Committee considers matters referred to it by members of the faculty and offers recommendations to the faculty on questions involving the interests or policies of the Graduate School of Medical Sciences.

The General Committee is composed of the dean and the associate dean of the Graduate School of Medical Sciences, the associate director of the Sloan-Kettering Division, one elected representative from each of the Fields of the Medical College Division and from each of the Units of the Sloan-Kettering Division, and two student representatives elected by the graduate student body. The General Committee approves new Fields; reviews the admission of students; approves major and minor subjects; reviews the curriculum of each Field; reviews the requirements for degrees; and acts on faculty and student petitions.

The chairman of the General Committee is the dean, who is the academic administrative officer of the Graduate School of Medical Sciences and is also an associate dean of the Graduate School of Cornell University. The secretary of the General Committee is the associate dean, who is also an assistant dean of the Graduate School of Cornell University.

Admission

Applications

For admission to the Graduate School of Medical Sciences an applicant must (1) have a baccalaureate degree or the equivalent from a college or university of recognized standing, (2) have adequate preparation in his chosen field of study, and (3) show promise of ability to pursue advanced study and research, as judged by his previous record.

Candidates may be admitted in September, February, or July. All credentials must be received at least two months prior to enrollment, and the complete application and all supporting credentials must have been approved by the dean at least one month prior to enrollment.

Inquiries about graduate study should be addressed to the Associate Dean of the Graduate School of Medical Sciences, 1300 York Avenue, New York, New York 10021 or to the Associate Director of the Sloan-Kettering Division, 444 East 68th Street, New York, New York 10021. These inquiries are referred to the appropriate Field Representative(s) or Unit Chairman who then corresponds directly with the prospective applicant and sends him pertinent application material. The applicant returns the completed application form to the Field Representative together with (1) official transcripts of records from all colleges and universities attended, (2) a statement of purpose of graduate study, and (3) two letters of recommendation from individuals in academic positions who know the applicant professionally. In addition, scores from the Graduate Record Examinations may be required by individual Fields to aid in evaluating an applicant.

The completed application and all supporting documents are reviewed by the Field or Division Credentials Committee and applicants considered potentially acceptable are usually called for a personal interview. At the time of interview, after discussing his interests with the members of the Field, the applicant may tentatively select a major sponsor. If an applicant is accepted by the Field, his application is forwarded to the dean who may refer it to the General Committee for final review and decision. A student is formally notified of his acceptance for study in the Graduate School of Medical Sciences by a letter from the associate dean.

It is the policy of Cornell University actively to support the American ideal of equality of opportunity for all, and no student shall be denied admission or be otherwise discriminated against because of race, color, creed, religion, or national origin.

Categories of Admission

An applicant is accepted by the Graduate School of Medical Sciences (1) as a degree candidate for the M.S. or Ph.D., or (2) as a provisional candidate.

Provisional candidacy provides opportunity for a prospective degree candidate, whose educational preparation is difficult to evaluate, to begin graduate studies. On the basis of the record of accomplishment in the first half of the academic year, the adviser or temporary Special Committee of a provisional candidate may recommend to the dean that (1) provisional candidacy be changed to degree candidacy, (2) provisional candidacy be continued for the remainder of the academic year, or (3) provisional candidacy be terminated. A maximum of one academic year in the status of provisional candidate is permitted and credit of a maximum of one residence unit may be allowed on petition, provided there is convincing evidence that performance has been of the same quality as would have been required of a degree candidate.

Degree Requirements

Major and Minor Subjects

The faculty members of each Field specify major and minor subjects of study for fulfillment of the requirements for the degrees of Master of Science and Doctor of Philosophy. A candidate for the degree of Master of Science is required to register for one major and one minor subject. A candidate for the degree of Doctor of Philosophy is

required to register for three subjects, one major and two minors. At least one of the minors must be outside the area of his major subject.

The Special Committee

The general degree requirements of the Graduate School of Medical Sciences are minimal in order to give maximal flexibility in choosing a desirable program of study. The student's program is determined with the aid and direction of a Special Committee of faculty members chosen by the student from those Fields which best fit his areas of interest. Satisfactory progress toward the degree is judged by the Special Committee rather than by arbitrary standards imposed by the Graduate School of Medical Sciences. There are no regulations of the Faculty of the Graduate School of Medical Sciences governing the specific content of instruction, courses, or grades to which the Special Committee must subscribe, except those imposed by the Fields. The Special Committee is the agent primarily responsible for the candidate's development as an independent scholar and scientist.

No later than four weeks after enrollment, a candidate must file a statement of the major and minor subjects he has selected for study. After selecting his major and minor subjects, the student must choose one member of the faculty to represent each subject and to serve on his Special Committee. The faculty member representing the major subject usually advises the student in his other selections and serves as the chairman of his Special Committee. At least one member of the Special Committee must represent a Field different from the candidate's major Field. Members of a Special Committee may agree to serve temporarily during the candidate's first year of residence until he has had opportunity to become acquainted with areas of research in the Fields of his choice. On completion of this year of residence, a permanent Special Committee will be formed. The membership of a Special Committee can be changed with agreement of all members of the old and newly formed Committees and the approval of the dean.

The members of the Special Committee decide upon the student's program of study and research and judge whether his progress toward a degree is satisfactory. After consulting with the other members, the chairman of the Special Committee prepares term reports on the candidate for submission to the dean. The members of the Committee serve on all of the candidate's examining committees and they approve his thesis.

Registration and Course Grades

At the beginning of each term, the student is required to register with the dean of the Graduate School of Medical Sciences and to file a Registration of Courses form indicating all courses he will take. A fee of ten dollars is charged for late registration. No student may double-register for an advanced general or professional degree with any other school or college except the Cornell University Medical College.

All courses for which the student registers for credit will be entered in his official record. Grades of graduate students are reported as: Excellent (E), Satisfactory (S), Unsatisfactory (U), Incomplete (I), Absent (Abs), or Unofficially Withdrawn (W). A grade of Incomplete or Absent cannot be changed later than one term following that in which the course was taken.

Residence

The Faculty of the Graduate School of Medical Sciences regards study in residence as essential. Full-time study for one half academic year with satisfactory accomplishment constitutes one residence unit. Two units of residence are the minimal requirement for the Master's degree and six units are the minimum for the Ph.D. degree. However, the time necessary to obtain the degree generally exceeds the minimal requirements. A candidate for the Ph.D. degree must spend two of the last four units of required residence in successive terms on the New York City or the Ithaca campus of Cornell University. No more than seven years may intervene between the time of first registration and the completion of all requirements for the doctoral degree; a student must complete all requirements for the Master's degree in four years.

The graduate student who participates in teaching or assists in research qualifies for full residence credit only if his duties are in the field of his major subject and do not require more than twenty hours per week. Part-time graduate study, if it is necessitated by off-campus employment non-contributory to the major field of study, is not encouraged. Requests for part-time study must be reviewed by the General Committee. If permission is granted for part-time study, the student must be in residence at least half-time.

The legislation with respect to eligibility of part-time students for residence units is as follows:

Employment	Residence Units Allowable Per Half Academic Year		
Total clock hours per week	Contributory in the major field of study and on campus	Noncontributory but on campus	Off campus
0–10 hrs.	1 unit	1 unit	¾ unit
11–20 hrs.	1 unit	¾ unit	¾ unit
21–30 hrs.	¾ unit (teaching) ¾–1 unit (research)*	½ unit	———

* Time spent assisting in research, if it is contributory to the major field of study, shall be credited toward allowance of a full residence unit.

Transfer of Residence Credit

No residence credit will be granted for study outside the Graduate School of Medical Sciences to fulfill the requirements of the M.S. degree. No commitment can be made about granting residence credit toward the Ph.D. requirements for previous study in another graduate school until after the candidate has entered into residence at the Graduate School of Medical Sciences. At that time, the student's Special Committee may recommend acceptance of study outside the Graduate School of Medical Sciences to the General Committee which will determine the number of residence units to be awarded. In general, a maximum of two units may be transferred, but the dean may approve acceptance of a maximum of three units and, on petition, the General Committee may approve a maximum of four units. No credit can be transferred for study undertaken as an undergraduate or as a special student even in courses designed for graduate students.

A student, who has satisfactorily completed two or more academic years of study toward the degree of M.D. at the Cornell University Medical College or another accredited medical school in the United States with a curriculum equivalent to that of the Cornell University Medical College, may transfer a maximum of two units of residence credit after passing an evaluation examination administered by a committee appointed by the General Committee of the Graduate School of Medical Sciences.

Study in Absentia

A candidate for the degree of Ph.D. may petition for permission to earn residence units for study away from Cornell University while regularly registered in the Graduate School of Medical Sciences. A candidate to whom this privilege has been granted may work temporarily under the immediate supervision of an individual designated by his Special Committee, but his program will continue to be directed by the Committee. For study in absentia, not more than two residence units may be earned toward fulfillment of the minimal residence requirements for the degree of Ph.D.

Examinations

Three examinations are required by the Faculty of the Graduate School of Medical Sciences: (1) final examination for the M.S. degree; (2) examination for admission to doctoral candidacy; and (3) final examination for the Ph.D. degree. Examinations are administered by an Examining Committee consisting of a chairman appointed by the dean, the members of the candidate's Special Committee, and, in Fields that so specify, other members of the Faculty of the Graduate School of Medical Sciences and outside examiners designated by the Field. In addition to these examinations, the candidate's major Field may require a qualifying examination as part of its evaluation of the candidate after he has completed two units of residence credit.

For the M.S. degree the final examination may be oral or both oral and written.

For the Ph.D. degree the admission to candidacy examination is both oral and written and certifies that the student is eligible to present a thesis to the Faculty of the Graduate School of Medical Sciences. The examination may not be taken until two units of residence credit have been accumulated; a minimum of two units of residence credit is required after passing this examination before the final examination can be scheduled. The final examination for the Ph.D. degree is an oral defense of the candidate's thesis. It must be passed within four years after completion of the required residence units, or after seven years from the date of first registration, whichever is sooner.

Foreign Language Requirements

Each Field of study has its own foreign language requirements. The student's Special Committee may require knowledge of foreign languages beyond the requirements of the Fields listed in this *Announcement.*

Examinations in foreign languages will be administered by the Office of the Dean at the beginning of each term. As an alternative to this examination, the candidate may demonstrate proficiency by passing the reading part of the language qualification tests administered by the College Entrance Examination Board.

Theses

A principal requirement for both the M.S. and the Ph.D. degrees is the presentation of a thesis constituting an imaginative contribution to knowledge. Ordinarily, the thesis is written on a research topic in the candidate's major field of study, under the direction of the chairman of his Special Committee. The Faculty requires that the Ph.D. thesis be published in abstract and be recorded on microfilm.

Tuition and Fees

Tuition for a student regularly matriculated in the Graduate School of Medical Sciences is $2,400 for the academic year and is payable in either two or three equal parts, the first of which is due at initial registration. Tuition includes fees for matriculation, hospitalization insurance, graduation, and miscellaneous thesis expenses.

A graduate student who has previously fulfilled all other degree requirements and who returns to the Graduate School of Medical Sciences to present his thesis and to take the final examination must register as a Candidate for Degree Only and pay a fee of $35.

Part of the tuition fee will be refunded to a student who officially withdraws or takes a leave of absence during the first nine weeks of a term.

A student who is to receive partial residence credit because of his employment should apply for proration of tuition on forms obtainable at the Office of the Dean.

The amount, time, and manner of payment of tuition, fees, or other charges may be changed at any time without notice.

Financial Assistance

Financial assistance is usually available to qualified applicants. Individual Fields or Units may offer predoctoral research fellowships, research assistantships, or teaching assistantships. These positions may provide a stipend in addition to tuition. Information about these positions may be obtained directly from the Field or Unit at the time of application.

Nationwide, competitive predoctoral fellowships are also available from the National Science Foundation, the National Research Council, and the U. S. Public Health Service. Information about these fellowships should be requested directly from the appropriate governmental agency.

New York State residents are eligible for several predoctoral fellowships and for Scholar Incentive Awards which assist in tuition payment. Application forms may be obtained from the Regents Examination and Scholarship Center, State Education Department, Albany, New York 12224.

Opportunity for part-time employment is often available in departmental research projects or other activities. Applications should be made directly to individual departments.

Student Health Service

Complete ambulatory medical care is provided for all students enrolled in the Graduate School of Medical Sciences through the Personnel Health Service of the Medical Center. The student matriculating for the first time is required to have a physical examination by a member of the Health Service staff. In addition, the student must report for a chest x-ray examination, tuberculin test, and necessary immunizations. No charge is made for medical care through the Health Service nor for any x rays, laboratory tests, or procedures which may be needed.

The student is required to carry Associated Hospital Service (Blue Cross) hospitalization insurance unless similar hospitalization insurance is currently in effect. The cost of this insurance for an unmarried student is included in the tuition fee. Wives and dependents of students may be covered by the hospitalization insurance policy for a small additional fee. Wives and families of students are not eligible for care through the Personnel Health Service but will be referred to appropriate members of the hospital staff for medical care.

Fields of Instruction

Instruction at the Medical College Division

Biochemistry

Faculty

Roy W. Bonsnes, Esther Breslow, George W. Dietz, Jr., Gordon F. Fairclough, Helena Gilder, Jack Goldstein, Rudy H. Haschemeyer, S. Steven Hotta, Alton Meister, Aaron S. Posner, Julian R. Rachele, Charlotte Ressler, Robert R. Riggio, Albert L. Rubin, W. Bruce Rowe, Brij Saxena, Edward T. Schubert, Gabriel Schwartz, Kurt H. Stenzel, Suresh S. Tate, Daniel Wellner, Kenneth Woods

Field Representative

Rudy H. Haschemeyer, Department of Biochemistry, Room E-113, Medical College

Graduate instruction is offered leading to the Ph.D. or M.S. degree. Within the framework of degree requirements and in consultation with the student, the course of study is planned to fit the needs of the individual. Although formal course work is required, emphasis is placed on research. Research opportunities exist in various areas of biochemistry including enzymology, structure and function of proteins and nucleic acids, molecular biology, physical biochemistry, and the intermediary metabolism of amino acids, carbohydrates, nucleic acids, and lipids. Entering graduate students usually work for short periods in several of the laboratories of the faculty members of the Field before beginning thesis research. Students are encouraged to choose challenging and fundamental research problems that are on the frontiers of biochemistry.

The laboratories of the faculty members are equipped with virtually all of the instruments and facilities required for modern biochemical research; thus, graduate students are instructed in such methodology as chromatography, counter-current distribution, radioactive and stable isotope techniques, spectrophotometry, electrophoresis, and analytical ultracentrifugation.

Students undertaking graduate study in biochemistry must have a sufficiently comprehensive background in chemistry to pursue the proposed course of study and must present evidence of knowledge of biology, general experimental physics, and mathematics (including differential and integral calculus). Opportunity is offered to remedy deficiencies in these areas during the first year of graduate study. The Graduate Record Examinations (the Aptitude Test and the Advanced Test in Chemistry) are ordinarily required.

The language requirement for the Ph.D. degree is proficiency in two modern foreign languages which are acceptable to the student's Special Committee. For the M.S. degree, proficiency in one foreign language suffices.

Proficiency in a computer science language, as demonstrated by executing a meaningful program, may substitute for proficiency in one of the required foreign languages.

Special Interests of the Faculty

R. Bonsnes: Intermediary metabolism; static and dynamic composition of body fluids.

E. Breslow: protein-protein and metal ion-protein interactions; chemistry of the neurophysins.

G. Dietz, Jr.: nucleic acid biochemistry; biochemical mechanisms of transport.

G. Fairclough: protein chemistry; clinical biochemistry.

H. Gilder: metabolic response to surgery; electrolyte studies of gastric juice; studies in experimental shock.

J. Goldstein: role of RNA in protein synthesis; fractionation of nucleic acids; role of macromolecules and protein synthesis in the maturation of red blood cells.

R. Haschemeyer: structure of fibrinogen and subunit interactions in protein and nucleoproteins; electron microscopy of enzymes and viruses.

S. Hotta: intermediary metabolism of brain; fundamental aspects of maintenance of cellular sulfhydryl groups.

A. Meister: enzymology; proteins and amino acids.

A. Posner: crystal chemistry; ultrastructural biochemistry; atomic structure of bone; hard tissue chemistry.

J. Rachele: metabolism of amino acids, one-carbon units, and methyl groups; isotope effects.

C. Ressler: relationship of amino acid metabolism in certain plants and microorganisms to human nutrition and disease; special aspects of the chemistry of amino acids and peptides.

A. Rubin: collagen structure and function; biomaterials research; dialysis; transplantation research.

W. Rowe: urea formation; action of methionine sulfoximine.

B. Saxena: chemistry, measurement, and mechanism

of action of pituitary protein hormones.
E. T. Schubert: enzyme studies of the developing kidney; investigation of renal dysfunction at enzyme level.
K. Stenzel: transplantation; dialysis and biomaterials research.
S. Tate: structure-activity relationships in enzymes; vitamin B_6 derivatives.
K. Woods: physicochemical understanding of human blood fractions; blood coagulation; structure of antibodies.

Courses

1. General Biochemistry. This introductory course is designed to provide the student with a knowledge of the fundamentals of biochemistry and an appreciation of the molecular basis of biological phenomena. Graduate students in Biochemistry are required to pass this course (or its equivalent) prior to pursuing advanced courses. First trimester: M T Th F 2–3. Second trimester: T Th F 2–3. The staff.

2. Introduction to Research. Experimental biochemistry dealing with the isolation, synthesis and analysis of substances of biochemical importance (enzymes, coenzymes, various metabolites and intermediates), and study of their properties by various chemical and physical techniques. The student obtains this varied research experience by spending approximately two months in the laboratory of each of four faculty members of his choice. For incoming graduate students majoring in Biochemistry. The staff.

3. Selected Topics in Biochemistry. Advanced study in selected topics will be offered in areas such as: (1) nucleic acids and protein synthesis; (2) intermediary metabolism; (3) kinetics and enzyme mechanism; (4) protein chemistry; (5) structure of membranes and the biochemistry of transport. Generally, one or two of these courses will be offered yearly in the third trimester. The staff.

4. Advanced Graduate Biochemistry. The course is offered jointly by the Faculties of the Medical College and Sloan-Kettering Divisions. Details are given on p. 22 under Interdivisional Courses.

Biological Structure and Cell Biology

Faculty

Carl G. Becker, Dorothea Bennett, Dana C. Brooks, Peter G. Bullough, John T. Ellis, James L. German III, Michael D. Gershon, Fakhry G. Girgis, Jack Goldstein, Roger L. Greif, Wilbur D. Hagamen, Martin D. Hamburg, Myron S. Jacobs, John MacLeod, Thomas H. Meikle, Jr., C. Richard Minick, Leonard L. Ross, Charles A. Santos-Buch, Edward T. Schubert, Gabriel H. Schwartz, John F. Seybolt, Julio L. Sirlin, David Soifer, Kurt H. Stenzel, Dieter H. Sussdorf, Roy C. Swan, John C. Weber, Myron Winick

Field Representative

Michael D. Gershon, Department of Anatomy, Room A-016, Medical College

Graduate study in the Field of Biological Structure and Cell Biology leads to a Ph.D. degree and emphasizes the basic relationships between structure and function of biological systems at all levels of organization. Thus the Field is fundamentally concerned with the nature, development and functional modulation, and significance of configuration, pattern and other spatial relations in biological systems. The scope of interest extends from the molecular level to that of the whole organism and embraces normal as well as pathological structure.

Opportunities for research training include the investigation of cellular fine structure, using such techniques as light and electron microscopy, isolation and analysis of cellular sub-fractions by differential ultracentrifugation, histochemistry, cytochemistry, and enzyme neuroanatomy, including the physiological correlates of changing neural structure.

For graduate study in the Field of Biological Structure and Cell Biology, adequate undergraduate preparation in biology, chemistry (including organic chemistry), physics, and mathematics is recommended. Requirements for admission are flexible in proportion to the promise and accomplishments of the applicant. Applicants are generally requested to present the results of the Graduate Record Examinations.

Requirements for minor sponsorship in the Field of Biological Structure and Cell Biology will be arranged with individual students, but research experience in the minor sponsor's laboratory is strongly encouraged.

In addition to the courses offered by the Field and listed below, appropriate courses for graduate students in the Field are General Biochemistry and those courses given by the Field of Neurobiology and Behavior.

A reading knowledge of French, German, Spanish, or Russian is desirable; proficiency in a foreign language may be required for a candidate by his Special Committee.

Special Interests of the Faculty

D. Bennett: mammalian genetics, with special reference to genetic regulation during early embryonic development.
D. C. Brooks: spontaneous electrical activity of the central nervous system; brain stem influences upon the visual system during sleep and wakefulness in the cat.
P. G. Bullough: combined clinical, biochemical, and histological study of osteogenesis imperfecta; and histological study of the pathogenesis of chondromalacia and cartilage breakdown.
J. T. Ellis: experimental pathology.
J. L. German: clinical and laboratory investigation in the field of human and medical genetics, particularly emphasizing cytogenetics.
M. D. Gershon: the role of monoamines and the action of psychotomimetic drugs in the mammalian nervous system.
F. G. Girgis: the cranial and facial sutures; their development, structure and the analysis of sutural position. Special attention is given to factors inducing chondrogenesis in the cranial vault.
W. D. Hagamen: self-stimulation, habituation, and changes in affective behavior in cats; artificial intelligence in computers.
M. S. Jacobs: anatomy of the cetacean central nervous system.
J. MacLeod: research in human male reproduction.
T. H. Meikle, Jr.: animal studies of neural mechanisms basic to learned behaviors, particularly visual learning.
T. C. Rodman: analytical cytology of cell nuclei; cytogenetics.
L. L. Ross: morphological and biochemical studies of central nervous system synapses.
J. Sirlin: biology of RNA.
D. Soifer: structure and function of microtubules.
R. C. Swan: fine structure of excitable cells.
J. C. Weber: vitamin D and mineral metabolism in hard tissue.

Courses

1. Microscopic Anatomy. The course in microscopic anatomy and development offered by the Department of Anatomy in the Medical College to the first-year medical class is open to graduate students. Selected concepts of fine structure, the mechanisms by which structure develops, differentiates, and ages, and the genetic control of these mechanisms are presented in the lectures to indicate a pattern of study and depth of analysis which the student can be expected to apply to his informal study of cells and tissues. First trimester and second trimester. The staff.

2. Laboratory in Microscopic Anatomy. The laboratory consists of a series of discussions and exercises designed to acquaint the student with the fundamental principles of microscopic anatomy. The students are issued slides to view through their own microscopes. Kodachrome transparencies are shown to supplement the slide collection. The lectures in microscopic anatomy and development are corequisites or prerequisites. First trimester and second trimester. Professor Gershon.

3. Gross Anatomy. Regional anatomy is studied principally through dissection of the human body. Supplementing this are prosections by instructors, tutorial group discussions and radiographic and endoscopic demonstrations. First trimester and second trimester. The staff.

4. Seminar. Seminars are scheduled on selected topics in biological structure including fine structure, development, cell biology, neuroanatomy, and genetics. Senior members of the staff and guest speakers conduct informal discussions on current research in their respective fields. Hours to be arranged. The staff.

Biomathematics

Faculty

Betty J. Flehinger, Richard P. Kelisky, Joel L. Lebowitz, Sol I. Rubinow

Field Representative

Sol I. Rubinow, Division of Biomathematics, Room C-208, Medical College

The Field of Biomathematics offers a wide range of opportunities for the development of quantitative methods in the biological and medical sciences, with special emphasis on the application of mathematics. Graduate study programs leading to advanced degrees in the Field of Biomathematics are available to students whose primary interests are mathematical, but who wish to concentrate on biological or medical applications.

Graduate students are admitted to study in this Field from a variety of educational backgrounds, including the several branches of engineering and the physical and biological sciences as well as mathematics. Their programs of study include a thorough grounding in mathematical methods and a particular biological area of interest.

The thesis in Biomathematics must be a mathematical contribution toward the solution of a problem arising in a biomedical area.

Graduate students in the Field of Biomathematics are required to obtain thorough training in linear algebra, complex variables, and partial differential equations and boundary value problems. In addition to other courses, an appropriate plan of study in the relevant aspects of biology, chemistry, physics, and medicine will be made to suit the particular area of application of the individual student. A programming language such as Fortran is required in lieu of a foreign language.

Special Interests of the Faculty

B. J. Flehinger: biostatistics, medical diagnosis with computers, clinical trials.
R. P. Kelisky: computers in medicine.
J. L. Lebowitz: cell proliferation, enzyme kinetics.
S. I. Rubinow: blood flow, cell proliferation, enzyme kinetics, physiological systems.

Courses

1. Introductory Biomathematics I, II, and III. An introduction to the use of elementary mathematics in various areas of medicine and biology. The course is divided into three parts, offered separately in each trimester. Topics vary from year to year. Hours to be arranged. Professor Rubinow.

2. Biomathematics Seminar. Presentation of research investigations by the staff, as well as student reports on various topics chosen from the current literature. Required of Biomathematics majors. Hours to be arranged. The staff.

Genetics

Faculty

Alexander G. Bearn, Dorothea Bennett, June L. Biedler (SKD), Edward A. Boyse (SKD), Liebe F. Cavalieri (SKD), Hartwig Cleve, Betty S. Danes, James L. German, Zsolt Harsanyi, Stephen D. Litwin, Lloyd J. Old (SKD), Toby C. Rodman, Selma Silagi, Julio L. Sirlin

Field Representative

Dorothea Bennett, Department of Anatomy, Room A-223, Medical College

Academic and research training is available chiefly in the following areas: cytogenetics, developmental genetics, human biochemical genetics, human somatic cell genetics, immunogenetics, microbial genetics, and nucleic acid biochemistry. The faculty includes members of the preclinical and clinical departments of the Medical College and faculty members of the Sloan-Kettering Division; a unique opportunity for integrating the study of genetics with other biological and medical interests is thus provided. Within broad limits each student pursues his own program according to his particular interests.

The usual prerequisites for admission to graduate study for an advanced degree in genetics are: undergraduate work in chemistry or biology, and courses in general genetics, general chemistry, organic chemistry, general biology, general physics, and mathematics through calculus. Applicants are required to present Graduate Record Examinations scores in the Aptitude Tests and in the Advanced Test in Chemistry or Biology.

Courses generally required of genetics majors are those numbered 1 through 3 below, and General Biochemistry and Microscopic Anatomy given by the Fields of Biochemistry and of Biological Structure and Cell Biology, respectively. Other courses appropriate for students in genetics include those numbered 4 through 6 and Molecular Genetics and Advanced Virology offered by the Biochemistry Unit of the Sloan-Kettering Division and by the Field of Microbiology, respectively.

Students minoring in genetics are required to take four semesters of the genetics seminar. A limited

period of work in the laboratory of the minor sponsor is encouraged.

Requirements for foreign language are at the discretion of the student's Special Committee, although the Field recommends a reading knowledge of French or German.

The Field requires an oral qualifying examination at the end of the first year of residence. The Field prefers that the admission to candidacy examination be taken at the end of the second year of graduate work, and that the written portion consist of two parts: (1) a research proposal defining the candidate's prospective thesis work and (2) answers written over a period of two weeks to general questions submitted by a committee of the field. The oral examination will include discussion of the specific research proposal and general biological topics.

Special Interests of the Faculty

A. G. Bearn: biochemical and somatic cell genetics of man.
D. Bennett: mammalian developmental genetics, immunogenetics.
J. L. Biedler: cytogenetics.
E. A. Boyse: mammalian immunogenetics.
L. Cavalieri: DNA replication in bacteria and bacteriophage.
H. Cleve: human biochemical genetics, genetic variability of serum proteins, enzymes, and membrane proteins.
B. S. Danes: somatic cell genetics (with particular emphasis on human genetic metabolic errors).
J. L. German: mammalian cell genetics and cytogenetics.
Z. Harsanyi: biochemical genetics of microorganisms.
S. D. Litwin: genetics of immunoglobulins and serum proteins.
L. J. Old: tumor immunovirology.
T. C. Rodman: cytogenetics with emphasis on mechanisms of genetic control.
S. Silagi: gene action and cellular differentiation in culture.
J. L. Sirlin: biology of macromolecules.

Courses

1. Genetics Seminar. The seminar is a six-semester sequence in advanced genetics covering genetic fine structure, biology of RNA, cytology and cytogenetics, developmental genetics, advanced general genetics with special emphasis on populations, and human and medical genetics. Genetic fine structure and biology of RNA will be the topics covered in 1971–72. T 3–5. Professors Bennett and German.

2. Human Genetics Rounds. The course consists of a conference at which a patient with a genetic disorder is presented for discussion of both medical and genetic aspects of the condition. Given every two weeks throughout the year. M 4. Professors Danes and Cleve.

3. Genetics Journal Club. An informal meeting of students and staff at which current literature or research is discussed. Held every two weeks throughout the year. F 12. The staff.

4. Medical Genetics Lectures. This course deals specifically with genetics as it pertains to human population and human disease, covering the topics of human cytogenetics, Mendelian principles in man, and gene action pertaining to gene interaction, regulation of gene activity, inborn errors of metabolism, Hardy-Weinberg equilibrium, and mutation and selection. Second trimester: W 3–4. Professors Bennett, Bearn, Cleve, Danes, German, and Litwin.

5. Clinical Cytogenetics. Practical experience in chromosome analysis in the laboratory. Introduction to tissue culture techniques. Participation in medical genetics rounds (pediatrics). Review in depth of assigned subjects pertaining to clinical problems actually encountered on rounds or in the cytogenetics laboratory. The course will be limited to two students. Third trimester: 1 day a week for 7 weeks; hours to be arranged. Professor German.

6. Biology of RNA. The course deals with the events and controls of transcription and translation, and is essentially an intensive laboratory course where the student will learn to separate, handle, and analyze RNA species in their native biologically active configuration. The course will be limited to two students. Prerequisite is an interview with instructor. Third trimester: 14 hours per week; hours to be arranged. Professor Sirlin.

Microbiology

Faculty

Robert W. Dickerman, Leonhard Korngold, Michael J. Lyons, Donald W. Mackenzie, William M. O'Leary, William F. Scherer, Laurence B. Senterfit, Gregory W. Siskind, Dieter H. Sussdorf
In addition, the following members of the Department of Microbiology in the Medical College participate in the graduate program: James L. Beebe, Zsolt Harsanyi.

Field Representative

Dieter H. Sussdorf, Department of Microbiology, Room C-235, Medical College

The Field of Microbiology offers graduate training leading to the Ph.D. degree. Candidates can select an area or research interest and activity from such microbiological topics as general and medical bacteriology, microbial chemistry and physiology, microbial genetics, immunology, mycology, and virology.

Prospective students should complete at the undergraduate level a minimum of one year (or its equivalent) in general chemistry, organic chemistry, general physics, mathematics (including college algebra), botany or zoology (preferably both), and one semester or its equivalent of analytical or quantitative chemistry. General microbiology or bacteriology and calculus are strongly recommended. Students who have not completed the above requirements may be admitted to graduate study on the condition that deficiencies be removed soon after admission. Applicants are ordinarily required to present Graduate Record Examinations scores for the Aptitude Tests and Advanced Test in Chemistry or Biology.

Individual programs are determined by the student's Special Committee, composed of faculty members representing his major and minor subjects. Students majoring in microbiology select their primary courses from those listed below. The nature and number of other courses, which may be taken at this institution or at nearby universities, will depend on the student's minor subjects, his research activities, his individual interests, and the advice of his Special Committee.

The Ph.D. candidate is required to be proficient in two modern foreign languages acceptable to his Special Committee. One foreign language may be substituted by a computer science language, in which proficiency is demonstrated by the execution of a meaningful program.

Although a qualifying examination is not ordinarily given, a student's Special Committee has the pre-

rogative of requiring it. The admission to candidacy examination is administered by a committee consisting of a chairman appointed by the dean, the student's Special Committee, and three additional faculty members in the Field of Microbiology. The written portion of this examination tests for basic facts and concepts in the candidate's areas of study and for his problem-solving ability within and across disciplinary boundaries. The oral examination provides an opportunity for the student to correct deficiencies in the written examination, to be examined further on general knowledge, and to discuss and be questioned on his planned or current research.

Special Interests of the Faculty

J. L. Beebe: role of microbial lipids in membrane activities, especially with regard to transport.

R. W. Dickerman: involvement of birds and mammals in the ecology of mosquito-transmitted viruses.

Z. Harsanyi: genetic control of enzyme structure, drug and chemically induced chromosomal aberrations, genetics of *Aspergillus nidulans.*

L. Korngold: antigenic structure of immunoglobulins and of various human tissues.

M. J. Lyons: biochemical and morphological aspects of the interaction of arboviruses with vertebrate and ecologically related arthropod cells; morphogenetic and ultrastructural studies of viruses.

D. W. Mackenzie: strain differentiation of pathogenic fungi and application to epidemiology, pathogenesis and immunogenesis, relationship between morphogenesis and pathogenesis of *Candida albicans;* fungal viruses.

W. M. O'Leary: microbial cellular composition, exo- and endo-toxin structure and function, mechanisms of pathogenesis, microbial lipids.

W. F. Scherer: cell-virus relationships, virus virulence, host defense mechanisms, ecology and epidemiology of arboviruses, especially mosquito-borne encephalitis viruses of tropical North and Central America.

L. B. Senterfit: antigenic structure of mycoplasma; pathogenesis of respiratory viral and mycoplasmic disease, vaccine development, clinical microbiology.

G. W. Siskind: factors involved in control of the immune response; changes in antibody affinity and heterogeneity with increasing time after immunization.

D. H. Sussdorf: function of the thymus and related lymphoid tissues in development of immunocompetence; cellular and molecular aspects of antigen degradation.

Courses

Students who wish to attend any of the following courses either for credit or as an auditor should contact the office of the Department of Microbiology or the faculty member responsible for each course well in advance of the beginning of each course. In general, as many students as possible are accommodated in lectures; however, participation in laboratory sections is restricted.

1. General Microbiology. This course is offered by the staff of the Field of Microbiology of the Medical College Division and of the Biology Unit of the Sloan-Kettering Division. For details, refer to Interdivisional Courses, p. 22. Given every second year. Not given in 1971–72. Professors Hutchison (SKD) and O'Leary.

2. Microbiology and an Introduction to Infectious Disease. This course is presented in the first and second trimesters and consists of laboratory experiments, lectures, and group discussions. The laboratory work includes an introduction to the procedures used in studying microorganisms, experiments on various physical and biological manifestations of antigen-antibody reactions, the actions of chemotherapeutic agents, a survey of the microbial flora of the upper respiratory and lower intestinal tracts of healthy humans, and an intensive study of the causal agents of specific infections, including fungi, spirochetes, rickettsiae, and viruses, as well as bacteria. The lectures are directed toward the development of basic concepts, particularly the principles involved in microbial growth, the principles underlying active immunization, and the factors that enter into host-parasite relationships. Emphasis is placed on aspects related to the etiology, pathogenesis, epidemiology, and prevention of infectious disease. Special attention is also given to the immunological principles underlying such noninfectious conditions as hypersensitivity, autoimmunity, and rejection of tissue transplants. Given every year. Professor Scherer.

3. Advanced Diagnostic Microbiology. The lecture and laboratory sessions acquaint the student with the procedures used in and technique of management of a clinical microbiology laboratory. Emphasis is upon developing the student's capability in the isolation and rapid identification of organisms from various types of clinical specimens. Liberal use is made of clinical materials available through the diagnostic laboratories of the New York Hospital. Given every other year in the third trimester. Given in 1971–72. Professor Senterfit.

4. Microbial Chemistry and Physiology. Lectures cover literature and methodology pertinent to physicochemical properties of microorganisms and their environments, the growth and death of microorganisms, chemical composition of cells and subcellular structures, nutritional requirements, microbiological assay and auxotrophic mutants, energy metabolism, degradations and biosyntheses, the physiology of pathogenesis, and important microbial products. Laboratory sessions provide experience with large-scale culture and recovery of cells, synthetic media, microbiological assay, extraction of cellular constituents, respirometry, and studies of substrate utilization employing radioactive metabolites. Minimal prerequisites are general microbiology, qualitative and quantitative analysis, organic chemistry, and at least one semester (or its equivalent) of biochemistry. Given every year in the third trimester. T Th, lectures 10–11; laboratory 2–5. Professor O'Leary.

5. Advanced Microbial Genetics. Selected concepts of molecular genetics are examined using both prokaryotic and eukaryotic microorganisms as models. Topics include intra- and intercistronic complementation, mitotic and meiotic recombination, genetic control mechanisms, gene conversion, polyploidy and aneuploidy, genetic interference, mechanisms of suppression, and polarity. The course is designed to elucidate the genetic methods available for studying hereditary material. Third trimester: one lecture weekly. Dr. Harsanyi.

6. Advanced Immunology. Two lectures and two laboratory periods weekly. Lectures emphasize current concepts regarding antigen and antibody structure, the physical and biological manifestations of antigen-antibody reactions, and recent developments in studies on the cellular basis of immunity, including antibody formation. The laboratory will cover the isolation, purification, and quantification of antibodies; the critical measurement of antigen-antibody reactions; histological mechanisms during the immune

process; and *in vivo* effects of specific antigen-antibody reactions. Minimal prerequisites are introductory immunology (as given in courses in general microbiology) and at least one semester (or its equivalent) of biochemistry. A semester course in histology or microscopic anatomy is desirable. Given every third year in the third trimester. Given in 1971–72. Professor Sussdorf.

7. Advanced Virology. This course presents, in lectures and laboratory sessions, modern concepts and techniques of virology. Virus structure, chemical composition, physical and biologic properties, and relationships with host cells are considered in depth. Minimal prerequisites for credit are general microbiology and at least one semester (or its equivalent) of biochemistry. Given every second or third year. Not given in 1971–72. Professor Lyons.

8. Arthropod-Borne Virology and Related Ecology and Epidemiology.
Section A. Principles of arthropod-borne virology.
Section B. Entomology in relation to arthropod-borne virology.
Section C. Ornithology in relation to arthropod-borne virology.
Section D. Mammalogy in relation to arthropod-borne virology.
Section E. Human and veterinary diseases caused by arthropod-borne viruses.

Section A is given at Cornell University Medical College usually during late June and early July, and sections B-E at field laboratory sites in Central America during late July and August. Section A and one or two others are offered each summer. Members of the faculty are from Cornell and collaborating institutions in Central America. Each section follows a syllabus and consists of literature review and analysis at Cornell University Medical College and other New York libraries, including the American Museum of Natural History, and seminars and practical experience at the field laboratory. Classes are limited to six students. The following Cornell University students are eligible: New York campus—graduate students majoring or minoring in microbiology, postdoctoral fellows in microbiology, medical students with special interest; Ithaca campus—graduate students majoring in entomology or fields of vertebrate zoology, veterinary students with special interest, undergraduate students beyond third year with special interest and sufficient background in biology. Students from other universities or research institutions may enroll provided spaces are available. Given in most but not all years. Those interested should inquire at the departmental office well in advance of beginning dates. Professor Dickerman.

9. Advanced Mycology. Initial consideration is given to gross vegetative organization of fungi relating cellular and subcellular structure and function. In addition to physiological and morphological characteristics of microscopic fungi, mechanisms of biosynthesis and energy metabolism are described in reference to the interaction between fungi and their environment. Other topics considered include natural and induced variation of fungi, fungi as tools of genetic investigation, biochemical and traditional systematics, bioassays, and steroid transformations.

Basic features of fungal growth are considered, and attention is also directed to the various associations between fungi and man. These include the role of fungi as sources of important microbial products, as causes of spoilage and destruction, and as pathogenic, toxigenic and allergenic agents of human disease.

Lectures are supplemented with laboratory exercises designed to provide familiarity with specialized mycological procedures, with the handling of fungi as genetic models and in bioassay systems, and with the methods for isolation and identification of fungi from clinical materials. Two lectures weekly. Two laboratory sessions weekly for five weeks. Given in ten weeks from March to mid-May, every second or third year. Not given 1971–72. Professor Mackenzie.

10. Microbial Ecology. This course examines the manifold and indispensible roles of microorganisms in the biosphere and their significance in the survival and well-being of other forms of life including man. Topics covered include: our microbial environment; the diversity, distribution and dispersal of microflora; biogeochemistry; the recycling of bio-atoms and maintenance of the biosphere; interactions between microbial populations; interactions between microorganisms and macroorganisms; energy flow and the food chain; and the relationships between changes in microecosystems and the effects on macroecosystems. Given every year in the third trimester, one or two one-hour lectures weekly, if sufficient demand. Professor O'Leary and Dr. Beebe.

11. The Methods and Materials of Research. This is intended to be an experimental and wide-ranging course given by all the faculty of the Field. It covers such diverse and essential subjects as logic and scientific method, manuscript preparation, the nature and use of the scientific literature, scientific photography, evaluation and choice of equipment, national scientific resources, and other matters yet to be determined. The purpose of this course is to provide students with some familiarity, even if limited, with many subjects not covered by any other course and yet essential to the practicing scientist. Given every second year. Not given in 1971–72. The staff.

12. Research on Special Problems. This course is designed for students in other Fields who wish to obtain some significant experience in microbiological research. For these students and others who want such experience, this Field offers individualized research on special problems. The nature, complexity, and time required for such research vary according to the needs and desires of each student. Such experience is available in each specialty covered by the faculty of this Field and can be arranged by consultation of the student with the appropriate faculty member. Available each year and throughout the year. The staff.

13. Thesis Research in Microbiology. Required of all students taking a major in microbiology. Given yearly and throughout the year. The staff.

14. Microbiology Seminar. These seminars consist of reports on surveys of the literature in the Field and on current research and are presented by graduate students, faculty and visiting scientists. Attendance is required of all students majoring or minoring in microbiology throughout their programs of study. Given yearly and throughout the year. One-hour sessions on alternate weeks. Professor Lyons.

Neurobiology and Behavior

Faculty

Dana C. Brooks, Michael D. Gershon, Sanford Goldstone, Bernice Grafstein, Wilbur D. Hagamen, Martin Hamburg, S. Steven Hotta, Myron S. Jacobs, John E. Lee, Thomas H. Meikle, Jr., Michiko Okamoto, Robert S. Porro, Donald J. Reis, Walter F. Riker, Jr.,

Leonard L. Ross, William N. Schoenfeld, Jeri A. Sechzer, Gerard P. Smith, Roy C. Swan, Myron Winick

Field Representative

Leonard L. Ross, Department of Anatomy, Room A-404, Medical College

The Field of Neurobiology and Behavior provides training in the study of the nervous system. It includes the disciplines of neuroanatomy, neuroembryology, neurophysiology, neuropharmacology, neurochemistry, neuroendocrinology, and neuropsychology and perception. The program of the Field emphasizes a multidisciplinary approach to the study of the nervous system, based on the belief that future advances in our understanding of the nervous system will be derived from a knowledge of the thinking and research techniques employed by more than one discipline. Towards this end, the program of the student entering the Field is planned in consultation with several staff members, and the student is expected to spend some period of time working closely with members of the faculty whose interests are related to his. In addition there are regularly scheduled seminars in the Field during which various aspects of work in progress are presented and discussed. By this means, the student is afforded the broadest possible view of the Field during his total training experience.

The student who chooses Neurobiology and Behavior as a major field will be required to satisfy the requirements of the courses in neural sciences, statistics, and biomathematics, and two of the following: microscopic anatomy, physiology, biochemistry, or pharmacology. In addition, participation in the seminar program is expected. While there are no language requirements, it is suggested that the student achieve mastery of a modern foreign language or a computer language. When Neurobiology and Behavior is chosen as a minor field of study, the student is required to participate in the neural science course and the seminar program as well as any additional experience which the minor adviser may suggest.

Special Interests of the Faculty

D. Brooks: brain stem influence upon the electrical activity of the visual system during both sleep and waking.

M. Gershon: development of the autonomic innervation of the gut.

B. Grafstein: growth of nerve and the transport of materials in axons.

M. Hamburg: neural code of hunger motivation utilizing the techniques of single unit recording.

M. Jacobs: comparative cytomorphological organization of the cetacean nervous system.

T. H. Meikle: animal studies of neural mechanisms basic to learned behavior, particularly visual learning.

R. Porro: histological, histochemical and electron microscopic studies of human neurological disorders.

D. J. Reis: central neural regulation of cardiovascular function and biogenic amines and aggressive behavior.

W. F. Riker: pharmacology and physiology of neuromuscular transmission.

L. L. Ross: biochemical morphology of central nervous system synapses.

W. N. Schoenfeld: effects of long-term stress upon selected behavioral and physiological systems and reinforcement schedules in behavior theory.

J. Sechzer: learning and memory in split-brain animals.

G. Smith: feeding behavior, emotional behavior and learning in rats and monkeys, utilizing the concepts of neuroendocrinology.

R. C. Swan: fine structure of the cerebellar cortex.

M. Winick: cellular development of the nervous system.

Courses

1. Neurosciences. This is the basic undergraduate medical course and is required of all major and minor candidates in the Field. It is a broadly based course taught by members of the Field and introduces the student to neuroanatomy, neurophysiology, and pertinent neurology. Third trimester. Professors Hamburg and Grafstein.

2. Brain, Mind, and Behavior. This weekly seminar seeks to identify and understand the relationships among brain, mind, and behavior. Topics will include the properties of neurons and glia, synaptic mechanisms, the primitive nervous system, behavioral and psychological properties of small and large brains, hunger, thirst, attention, emotion, reinforcement, learning, memory, and language. No prerequisites required. Admission by permission of the instructor. Spring term: hours to be arranged. Professor Smith.

3. Environmental Assaults on the Nervous System. This course will consider the factual basis and potential implications of some of the ways in which man may intentionally or unintentionally intervene in his brain function. Some of the topics to be considered will be: effects of sensory isolation; mercury and lead poisoning; trauma; actions of drugs; reflex conditioning and brainwashing; effects of malnutrition; teratology; electrical stimulation of the conscious brain; possibilities of memory transfer, extrasensory perception, and interspecies communication. The elective will require two hours of class time and about two hours of assigned reading per week. The class sessions will include lectures by staff members and seminar presentations by participating students, as well as discussion periods based on the reading. Third trimester: 2 hours per week. 4–20 students. Professor Grafstein and staff.

Pathology

Faculty

Daniel R. Alonso, Carl G. Becker, Peter G. Bullough, Margaret H. S. Clements, M. Renate Dische, John T. Ellis, Milton Helpern, Aaron Kellner, John G. Kidd, Robert C. Mellors, C. Richard Minick, Janet Mouradian, George E. Murphy, Robert S. Porro, Alfred M. Prince, Charles A. Santos-Buch, John E. Seybolt, Myron Susin, Carolyn W. Watson, Jack Woodruff

Field Representative

Carl G. Becker, Department of Pathology, Room C-444, Medical College

Pathology is the study of the causes and mechanisms of disease processes. The purpose of a graduate program in pathology is to provide individuals with a baccalaureate or medical degree with a basic knowledge of disease processes by a study of the disciplines of anatomic and clinical pathology and by learning modern techniques of biologic investigation. It is hoped that a student completing this program will have both the information and technical skills to make significant inquiries into the nature of disease processes and to bridge the gap between classical, descriptive pathology and such disciplines

as biochemistry and molecular biology.

The graduate program in pathology includes the observation of diseases in their various forms at autopsy and in clinical laboratories and study and research in the areas of immunology and immunopathology, oncology, virology, cellular biology, and electron microscopy. It may also include study in advanced mathematics, physiology, biophysics, pharmacology, anatomy, cytochemistry and histochemistry, advanced biochemistry, genetics, and microbiology.

New students are expected to have completed mathematics through integral calculus, chemistry through organic chemistry (although physical chemistry is recommended), basic physics, and at least general biology. A reading knowledge of at least one foreign language is suggested but not required. For those students entering the program with baccalaureate degrees only, the Graduate Record Examinations, including the Aptitude Tests and the Advanced Test in Biology or Chemistry, are required.

Graduate students in pathology are required, as an initial part of their program, to take the course in general and systemic pathology offered to second-year medical students. They are required to minor in at least one and not more than two other biomedical Fields. Courses in biomathematics, advanced biochemistry, genetics, and microbiology are also required. Additional courses not available at the Graduate School of Medical Sciences can be taken at neighboring institutions with approval of the Department of Pathology and the candidate's Special Committee.

Special Interests of the Faculty

D. R. Alonso: cardiovascular pathology.
C. G. Becker: cardiovascular and renal diseases; immunopathology; host-parasite relationships.
P. G. Bullough: diseases and metabolism of bone.
M. H. S. Clements: exfoliative cytopathology.
M. R. Dische: pediatric pathology; biochemistry of metabolic diseases; biochemistry.
J. T. Ellis: electron microscopy; kidney disease and muscle diseases.
M. Helpern: forensic pathology.
A. Kellner: immunohematology; lipid metabolism; pathogenesis of arteriosclerosis.
J. G. Kidd: virology and oncology.
R. C. Mellors: studies in immunopathology relating to the role of viruses in autoimmune disease and leukemogenesis.
C. R. Minick: pathogenesis of arteriosclerosis and hypertension; lipid metabolism; immunopathology; electron microscopy.
J. Mouradian: surgical pathology.
G. E. Murphy: cardiovascular diseases; host-parasite relationships.
R. S. Porro: neuropathology; ultrastructure and histochemistry of diseases of central nervous system and skeletal muscle.
A. M. Prince: virology; pathogenesis of liver diseases.
C. A. Santos-Buch: cellular biology; immunopathology; cardiovascular disease; electron microscopy.
J. E. Seybolt: exfoliative cytopathology.
M. Susin: pathology of renal disease; electron microscopy.
C. W. Watson: exfoliative cytopathology.
J. Woodruff: virology.

Courses

1. General and Systemic Pathology. Lectures, practical classes and seminars. First trimester: M W F 9–1. Second trimester: M W 10–1, Th 9–1. The staff.

2. Correlative Pathology. Gross and microscopic material is correlated and related to the disease processes. The staff.

3. Forensic Pathology. Courses are offered in the above by special arrangement with the chief medical examiner of the City of New York. Professor Milton Helpern.

4. Seminars in Pathology. Discussions outlining the scope of modern pathology are given weekly. These include reports on original research by members of the staff and by visiting lecturers. Hours to be announced. The staff.

5. Experimental Pathology. Independent research projects in various areas of pathology are offered. The staff.

The following courses are given by various members of the Field in collaboration with faculty members of related Fields. The terms and hours are by arrangement.

Immunopathology
Cardiovascular pathology
Autopsy pathology
Orthopedic pathology
Renal pathology
Gastrointestinal pathology
Neuropathology
Surgical pathology
Cytopathology
Tumor pathology
Clinical Biochemistry
Hematology and Immunohematology
Clinical Microbiology

Pharmacology

Faculty

Amir Askari, John J. Burns, Walter W. Y. Chan, Leslie P. Felpel, Arthur H. Hayes, Jr., Raymond W. Houde, Charles E. Inturrisi, Roberto Levi, Walter Modell, Michiko Okamoto, Walter F. Riker, Jr., Alan Van Poznak

Field Representative

Michiko Okamoto, Department of Pharmacology, Room E-411, Medical College

In graduate training, emphasis is placed on sound basic training in general pharmacology. By means of individual instruction, the candidate is later afforded an exposure to several specialized aspects of pharmacology. The latter part of the graduate curriculum is devoted to research in an area of the candidate's choice.

An adequate preliminary training in organic chemistry, physical chemistry, biochemistry, and physiology is prerequisite to graduate work in pharmacology. Training in statistics is strongly recommended.

Proficiency in one foreign language is required of all Ph.D. candidates majoring in pharmacology.

Special Interests of the Faculty

A. Askari: biochemical pharmacology; mechanisms of drug effects on the transport of ions through biological membranes.
J. J. Burns: biochemical pharmacology; drug metabolism.
W. W. Y. Chan: renal pharmacology; endocrine pharmacology; polypeptide pharmacology.
L. P. Felpel: neuropharmacology.

A. H. Hayes, Jr.: clinical pharmacology; cardiovascular pharmacology.
R. W. Houde: clinical pharmacology of the analgesic drugs; development of methods of evaluating the effects of drugs on subjective responses.
C. E. Inturrisi: biochemical pharmacology; drug metabolism.
R. Levi: cardiovascular pharmacology and electrophysiology; immuno pharmacology.
W. Modell: clinical pharmacology; pharmacology of cardiac drugs; adverse drug reactions.
M. Okamoto: neuropharmacology, especially neuromuscular transmission.
W. F. Riker, Jr.: general pharmacology, neuropharmacology, especially neuromuscular transmission.
A. Van Poznak: pharmacology of halogenated hydrocarbons; neuropharmacology.

Courses

1. General Pharmacology. The basic pharmacology course offered to second-year medical students is open to graduate students. The course consists of lectures, laboratory work, demonstrations, and seminars given during the first and second trimesters. The purpose of these exercises is to teach the principles of pharmacology. Detailed consideration is given to the parameters of drug action to provide the student with the fundamental concepts essential for the evaluation of any drug. Consequently, emphasis is placed on the scientific basis of pharmacology. Prototype drugs, considered essentially systemically, serve to illustrate several mechanisms and parameters of drug action. Therapeutic applications are considered only insofar as they illustrate principles of pharmacology or drug hazards. Prerequisites: biochemistry and physiology. First trimester: T 9–10, Th 9–1. Second trimester: M 9–10, T 9–12, Th 9–1. The staff.

2. Research in Pharmacology. Research opportunities may be arranged throughout the year for graduate students who are not majoring in pharmacology but who wish some investigative experience in the discipline. Special opportunities are offered for work on the nervous and cardiovascular systems and in biochemical aspects of pharmacology. The staff.

3. Advanced Courses and Seminars. The Field of Pharmacology offers several advanced courses and seminars in the areas that are of interest to the faculty of the Field and the graduate students. The content, the format, and the schedule of these courses are determined each year on the basis of the number and the backgrounds of the interested students. The staff.

Physiology

Faculty

S. Balagura-Baruch, W. A. Briscoe, W.W.Y. Chan, C. Fell, B. Grafstein, R. L. Greif, A. H. Hayes, Jr., N. B. Javitt, R. Levi, M. Lipkin, T. M. Maack, L. A. Pilkington, R. F. Pitts, E. E. Windhager

Field Representative

Colin Fell, Department of Physiology and Biophysics, Room C-512, Medical College

Opportunities are offered toward the Ph.D. degree in several areas of physiology and biophysics. Ample space is available and laboratories are well equipped to provide predoctoral training in a medical environment.

Introductory courses in biology, inorganic and organic chemistry, physics, and mathematics through the level of differential and integral calculus are required. Additional course work in these disciplines at the undergraduate level is encouraged. Although not required, candidates are urged to take the Graduate Record Examinations, since performance in these examinations is an important factor in the selection of applicants. Applicants with otherwise exemplary records, who lack certain course requirements, will be considered for acceptance provided that candidates remedy such deficiencies while in training.

The course of study emphasizes the importance of teaching and research in the preparation and development of individuals for careers in physiology. This goal is achieved by a combination of didactic courses, seminars, and closely supervised research leading toward the preparation of a satisfactory thesis.

A special program of study will be developed for each student in consultation with his Special Committee. In addition to the general requirements set by the Graduate School for all Fields, all candidates for the doctoral degree in physiology will be expected to meet the following specific requirements:

1. Evidence of a satisfactory background in neurosciences. Ordinarily, the course in neurosciences described under the Field of Neurobiology and Behavior, or an equivalent course, will be taken concurrently with the course in physiology and biophysics.

2. Satisfactory completion of the course in physiology and biophysics, or an equivalent course.

3. For majors and minors in the Field, a minimum of two elective courses in the Field ordinarily will be required, in addition to the course in physiology and biophysics.

4. Proficiency in reading scientific literature in one modern foreign language.

5. Satisfactory completion of an individualized laboratory experience in an area of research different from that chosen for the doctoral dissertation.

Special Interests of the Faculty

S. Balagura-Baruch: renal metabolism and transport of Krebs cycle intermediates.
W. A. Briscoe: blood gas transfer in health and disease.
W.W.Y. Chan: pharmacology of neurohypophysial hormones and related polypeptides.
C. Fell: cardiovascular function: in particular, blood flow distribution, blood volume, and blood volume distribution.
B. Grafstein: nerve regeneration and transport of materials in nerve axons.
R. L. Greif: physiology of the thyroid gland and its secretions.
A. H. Hayes: cardiovascular and clinical pharmacology.
N. B. Javitt: gastrointestinal and hepatic physiology and pathophysiology.
R. Levi: heart electrophysiology; heart hypersensitivity reactions; histamine in cardiac function.
M. Lipkin: proliferation and differentiation of normal and diseased gastrointestinal cells.
T. M. Maack: protein transport and metabolism by the kidney.
L. A. Pilkington: integrated renal metabolism.
R. F. Pitts: renal metabolism of amino acids; renal regulation of acid-base balance.
E. Windhager: renal electrolyte metabolism.

Courses

Students planning to register for the course Physiology and Biophysics must consult the Field representative before the start of the second trimester. Students

who wish to take a third-trimester course (2–8) are advised to consult the Field representative no later than the seventh week of the second trimester in order to assure a place in the course.

1. Physiology and Biophysics. Lectures and conferences in body fluids, bioelectric phenomena, circulation, respiration, and gastrointestinal function. Second trimester: 4 hours per week. The staff.

Lectures and conferences on kidney function, acid-base regulation, endocrinology, and metabolism, and a weekly laboratory on selected aspects of physiology. Third trimester: 11 hours per week. The staff.

2. Respiratory and Renal Mechanisms of Regulation of Acid-Base Balance. Each session consists of an informal lecture and a succeeding seminar discussion based on assigned reading in the area of the immediately preceding lecture. Third trimester: 3 hours per week. 5–15 students. Professor Pitts and staff.

3. Selected Topics in Endocrinology. Important scientific papers dealing with certain aspects of endocrinology are distributed to the participants one week in advance of discussion. Each paper is considered in detail in a seminar directed by an investigator in the area under discussion. One or two preliminary orientation sessions are given by Professor Greif before distribution of the first scientific paper, and, if feasible, one or two laboratory days are planned. Third trimester: 3 hours per week. 6–12 students. Professor Greif and staff.

4. Selected Topics in Gastrointestinal and Hepatic Physiology and Pathophysiology. Topics include bilirubin metabolism and excretion, cholesterol metabolism, bile salt excretion, bile formation, esophageal motility, gastric function, intestinal cell turnover, absorption of fat, absorption of carbohydrate, the malabsorption syndrome. Third trimester: 2 hours per week. 5–12 students. Professor Javitt.

5. Selected Topics in Respiratory Physiology. Topics covered include: 1) physiological anatomy of the lung; (2) logical formulation and solution of clinical problems; (3) ventilation, alveolar air diagram, nitrogen washout; (4) relevant lung function tests; (5) lung volumes, effect of posture and disease; (6) diffusion, Fick equation, Bohr integration; (7) acid-base considerations in blood; (8) mechanical properties of lung; (9) ventilation-perfusion ratio and Bohr integral isopleths; (10) ecology, sealed spaces, altitude, diving; (11) lung function in the first week of life. Students wishing to take this course must consult with Professor Briscoe no later than the seventh week of the second trimester. Third trimester: 2 hours per week. Maximum of 12 students. Professor Briscoe.

6. Selected Topics in Kidney and Electrolyte Physiology and Pathophysiology. Lectures, seminars, and demonstrations. Topics include: (1) GFR, clearance concept, reabsorption and secretion of electrolytes; 2) concentrating mechanism; (3) electrophysiology of the nephron; (4) pathophysiology of potassium; (5) renal blood flow and its intrarenal distribution; (6) renal physiology in the newborn; (7) control of body fluid volume and tonicity; (8) pathology of renal failure; urinary sediment; pathophysiology of renal failure; (9) radiology of the kidneys; (10) dialysis; (11) transplantation. Third trimester: 2 hours per week. Maximum of 12 students. Professor Windhager and staff.

7. Special Topics in Cardiovascular Physiology. Original research papers will be made available in advance of each session, and these and the general problems associated with each topic will serve as the basis for the discussion. Insofar as possible, experimental approaches to each problem will be demonstrated. To some extent, choice of topics can be determined by the interests of the group. Probable topics include: (1) regulation of peripheral blood flow; (2) integrated cardiovascular responses to hypoxia; (3) pulsatile flow in arteries; (4) measures of myocardial performance; (5) blood volume, hemorrhage, and hemorrhagic shock; (6) cardiac catheterization in man, congenital heart disease, valvular heart disease. Third trimester: 3 hours per week. 6–12 students. Professor Fell.

8. Environmental Assaults on the Nervous System. This course is described under courses offered by the Field of Neurobiology and Behavior.

Instruction at the Sloan-Kettering Division

Graduate Seminar. The weekly graduate seminar is offered each year and is attended by all first- and second-year students of the Division. Two or three topics are selected for discussion each year. Topics are usually chosen from the following: nucleic acid and protein chemistry and biochemistry; chromosome structure and function; special topics in bacterial genetics; regulation; radiobiology; mammalian and bacterial viruses. The discussion is carried principally by graduate students under the guidance of faculty members whose area of specialization coincides with the topic. From time to time outstanding authorities are invited as guest speakers. In addition, students in the third and later years of graduate study address the seminar on the progress being made in their thesis work.

Biochemistry

Faculty

N. W. Alcock, M. E. Balis, A. Bendich, E. Borenfreund, G. B. Brown, L. F. Cavalieri, J. D. Fissekis, M. Fleisher, J. J. Fox, A. Giner-Sorolla, S. Green, M. G. Hamilton, J. D. Karam, L. Kopelovich, W. Kreis, J. Lenard, F. P. Mamaril, J. S. Nisselbaum, J. C. Parham, M. L. Petermann, B. H. Rosenberg, J. S. Salser, M. K. Schwartz, M. R. Sherman, V. P. Skipski, M. Sonenberg, C. C. Stock, L. Sweetman, N. J. Swislocki

Unit Chairman

M. Earl Balis, Sloan-Kettering Division, Room 921K, Kettering Laboratory

Opportunities are available for advanced work and research in chemistry and metabolism, bio-organic chemistry, enzymology, hormone chemistry and action, and molecular biology.

Undergraduate requirements for a major in biochemistry include courses in inorganic chemistry, qualitative and quantitative chemistry, organic chemistry, physical chemistry, physics, general biology, and mathematics (through calculus). Any of these requirements not completed at the undergraduate level must be completed during graduate study. Applicants are urged strongly to support their applications with Graduate Record Examinations scores in both the Aptitude Test (verbal and quantitative) and the Advanced Test in Chemistry or Biology.

Students electing biochemistry as a major or minor subject must complete the Medical College course in biochemistry, or its equivalent, as a minimal requirement.

In addition, students who major in biochemistry are responsible for the course matter of Graduate Biochemistry.

All students are required to take an oral qualifying examination. A written examination may be required at the discretion of the student's Special Committee. The admission to candidacy examination is both written and oral.

The only language requirements are those imposed by the student's Special Committee.

Special Interests of the Faculty

Biochemical analysis: N. W. Alcock, M. Fleisher, M. K. Schwartz, V. Skipski.

Biochemical genetics: A. Bendich, E. Borenfreund, L. F. Cavalieri, J. Karam, B. H. Rosenberg.

Biochemical pharmacology: M. E. Balis, A. Giner-Sorolla, S. Green, W. Kreis, J. S. Salser, C. C. Stock.

Biochemistry of cancer and carcinogenesis: M. E. Balis, A. Bendich, E. Borenfreund, B. G. Brown, M. Fleisher, S. Green, L. Kopelovich, J. C. Parham, M. K. Schwartz, M. R. Sherman, C. C. Stock.

Biosynthesis of macromolecules: L. F. Cavalieri, M. G. Hamilton, J. Karam, J. Lenard, M. L. Petermann, B. H. Rosenberg, M. Sonenberg.

Chemistry and biochemistry of hormones: J. Lenard, M. Sonenberg, N. I. Swislocki.

Chemistry and biochemistry of lipids and membranes: A. Bendich, J. Lenard, V. Skipski, M. Sonenberg, N. I. Swislocki.

Chemistry of natural products: G. B. Brown, J. D. Fissekis, J. J. Fox, A. Giner-Sorolla, J. C. Parham.

Intermediary metabolism: N. W. Alcock, M. E. Balis, G. B. Brown, L. Kopelovich, F. Mamaril, L. Sweetman, N. I. Swislocki.

Mechanism of enzyme activity: G. B. Brown, S. Green, F. Mamaril, J. S. Nisselbaum, M. K. Schwartz, L. Sweetman.

Structure and function of macromolecules: M. E. Balis, A. Bendich, E. Borenfreund, L. F. Cavalieri, M. G. Hamilton, J. Lenard, M. L. Petermann, B. H. Rosenberg, J. S. Salser, M. R. Sherman, M. Sonenberg.

Courses

1. Graduate Biochemistry. The course and the hours are described on p. 22 under Interdivisional Courses.

2. Molecular Genetics. The course is concerned with the structure and function of the genetic material of bacteria and viruses. Lectures, seminars, and term reports will include the following subjects: replication, recombination, mutagenesis, transcription, translation, and regulation of gene activity. Given every other year. Not given in 1971–72. Professor Cavalieri.

Biology

Faculty

A. M. Albrecht, J. L. Biedler, E. A. Boyse, A. T. Burness, E. P. de Harven, E. S. Essner, E. Fleissner, J. E. Fogh, F. W. Foote, Jr., P. J. Gomatos, D. J. Hutchison, N. Ikagami, R. M. Krug, M. Michel, H. F. Oettgen, L. J. Old, F. S. Philips, F. K. Sanders, F. M. Sirotnak, S. S. Sternberg, E. H. Stonehill, M. N. Teller, L. Wade, M. S. Zedeck

Unit Chairman

Dorris J. Hutchison, Walker Laboratory,
Sloan-Kettering Institute for Cancer Research,
Rye, New York

The program in biology is oriented toward an understanding of factors which initiate control and modify growth and biological development. Opportunity is offered for advanced work and research in cell biology, cytology, genetics, immunology, microbiology, pharmacology, and virology.

Undergraduate prerequisites for a major in biology include courses in inorganic chemistry, organic chemistry, qualitative and quantitative chemistry, physical chemistry, physics (mechanics, electricity, and magnetism; sound, heat, and light), mathematics (through calculus), and general biology or zoology or botany or microbiology. Any of these requirements not completed at the undergraduate level must be completed during the first year of graduate study. Applicants are urged strongly to support their applications with scores attained on the Graduate Record Examinations in both the Aptitude Test (verbal and quantitative) and the Advanced Test in Biology or Chemistry.

Programs are determined individually on the basis of interest, training, and prior experience. Elective courses in basic medical sciences include those described for the Medical College. Formal graduate courses, seminars, and tutorials are arranged with the faculties of the Sloan-Kettering Division and the Medical College Division.

Degree requirements include successful completion of three examinations: (1) qualifying, (2) admission to candidacy, and (3) defense of thesis. A major and two minor subjects are also required. The foreign language requirement will be determined by the student's Special Committee.

Special Interests of the Faculty

Cell biology, cell differentiation, and viral and chemical carcinogenesis: A. T. Burness, J. E. Fogh, F. K. Sanders, E. H. Stonehill, M. N. Teller.

Cytology, fine structure of cancer cells: E. P. de Harven, E. S. Essner, S. S. Sternberg.

Genetics, drug resistance: J. L. Biedler, F. M. Sirotnak.

Immunology, tumor immunology, and immunogenetics: E. A. Boyse, H. F. Oettgen, L. J. Old.

Microbiology, drug resistance: A. M. Albrecht, D. J. Hutchison.

Pharmacology, mechanism of drug action: F. S. Philips, M. S. Zedeck.

Virology, genetics, and physical and chemical structure of viruses: E. Fleissner, P. J. Gomatos, N. Ikagami, R. M. Krug, M. Michel.

Courses

1. Cytology. A formal course in general animal cytology. The topics include cell theory, principles of light and electron microscopy, mitosis, cytogenetics, cellular fine structure, biochemical analysis and enzymology of organelles isolated by differential centrifugation, cytopathology, and cytology of cancer cells and tissue cultures.

2. Virology. A formal course in which major emphasis is placed on the basic mechanisms in the biology of animal viruses. The topics considered include virus structure and composition; assay of viruses and viral-specific products; interaction of viruses with receptors and antibodies; syntheses of viral nucleic acids and proteins and assembly of viral particles; structural and functional alterations in viral-infected cells; pathogenesis of viral diseases; and viral genetics.

3. Tumor Biology. This course consists of a series of lectures on basic aspects of the cancer cell including cell differentiation, viral and chemical carcinogenesis, tumor antigens, genetics, microscopic anatomy, and the physical and biochemical behavior of cancer cells.

4. Tumorigenesis. A series of lectures dealing with carcinogenesis and related subjects. Topics include the nature of neoplastic changes *in vivo* and *in vitro;* comparison of chemicals, viruses, and physical agents; metabolism and mechanism of action of chemical carcinogens; and genetic, hormonal, and immunological factors involved in carcinogenesis.

5. Genetics Seminar. The course is described on p. 13 under the Field of Genetics.

6. General Microbiology. This course is described on p. 22 under Interdivisional Courses.

Biophysics

Faculty

B. Djordjevic, E. R. Epp, J. Fried, A. S. Gelbard, E. W. Hahn, N. D. Kessaris, J. S. Laughlin, S. M. Lehnert, W. G. Monahan, H. Moroson, I. Pullman, R. S. Tilbury, L. Zeitz

Unit Chairman

Edward R. Epp, Sloan-Kettering Division, Room 203K, Kettering Laboratory

Graduate work is offered leading to the Ph.D. degree in biophysics and the M.S. in radiation physics. A candidate for the Ph.D. must have a B.A. or B.S. degree with a major in physics, or with a major in biology, chemistry, or mathematics and a minor in physics. A candidate for the M.S. must have a B.A. or B.S. in physics from a recognized university.

Undergraduate prerequisites for the Ph.D. candidate include courses in general physics, electricity and magnetism, mechanics, mathematics (through calculus), and thermodynamics, and acceptable laboratory experience in these subjects. Any of those requirements not completed at the undergraduate level must be completed during graduate study. Graduate course work required for the Ph.D. is flexible depending upon the student's background and basic interests but ordinarily would include advanced quantum mechanics, electrodynamics, and nuclear physics and courses in the student's minor subjects. In addition, a month spent full time on a laboratory project is required in each of his two minor disciplines. The student must pass both a qualifying examination covering various basic aspects of his major and minor subjects and the examination for admission to Ph.D. candidacy. The thesis required for the Ph.D. in biophysics should demonstrate the ability of the student to make a thorough and original investigation in an important area of biophysics. There is no mandatory foreign language requirement.

Some of the research projects in biophysics which are pertinent to the Ph.D. program include: studies of the metabolism of various isotope-labeled compounds in man; metabolism of biologically important compounds in tissue cultures of human tumor cells, in bacteria, and in viruses; the mechanism of radiation action on bacteria, phage, yeast, and small animals, including metabolism studies with human and other tumors influenced by radiation under different environmental conditions; fundamental radiobiological studies of mammalian cells in tissue culture, using synchronized cell populations and metabolic inhibitors; trace element analysis of tissue sections by means of fluorescent x-ray spectrometers; electron spin resonance spectroscopy of free radicals in carcinogenic and irradiated compounds; study of the early radiation-induced processes in cells using high-intensity pulsed irradiation techniques; the investigation, using existing computer facilities, of mathematical models which simulate the behavior of biological systems, e.g., the proliferation of cells in human leukemia; the measurement of radiation by calorimetric, chemical, and solid-state techniques.

A candidate for the M.S. must have a B.A. or B.S. in physics from a recognized university. The candidate is expected to have completed undergraduate courses in general physics, mechanics, electronics, electricity and magnetism, modern physics and mathematics through differential equations. With regard to course work, the candidate is expected to pass satisfactorily courses selected from some of the following subjects: physics, biophysics, biology, radiobiology, biochemistry, and biomathematics. The student must minor in one of the above subjects other than physics. The thesis subject must be in the field of radiation physics and must represent a comprehensive study demonstrating a thorough knowledge of the chosen subject. A final oral examination will be given primarily on the subject of the thesis and may be preceded by a written examination covering the fundamental principles of the course work. There is no mandatory foreign language requirement.

The course of study leading to the M.S. degree in radiation physics trains physicists in the various aspects of production, measurement, and application of radiation to various medical and biological problems. These problems particularly involve the use of radiation in the diagnosis and treatment of cancer. A variety of radiation sources is available, capable of generating photons and electrons with energies ranging from 5 Kev to 25 Mev and with electron dose-rates up to 10^{14} rads per second. Experience is also provided in the handling and use of many different radioisotopes. The magnitude and variety of facilities and unique radiation projects at the Sloan-Kettering Institute and the Memorial Hospital are particularly pertinent for training in this area. An important feature is the coexistence of fundamental research and practical and clinical applications in the same center.

Special Interests of the Faculty

Radiobiology: B. Djordjevic, E. R. Epp, A. Gelbard, E. W. Hahn, S. Lehnert, H. Moroson, L. Zeitz.

Radiation Biophysics: E. R. Epp, J. S. Laughlin, I. Pullman, L. Zeitz.

Theoretical Biophysics: E. R. Epp, J. Fried, N. Kessaris.

Biological Radiation Dosimetry: E. R. Epp, N. Kessaris, J. S. Laughlin.

Radioactive Isotope Metabolism: J. S. Laughlin, W. G. Monahan.

Isotope Data Analysis and Instrumentation: J. Fried, J. S. Laughlin, W. G. Monahan, L. Zeitz.

Radiation Chemistry: A. Gelbard, R. S. Tilbury.

Courses

1. Radiological Physics. Lectures and problems. A series of hourly lectures and assigned problems in applied mathematics, fundamentals of radiation physics, x-ray and radium treatment planning, diagnostic x-ray principles, radiation protection, and uses of radioactive isotopes.

2. Radiobiology. A full-year course in fundamental radiobiology dealing with the effects of radiation on cells, viruses, and macromolecules, as well as on whole animals. The course also covers areas of radiation physics and radiation chemistry pertinent to radiobiology.

3. Advanced Biophysics. Laboratory courses in each of the topics of radiation biophysics.

4. Biophysics Colloquia. Reports on research in progress by faculty and outside lecturers. Required for majors in biophysics.

Interdivisional Courses

Graduate Biochemistry. A graduate course in biochemistry is offered jointly by the faculties of the Medical College and the Sloan-Kettering Division. In each trimester, two lectures are given each week. It is not essential that students take the course in any particular sequence. The course includes consideration at an advanced level of the following subjects, with particular attention to contributions of recent research: Fall 1971—Physical Methods in Biochemistry; Winter 1971—Chemistry of Nucleic Acids and Proteins; Spring 1972—Metabolic and Membrane Phenomena. T Th 10:15–11:45. Professors Bendich, Fissekis, Haschemeyer, Lenard, and staff.

General Microbiology. This course is offered by the staff of the Field of Microbiology of the Medical College Division and of the Biology Unit of the Sloan-Kettering Division. It is intended to provide a general knowledge of the subject for students minoring in microbiology and for nonminors who want a background in the subject. It is not primarily intended for students majoring in the subject who already have an extensive background from undergraduate school. Lectures are given weekly during both semesters. Aspects of microbiology covered include fundamental procedures, microbial growth and physiology, genetics, immunology and serology, virology, plant and animal pathogens, and applied microbiology. Auditors from all Fields and Divisions are welcome. Offered every second year. Not given in 1971–72. Professors Hutchison and O'Leary.

Special Programs

Joint Ph.D. Program in Epidemiology and Health Systems Engineering

Faculty

Thomas A. Hodgson, Jr., Walter Lynn, Jeanne Magagna, John P. Maher, Walsh McDermott, Valerie Miké, Katsuhiko Yano

The Department of Public Health, Cornell University Medical College, in joint sponsorship with the Center for Environmental Quality Management (CEQM), Cornell University, offers graduate training and research leading to the Ph.D. degree in epidemiology and systems engineering. The required course work is given at the Ithaca campus; research projects are based primarily in the Department of Public Health at the Medical College. Opportunities for research cover a large area. The development of disease models, the application of systems analysis to health planning, and the epidemiology of specific diseases constitute the current areas of research which are jointly supported by the CEQM-CUMC group.

Applicants must fulfill the admission requirements of the Graduate School of Cornell University. Final selection is made by a joint CEQM-CUMC committee.

The University does not grant M.P.H. or D.P.H. degrees.

Coordinated M.D.—Ph.D. Programs

Programs of study leading to the Ph.D. degree are available to (1) students entering Cornell University Medical College, (2) medical students already matriculated at the Medical College, and (3) resident physicians in hospitals affiliated with the Medical College.

Entering Medical Students

The applicant to this program for entering medical students must apply to both the Cornell University Medical College and the Graduate School of Medical Sciences and be accepted under the admissions procedures of both schools.

The purpose of this program is to expose the student to both medical and graduate disciplines from the outset. The student spends his first two years as a medical student studying the basic medical sciences and attending regular graduate seminars. The summer months are spent in the laboratory learning experimental techniques and doing research. The third and fourth years of the student's program are spent as a full-time graduate student and are devoted exclusively to laboratory research and writing the thesis. The fifth year of the program is spent as a medical student in clinical study. The sixth year can be spent in either laboratory or clinical work. This six-year program represents the minimum time required to satisfy residence requirements of both the M.D. and Ph.D. degrees at Cornell University.

Matriculated Medical Students

A medical student enrolled in the Cornell University Medical College may interrupt his medical studies at any time to pursue full-time graduate study leading to the Ph.D. degree. The student must fulfill all regular requirements of the Graduate School of Medical Sciences. A maximum of two residence credits for basic science course work taken in the medical curriculum can be granted toward the Ph.D. degree after the student passes an evaluation examination.

A medical student who elects to begin graduate work leading to the Ph.D. degree in his senior year of medical school may register in both the Cornell University Medical College and the Graduate School of Medical Sciences. He begins his graduate didactic work during that year, and, ordinarily, the M.D. degree is granted at the end of that year. Research in the area of the Ph.D. thesis topic is begun during the fifth year. A two-year period of full-time research is a realistic minimum estimate for the time required to execute the experimental and theoretical work necessary to fulfill the requirements for the Ph.D. degree.

Resident Physicians

The resident physician may enroll in the Graduate School of Medical Sciences as a full-time graduate student working toward the Ph.D. Part-time graduate study is not permitted. A maximum of two residence credits for medical school course work in the basic sciences can be granted toward the residence requirements of the Ph.D. degree after the student passes an evaluation examination.

Prospective applicants to these programs should communicate with the associate dean of the Graduate School of Medical Sciences.

Register

Administration

Cornell University

Dale R. Corson, President of the University
Robert A. Plane, University Provost
W. Donald Cooke, Vice President for Research
Lewis H. Durland, University Treasurer
William D. Gurowitz, Vice President for Campus Affairs
W. Keith Kennedy, Vice Provost
Samuel A. Lawrence, Vice President for Administration
E. Hugh Luckey, Vice President for Medical Affairs
Thomas W. Mackesey, Vice President for Planning
Paul L. McKeegan, Director of the Budget
Arthur H. Peterson, University Controller
Richard M. Ramin, Vice President for Public Affairs
Robert F. Risley, Vice Provost
Neal R. Stamp, Secretary of the Corporation and University Counsel

Graduate School of Medical Sciences

Dale R. Corson, President of the University
E. Hugh Luckey, Vice President for Medical Affairs
W. Donald Cooke, Dean of the Graduate School
Thomas H. Meikle, Jr., Dean of the Graduate School of Medical Sciences; Associate Dean of the Graduate School
Julian R. Rachele, Associate Dean of the Graduate School of Medical Sciences; Assistant Dean of the Graduate School
Leo Wade, Acting Director, Sloan-Kettering Division
Frederick S. Philips, Associate Director, Sloan-Kettering Division

Faculty

Professors

M. Earl Balis, Professor of Biochemistry. B.A. 1943, Temple University; Ph.D. 1949, University of Pennsylvania.
Alexander G. Bearn, Professor of Medicine. M.B., B.S. 1946, M.D. 1951, University of London.
Aaron Bendich, Professor of Biochemistry. B.S. 1939, City College of New York; Ph.D. 1946, Columbia University.
Dorothea Bennett, Professor of Anatomy. A.B. 1951, Barnard; Ph.D. 1956, Columbia University.
Oscar Bodansky, Professor of Biochemistry. M.A. 1922, Ph.D. 1925, Columbia University; M.D. 1938, University of Chicago.
Edward A. Boyse, Professor of Biology. B.S. 1952, M.D. 1957, University of London.
William A. Briscoe, Professor of Medicine. B.A. 1939, M.A. 1941, B.M., B.Ch. 1942, D.M. 1951, Oxford University.
Dana C. Brooks, Professor of Anatomy. B.E.E. 1949, M.D. 1957, Cornell University.
George B. Brown, Professor of Biochemistry. B.S. 1934, Illinois Wesleyan University; Ph.D. 1938, University of Illinois.
John J. Burns, Visiting Professor of Pharmacology. B.S. 1942, Queens College; M.A. 1948, Ph.D. 1950, Columbia University.
Liebe F. Cavalieri, Professor of Biochemistry. B.S. 1943, Ph.D. 1945, University of Pennsylvania.
Etienne P. De Harven, Professor of Biology. M.D. 1953, Université Libre de Bruxelles.
John T. Ellis, Professor of Pathology. B.A. 1942, University of Texas; M.D. 1945, Northwestern University.
Edward R. Epp, Professor of Biophysics. B.A. 1950, University of Saskatchewan; Ph.D. 1955, McGill University.
Frank W. Foote, Jr., Professor of Pathology. B.A. 1931, M.D. 1935, University of Virginia.
Jack J. Fox, Professor of Biochemistry. A.B. 1939, Ph.D. 1950, University of Colorado.
Sanford Goldstone, Professor of Psychology in Psychiatry. B.S. 1947, City College of New York; Ph.D. 1953, Duke University.
Peter J. Gomatos, Professor of Microbiology. S.B. 1950, Massachusetts Institute of Technology; M.D. 1954, Johns Hopkins University; Ph.D. 1963, Rockefeller University.
Roger L. Greif, Professor of Physiology and Biophysics. B.S. 1937, Haverford College; M.D. 1941, Johns Hopkins University.
Milton Helpern, Visiting Professor of Pathology. B.S. 1922, City College of New York; M.D. 1926, Cornell University.
Dorris J. Hutchison, Professor of Microbiology. B.S. 1940, Western Kentucky State College; Ph.D. 1949, Rutgers University.
Aaron Kellner, Clinical Professor of Pathology. B.A. 1934, Yeshiva College; M.S. 1936, Columbia University; M.D. 1939, University of Chicago.
John G. Kidd, Professor of Pathology. A.B. 1928,

Duke University; M.D. 1932, Johns Hopkins University.

John S. Laughlin, Professor of Biophysics. A.B. 1940, Williamette University; Ph.D. 1947, University of Illinois.

Joel L. Lebowitz, Visiting Professor of Biomathematics. B.S. 1952, Brooklyn College; M.S. 1955, Ph.D. 1956, Syracuse University.

John Macleod, Professor of Anatomy. A.B. 1934, M.Sc. 1937, New York University; Ph.D. 1941, Cornell University.

Walsh McDermott, Livingston Farrand Professor of Public Health. A.B. 1930, Princeton University; M.D. 1934, Columbia University.

Alton Meister, Israel Rogosin Professor of Biochemistry. S.B. 1942, Harvard University; M.D. 1945, Cornell University.

Robert C. Mellors, Professor of Pathology. A.B. 1937, M.A. 1938, Ph.D. 1940, Western Reserve University; M.D. 1944, Johns Hopkins University.

Walter Modell, Professor of Pharmacology. B.S. 1928, City College of New York; M.D. 1932, Cornell University.

George E. Murphy, Professor of Pathology. A.B. 1939, University of Kansas; M.D. 1943, University of Pennsylvania.

Lloyd J. Old, Professor of Biology. B.A. 1955, M.D. 1958, University of California.

Mary L. Petermann, Professor of Biochemistry. A.B. 1929, Smith College; Ph.D. 1939, University of Wisconsin.

Frederick S. Philips, Professor of Pharmacology. B.A. 1936, Columbia University; Ph.D. 1940, University of Rochester.

Robert F. Pitts, Maxwell M. Upson Professor of Physiology and Biophysics. B.S. 1929, Butler University; Ph.D. 1932, Johns Hopkins University; M.D. 1938, New York University.

Aaron S. Posner, Professor of Biochemistry. B.S. 1941, Rutgers University; M.S. 1949, Polytechnic Institute of Brooklyn; Ph.D. 1954, University of Liege.

Julian R. Rachele, Professor of Biochemistry. B.A. 1934, M.S. 1935, Ph.D. 1939, New York University.

Donald J. Reis, Professor of Neurology. A.B. 1953, M.D. 1956, Cornell University.

Walter F. Riker, Jr., Professor of Pharmacology. B.S. 1939, Columbia University; M.D. 1943, Cornell University.

Leonard L. Ross, Professor of Anatomy. A.B. 1946, M.S. 1949, Ph.D. 1954, New York University.

Albert L. Rubin, Professor of Biochemistry. M.D. 1950, Cornell University.

Sol I. Rubinow, Professor of Biomathematics. B.S. 1944, City College of New York; M.S. 1947, Brown University; Ph.D. 1951, University of Pennsylvania.

F. Kingsley Sanders, Professor of Cell Biology. B.A. 1939, Ph.D. 1942, Oxford University.

William F. Scherer, Professor of Microbiology. M.D. 1947, University of Rochester.

William N. Schoenfeld, Clinical Professor of Psychology in Psychiatry. B.S. 1937, City College of New York; A.M. 1939, Ph.D. 1942, Columbia University.

Morton K. Schwartz, Professor of Biochemistry. B.A. 1948, Lehigh University; Ph.D. 1952, Boston University.

Martin Sonenberg, Professor of Biochemistry. B.S. 1941, University of Pennsylvania; M.D. 1944, Ph.D. 1952, New York University.

C. Chester Stock, Professor of Biochemistry. B.S. 1932, Rose Polytechnic Institute; Ph.D. 1937, Johns Hopkins University.

Roy C. Swan, Joseph C. Hinsey Professor of Anatomy. A.B. 1941, M.D. 1947, Cornell University.

Alan Van Poznak, Clinical Associate Professor of Pharmacology. A.B. 1948, M.D. 1952, Cornell University.

Erich H. Windhager, Professor of Physiology. M.D. 1954, University of Vienna.

Myron Winick, Professor of Pediatrics. A.B. 1951, Columbia University; M.S. 1952, University of Illinois; M.D. 1956, State University of New York (Brooklyn).

Associate Professors

Amir Askari, Associate Professor of Pharmacology. B.S. 1953, University of Dubuque; M.S. 1956, New York University; Ph.D. 1960, Cornell University.

Sulamita Balagura-Baruch, Associate Professor of Physiology. M.D. 1959, University del Valle.

Carl G. Becker, Associate Professor of Pathology. B.S. 1957, Yale University; M.D. 1961, Cornell University.

Roy W. Bonsnes, Associate Professor of Biochemistry. B.S. 1930, University of Connecticut; Ph.D. 1939, Yale University.

Ellen Borenfreund, Associate Professor of Biochemistry. B.S. 1946, Hunter College; Ph.D. 1957, New York University.

Peter Bullough, Associate Professor of Pathology. M.D. 1956, Liverpool University.

Walter W.Y. Chan, Associate Professor of Pharmacology. B.A. 1956, University of Wisconsin; Ph.D. 1961, Columbia University.

Hartwig Cleve, Associate Professor of Medicine. A.B. 1946, Helmstedt, Germany; M.D. 1953, University of Göttingen.

B. Shannon Danes, Associate Professor of Medicine. B.A. 1948, Mount Holyoke; M.A. 1949, University of Texas; Ph.D. 1952, State University of Iowa; M.D. 1962, Columbia University.

M. Renate Dische, Clinical Associate Professor of Pathology. B.S. 1941, Immaculata College; Ph.D. 1953, M.D. 1957, Columbia University.

Colin Fell, Associate Professor of Physiology. A.B. 1951, Antioch; M.S. 1953, Ph.D. 1957, Wayne State University.

Betty J. Flehinger, Visiting Associate Professor of Biomathematics. A.B. 1941, Barnard College; M.A. 1942, Cornell University; Ph.D. 1960, Columbia University.

Jørgen E. Fogh, Associate Professor of Microbiology. M.D. 1949, University of Copenhagen.

James L. German III, Clinical Associate Professor of Anatomy. B.S. 1945, Louisiana Polytechnic Institute; M.D. 1949, Southwestern University.

Michael D. Gershon, Associate Professor of Anatomy. B.A. 1958, M.D. 1963, Cornell University.

Helena Gilder, Associate Professor of Biochemistry. in Surgery; Assistant Professor of Biochemistry. A.B. 1935, Vassar College; M.D. 1940, Cornell University.

Jack Goldstein, Associate Professor of Biochemistry. B.A. 1952, Brooklyn College; M.N.S. 1957, Ph.D. 1959, Cornell University.

Bernice Grafstein, Associate Professor of Physiology. B.A. 1951, University of Toronto; Ph.D. 1954, McGill University.

Saul Green, Associate Professor of Biochemistry. B.S. 1948, City College of New York; Ph.D. 1952, State University of Iowa.

Stanley Gross, Clinical Associate Professor of Pathology. B.S. 1936, M.D. 1939, New York University.

Wilbur D. Hagamen, Associate Professor of Anatomy. B.S. 1945, Baldwin-Wallace College; M.D. 1951, Cornell University.

Eric W. Hahn, Associate Professor of Biophysics. B.S. 1954, University of Georgia; Ph.D. 1960, University of Illinois.

Mary G. Hamilton, Associate Professor of Biochemistry. B.A. 1947, University of Buffalo; Ph.D. 1961, Cornell University.

Rudy H. Haschemeyer, Associate Professor of Biochemistry. B.A. 1952, Carthage College; Ph.D. 1957, University of Illinois.

Raymond W. Houde, Associate Professor of Pharmacology. A.B. 1940, M.D. 1943, New York University.

Myron S. Jacobs, Clinical Associate Professor of Anatomy. B.A. 1945, University of Pennsylvania; M.S. 1951, Ph.D. 1955, New York University.

Norman B. Javitt, Associate Professor of Medicine. A.B. 1947, Syracuse University; Ph.D. 1951, University of North Carolina; M.D. 1954, Duke University.

Richard P. Kelisky, Visiting Associate Professor of Biomathematics. B.S. 1951, Texas Technological College; Ph.D. 1957, University of Texas.

Leonhard Korngold, Associate Professor of Microbiology in Surgery (Orthopedics). B.A. 1947, Brooklyn College; M.Sc. 1948, Ph.D. 1950, Ohio State University.

Willi Kreis, Associate Professor of Biochemistry. B.S. 1953, Ph.D. 1957, University of Zurich.

Roberto Levi, Associate Professor of Pharmacology. M.D. 1960, University of Florence.

Martin Lipkin, Associate Professor of Medicine. A.B. 1946, M.D. 1950, New York University.

Donald W. R. Mackenzie, Associate Professor of Microbiology. B.Sc. 1953, Ph.D. 1958, Edinburgh University.

Thomas H. Meikle, Jr., Associate Professor of Anatomy. A.B. 1951, M.D. 1954, Cornell University.

C. Richard Minick, Associate Professor of Pathology. B.S. 1957, University of Wyoming; M.D. 1960, Cornell University.

Jerome S. Nisselbaum, Associate Professor of Biochemistry. B.A. 1949, University of Connecticut; Ph.D. 1953, Tufts College.

Michiko Okamoto, Associate Professor of Pharmacology. B.S. 1954, Tokyo College of Pharmacy; M.S. 1957, Purdue; Ph.D. 1964, Cornell University.

William M. O'Leary, Associate Professor of Microbiology. B.S. 1952, M.S. 1953, Ph.D. 1957, University of Pittsburgh.

Alfred M. Prince, Clinical Associate Professor of Pathology. A.B. 1949, Yale University; M.A. 1951, Columbia University; M.D. 1955, Western Reserve University.

Charlotte Ressler, Associate Professor of Biochemistry. B.A. 1944, New York University; M.A. 1946, Ph.D. 1949, Columbia University.

Barbara H. Rosenberg, Associate Professor of Biochemistry. B.S. 1950, Ph.D. 1962, Cornell University.

Charles A. Santos-Buch, Associate Professor of Pathology. A.B. 1953, Harvard University; M.D. 1957, Cornell University.

Brij Saxena, Associate Professor of Biochemistry in Medicine. Ph.D. 1954, University of Lucknow; Dr. rer. nat. 1957, University of Muenster; Ph.D. 1961, University of Wisconsin.

Jeri A. Sechzer, Associate Professor of Psychology in Psychiatry. B.S. 1956, New York University; M.A. 1961, Ph.D. 1962, University of Pennsylvania.

Laurence B. Senterfit, Associate Professor of Microbiology. B.S. 1949, M.S. 1950, University of Florida; Sc.D. 1955, Johns Hopkins University.

John F. Seybolt, Clinical Associate Professor of Pathology. B.S. 1938, Yale University; M.D. 1943, Cornell University.

Selma Silagi, Associate Professor of Genetics in Obstetrics and Gynecology. A.B. 1936, Hunter; Ph.D. 1961, Columbia University.

Julio L. Sirlin, Associate Professor of Anatomy. D.Sc. 1953, University of Buenos Aires.

Francis M. Sirotnak, Associate Professor of Microbiology. B.S. 1950, University of Scranton; Ph.D. 1954, University of Maryland.

Gregory W. Siskind, Associate Professor of Medicine. B.A. 1955, Cornell University; M.D. 1959, New York University.

Vladimir P. Skipski, Associate Professor of Biochemistry. M.S. 1938, Kiev University; Ph.D. 1956, University of Southern California.

Gerard P. Smith, Associate Professor of Physiology in Psychiatry. B.S. 1956, St. Joseph's College; M.D. 1960, University of Pennsylvania.

Leslie H. Sobin, Associate Professor of Pathology. B.S. 1955, Union College; M.D. 1959, State University of New York (Brooklyn).

Cyril Solomon, Clinical Associate Professor of Pathology. B.S. 1932, M.D. 1936, University of Maryland.

Kurt H. Stenzel, Associate Professor of Biochemistry. B.A. 1954, New York University; M.D. 1958, Cornell University.

Stephen S. Sternberg, Associate Professor of Pathology. B.A. 1941, Colby College; M.D. 1944, New York University.

Leo Wade, Associate Professor of Preventive Medicine. A.B. 1933, M.D. 1938, Washington University.

Daniel Wellner, Associate Professor of Biochemistry. A.B. 1956, Harvard University; Ph.D. 1961, Tufts University.

Kenneth R. Woods, Associate Professor of Biochemistry. B.A. 1948, Arizona State University; Ph.D. 1955, University of Minnesota.

Louis Zeitz, Associate Professor of Biophysics. A.B. 1948, University of California; Ph.D. 1962, Stanford University.

Assistant Professors

Alberta M. Albrecht, Assistant Professor of Microbiology. B.S. 1951, Seton Hall College; Ph.D. 1961, Rutgers University.

Nancy W. Alcock, Assistant Professor of Biochemistry. B.S. 1949, University of Tasmania; Ph.D. 1960, University of London.

June L. Biedler, Assistant Professor of Biology. A.B. 1947, Vassar College; Ph.D. 1959, Cornell University.

Esther M. Breslow, Assistant Professor of Biochemistry. B.S. 1953, Cornell University; M.S. 1955, Ph.D. 1959, New York University.

Alfred T. H. Burness, Assistant Professor of Cell Biology. B.Sc. 1955, Ph.D. 1959, Liverpool University.

Arthur S. Carlson, Clinical Assistant Professor of Pathology. A.B. 1941, Brooklyn College; M.D. 1952, Cornell University.

Margaret H. S. Clements, Assistant Professor of Pathology. B.A. 1951, M.B., B.Ch., B.A.O. 1956, Dublin University.

Robert W. Dickerman, Assistant Professor of Microbiology. B.S. 1951, Cornell University; M.A.

1953, University of Arizona; Ph.D. 1961, University of Minnesota.

George W. Dietz, Jr., Assistant Professor of Biochemistry. B.A. 1959, Williams College; Ph.D. 1965, Yale University.

Bozidar Djordjevic, Assistant Professor of Biophysics. M.S. 1952, University of Belgrade; Ph.D. 1960, Rutgers University.

Edward S. Essner, Assistant Professor of Biology. B.S. 1947, Long Island University; Ph.D. 1951, University of Pennsylvania.

Gordon F. Fairclough, Assistant Professor of Biochemistry. B.A. 1960, Ph.D. 1966, Yale University.

Leslie P. Felpel, Assistant Professor of Pharmacology. B.S. 1961, Albany College of Pharmacy; M.S. 1964, Ph.D. 1966, Purdue University.

Caleb E. Finch, Assistant Professor of Anatomy. B.S. 1961, Yale University; Ph.D. 1969, Rockefeller University.

John D. Fissekis, Assistant Professor of Biochemistry. B.S. 1954, University of Athens; Ph.D. 1960, University of Texas.

Martin Fleisher, Assistant Professor of Biochemistry. B.A. 1958, Harpur College; Ph.D. 1966, New York University.

Erwin Fleissner, Assistant Professor of Microbiology. B.A. 1957, Yale University; Ph.D. 1963, Columbia University.

Jerrold Fried, Assistant Professor of Biophysics. B.S. 1958, California Institute of Technology; Ph.D. 1964, Stanford University.

Alfredo Giner-Sorolla, Assistant Professor of Biochemistry. M.S. 1944, University of Valencia; Ph.D. 1958, Cornell University.

Fakhry Girgis, Assistant Professor of Anatomy. M.B., B.Ch. 1949, Cairo University; Ph.D. 1957, Queen's University (Belfast).

George F. Gray, Jr., Assistant Professor of Pathology. B.A. 1956, University of Texas; M.D., M.S. 1961, Baylor University.

Martin D. Hamburg, Assistant Professor of Anatomy. B.A. 1965, New York University; Ph.D. 1969, University of Michigan.

Arthur H. Hayes, Jr., Assistant Professor of Pharmacology. A.B. 1955, University of Santa Clara; M.A. 1957, Oxford University; M.D. 1964, Cornell University.

S. Steven Hotta, Assistant Professor of Biochemistry. A.B. 1950, Ph.D. 1953, University of California; M.D. 1958, Johns Hopkins University.

Nobuko Ikegami, Assistant Professor of Microbiology. B.S. 1951, M.D. 1955, D.S.M. 1960, Osaka University.

Charles E. Inturrisi, Assistant Professor of Pharmacology. B.S. 1962, University of Connecticut; M.S. 1965, Ph.D. 1967, Tulane University.

Jim D. Karam, Assistant Professor of Biochemistry. B.S. 1958, American University of Beirut; Ph.D. 1965, University of North Carolina.

Nikitas D. Kessaris, Assistant Professor of Biophysics. B.A. 1952, Emory University; M.S. 1953, Ph.D. 1966, Harvard University.

Levy Kopelovich, Assistant Professor of Biochemistry. B.S. 1958, Hebrew University; Ph.D. 1962, University of California.

Robert M. Krug, Assistant Professor of Microbiology. B.A. 1961, Harvard University; Ph.D. 1966, Rockefeller University.

John E. Lee, Clinical Assistant Professor of Anatomy. A.B. 1954, Princeton University; M.D. 1958, Duke University.

John Lenard, Assistant Professor of Biochemistry. B.A. 1958, Ph.D. 1964, Cornell University.

Michael J. Lyons, Assistant Professor of Microbiology. B.Sc. 1953, M.Sc. 1954, National University of Ireland; Ph.D. 1958, University of Glasgow.

Thomas M. Maack, Assistant Professor of Physiology. M.D. 1962, University of Sao Paulo.

John P. Maher, Assistant Professor of Public Health. B.S. 1956, St. Peter's College; M.D. 1960, State University of New York (Brooklyn); M.P.H. 1968, Harvard University.

Valerie Miké, Assistant Professor of Biostatistics in Public Health. B.A. 1956, Manhattanville College; Ph.D. 1967, New York University.

Wayne G. Monahan, Assistant Professor of Biophysics. B.S. 1963, Ph.D. 1968, Ohio State University.

Harold Moroson, Assistant Professor of Biophysics. B.S. 1950, Columbia University; Ph.D. 1958, Polytechnic Institute of Brooklyn.

Herbert F. Oettgen, Assistant Professor of Biology. M.D. 1951, University of Cologne.

James C. Parham II, Assistant Professor of Biochemistry. B.S. 1959, Bates College, Ph.D. 1963, Duke University.

Lou Ann Pilkington, Assistant Professor of Physiology. M.S. 1959, Ph.D. 1961, University of Oklahoma.

Robert Porro, Assistant Professor of Pathology. A.B. 1956, University of California; M.D. 1960, Duke University.

Ira Pullman, Assistant Professor of Biophysics. B.S. 1941, Columbia University; Ph.D. 1953, University of Illinois.

Robert R. Riggio, Assistant Professor of Biochemistry. B.A. 1954, Dartmouth College; M.D. 1958, New York University.

Theodore Robertson, Clinical Assistant Professor of Pathology. B.S. 1939, M.D. 1943, Cornell University.

Toby C. Rodman, Assistant Professor of Anatomy. B.S. 1937, Philadelphia College of Pharmacy and Science; M.S. 1961, Ph.D. 1963, New York University.

Josephine Salser, Assistant Professor of Biochemistry. B.S. 1950, University of the Philippines; Ph.D. 1955, Radcliffe College.

Edward T. Schubert, Assistant Professor of Biochemistry. B.S. 1949, M.S. 1952, Ph.D. 1959, Fordham University.

Gabriel H. Schwartz, Assistant Professor of Biochemistry. A.B. 1958, Princeton University; M.D. 1962, Columbia University.

George Stassa, Clinical Assistant Professor of Anatomy. A.B. 1956, M.D. 1960, Columbia University.

Elliott H. Stonehill, Assistant Professor of Microbiology. B.S. 1950, City College of New York; M.A. 1956, Brooklyn College; Ph.D. 1965, Cornell University.

Myron Susin, Assistant Professor of Pathology. B.A. 1956, Augustana College; M.D. 1960, University of Illinois.

Dieter H. Sussdorf, Assistant Professor of Microbiology. B.A. 1952, University of Kansas City; Ph.D. 1956, University of Chicago.

Norbert I. Swislocki, Assistant Professor of Biochemistry. B.A. 1956, Ph.D. 1964, University of California.

Morris N. Teller, Assistant Professor of Biology. B.S. 1940, Brooklyn College; Ph.D. 1948, University of Minnesota.

Roy S. Tilbury, Assistant Professor of Biophysics. B.S. 1955, London University; Ph.D. 1963, McGill University.

Carolyn W. Watson, Clinical Assistant Professor of

Pathology. B.A. 1945, Hollins College; M.D. 1949, University of Maryland.

John Weber, Assistant Professor of Anatomy. B.A. 1961, D.D.S. 1965, Columbia University.

Katsuhiko Yano, Assistant Professor of Public Health. M.D. 1951, Ph.D. 1961, Hiroshima Prefectural Medical College.

Morris S. Zedeck, Assistant Professor of Pharmacology. B.S. 1961, Brooklyn College of Pharmacy; Ph.D. 1965, University of Michigan.

Degree Recipients, 1971

Doctors of Philosophy

William Frederick Bowers, B.A. 1966, University of California (Berkeley); Ph.D. 1971, Cornell University. Major: Biochemistry. Boston, Massachusetts.

Anna Barbara Drakontides, B.A. 1955, M.A. 1960 Hunter College; M.S. 1968, Cornell University; Ph.D. 1971, Cornell University. Major: Biological Structure. New York, New York.

Louise A. Lichtenberg, B.A. 1964, Oberlin College; Ph.D. 1970, Cornell University. Major: Biochemistry. Washington, D. C.

Gesina L. Longenecker, B.S. 1965, Newcomb College; Ph.D. 1971, Cornell University. Major: Pharmacology. New Orleans, Louisiana.

Neal A. Machtiger, B.S. 1966, Cornell University; Ph.D. 1971, Cornell University. Major: Microbiology. Valley Stream, New York.

Robert Charles Nowinski, B.S. 1967, Beloit College; Ph.D. 1971, Cornell University. Major: Biology. New Rochelle, New York.

Margaret Payne Parham, B.S. 1964, Medical College of Virginia, School of Pharmacy; Ph.D. 1971, Cornell University. Major: Biochemistry. Richmond, Virginia.

Jeanne Isabelle Rader, B.A. 1966, Syracuse University; Ph.D. 1971, Cornell University. Major: Biology. Hamburg, New York.

Charles Stuart Rubin, B.S. 1965, University of Scranton; Ph.D. 1971, Cornell University. Major: Biochemistry. Scranton, Pennsylvania.

Anne Tax, B.A. 1966, Douglass College, Rutgers—The State University; Ph.D. 1971, Cornell University. Major: Microbiology. Linden, New Jersey.

Roberta E. Weisbrod, B.S. 1964, Brooklyn College; Ph.D. 1971, Cornell University. Major: Biochemistry. Brooklyn, New York.

Marion M. Zatz, B.A. 1965, Barnard College; Ph.D. 1971, Cornell University. Major: Microbiology. New York, New York.

Masters of Science

Thomas Baker, B.A. 1968, Hunter College; M.S. 1971, Cornell University. Major: Pharmacology. Bronx, New York.

Karen M. Lowry, B.S. 1968, Fordham College of Pharmacy; M.S. 1971, Cornell University. Major: Pharmacology. Stamford, Connecticut.

Peter George Sohnle, B.A. 1966, Rutgers—The State University; M.S. 1971, Cornell University. Major: Microbiology. Basking Ridge, New Jersey.

Students, 1971–72

Candidates For The Degree of Doctor of Philosophy

Jill P. Adler, B.S. 1968, Douglass College. Major: Microbiology. Paterson, New Jersey.

Anthony P. Albino, B.A. 1970, Hunter College. Major: Biology. Brooklyn, New York.

Alain Amzallag, B.S. 1970, McGill University. Major: Genetics. Montreal, Canada.

Karen Jane Artzt, B.A. 1964, Cornell University. Major: Genetics. New York, New York.

Sr. Mary Frances Asterita, B.A. 1961, Marymount College; M.S. 1969, New York University. Major: Physiology. New York, New York.

Richard William Avenia, B.S. 1967, St. John's University. Major: Pharmacology. Valley Stream, New York.

Michael I. Bernhard, B.S. 1966, Tufts University; M.S. 1969, New York University. Major: Biology. Roslyn Heights, New York.

Lois Bren Bierlmaier, B.A. 1964, Clark University; M.S. 1967, Syracuse University. Major: Microbiology. Mt. Kisco, New York.

Norman R. Boisse, B.S. 1970, University of Connecticut School of Pharmacy. Major: Pharmacology. Old Orchard Beach, Maine.

Barbara A. Brennessel, B.S. 1969, Fordham University. Major: Biochemistry. Brooklyn, New York.

Dorothy L. Buchhagen, B.S. 1966, Columbia University. Major: Biology. New York, New York.

Ricardo Calvo, B.S. 1965, New York University; M.S. 1967, Columbia University. Major: Neurobiology and Behavior. Bronx, New York.

Norine L. Capurro, B.S. 1969, University of Santa Clara. Major: Pharmacology. San Leandro, California.

Maria T. Caserta, B.A. 1970, Thomas More College, Fordham University. Major: Neurobiology and Behavior. Woodside, New York.

Arthur J. L. Cooper, B.S. 1967, Northern Polytechnic (University of London); M.S. 1968, Imperial College of Science and Technology (London). Major: Biochemistry. London, England.

Linda W. DeLap, B.S. 1970, Michigan State University. Major: Biochemistry. Fanwood, New Jersey.

Victor M. de Leon, B.S. 1961, University of Puerto Rico. Major: Genetics. New York, New York.

Khatchik M. Deuvletian, B.S. 1967, M.S. 1969, American University of Beirut. Major: Microbiology. Beirut, Lebanon.

Annamay T. Duffy, A.A. 1958, Mercy College; B.A. 1959, Manhattanville College; M.S. 1962, Catholic University of America. Major: Biochemistry. Dobbs Ferry, New York.

June C. Dyer, B.S. 1966, McGill University; M.S. 1969, McMaster University. Major: Genetics. Pembroke West, Bermuda.

Edward F. Erker, B.S. 1968, University of Massachusetts. Major: Pharmacology. Walpole, Massachusetts.

Polly R. Etkind, A.B. 1966, Goucher College. Major: Biology. Elmira, New York.

Nancy G. Famulari, B.A. 1968, Colby College. Major: Biochemistry. Nahant, Massachusetts.

Ann Jane Feeney, B.A. 1970, Newton College of the Sacred Heart. Major: Biology. East Wegmath, Massachusetts.

Anthony Ferrara, B.A. 1969, Temple University. Major: Biochemistry. Philadelphia, Pennsylvania.

Lorraine A. Flaherty, B.S. 1967, Jackson College (Tufts University). Major: Genetics. Rutherford, New Jersey.
Kamal Mohini Gaind, B.S. 1970, City College of the City University of New York. Major: Biochemistry. New York, New York.
David L. Gibbs, B.A. 1970, University of the Pacific. Major: Microbiology. San Francisco, California.
Ellyn J. Glazer, B.A. 1970, Brooklyn College. Major: Pharmacology. Brooklyn, New York.
Ellen D. Goldberg, B.A. 1967, Russell Sage College. Major: Genetics. Hillside, New Jersey.
William W. Goodhue, Jr., B.S. 1966, Georgetown University; M.D. 1970, Cornell University Medical College. Major: Pathology. Kauai, Hawaii.
Shelley M. Gordon, B.S. 1970, University of Michigan. Major: Genetics. Syracuse, New York.
Dennis J. Grab, A.B. 1969, Hunter College. Major: Biology. Brooklyn, New York.
Nicola Green, B.A. 1969, Smith College. Major: Microbiology. Wakefield, Massachusetts.
Edmund W. Hafner, B.A. 1964, University of Rochester; M.A.T. Harvard University. Major: Biochemistry. Roslyn, New York.
George R. Henderson, B.S. 1967, St. Lawrence University; M.A. 1970, S.U.N.Y. at Binghamton. Major: Physiology. Johnson City, New York.
Bernard Horowitz, B.S. 1966, University of Chicago. Major: Biochemistry. Philadelphia, Pennsylvania.
Peter B. Jahrling, B.A. 1967, Cornell University. Major: Microbiology. Ridgewood, New Jersey.
Mona D. Jensen, B.S. 1966, Massachusetts Institute of Technology. Major: Biochemistry. College Park, Maryland.
Robert F. Kaiko, B.S. 1970, University of Connecticut School of Pharmacy. Major: Pharmacology. Jewett City, Connecticut.
Barry B. Kaplan, B.A. 1968, Hofstra University; M.A. 1969, Hofstra University. Major: Biological Structure. Bayside, New York.
S. Robert Lehr, B.S. 1966, Polytechnic Institute of Brooklyn. Major: Biophysics. Brooklyn, New York.
Harriet R. Levie, B.A. 1960, Barnard College; M.A. 1964, Hunter College. Major: Biochemistry. New York, New York.
Herbert E. Lowndes, B.A. 1968, M.S. 1970, University of Saskatchewan. Major: Pharmacology. Saskatoon, Saskatchewan, Canada.
Bonnie J. Mathieson, B.S. 1967, University of Illinois; M.S. 1970, Stanford University. Major: Biology. Palo Alto, California.
Irvine G. McQuarrie, B.S. 1961, University of Utah; M.D. 1965, Cornell University Medical College. Major: Neurobiology and Behavior. New York, New York.
Paul V. O'Donnell, B.S. 1968, Rensselaer Polytechnic Institute. Major: Biochemistry. Medway, Massachusetts.
Paul O. Okonkwo, B.S. 1967, M.S. 1968, Cornell University. Major: Pharmacology. Biafra, West Africa.
Br. Raymund A. Peckauskas, B.A. 1955, Catholic University of America; M.S. 1956, Catholic University of America. Major: Biophysics. New York, New York.
Lawrence M. Pinkus, B.A. 1966, The Johns Hopkins University. Major: Biochemistry. Mohegan Lake, New York.
Lillian D. Rabbani, B.S. 1966, City College of New York; M.S. 1969, State University of New York (Albany). Major: Microbiology. New York, New York.
Lesley A. Radov, B.S. 1970, University of Wisconsin. Major: Microbiology. Erie, Pennsylvania.
Noel M. Relyea, B.A. 1968, Cornell University. Major: Biochemistry. Riverside, Illinois.
Paul G. Richman, B.S. 1967, Brooklyn College. Major: Biochemistry. Brooklyn, New York.
Howard C. Rosenberg, B.A. 1969, Ithaca College. Major: Pharmacology. Atlantic City, New Jersey.
Robert A. Ross, B.A. 1969, Hobart College. Major: Neurobiology and Behavior. Baltimore, Maryland.
Taube P. Rothman, B.A. 1969, Hunter College. Major: Genetics. Dobbs Ferry, New York.
Meryl S. Rubin, B.S. 1960, The College of the City of New York. Major: Biochemistry. New York, New York.
Janet E. Rubinstein, B.S. 1970, Tufts University. Major: Biology. Portland, Maine.
Michael D. Sapozink, B.S. 1970, Cornell University. Major: Biophysics. Rochester, New York.
Charles Seymour III, B.A. 1966, Yale University. Major: Virology. New York, New York.
Laura K. Seymour, B.A. 1967, University of Pennsylvania. Major: Microbiology. New York, New York.
Bonnie J. Shubart, B.A. 1968, Wellesley College. Major: Neurobiology and Behavior. Alexandria, Virginia.
Janet D. Smith, B.S. 1967, Bucknell University. Major: Biology. Clark, New Jersey.
Rosemary Soave, B.S. 1970, Fordham University. Major: Biochemistry. New York, New York.
Roger W. Soller, B.A. 1968, Colby College. Major: Neurobiology and Behavior. Hartsdale, New York.
Meryl G. Steinberg, B.A. 1970, Hofstra University. Major: Genetics. East Meadow, New York.
Marilyn Stephens, B.S. 1962, Marymount College; M.S. 1964, Georgetown University. Major: Biochemistry. New York, New York.
Jeffrey B. Stevens, B.S., M.S. 1970, Michigan State University. Major: Biochemistry. Essexville, Michigan.
William J. Suling, B.S. 1962, Manhattan College; M.S. 1965, Duquesne University. Major: Microbiology. Bronx, New York.
Laura M. Tarantino, B.S. 1968, College Misericordia. Major: Biochemistry. Exeter, Pennsylvania.
Elizabeth B. Thompson, B.A. 1964, Radcliffe College. Major: Biological Structure. Newark, New Jersey.
Charles Chi-Chuen Tong, A.B., 1969, Hunter College. Major: Biology. Hong Kong.
Paul A. VanDerWerf, B.A. 1963, M.S. 1966, University of Minnesota. Major: Biochemistry. Sandstone, Minneapolis.
Karl G. Verebely, B.A. 1965, Hunter College; M.A. 1967, The City University of New York. Major: Pharmacology. Kew Gardens, New York.
Donald H. Waters, B.S. 1967, Philadelphia College of Pharmacy and Science. Major: Pharmacology. E. Brunswick, New Jersey.
Jacqueline M. S. Winterkorn, B.A. 1967, Barnard College. Major: Neurobiology and Behavior. New York, New York.
Tze-Kong Young, B.M. 1960, National Defense Medical Center. Major: Physiology. Taiwan, China.

Candidates For The Master of Science Degree

Miriam M. Gitterman, B.A. 1968, University of Pennsylvania. Major: Biophysics. New York, New York.
Bette A. Pancake, B.A. 1966, Ohio Wesleyan University. Major: Microbiology. Mountain Lakes, New Jersey.

Entering Students

Margaret J. Arny, B.A. 1971, Earlham College. Major: Biology. Madison, Wisconsin.

Roberta J. Barnes, B.S. 1971, William Smith College. Major: Microbiology. Wallingford, Pennsylvania.

Barbara J. Burchanowski, B.S. 1971, Pennsylvania State University. Major: Biological Structure and Cell Biology. Montoursville, Pennsylvania.

Theresa A. Calvelli, B.S. 1971, Marymount College. Major: Biology. Dobbs Ferry, New York.

Cheryl E. Dreyfus, B.S. 1967, University of Vermont; M.S. 1969, Cornell University. Major: Biological Structure and Cell Biology. Woodbridge, New Jersey.

Leonard F. Estis, B.S. 1971, University of Pittsburgh. Major: Biochemistry. King of Prussia, Pennsylvania.

Dana M. Fowlkes, B.A. 1971, Colgate University. Major: Microbiology. Hamilton, New York.

Edmund A. Goidl, M.S. 1971, American University. Major: Microbiology. Rockville, Maryland.

Robert Scott Greenfield, B.A. 1971, S.U.N.Y. at Buffalo. Major: Biochemistry. East Meadow, New York.

Valerie L. Johnson, B.S. 1971, University of California. Major: Physiology. Yuba City, California.

Richard J. Kascsak, B.S. 1969, St. Francis College. Major: Microbiology. Franklin Square, New York.

Anthony A. Lombardo, B.S. 1969, St. Francis College; M.S. 1971, Duquesne University. Major: Physiology. Brooklyn, New York.

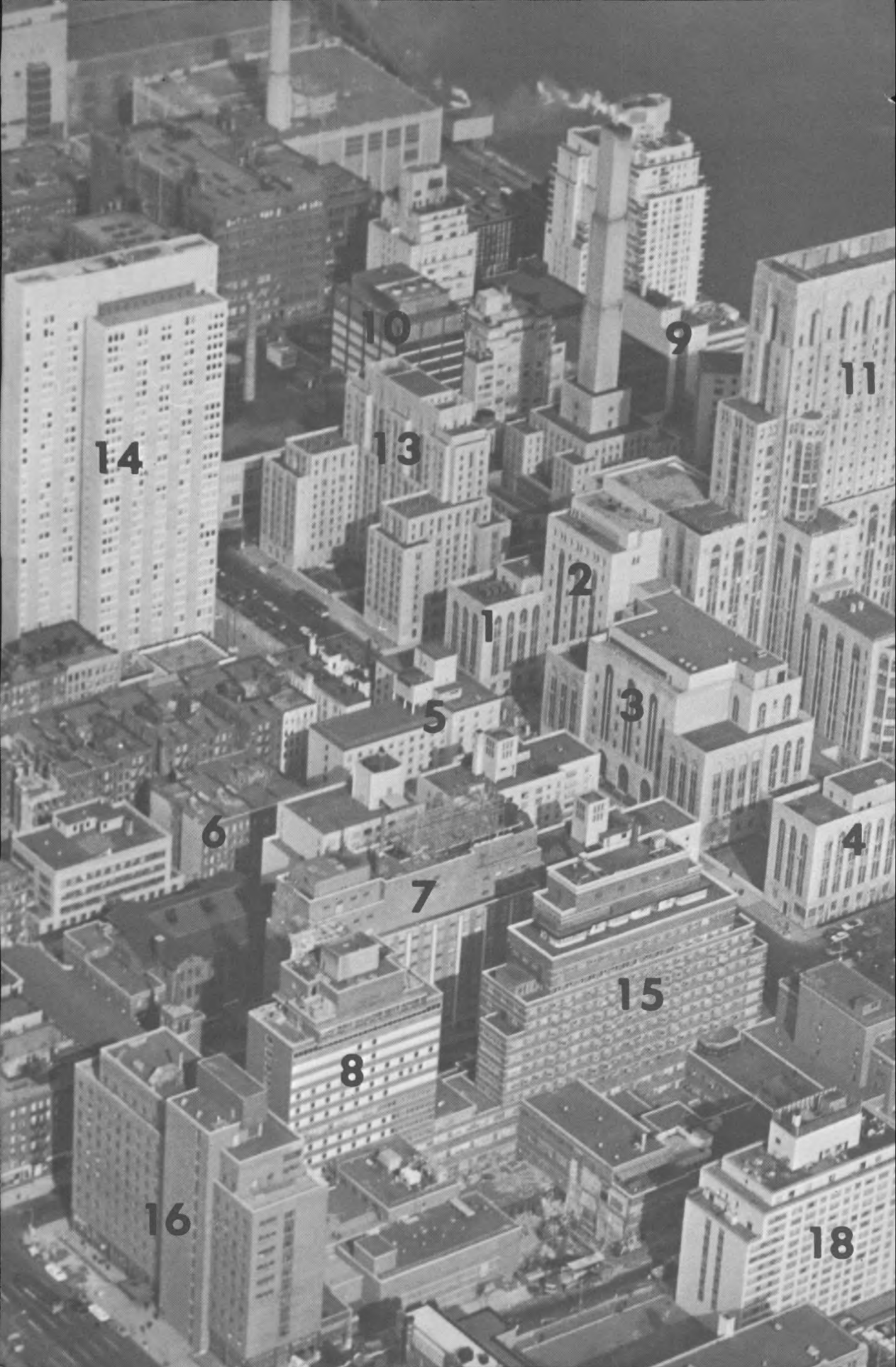
Susan Lundt, B.A. 1967, Mount Holyoke. Major: Biochemistry. New York, New York.

Terence M. McCaffrey, B.S. 1969, Manhattan College. Major: Biochemistry. Hauppauge, New York.

Leslie Morioka, B.A. 1968, Barnard College. Major: Genetics. Honolulu, Hawaii.

Ronald D. Sekura, B.S. 1968, Pennsylvania State; M.S. 1970, Pennsylvania State. Major: Biochemistry. Manville, New Jersey.

Andrew Yen, B.A. 1969, Haverford College; M.S. 1970, University of Washington (Seattle). Major: Biophysics. Seattle, Washington.


1
2
3
4
5
6
7
8
9
10
11
13
14
15
16
18

Cornell University Medical College
1 Anatomy Building
2 William Hale Harkness Medical Research Building
3 Samuel J. Wood Library and Research Building
4 Biochemistry-Pharmacology Building
5 Olin Hall
6 Livingston Farrand Apartments

Sloan-Kettering Institute for Cancer Research
7 Kettering Laboratory
8 Howard Laboratory

9 **Margaret Caspary Research Building**

10 **Institute for Muscle Disease**

11 **The New York Hospital**
12 Payne Whitney Psychiatric Clinic
13 Nurses' Residence
14 Payson House

15 **Memorial Hospital**
16 Ewing Pavilion
17 Sloan House
18 Norman Winston House

19 **Rockefeller University**

Index