

1995

Boston University School of Medicine Division of Graduate Medical Sciences: 1995-1996

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Boston University

**BOSTON UNIVERSITY
SCHOOL OF MEDICINE**

**DIVISION OF GRADUATE
MEDICAL SCIENCES**

Boston University
School of Medicine/
School of Public Health
Main Entrance

CALENDAR 1995/96

Summer I 1995

April

11 Tue Registration begins.

May

23 Tue Registration ends, instruction begins.

29 Mon Holiday, classes suspended.

July

1 Sat End of session.

Summer II 1995

Apr

11 Tue Registration begins.

July

5 Wed Registration ends, instruction begins.

August

12 Sat End of session.

Semester I 1995

September

5 Tues Instruction begins.*

October

9 Mon Holiday, classes suspended.

10 Tues Substitute Monday schedule of classes.

14 Sat Homecoming/Parents Weekend through Sunday, October 15.

November

14 Tue Registration begins for Spring 1996.

22 Wed Fall recess through Sunday, November 26. Classes suspended.

27 Mon Instruction resumes.

December

12 Tues Instruction ends.

13 Wed Study period through Thursday, December 14.

15 Fri Final exams begin.

20 Wed Final exams end.

Semester II 1996

January

16 Tue Instruction begins.*

February

19 Mon Holiday, classes suspended.

20 Tue Substitute Monday schedule of classes.

March

2 Sat Spring recess through Sunday, March 10. Classes suspended.

11 Mon Instruction resumes.

April

9 Tue Registration for Fall 1996.

15 Mon Holiday, classes suspended.

17 Wed Substitute Monday schedule of classes.

May

1 Wed Instruction ends.

2 Thu Study period through Friday, May 3.

6 Mon Final exams begin.

14 Tue Final exams end.

19 Sun Commencement.

The academic calendar is subject to change.

The University, in scheduling classes on religious holidays, intends that students observing those holidays be given ample opportunity to make up work. Faculty members who wish to observe religious holidays will arrange for another faculty member to meet with their classes or for cancelled classes to be rescheduled.

The calendars for the School of Law, School of Medicine, and School of Graduate Dentistry are published separately and are distributed by those Schools.

Note: Classes will be held on the Veterans Day holiday.

* Information regarding the days and hours of registration before the start of classes is published in the semester Class Schedule.

**BOSTON UNIVERSITY
SCHOOL OF MEDICINE**

DIVISION OF GRADUATE
MEDICAL SCIENCES



1995/96

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Dr. Douglas Cotanche and Ken Lee at the scanning electron microscope.

A MESSAGE FROM THE ASSOCIATE DEAN AND DIRECTOR

At Boston University Medical Center, clinical and basic scientists along with graduate students are creating the foundation for 21st-century science. From molecular biology to clinical trials, from computer models to pharmaceutical products, the research teams at the School of Medicine, Division of Graduate Medical Sciences, the School of Public Health, and the Goldman School of Graduate Dentistry are continually harnessing the technology of the future.

Boston University School of Medicine ranks between the 85th and 90th percentile nationally in research grants and contracts per faculty; the school ranks in the 90th percentile for ratio of basic science graduate students per basic science faculty. These superb indicators of strength in research resulted from a decision 20 years ago to expand vigorously a network of centers and institutes at our Center. The Boston University Medical Center Campus is now home to a Pulmonary Center, an Arthritis Center, a Cardiovascular Institute, a Cancer Center, a Center for Human Genetics, a Gerontology Center, as well as the Mallory Institute of Pathology, the Thorndike Memorial Laboratory, the Maxwell Finland Laboratory for Infectious Diseases, and the Sloan Epidemiology Unit.

To accommodate the growth in these areas and in research emanating from the basic science departments, significant additions to the School's physical plant have been made. A new 35,000 square foot Dermatology Research Facility opened in 1991 at 609 Albany Street, and the Center for Advanced Biomedical Research, with 180,000 square feet of research space, was opened in 1993. In 1995, the new state-of-the-art McNary Learning Center will be opened and operable. It will contain lecture halls, seminar rooms, and a highly sophisticated computerized teaching lab.

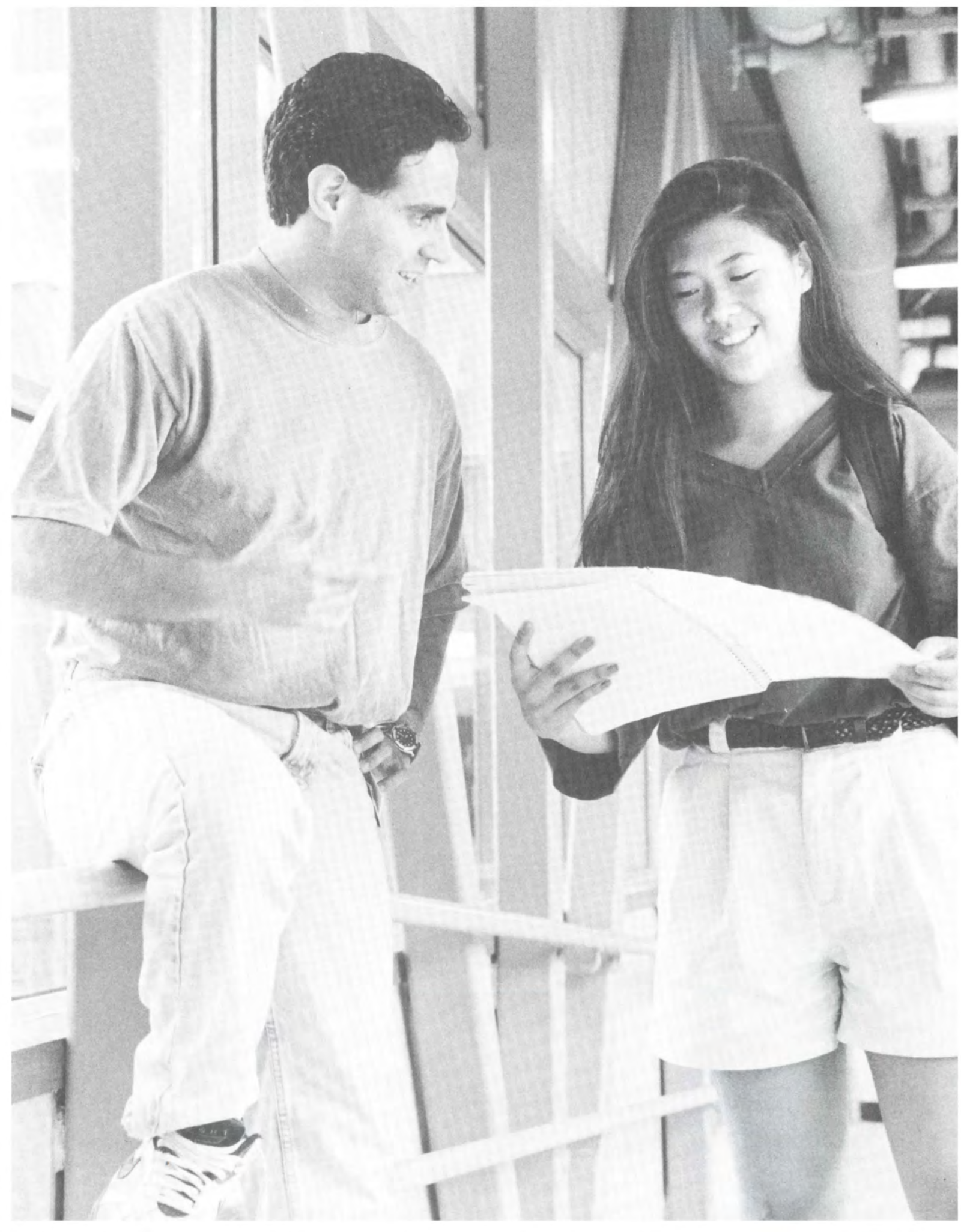
These new additions to research and teaching space will be fortified with an impressive modernization program of our existing research facilities. These changes will surely help to perpetuate an environ-



ment conducive to integrated inquiry between basic scientists and clinical investigators. Indeed, the prevalence of joint appointments between basic science and clinical departments attests to the high level of cooperation between clinical and basic scientists and clinicians in the conceptualiza-

tion, discovery, and development of unusual research programs.

Carl Franzblau, PhD
Associate Dean and Director
Graduate Biomedical Science Studies



GRADUATE DEPARTMENTS AND DEGREE PROGRAMS

Students in the Division of Graduate Medical Sciences (GMS)—the focus of graduate education in the biomedical sciences at Boston University Medical Center—are provided with the opportunity of undertaking study and research in the well-equipped laboratory facilities of the preclinical departments that make up the Division. PhD degree study is available in anatomy and neurobiology, behavioral neuroscience, biochemistry, biophysics, microbiology, pathology, pharmacology, and pathology. MA degree study is available in medical sciences and all of the above areas except behavioral neuroscience and pathology. Interdepartmental training and research programs in molecular and cellular biology, immunology, human genetics, and neuroscience are also available. Dual degree programs with the School of Medicine, the School of Public Health, the College of Engineering, and the School of Management are an ever-expanding aspect of current multi-dimensional biomedical research and education. Specific requirements and research opportunities in these various areas are outlined elsewhere.

To accommodate the growth in these areas and in research emanating from the basic science departments, significant additions to the School's physical plant have been made and more are underway.

These additions to research space will help to perpetuate an environment conducive to integrated inquiry between basic scientists and clinical investigators. Indeed, the prevalence of joint appointments between basic sciences and clinical departments attests to the high level of cooperation between scientists and clinicians in the conceptualization, discovery, development, and testing of new therapeutic methods and pharmacological products.

Abbreviations and Symbols

A system of abbreviations and symbols is used in the course listings that appear in this bulletin.

Part of each course number is an alphabetical prefix that indicates the University School, College, or program (first three letters) and the department or division (next two letters) in which the course originates. For example, GMS AN 808 indicates a course in the Division of Graduate Medical Sciences Department of Anatomy and Neurobiology. The alphabetical prefixes that appear in this bulletin are explained in the table below.

The course number indicates the course's level of difficulty. Courses at the 500 and 600 level are open to both undergraduate and graduate students; those listed in this bulletin are approved for MA and PhD credit. Graduate students in these courses are often expected to complete extra work in the form of special projects. Students should consult the course instructor about any special requirements.

Other course levels are as follows:

700–899 Primarily for graduate students
900–999 For graduate students only

An X after a course number indicates that the course is given off campus.

Course descriptions usually offer a brief outline of the content of the course, any prerequisites or corequisites, the instructor, and the semester the course is offered.

The following abbreviations are frequently used:

prereq	prerequisite
coreq	corequisite
cr	credits
sem.	semester



Not offered means the course is not offered during the current academic year but may be offered in the future. In many cases, these courses are offered every other year.

Offered irregularly means the course will be offered if there is sufficient demand.

Courses carry 4 credits per semester unless specified otherwise.

Abbreviations Used in Course Numbers

GMS	Division of Graduate Medical Sciences
AN	Anatomy and Neurobiology
BI	Biochemistry
BN	Behavioral Neuroscience
BT	Biomedical Technology Program
CP	Medical Sciences Certificate Programs
CT	Computer Technology Program
DM	Department of Dermatology
HG	Human Genetics
ID	Infectious Disease
IS	Interdisciplinary Studies
MI	Microbiology
MS	Division of Graduate Medical Science
OT	Ophthalmic Technology Program
PA	Pathology and Clinical Medicine
PH	Physiology
PM	Pharmacology and Experimental Therapeutics

Accreditations and Memberships

Boston University is accredited by the New England Association of Schools and Colleges, Inc., is recognized by the University of the State of New York, and is a member of the following agencies: the American Society of Composers, Authors and Publishers; the American Council of Learned Societies; Universities Research Association; EDUCOM Interuniversity Communications Council; and the National Association of Schools and Colleges of the United Methodist Church.

GRADUATE MEDICAL SCIENCES COURSES

In addition to the courses offered by each department, the following are courses offered through the Division by faculty from multiple cooperating departments.

GMS CT 501 Introduction to Personal

Computers Prereq: consent of instructor. Designed to introduce language and applications of microcomputers in medical and public health settings. Provides working knowledge of operating systems, hard disk management and word processing, Lotus 1-2-3 and its various applications; spreadsheets, databases, and graphics. *Nicastro*. 2 cr, either sem.

GMS CT 552 Computers in Medicine Computer applications and programs encountered in the course of a medical career. Lectures and hands-on work in computer laboratory. Applications/programs: databases, bibliographic searches, statistics, and expert systems. *Nicastro, Ward*. 2nd sem.

GMS MS 502 Pharmacology: Drug Actions and Reactions Prereq: biology and chemistry; consent of instructor. Basic concepts and principles of the interactions of chemicals and living organisms, exemplified by drugs that are in wide usage, and the physiological and biochemical principles needed to understand pharmacologic actions. *Levine*. 2nd sem.

GMS MS 504 Human and Clinical Nutrition Prereq: biology, chemistry, or equivalent, and consent of instructor. Integration of biochemical and physiological factors in human nutrition. Nutritional requirements and methods of meeting nutritional needs examined in the light of current research. Emphasis on analysis of the rationale of current nutritional practices as they relate to human disease. *Vitale*. 2nd sem.

GMS MS 703 Neuroscience Prereq: consent of instructor. Integrated treatment of anatomy and physiology of the nervous system. In anatomy classes, brains and spinal cords are dissected and microscopic slides examined to study cytology and projections of neurons. Other practical classes and demonstrations cover physiology, neurology, ophthalmology and otolaryngology. *Feldman*. 2nd sem.

GMS MS 748 Endocrinology Prereq: biochemistry or physiology, and consent of instructor. Integrated treatment of human endocrinology, biosynthesis of hormones, their receptor interactions, and their physiological effects. *Head*. 2nd sem.

GMS MS 753 Cell Biology Prereq: consent of instructor. Morphology of organelles, biochemical consideration of receptors, responses to extracellular matrices, vesicles within the cell, and secretion; regulation of gene expression. Behavior of cells in culture and the cell cycle. Cellular differentiation, embryogenesis, biochemistry of fertilization, cell movement, and control of cell differentiation. *Fine*. 4 cr, 1st sem.

GMS MS 781 Introduction to Human Genetics

Prereq: general biology, genetics, biochemistry, cell biology, molecular genetics or the equivalent, and consent of instructor. Teaches the basic principles and research methods of human genetics, including the study of genes at the molecular, chromosomal, organismal, and population levels. Emphasis is on classical genetic examples in human disease. Applications of the technology in gene identification, genetic testing, and forensic science are presented. *Farrer*. 1st sem.

GMS MS 782 The Biology of the Visual System

in Health and Disease Principles of cell biology as applicable to the eye and visual system in normal and diseased states and the mechanisms or processes unique to this system. Each basic science lecture outlining the relationship between basic and clinical science. *Leibowitz*. 2 cr, 2nd sem.

GMS MS 783, 784 Molecular Basis of Neurologic Diseases

Molecular mechanisms of stroke, multiple sclerosis, Huntington's disease, Alzheimer's disease, amyotrophic lateral sclerosis, muscular dystrophy, and neoplasia are considered. Fundamentals and current research of molecular biology are reviewed. Current publication seminar discussion is held with student participation. Keynote lectures are given monthly by distinguished guest speakers. *Abraham, Kowall*. 2 cr each sem., year course.

MAJOR FIELDS AND AREAS OF SPECIALIZATION

Graduate students in the Division of Graduate Medical Sciences utilize the facilities of the basic science and clinical departments, research laboratories, and centers of the Boston University School of Medicine and the affiliated hospitals of the Boston University Medical Center (BUMC). In addition, spe-

cial programs may be arranged between the Division of Graduate Medical Sciences in the School of Medicine and the School of Public Health in the School of Medicine; the Department of Veterans Affairs (VA) Medical Centers; the Departments of Biology, Chemistry, and Psychology on the Charles River Campus; the School of Management; and the College of Engineering. Information about all programs and specific research interests of the faculty members involved may be obtained by writing to the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118.

Both MA and PhD degrees (except where noted otherwise below) are offered by the Division in each of the following departments and programs.

Anatomy and Neurobiology

Graduate instruction in the Department of Anatomy and Neurobiology is offered in gross human anatomy, microscopic anatomy, and neuroscience, in addition to several courses designed specifically for graduate students. Current areas of graduate research include: examination of connections, neurocytology, and immunocytochemistry of various parts of the nervous system, such as the cerebral cortex, auditory system, facial nucleus, hippocampus, spinal cord, and basal ganglia; development of visual cortex and retina; aging in various parts of the nervous system; sensory cell regeneration in the cochlea; neurobiological basis of memory; neurobiology of cell signaling; molecular innervation of the lung; and cell biology of collagen.

School of Medicine Division of Graduate Medical Sciences**MA Programs**

Anatomy
Biochemistry
Medical Sciences
Microbiology
Pharmacology
Physiology
Joint MA/MPH with School of Public Health
Joint MA/MBA with School of Management
Joint MA/MD with School of Medicine

PhD Programs

Anatomy
Behavioral Neuroscience
Biochemistry
Biophysics
Interdisciplinary Studies
Microbiology
Pharmacology
Physiology
Joint MD/PhD
Joint MD/PhD with Biomedical Engineering

Behavioral Neuroscience

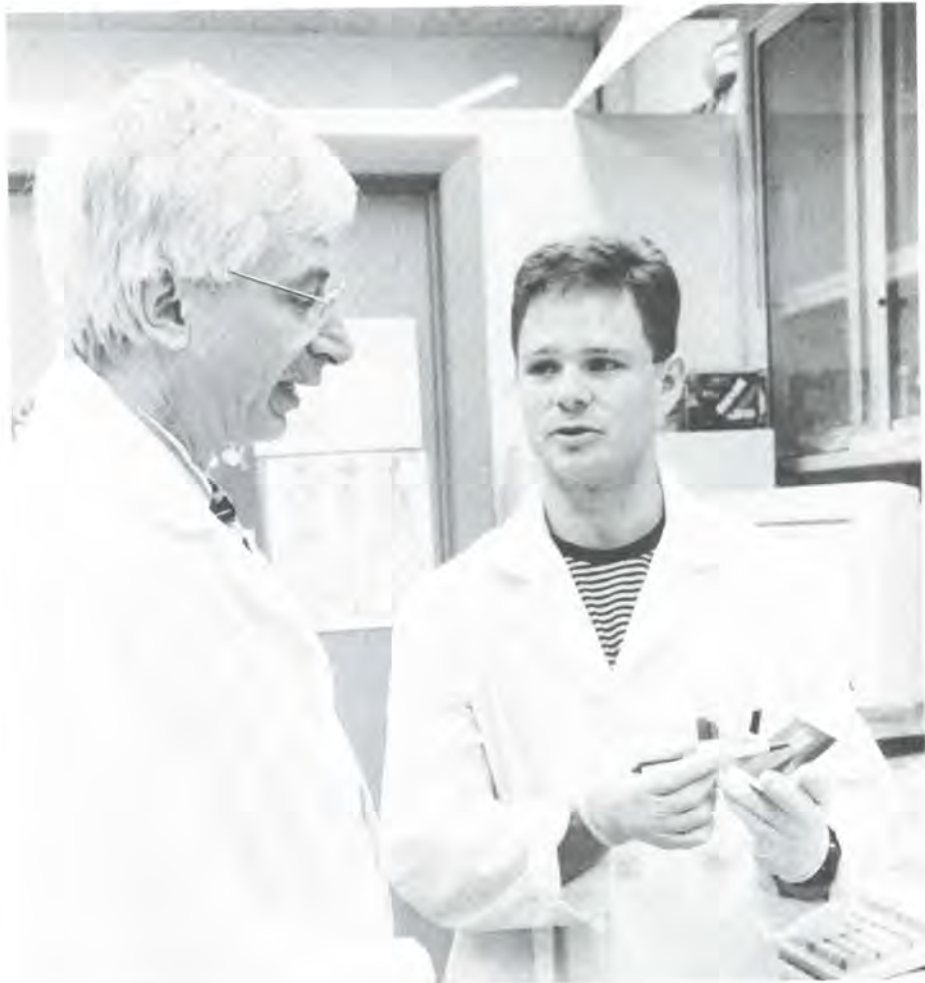
The program in behavioral neuroscience awards the PhD degree only; the MA degree is not offered. The program offers opportunities for research related to human brain dysfunction. Principal research interests of the current core faculty include language disorders; disorders of purposeful movement; pathology of learning and memory; drugs and behavior; dementias; brain mechanisms of reinforcement; psychoneuroimmunology; visuospatial and other perceptual disorders; affective disorders; and developmental disorders. The methods employed in the study of human brain disorders include neuropsychological, neurological, and behavioral assessment procedures; dichotic listening; visual half-field and bimanual stimulation; instrumental and classical conditioning; brain imaging techniques; psychopharmacology; and electrophysiology. The department maintains a close affiliation with the Boston VA Medical Center, where students are encouraged to attend seminars, colloquia, and hospital rounds in the psychology and neurology services.

Biochemistry

The major research interests of the faculty in the Department of Biochemistry are in the areas of molecular and cellular biochemistry. More specifically, research projects include: (1) regulation of gene expression in response to development, tissue specificity, growth and differentiation, interaction with environmental factors, and various disease states; (2) vesicle trafficking; (3) signal transduction by peptide hormones, growth factors, and cytokines; (4) plant molecular biology; (5) gene expression, biosynthesis, response to exogenous factors, degradation, metabolism, and enzymology of the extracellular matrix; (6) cell cycle; (7) molecular immunology; (8) neurobiochemistry; (9) structure/function relationships of lipoproteins, lipoprotein genes, and their influence on cell function; and (10) mechanism of action of steroid hormones. In addition to many basic science projects, a variety of clinically related studies in the fields of cardiovascular disease and hypertension, pulmonary disease and fibrosis, aging, Alzheimer's disease, reproduction, obesity, inflammation, cancer, thrombosis, and diabetes are also in progress.

Biophysics

The research interests of the faculty of the Department of Biophysics range from cell and structural biology to traditional physical chemical studies of small and macro-mole-



cules. Of particular interest is the study of the three-dimensional structure of proteins, lipids, and complex carbohydrates and their function in cellular membranes, cellular organelles, serum lipoproteins, adipose tissue, nerve and brain tissue, and such pathological deposits as atherosclerotic plaques, gallstones, Alzheimer's disease, and amyloid plaques and abnormal lipoproteins. The techniques of modern cell biology and biochemistry and techniques used in structural biology, particularly high-resolution cryo-electron microscopy and image reconstruction, protein and lipid X-ray diffraction, 2D and classical NMR spectroscopy, coupled with classical physical chemical techniques such as microcalorimetry, circular dichroic and fluorescence spectroscopy, ultra-centrifugation and immunochemistry make it possible to study thermodynamic and kinetic processes as structure changes during function. Supporting these systems is a modern computer laboratory for image analysis and reconstruction and molecular modeling. Classic and cryoelectron microscopy allow the determination of the structures of mac-

romolecular complexes down to 10 to 20 Å resolution, whereas X-ray crystallography and 2D NMR allow structures of the components to be determined at atomic resolution.

Medical Sciences

The program in medical sciences awards the MA degree only; the PhD degree is not offered. The program provides the essential background for the pursuit of training in various health professions. Special programs combining the MA in Medical Sciences with programs in the School of Medicine, the School of Public Health, and the School of Management are also available. The program consists of the equivalent of two semesters of fundamental coursework and two semesters of directly supervised research; the latter two semesters can be completed during two summers. Students wishing to complete the program in 12 months must register full time (12–16 credits) in the fall and spring semesters and for at least two credits in both summer semesters or pay the continuing student



Dr. Kathy Svoboda and Michelle Hirsch review their poster presentation.

fee for each of the two summer semesters. The required research thesis is carried out by the candidate under direct supervision of a member of the graduate faculty. The research project may involve only library research, or a combination of library and laboratory research. Completion of all requirements of the MA in Medical Sciences, including the thesis, is mandatory before a student in this program can matriculate in any doctoral program at Boston University. Students in the MA program in Medical Science do not have to complete its requirements, however, before admission to one of its dual degree options described below.

Microbiology

The research interests of the faculty of the Department of Microbiology range from studies of gene expression and function to bacteriology, virology, and immunology. PhD training is available in microbiology and through the interdepartmental program in immunology. Specific research areas include: regulation of gene expression in pathogenic and sporulating bacteria, mechanisms of drug resistance in bacteria, eukaryotic cell growth control and carcinogenesis, mechanisms of eukaryotic cell injury, pathogenesis of acquired immune deficiency syndrome, protein structure/function analysis, regulation of humoral and cell mediated immunity, signal transduction and gene expression in lymphocytes, dysregulation of lymphocyte function in autoimmunity, interactions between the neuroendocrine and immune systems.

Pathology and Laboratory Medicine

The Department of Pathology and Laboratory Medicine awards the PhD degree only; the MA degree is not offered. The curriculum comprises two tracks: experimental pathology and immunology. Integration of results of basic research with knowledge of pathophysiology in humans and laboratory animals is a major goal of the training program and is achieved by the close affiliations maintained with the Pathology Departments at Boston City Hospital, University Hospital (Mallory Institute of Pathology), and Boston Veterans Administration Hospital. Research interests of the faculty include the following: mechanisms of chemical carcinogenesis and mutagenesis; pathogenesis of atherosclerotic and other vascular diseases; humoral and cellular immunology and immunologically based cancer therapy; human somatic cell, molecular, and cancer genetics; nutritional effects on toxicity and carcinogenicity of chemicals; neurochemistry; and ophthalmological diseases. Methods of investigation include morphologic procedures used in classical pathology as well as molecular and immunologic morphologic procedures; *in vitro* culture and study of bacterial and mammalian cells; immunological manipulation of animals and cells and identification of cell components or products; and identification of genetic and other biological markers.

Pharmacology and Experimental Therapeutics

Research and training in molecular and cellular neuroscience represent a major focus of the Department of Pharmacology and Experimental Therapeutics. Research interests of the faculty include modulation and

regulation of neurotransmitter receptors at the cellular and genomic levels, mechanisms of signal transduction, developmental neurobiology, and the pharmacology of behavior. Training emphasizes a multidisciplinary approach to fundamental problems in neuroscience. Trainees become conversant with a variety of approaches to the study of the nervous system, including molecular biology, electrophysiology, biochemistry, anatomy, and behavior. Modern approaches to drug design include the use of recombinant DNA technology.

Physiology

The Department of Physiology offers graduate training in cellular and molecular physiology. Research opportunities exist for studying the function of the human body in health and disease at all levels, ranging from the atomic resolution of protein molecules to the function of organ systems. Studies in structural biology include x-ray crystallography of calcium regulatory and membrane bound proteins and a number of enzymes; electron microscopy, cryoelectron microscopy, and 3-D image reconstruction of muscle proteins. Research in electrophysiology includes single channel recording, measurement of ion fluxes by microelectrode and by optical imaging of intracellular probes, as well as spectrophotometric measurements of individual photopigments. Techniques in molecular biology are being utilized for sequence determination and expression of cDNAs to produce proteins and characterize them by mutational analysis. Particular areas of interest in the Department to which these various techniques are being applied include: signal transduction through calcium regulation of intracellular processes, membrane transport and ion channel properties, expression of channels during neuronal development, phototransduction, motility in microtubule and actomyosin based systems, and mechanisms of enzyme action.

GENERAL REQUIREMENTS FOR THE MA DEGREE

Course Requirements

Candidates for the MA degree are required to complete a minimum of 32 credits or the equivalent at the graduate level, of which at least 16 credits must be in formal coursework. At least 16 credits must be in the major field. Normally, no more than 16 credits may be taken concurrently. Each student must

register for at least 4 credits each semester until completion of all degree course requirements unless the student obtains an authorized leave of absence. The number of courses that may be transferred to an MA program is explained in more detail in the "Transfer of Credit" section of this bulletin.

Continuing Registration

See "Continuing Students" and "Leave of Absence" sections of this bulletin.

Residency Requirement

Students must be registered in both the semester in which they complete degree requirements and in the preceding semester.

Time Limit

The program must be completed within three years after the first registration for study leading to the MA degree.

MA DEGREE PROGRAMS

The program for the MA in anatomy and neurobiology, biochemistry, biophysics, microbiology, pharmacology, or physiology consists of approximately one year of fundamental coursework and one year of supervised research work. The program for the MA in Medical Sciences requires two semesters of fundamental coursework and two semesters of library or laboratory research which can be completed during two summer sessions.

Fields of Specialization

A candidate selects a major from the following: anatomy and neurobiology, biochemistry, biophysics, medical sciences, microbiology, pharmacology and experimental therapeutics, and physiology. The candidate selects, in consultation with the appropriate graduate committee, a major advisor who is a member of the faculty of the selected department or program.

Course Requirements and Selection

Candidates plan their courses in consultation with the major advisor and in accordance with the requirements of their major field. Coursework may be in formal courses, seminars, and research in proportion to the particular needs and backgrounds of the candidates as worked out in consultation with the major advisor.

Candidates for the MA in Medical Sciences Program *only* must fulfill the following

requirements: biochemistry, physiology, experimental design and biometrics; and the equivalent of at least 8 credits from a selected list of graduate courses.

Research Thesis or Comprehensive Examination

A research thesis or comprehensive examination is required. The choice of this requirement rests with the major department or program. The thesis is to be based on a research project carried out by the candidate. A laboratory thesis is recommended and is required by certain departments. A library thesis is accepted by certain programs. Regulations regarding the thesis are available at the Division of Graduate Medical Sciences.

MA/MPH DUAL DEGREE PROGRAM

The MA/MPH dual degree program combines studies in the School of Medicine and the School of Public Health. This program reduces the time and the number of courses that would otherwise be required to complete separately the requirements of two degrees. The Master of Public Health, taken as a separate degree, requires completion of 48 credits. The Master of Arts in Medical Sciences, taken separately, requires the completion of 32 credits. The combined MA/MPH, however, is awarded upon completion of 64 credits and thus can be completed in two calendar years (two academic years and one summer).



Applications

Applicants must apply by completing an application to the Division of Graduate Medical Sciences and an application to the School of Public Health, indicating on each that admission to the combined degree program is desired. Letters of recommendation, test scores, and transcripts must accompany one of the applications and are shared by both admissions committees. Applications may be obtained from the School of Public Health and from the Division of Graduate Medical Sciences. Applicants already enrolled in either program who decide to pursue a joint degree may, with the counsel of their advisor, apply for formal admission to the other School. Upon acceptance, the director of the combined program reviews the applicant's transcript and advises what courses must be taken to complete the requirements.

Course Requirements

Candidates normally register for two semesters in the Division and two semesters in the School of Public Health, but may cross-register and take courses in both schools during any semester. For the MPH degree, students must successfully complete 16 credits of core courses in the School of Public Health and a minimum of four courses in one of the selected concentrations: environmental health, health law, health services, and social and behavioral sciences. For specific concentration course requirements, see the *School of Public Health Bulletin*.

For the MA in Medical Sciences/MPH degree, students must complete 16 credits of core courses and at least 8 credits from selected electives. Any remaining credits may be taken in either the Division of Graduate Medical Sciences or the School of Public Health. Up to 8 elective credits may be taken as directed study or research courses in either program. Core and elective course requirements may vary slightly depending upon the individual student's academic background and selection of courses. Please consult MPH and MA program catalogues for further details concerning transfer of credit and waiver of courses.

Thesis

A thesis is required. The thesis is to be based on research carried out by the candidate under direct supervision of a member of the graduate faculty selected by the candidate in consultation with the program director. The research project may involve only library research or a combination of library and laboratory (field) research.

MA/MBA DUAL DEGREE PROGRAM

The MA/MBA dual degree program offers an opportunity to combine a broad-based program in the medical sciences with professional study in health care management and administration. The combined degree program reduces what would otherwise be three years of study for two graduate degrees to two years, including two summer sessions. The MBA with concentration in health care management taken as a separate degree requires completion of 64 credits. The MA in Medical Sciences, taken separately, requires the completion of 32 credits. The joint MA/MBA, however, is awarded upon completion of 80 credits, distributed as described below.

Applicants to the MA/MBA program must meet the requirements for admission to an MA program in the Division of Graduate Medical Sciences. In addition, special requirements for the School of Management include: submission of the official scores on the Graduate Management Admissions Test and completion of undergraduate, introductory studies in the humanities and social sciences.

Applications

Students apply by completing an application to the Division of Graduate Medical Sciences and an application to the School of Management, indicating on each form that admission to the joint degree program is desired. Letters of recommendation, test scores, and transcripts must accompany one of the applications and are shared by both admissions committees.

Students already enrolled in either program who decide to pursue a joint degree may, with the counsel of their advisor, apply for formal admission to the other School. Upon acceptance, the director of the joint program reviews the applicant's transcript and advises what courses may be taken to complete the combined dual degree requirements.

Degree Requirements

Candidates usually register for two semesters in the Division of Graduate Medical Sciences (GMS) and two semesters in the School of Management (SMG), but may cross-register and take courses in both schools in any semester. For the MBA degrees, students must complete successfully nine core courses (32 credits), three special courses in health care management, and 8 credits taken as

SMG electives. For the MA in Medical Sciences, students must complete 14 credits of core courses and at least 8 credits from selected electives. Any remaining credits may be taken in either the School of Medicine or the School of Management. Up to 8 elective credits may be taken as directed study or research courses in the School of Management. Core and elective course requirements may vary slightly depending upon the individual student's academic background and selection of courses.

Thesis

A thesis is required. The thesis is to be based on research carried out by the candidate under direct supervision of a member of the graduate faculty selected by the candidate from the Division of Graduate Medical Sciences or the School of Management. The research project may involve library research only or a combination of library and laboratory (field) research. The thesis must be defended in an oral examination before a joint medical science/management faculty committee. The paper may be developed from a course paper with approval. If the course instructor serves on the examining committee, a third member should be added.

MA/MD DUAL DEGREE PROGRAM

The program leading to the combined degrees of Doctor of Medicine and Master of Arts in Medical Sciences was established to provide students motivated toward research and academic careers with the opportunity for integrated scientific and medical training. The goal of the combined MA/MD program is to prepare its graduates for productive careers in both basic research and clinical medicine. Consequently, the program requires a laboratory research thesis. The dual degree program requires a minimum five years of study and leads to both the Doctor of Medicine and the Master of Arts in Medical Sciences degrees.

Admission

The applicant must meet the requirements for admission to the School of Medicine as a candidate for the MD degree and as a candidate for the MA degree. The minimum entrance requirements and the prerequisite courses for the MD degree are the same as those for the MA degree except that applicants for the combined MA/MD program are required to submit the results of the Medical College Admission Test only instead

of the Graduate Record Examination, which is normally required for admission to the MA degree program.

It is anticipated that most of the applicants will apply directly for admission to the program as first-year medical students, but applications will be accepted at any time from students who are already in residence at the School of Medicine.

Application

Applications for the MA/MD program and instructions for submission of complete credentials are available from the Boston University School of Medicine, Office of Admissions, 80 East Concord Street, Boston, MA 02118. Applicants are first screened for their admissibility to the School of Medicine's MD degree program, using the same procedures and criteria used for students who apply to the MD degree program only. After determination of acceptability for admission to the MD program, application for the dual degree program is submitted for processing through the normal channels for admission to the MA degree program. Please note that initial action by the Admissions Office on the MD application implies no differences between the Schools in standards of acceptance. Rather, it reflects the fact that the first-year class in medicine is limited to a finite number. The normal channel of admission to the MA program includes acceptance by the basic science department in which the applicant wishes to carry out research.

Degree Requirements

The degree requirements for the MA/MD program are those for the Doctor of Medicine and the Master of Arts in the School of Medicine. For the MD degree, the student must be at least 21 years of age; have been enrolled in an accredited medical school for at least four full academic years, two of which must have been spent in the regular third- and fourth-year courses at Boston University School of Medicine; have passed all required courses and examinations; and have discharged all financial obligations to Boston University. For the MA degree, the student must provide evidence of having been enrolled in the Division of Graduate Medical Sciences for at least one full academic year and one summer, attained the specified number of credits, and fulfilled the thesis requirements for the Master of Arts in Medical Sciences. In the MA/MD program, the specific course requirements of the Master of Arts in Medical Sciences are satisfied by the regular medical curriculum. The 32

credits required for the MA degree can, therefore, be fulfilled through directed study and research credits. The curriculum as a whole is designed to provide at least a one-year research concentration in a specific area of medical science combined with the usual four-year medical curriculum.

Students admitted into the MA/MD program begin their training with the first year of the regular medical school curriculum and complete the second year of this curriculum before beginning work on the graduate portion of the program. After these two years, students begin their graduate education and research training in the basic science department and/or area of specialization of their choice. In this, the third year of the program, which includes the full academic year and one summer, the student is expected to devote full time to research and to register for 32 credits of directed study and/or research. There are no further formal graduate course requirements, although seminar attendance is required.

Thesis

Candidates are required to submit a written thesis based on the research carried out in the graduate year enrolled in the Division. This requirement may be completed during the third and fourth years of medicine.

GENERAL REQUIREMENTS FOR THE PHD DEGREE

Course Requirements

For postbachelor's and post-master's PhD degree programs are as follows:

Postbachelor's PhD

Candidates without a master's degree or its equivalent are required to complete 64 credits or the equivalent, of which a minimum of 24 credits must be in formal coursework. Specific requirements relative to the selection of courses, seminars, and research or directed study are determined for each student by the department or program which the student enters. Normally, no more than 16 credits may be taken concurrently. Each student must register for at least 4 credits each semester until completion of all departmental course requirements unless granted an authorized leave of absence. The number of courses that may be transferred to a postbachelor's program is explained in more detail in the "Transfer of Credit" section of this bulletin.

Post-Master's PhD

Candidates with a master's degree or its equivalent are required to complete the equivalent of 32 credits. Specific requirements relative to the selection of courses, seminars, and research or directed study are determined for each student by the department or program which the student enters. Normally, no more than 16 credits may be taken concurrently, and each student must register for at least 4 credits each semester until completion of all departmental course requirements unless granted an authorized leave of absence. Regulations regarding transfer of credit to a post-master's program are explained in more detail in the "Transfer of Credit" section of this bulletin.





Continuing Registration

See "Continuing Students" and "Leave of Absence" sections of this bulletin.

Residency Requirement

Each student must satisfy a residency requirement of a minimum of two consecutive regular semesters of full-time graduate study at Boston University after completion of the first 32 credits. Full-time study in this context is full-time commitment to the discipline as determined by the department. This commitment permits access to libraries, laboratories, instructional staff, and other academic facilities of the University, including the department of concentration. In order to graduate, students must be registered as part- or full-time in the semester in which they complete degree requirements and in the preceding semester.

Time Limit

The postbachelor's PhD program must be completed within seven years after the first registration for doctoral study. The post-master's PhD program must be completed within five years after the first registration for the doctoral program.

Qualifying Examination

A PhD candidate must pass both an oral and a written qualifying examination in the major field (and, if the department or program requires, in a minor field) administered according to the guidelines of the individual department or program. Both oral and written portions of the exam must be passed in order to remain in the PhD candidacy. Failure to pass either the oral or the written sections after two attempts results in termination of the PhD candidacy. Written permission to retake either exam must be obtained from the major department and/or program. Both examinations should normally be completed no later than the end of the second year or within six months of completion of the academic courses required by the candidate's program or department. A minimum of five faculty members serve on the oral qualifying examination committee; at least three must be from the major department or program, and the remaining members must be from within Boston University. All parts of the qualifying examination must be passed before the dissertation outline will be accepted by the Division of Graduate Medical Sciences.

PhD Candidacy

A student in a PhD program is accepted to PhD candidacy upon successful completion of such qualifying examinations as are designated by the department. At that time, the department notifies the Division, and the student receives formal acceptance to PhD candidacy from the Division of Graduate Medical Sciences. The maximum period allowable between matriculation and acceptance to PhD candidacy is established by the individual department. Once entered, a PhD candidacy expires on its fifth anniversary and after such time is renewed only if the student requalifies for candidacy as determined by the department and the Division. In no instance is a student who is not a PhD candidate allowed to defend a completed PhD dissertation.

Dissertation Advisory Committee

After successful completion of coursework and the qualifying examinations, a student selects a dissertation topic. An Advisory Committee, consisting of a minimum of three faculty members (at least two of whom are from the major department) will meet with the student once per year, with a minimum of three advisory committee members in attendance. The committee's membership must be approved by the student's department. The first and second readers of the student's dissertation must be members of this Advisory Committee. Some programs require three readers. The dissertation outline should be completed and approved by this committee before the more extensive phase of dissertation research is undertaken. Students are responsible for filing the outline in the Division Office. (See "Calendar" for due dates.) Performance in the research component of the PhD program will be assessed by the Advisory Committee. Failure to maintain an acceptable research program will result in a recommendation to terminate the PhD candidacy. This recommendation will be presented to the Student Affairs Committee of the department. Followed by submission to the Associate Dean of Graduate Medical Sciences.

Dissertation Examination and Seminar

Students undergo a final oral examination in which they defend their dissertations as valuable contributions to knowledge in their fields and demonstrate mastery of their fields of specialization in relation to their dissertations.

The Advisory Committee will, in most cases, become members of the Dissertation Committee. The Dissertation Examination Committee must consist of at least five faculty members, one of whom must be outside the major department. All five members must be present for the dissertation examination. If any member of the Dissertation Committee is not a faculty member at Boston University a special faculty appointment in the Division of Graduate Medical Sciences must be obtained. Students must obtain written approval of the dissertation by the first and second readers prior to scheduling the final Divisional seminar and dissertation defense. This approval and distribution of the dissertation to the committee must occur at least two weeks prior to the defense. In addition, prior to scheduling the oral defense, the dissertation abstract and its approval form must be submitted. The approval form for the dissertation abstract can be obtained from the Division Office and must be signed by the thesis advisor, the chairman or graduate coordinator of the major department or program, and the Associate Dean of Graduate Medical Sciences.

The abstract, which cannot exceed 350 words in length, describes the dissertation's thesis, methods, and general content. Final departmental approval of the abstract can be given only after the dissertation has been successfully defended. Abstracts are subject to review by the Associate Dean of Graduate Biomedical Sciences.

Each graduating candidate presents a Divisional seminar which is open to the academic community. Immediately following the seminar, the Examination Committee meets with the candidate for the final dissertation defense.

PHD DEGREE PROGRAMS

The program for the PhD degree consists of the equivalent of two years of formal coursework and satisfactory completion of a laboratory research project, the results of which are to be incorporated in a dissertation. The candidate need not be in residence at Boston University during the time of preparation of the PhD dissertation. The program of study for the PhD must include the equivalent of 64 credits of graduate-level courses and research. Formal coursework must consist of at least 24 credits. Half of these total credits (32) may be satisfied by the MA degree, or its equivalent. In this case, a minimum of 8 credits in formal coursework must be taken

in the Division of Graduate Medical Sciences at Boston University School of Medicine. A student must be enrolled for at least 4 credits each semester until completion of the credit requirements. After completion of all credit requirements, the student must be enrolled as a continuing student each regular semester until all requirements for the degree have been met, except under conditions of authorized leave of absence. (See the "General Requirements for the PhD" section in this bulletin.)

Course Requirements, Selection, and Fields of Specialization

The PhD candidate's outline of study for courses of instruction should be developed in the light of individual needs and background, as worked out in consultation with the major advisor, and approved by the chairman or director of the major department or program of the Division of Graduate Medical Sciences.

In addition to the general requirements of the Division, each candidate must fulfill the



following minimum requirements corresponding to the major area of specialization.

Anatomy and Neurobiology Required courses: gross anatomy, microscopic anatomy, neuroscience, cell biology, plus three additional departmental graduate courses. Attendance at departmental and graduate student seminars is also required.

Behavioral Neuroscience Prerequisites: biology, introductory psychology, experimental psychology, physiological psychology, abnormal psychology, and statistics. Required courses: neuropsychology seminar (one year), neuropsychological assessment, and basic neuroscience.

Biochemistry Prerequisites: biology and general and organic chemistry. Required courses: biochemistry, cell biology, four courses in advanced biochemistry or related fields and biochemistry seminar.

Biophysics Prerequisite: physical chemistry. Required courses: biophysics of macromolecular assemblies and biophysics seminar.

Microbiology Required courses: biochemistry; microbiology, cell biology or basic immunology; virology/parasitology; genetics of microorganisms; and microbiology seminar. Three courses in advanced microbiology, immunology, or related fields

Pathology and Laboratory Medicine Required courses: biochemistry, molecular biology, experimental pathology, biostatistics, laboratory in experimental pathology, special topics in pathology; and pathology and laboratory medicine seminar.

Pharmacology and Experimental Therapeutics Required courses: general medical pharmacology or molecular neurobiology and pharmacology and the equivalent of at least four 2-credit courses in advanced topics; attendance at and participation in scheduled conferences and pharmacology seminars.

Physiology Prerequisites: General physics, chemistry courses, and mathematics (one year of calculus). Required courses: physiology; cellular physiology; physiology seminar; and experimental methods.

MD/PHD DUAL DEGREE PROGRAM

The combined degree program is conducted under the auspices of the School of Medicine and is designed for and open to highly qualified individuals who are strongly motivated

toward an education and a career in both medicine and research. The purpose of the program is to provide students with the opportunity to obtain advanced education and research training in one of the medical sciences, while providing exposure to and training in clinical medicine. The program requires six to seven years of study and leads to both the MD and PhD degrees.

Application

The applicant must meet the requirements for admission both to the Medical School as a candidate for the MD degree and as a candidate for the PhD degree, as outlined above. The minimum entrance requirements and the prerequisite courses for the MD degree are the same as those for the PhD degree. Applicants for the MD/PhD Combined Degree Program are required to submit the results of the Medical College Admission Test only and not those of the Graduate Record Examination, which are normally required for admission to the PhD program. The applicant must also have completed the special prerequisites of the major department or program. The latter prerequisite courses may be completed while the candidate is in residence as a graduate student but may not be presented for graduate credit. Applicants must also have carried out research during their undergraduate program or have research experience. Most applicants apply for admission to enter the program as first-year students, but applications are accepted from students who are already in residence in the School of Medicine.

Applicants must apply simultaneously to the School of Medicine (via American Medical College Application Service, 1776 Massachusetts Avenue, N.W., Washington, DC 20036) and the Division of Graduate Medical Sciences. The applicant is also asked to notify the School of Medicine, Boston University Medical Center, 80 East Concord Street, Boston, MA 02118, in writing, that the student has completed both applications and is applying for the combined MD/PhD degree program.

The information on application procedures given above applies only to applicants for the combined MD/PhD degree. There are special eligibility requirements for students who are enrolled in graduate programs and who wish to apply to the Medical School as candidates for the MD degree only. Students currently enrolled in a graduate program may apply to the Medical School in the terminal year of the graduate program for

which they were originally accepted. Students are required to submit a letter from the thesis or major advisor, which has been countersigned by the chairman of the department or program in which they are concentrating, approving of their application. Evidence of completion of all the graduate degree requirements must be submitted before matriculation into the Medical School.

Degree Requirements

The degree requirements for the combined MD/PhD program are the separate degree requirements for the Doctor of Medicine and the Doctor of Philosophy in the School of Medicine. For the MD degree, the student must be at least 21 years of age; have been enrolled in the School of Medicine for at least four full academic years; have passed all required courses and examinations; and have discharged all financial obligations to Boston University. For the PhD degree, the student must have fulfilled all the requirements for admission to the Division of Graduate Medical Sciences and have been enrolled in the Division for the equivalent of at least two full academic years. In addition, the candidate must have fulfilled all the requirements for major (and in some cases minor fields of specialization), qualifying examination, and dissertation, as described above. Interdisciplinary programs, such as the MD/PhD program in Biomedical Engineering can also be arranged. Students enrolled in the combined MD/PhD program must complete the requirements for both degrees before any degree will be awarded, with the following exception: a student admitted into the combined degree program on entering Boston University may withdraw from the combined degree program and elect to receive one or the other degree upon completion of the appropriate requirements.

DEPARTMENT OF ANATOMY AND NEUROBIOLOGY

Chairman Alan Peters
Director of Graduate Studies Mark B. Moss

Faculty

Martin L. Feldman, PhD, Professor
Deepak N. Pandya, MD, Professor
Sergei P. Sorokin, MD, Research Professor
Douglas A. Cotanche, PhD, Associate Professor
Richard F. Hoyt, Jr., PhD, Associate Professor
Mark B. Moss, PhD, Associate Professor
Bertram R. Payne, PhD, Associate Professor
Alan Peters, PhD, Professor
Douglas L. Rosene, PhD, Associate Professor
Kathy K. Svoboda, PhD, Associate Professor
Deborah W. Vaughan, PhD, Associate Professor
Alan F. Wiechmann, PhD, Associate Professor
Lawrence C. Zoller, PhD, Associate Professor
Gene J. Blatt, PhD, Assistant Professor
Julie H. Sandell, PhD, Assistant Professor
Celeste R. Wirsig-Weichmann, PhD, Assistant Professor

Joint Faculty

Thomas L. Kemper, MD, Professor (Professor of Neurology)
Eric L. Schwartz, PhD, Professor (Professor of Cognitive and Neural Systems and Professor of Electrical and Computer Engineering)
Mary C. Williams, PhD, Professor (Professor of Pulmonary Medicine)
Helen Barbas, PhD, Assistant Professor (Associate Professor of Health Sciences)
Thomas F. Freddo, OD, PhD, Associate Professor (Associate Professor of Ophthalmology)

The Department of Anatomy and Neurobiology has consistently been ranked among the top-funded departments of anatomy nationally. The relatively small size of the department ensures close contact between graduate students and their advisors. The department specializes in the neurosciences, aging, development, and cell and molecular biology. Specific areas of research include: examination of connections and immunocytochemistry of specific parts of the nervous system such as the cerebral cortex, temporal lobe, basal forebrain, auditory system, and facial motor system; development of the visual cortex; development and regeneration

of the cochlea; neurobiological basis of memory; pulmonary cell biology including neuroendocrine regulation of lung development and innervation of the lungs; the developmental biology of macrophages; development of the retina; and the neurobiological basis of normal aging and age-related disorders including Alzheimer's disease, Parkinson's disease and cerebrovascular dementia. Courses are offered in human gross anatomy, microscopic anatomy, neurosciences, cell biology, techniques in neuroscience, neural development and plasticity, neurobiology of aging, neurobiological basis of neurologic disease, neurobiology of



Dr. Thomas Kemper and Muhammad Ramzan examine new tissue preparations.

memory, and special topics in anatomy and neurobiology.

Admission Procedures

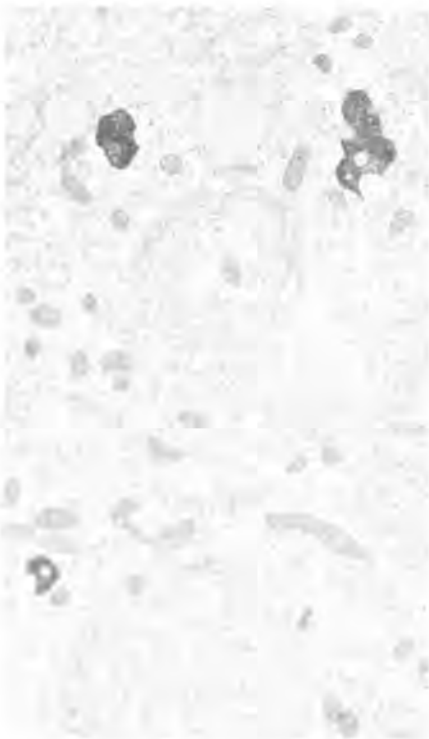
The procedures for admission to the graduate programs in anatomy and neurobiology are described in the section of this bulletin on admissions procedures of the Division of Graduate Medical Sciences. Interviews are recommended for Graduates to the MA and PhD programs and are required for applicants to the MD/PhD program. Admissions and other matters relating to graduate study are reviewed by the Graduate Advisory Committee of the department.

Core Course Requirements

Most students entering the program are expected to take Gross Anatomy, Microscopic Anatomy, Neuroscience and Cell Biology during the first two years of study, although students may be excused from taking one or more of these courses if it is deemed that an equivalent course has been successfully completed in the preceding five years.

Additional Course Requirements

In addition to the core courses, doctoral students must enroll in at least three other graduate courses offered by members of the faculty of the department. Also, student attendance at all departmental and student seminars (research colloquia) is required.



Students usually choose a research advisor at the end of the first year and begin their research experience during the first summer.

COURSES

GMS AN 500 Microscopic Anatomy Prereq: CLA BI 203 and consent of instructor. Morphological and functional histology of tissues and organs. Lectures and coordinated laboratory study. Microscopes required. Loan collection of slides provided. *Staff*. 4 cr, 2nd sem.

GMS AN 500S Microscopic Anatomy Prereq: CLA BI 203 and consent of instructor. Morphological and functional histology of tissues and organs. Lectures and coordinated laboratory study. Microscopes required. Loan collection of slides provided. *Staff*. 4 cr, Summer sem.

GMS AN 701 Gross Anatomy Prereq: consent of instructor. Human anatomy in three units: locomotion, which includes arms, legs, and back; head and neck; thorax, abdomen, and pelvis. Graduate students may elect one or all of the units. *Blatt, staff*. Variable cr (up to 8 cr), 1st sem.

GMS AN 702 Neurobiology of Learning and Memory Prereq: consent of instructor. This course covers the neurobiological bases of learning and memory from the cellular to the systems level. Initial sessions cover the behavioral aspects of learning and memory—how it is operationally defined and what are the different theoretical concepts from cognitive psychology that are current. Subsequent sessions investigate the neurophysiological, neuroanatomical, and neurochemical mechanisms of memory at the cellular level and then move on to the study of systems that function at the level of the whole organism. Concentration is on studies in mammals, particularly primates. *Moss, Rosenc*. 2 cr, 2nd sem.

GMS AN 705, 706 Microscopic Anatomy of Tissues and Organs Prereq: consent of instructor. Lecture and laboratory study of tissue and organ functional histology, with emphasis on both light and electron microscopy. Loan collection of slides provided. *Vaughan*. 6 cr, 1st sem.

GMS AN 707 Neurobiology of Aging Prereq: consent of instructor. With growing awareness of an accelerating increase in the size of the elderly population, there has been increasing interest in the neuropsychology of normal aging. Similarly, since aging is a major risk-factor for many dementia states, interest has also focused on the neuropsychology of age-related disorders such as Alzheimer's disease, Parkinson's disease and the Dementias of the frontal lobe type. This course attempts to summarize what is known about cognitive and related changes associated with normal aging and age-related disease. The course is divided into four major sections. The first considers the cognitive changes associated with normal aging; the second deals with the most common causes of cognitive decline seen in the elderly; the third

reviews the current data concerning neuroimaging in aging and dementia, and the fourth part covers future directions in the study of normal aging. *Moss*. 2 cr, 2nd sem.

GMS AN 709 Neural Development and Plasticity Prereq: GMS MS 703 and consent of instructor. Lectures, discussion, and readings on current issues relating to neural changes during development and how the nervous system is modified by interactions of the organism with the environment, and how the nervous system responds to injury. Emphasis on cellular and systems levels of organization. *Cotanche, Payne, staff*. 2 cr, 2nd sem.

GMS AN 801, 802 Seminar: Research Colloquium Oral presentation and discussion by students and staff members of topics of interest in anatomy and allied fields. *Feldman, Sandell*. 2 cr each, 1st & 2nd sem.

GMS AN 803, 804 Special Topics in Anatomy Presentation of problems of current interest in anatomical science offered to small groups of students at the instigation of either interested faculty or students. Examples of topics that might be discussed are: differentiation; aging in specific areas of the brain; electron microscopy; fine structure of neurons; biology of the lung; and retinal biology. *Staff*. 1st & 2nd sem.

GMS AN 807 Neurobiology of the Visual System Prereq: GMS MS 703 or consent of instructor. This is a seminar for graduate students in all departments who have had a basic neuroscience course and are interested in the anatomical and physiological substrates of vision. Study of the visual system progresses from the retina through the thalamus and brainstem to cortical visual areas and associated structures such as the hippocampus, amygdala, and basal ganglia. Students present primary journal articles and occasional reviews with guidance from faculty who are presently engaged in research involving the structures under discussion. *Payne, Sandell*. 2 cr, 2nd sem.

GMS AN 808 Neuroanatomical Basis of Neurologic Disorders Prereq: Medical Neuroscience course or equivalent, and consent of instructor. Localization of specific anatomical changes in the brain in such disorders as autism, dyslexia, schizophrenia, olivopontocerebellar atrophy and selected neurodegenerative diseases such as Alzheimer's and ALS. Developmental mechanisms leading to neuroanatomical alterations are discussed when appropriate. Lectures, discussion of classical and current literature, and guest speakers. *Blatt, Kemper*. 2 cr, 2nd sem.

GMS AN 901, 902 Anatomy Research Variable cr

GMS AN 904 Research Practicum Prereq: consent of instructor. Designed primarily for departmental graduate students to offer them first hand familiarity with a variety of modern experimental techniques. Involves both participation in, and observation of, the techniques together with discussion and readings. *Feldman*. 2 cr, 2nd sem.

DEPARTMENT OF BIOCHEMISTRY

Chairman Carl Franzblau
Associate Chairman and Director of Graduate Studies Ellen Berkowitz

Faculty

Ellen M. L. Berkowitz, PhD, Associate Professor
Peter M. Brecher, PhD, Professor
Theresa Davies, PhD, Assistant Research Professor
Deborah E. Dobson, PhD, Assistant Professor
Barbara A. Faris, Assistant Research Professor
Stephen R. Farmer, PhD, Professor
Richard E. Fine, PhD, Professor
Judith A. Foster, PhD, Professor
Carl Franzblau, PhD, Professor
Stephen Gacheru, PhD, Assistant Research Professor
Wayne A. Gonnerman, PhD, Assistant Professor
Robin Johnson, PhD, Assistant Research Professor
Herbert M. Kagan, PhD, Professor
Konstantin Kandror, PhD, Assistant Research Professor
Crystal Leslie, PhD, Assistant Research Professor
Bernice M. Martin, PhD, Assistant Research Professor
Edward J. Modest, PhD, Research Professor
Shirley Morris, PhD, Assistant Research Professor
Matthew Nugent, PhD, Assistant Professor
Constance Phillips, MPH, Assistant Research Professor (Biotechnology)
Paul F. Pilch, PhD, Professor
Peter Polgar, PhD, Professor
Katya Ravid, PhD, Assistant Professor
V. B. Reddy, PhD, Associate Research Professor

Karl Schmid, PhD, Professor Emeritus
Barbara M. Schreiber, PhD, Assistant Research Professor
Elizabeth R. Simons, PhD, Professor
F. Marott Sinex, PhD, Professor Emeritus
Jean D. Sipe, PhD, Research Professor
Barbara Smith, PhD, Professor
Gail Sonenshein, PhD, Professor
Phillip J. Stone, PhD, Professor
Linda Taylor, PhD, Assistant Research Professor
Keith Tornheim, PhD, Associate Professor

Paul A. Toselli, MD/PhD, Associate Professor
Abdulmaged M. Traish, PhD, Associate Professor
Robert F. Troxler, PhD, Professor
Leslie Wolfe, PhD, Instructor
Herbert H. Wotiz, PhD, Professor Emeritus
Vassilis I. Zannis, PhD, Professor

Joint Faculty

Carmela Abraham, PhD, Associate Research Professor (Associate Professor of Medicine)
David Atkinson, PhD, Research Professor (Professor of Biophysics)



Dr. Judith Foster and two graduate students review data.



Dr. Barbara Schreiber in the laboratory.

- Clinton Baldwin**, PhD, Assistant Research Professor (Assistant Research Professor of Pediatrics)
- Peter Bergethon**, MD, Assistant Research Professor (Research Instructor of Medicine)
- Jerome Brody**, MD, Associate Research Professor (Professor of Medicine)
- David Center**, MD, Research Professor (Professor of Medicine)
- Sati C. Chattoraj**, PhD, Professor (Professor of Obstetrics and Gynecology)
- Barbara Corkey**, PhD, Associate Research Professor (Associate Research Professor of Medicine)
- Daniel Deykin**, MD, Professor (Professor of Medicine)
- Richard Diamond**, MD, Research Professor (Professor of Medicine)
- Douglas Faller**, PhD, Research Professor (Professor of Medicine)
- Matthew J. Fenton**, PhD, Assistant Research Professor (Assistant Research Professor of Medicine)
- Alan Fine**, MD, Assistant Research Professor (Assistant Professor of Medicine)
- Balz Frei**, PhD, Assistant Research Professor (Assistant Research Professor of Medicine)
- Ronald Goldstein**, MD, Associate Research Professor (Professor of Medicine)
- Dana Graves**, DDS, DMSc, Associate Research Professor (Professor of Periodontology and Oral Biology)
- James Hamilton**, PhD, Associate Research Professor (Professor of Biophysics)
- Gerhard Heinrich**, MD, Assistant Research Professor (Associate Professor of Medicine)

- William Hollander**, MD, Professor (Professor of Medicine)
- Bruce Jackson**, PhD, Adjunct Assistant Research Professor
- Maria A. Kukuruzinska**, PhD, Assistant Research Professor (Assistant Professor of Periodontology and Oral Biology)
- Joseph Korn**, MD, Research Professor (Professor of Medicine)
- Wayne LaMorte**, MD, PhD, Assistant Research Professor (Assistant Professor of Surgery)
- Joseph Loscalzo**, MD, PhD, Research Professor (Professor of Medicine)
- Richard Mandel**, PhD, Assistant Research Professor (Associate Professor of Pathology and Laboratory Medicine)
- S. Alex Mitsialis**, PhD, Assistant Research Professor (Assistant Professor of Medicine)
- Mary J. Murnane**, PhD, Assistant Research Professor (Associate Professor of Pathology and Laboratory Medicine)
- John R. Murphy**, PhD, Research Professor (Research Professor of Medicine)
- Gwynneth D. Offner**, PhD, Assistant Research Professor (Associate Professor of Medicine)
- Frank Oppenheim**, DMD, PhD, Associate Professor (Professor of Periodontology and Oral Biology)
- Hee Young Park**, PhD, Assistant Research Professor
- Charalabos Pothoulakis**, MD, Research Instructor
- Nadia Rosenthal**, PhD, Adjunct Associate Professor (Associate Professor in Medicine, Harvard Medical School)

Hugues J. P. Ryser, MD, Professor (Professor of Pathology and Laboratory Medicine)

David Sassoon, PhD, Adjunct Assistant Professor (Assistant Professor of Molecular Biology, Mt. Sinai Medical Center)

Jacqueline Sharon, PhD, Associate Research Professor (Professor of Pathology and Laboratory Medicine)

Michael Shia, PhD, Assistant Research Professor (Assistant Professor of Medicine)

G. Graham Shipley, PhD, Professor (Professor of Biophysics)

Donald Small, MD, Professor (Professor of Biophysics)

Gordon Snider, MD, Associate Professor (Professor of Medicine)

Philip C. Trackman, PhD, Assistant Research Professor (Assistant Professor of Periodontology and Oral Biology)

Vickery Trinkaus-Randall, PhD, Associate Research Professor (Associate Professor of Ophthalmology)

Mary Walsh, PhD, Research Instructor (Assistant Professor of Biophysics)

Qiang Yu, PhD, Assistant Research Professor (Assistant Professor of Medicine)

Ken Zaner, MD/PhD, Assistant Research Professor (Associate Professor of Medicine)

Raphael Zoeller, PhD, Assistant Research Professor (Assistant Research Professor of Biophysics)

The Department of Biochemistry includes 38 full-time faculty members, 12 postdoctoral fellows, and 70 graduate students, all of whom participate in a variety of active research and training programs. The research in the department is included within the broad spectrum of biomedical research programs. Overall, these efforts address fundamental mechanisms of life processes, with emphasis on the underlying bases of human disease. The department is housed in a modern, well-equipped facility within the Boston University Medical Center. Members of the Department of Biochemistry are actively involved in collaborative efforts both within the department and with other researchers throughout the various basic and clinical science departments at the Medical Center. The major focus of the biochemistry research in the department is on the fields of molecular and cellular biology. Specific research interests include extracellular matrix biochemistry and molecular biology, regulation of gene expression in eukaryotic cells, developmental biochemistry, vesicle trafficking and signal transduction, protein structure and

function, mechanisms of catalysis, porphyrin biochemistry, protein-membrane interactions, growth control and cell cycle, neuro-biochemistry, mechanism of action of steroid hormones, and mechanisms of oncogenesis. Research activities are well supported by a variety of interdisciplinary research program project grants, graduate student training grants, and individual research grants.

The Department of Biochemistry provides research training to graduate, post-doctoral, medical, and allied health sciences students. Graduate-level courses are presented covering the major subdisciplines of biochemistry, cell biology and molecular biology by faculty with particular expertise in these areas. These advanced courses emphasize recent findings as well as relevant fundamental background information. Seminar programs within the department and in the surrounding biomedical community provide students with an opportunity to actively participate in discussions on the most recent advances in the field of biomolecular sciences.

A brochure describing the special interests of faculty members in the Department of Biochemistry may be obtained by writing to the Chairman, Boston University School of Medicine, Department of Biochemistry, 80 East Concord Street, Boston, MA 02118 or by calling 617/638-4135.

Requirements for Admission

Students who have completed an undergraduate degree usually with a major in biochemistry, biology, or chemistry and have taken courses in general biology, general chemistry, organic chemistry, physical chemistry, and calculus may apply for either an MA or a PhD in biochemistry. Coursework in biochemistry is also recommended. Students who have completed an MA degree in biochemistry or a closely related field can apply for a post-master's PhD. MD/PhD students are also eligible for admission.

A part-time MA program is available to qualified applicants who are employees of the Boston University School of Medicine (contact the director of Graduate Studies for further information). A student presently enrolled in an MA program in biochemistry may apply for the PhD program if he/she has completed 12 or more graduate credits in biochemistry (including GMS MS 753, BI 755, BI 756, and excluding student seminar) and has obtained a GPA of 3.25 or better. In addition, the student must have taken and successfully passed the Written Qualifying Examination in biochemistry.

Programs of Study

Each new student consults with an assigned advisor during the orientation period prior to the start of the fall semester to plan the first year's program. During the first year the PhD candidate also participates in four laboratory rotations to facilitate the choice of a research advisor. The MA student is required to complete two laboratory rotations in the first semester of the first year. Specific course requirements (except for research) may be waived for students who present evidence of equivalent preparation, although the limitations on transfer of credit set by the Division of Graduate Medical Sciences still pertain. The general rules and regulations in the Division of Graduate Medical Sciences concerning graduate students are presented elsewhere in this bulletin and should be consulted.

MA IN BIOCHEMISTRY

Course Requirements

Eight semester courses (32 credits); including (1) general biochemistry (GMS BI 755 and 756 or the equivalent); (2) two courses in advanced biochemistry or a related field (see listing below); (3) one biochemistry seminar (GMS BI 854); and (4) a maximum of 16 credits in research.

Thesis or Comprehensive Examination

Normally, all candidates submit a written thesis based upon their laboratory research. Under special circumstances a comprehensive examination or a library thesis may be substituted for the research thesis at the discretion of the Committee on Graduate Student Affairs.

PHD IN BIOCHEMISTRY

Course Requirements for Postbachelor's PhD

Sixteen semester courses (64 credits) including (1) general biochemistry (GMS BI 755 and 756 or the equivalent); (2) GMS MS 753 Cell Biology; (3) a minimum of four courses in advanced biochemistry or a related field; (4) one biochemistry seminar (GMS BI 854); and (5) research totaling approximately 32 credits.

Post-master's PhD and MD/PhD students need to complete 32 credits including 12-16

credits of formal coursework. The particular courses and the number of credits depend upon the student's previous graduate studies. Seminar and research requirements are the same as those for the post-bachelor's PhD.

Qualifying Examination

Candidates for the doctoral degree must pass both a written qualifying examination taken at the end of the first year of graduate study and an oral qualifying examination taken at the end of the second year. (See the "Academic Policies and Procedures" section in this bulletin for further details.)

Dissertation Advisory Committee

Candidates are expected to discuss their research progress with a five-member dissertation Advisory Committee annually, beginning in their first post-qualifying examination year. (See information in the "Academic Policies and Procedures" section)

Residency Requirements, Dissertation Examination and Seminar

See "Academic Policies and Procedures" section in this bulletin.

COURSES

GMS BI 555, 556 Biochemistry A, B Prereq: organic chemistry or equivalent, and consent of instructor. This two-semester course provides the biochemical foundation for advanced studies in basic and clinical sciences. Topics presented in the first semester include the structure and function of macromolecules, the mechanisms of enzyme action, the metabolism of carbohydrates and lipids, as well as bioenergetics. The second semester continues with the metabolism of lipids, amino acids and nucleotides, the control of metabolic processes, the function of hormones, biochemical genetics, and transcriptional and translational events. *Pilch, Farmer*. 4 cr, 1st & 2nd sem.

GMS BI 751 Biochemistry Prereq: consent of instructor. Basic principles and concepts of graduate-level biochemistry in a one-semester course. Instruction includes protein structure and function; mechanisms of enzyme action; carbohydrate and lipid metabolism; bioenergetics; metabolism of amino acids and nucleotides; DNA and RNA synthesis, structure and function; and regulation of gene expression. *Berkowitz*. 6 cr, 1st sem.

GMS BI 753 Biochemical Aspects of Clinical and Research Problems Prereq: GMS BI 751, which must be taken concurrently, or consent of instructor. Presents biochemical aspects of clinical case studies and laboratory research

problems and technology in coordination with the concepts taught in GMS BI 751. *Berkowitz*. 2 cr, 1st sem.

GMS BI 755, 756 General Biochemistry

Prereq: consent of instructor. The overall goal of this two-semester course is to provide a comprehensive in-depth view of the principles, concepts, and methodology underlying the field of biochemistry. The first semester lecture/session schedule is integrated with GMS MS 753 Cell Biochemistry so students study basic biochemical concepts within the context of the cell and its various compartments and stages of cellular differentiation and growth. Emphasis is placed on experimental approaches to the characterization of macromolecular and molecular structure function relationships and the regulation of gene expression. The second semester concentrates on an in-depth discussion of specific classes of biological molecules, their metabolism, and their cellular and organismal roles. *Foster, Brecher*. 4 cr, 1st and 2nd sem.

GMS BI 766 Techniques in Biochemistry

Not offered 1994/95

GMS BI 778 Mechanisms of Cardiovascular Disease

Not offered 1994/95

GMS BI 780 Control of Metabolic Processes

Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Detailed consideration of metabolic pathways and major sites of metabolic regulation. Catalytic properties, cofactors, and methods of regulation functioning in the pathways of intermediary metabolism are studied. Topics include: carbohydrate and lipid metabolism, alternate pathways, photosynthesis, and amino acid metabolism. Offered alternate years. *Brecher, Troxler*. 2 cr, 2nd sem.

GMS BI 781 Basic Pulmonary Science

Not offered 1994/95

GMS BI 782 Molecular Biology

Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Advanced molecular biology using the current literature as a source of infor-

mation. Emphasis is also placed on relevant research techniques. Topics include structure and function of nucleic acids, recombinant DNA research, molecular biology of important cellular processes, and regulation of gene expression emphasizing control mechanisms in eukaryotic cells. Offered alternate years.

Berkowitz, Farmer. 2 cr, 2nd sem.

GMS BI 783 Structure and Function of Proteins

Prereq (or may be taken simultaneously): GMS BI 755 and 756 or equivalent and consent of instructor. This course correlates the structure of proteins with their function. It considers the universality of certain regions, such as zinc fingers, calcium binding regions, DNA liganding sequences, in terms of their three dimensional structure, and considers the effect of site specific mutations in these regions on the function of the protein containing them. Apoproteins, apolipoproteins, glycoproteins, structural proteins, and adhesion molecules are used as examples of the correlation between structure and function of these entities. Alternates with GMS BI789. *Simons*. 2 cr, 1st sem.

GMS BI 784 Lipid Biochemistry

Not offered 1994/95

GMS BI 785 Steroid Biochemistry

Not offered 1994/95

GMS BI 786 Biochemical Mechanisms of Aging

Prereq: consent of instructor. Current issues and key research advances in the understanding of the biochemical processes involved in aging of mammals are discussed. Theories on aging are analyzed, and age-related changes in gene structure and expression are presented. Alterations in the function of the neuroendocrine and immune systems with aging are also discussed. Offered alternate years. *Polgar*. 2 cr, 2nd sem.

GMS BI 787 Molecular Mechanisms of Growth and Development

Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Examines the most recent advances in the

molecular mechanisms involved in regulation of cell proliferation, differentiation, and development. Control of the cell cycle and regulation of the expression of differentiated function are discussed. The role of extracellular growth factors and nuclear transcriptional regulatory proteins are explored. Students present and actively discuss recent primary research articles. Offered alternate years. 2 cr, 1st sem.

GMS BI 788 Enzyme Catalysis

Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Advanced aspects of chemical, thermodynamic and kinetic principles of catalytic mechanisms. Topics include genetic, kinetic, and chemical methods of analysis of enzyme mechanisms; transition state and mechanism-based inhibitors in the control of metabolic reactions; allosteric regulation; enzymes as chemotherapeutic targets in human disease. Offered alternate years. *Kagan*. 2 cr, 2nd sem.

GMS BI 789 Physical Biochemistry

Prereq: consent of instructor. Considers the role played by the universal biochemical solvent, water, in cellular functions. The structure of water, its role in protein or nucleic acid folding, as well as the part played by water or by its exclusion in biochemical reactions, forms the basis of the course. The role of uncharged vs. charged solutes, and the effect of enclosure of aqueous solutions of macromolecules in semipermeable membranes (i.e., modeling of a cell, as well as of the protein solutions within it) are also considered. *Simons, Bergethon*. 2 cr, 1st sem.

GMS BI 790 Receptors and Signal Transduction

Prereq: GMS BI 755, 756 or equivalent and consent of instructor. The goal of this course is to provide an in-depth description of the molecular mechanisms of ligand-receptor binding and signal transduction. Emphasis is placed on the mechanism of action of hormones, neurotransmitters, and growth factors. Individual components of receptor-induced signaling pathways are investigated in detail and integrated into models of cellular control. Relies heavily on current literature and student directed discussion. Offered alternate years. *Pilch, Tiaish*. 2 cr, 2nd sem.

GMS BI 851, 852 Special Topics in Biochemistry

Prereq: GMS BI 755, 756 or equivalent and consent of instructor.

GMS BI 854 Biochemistry Seminar

Required for all first- and second-year post-bachelor's PhD biochemistry students and for all first-year MA, post-master's PhD, and MD/PhD biochemistry students. Students present seminars on current topics in biochemistry. The emphasis of this course is on effective use of the biochemical literature and methods of improving oral presentations. *Dobson*. 2 cr, 2nd sem. (Register only in final semester of attendance.)

GMS BI 951 Research in Biochemistry

Variable cr



Dr. Stephen Farmer collects data from a tissue culture experiment.

DEPARTMENT OF BIOPHYSICS

Chairman Donald M. Small
Chairman, Student Affairs and Admissions
Committee James A. Hamilton

Faculty

Christopher W. Akey, PhD, Assistant Professor

David Atkinson, PhD, Professor

James A. Hamilton, PhD, Professor

G. Graham Shipley, PhD, DSc, Professor

Donald M. Small, MD, Professor

Mary T. Walsh, PhD, Assistant Professor

Raphael A. Zoeller, PhD, Assistant Professor

Joint Faculty

Peter Brecher, PhD, Research Professor (Professor of Biochemistry)

M. Carter Cornwall PhD, Research Professor (Professor of Physiology)

Paul F. Pilch, PhD, Research Professor (Professor of Biochemistry)

Elizabeth R. Simons, PhD, Research Professor (Professor of Biochemistry)

The Graduate Program

The Department of Biophysics at the School of Medicine offers an MA/PhD program in biophysics. The program seeks students with backgrounds in the life and basic sciences. Particular emphasis is placed on students with undergraduate training in the biological or chemical sciences, with the aim of training them in modern biophysical approaches and methodologies that emphasize structural biology.

The research interests of the faculty of the Department of Biophysics range from cell and structural biology to traditional physical chemical studies of small and macro-molecules. Of particular interest is the study of the three-dimensional structure of proteins, lipids, and complex carbohydrates and their function in cellular membranes, cellular

organelles, serum lipoproteins, adipose tissue, nerve and brain tissue, and such pathological deposits as atherosclerotic plaques, gallstones, Alzheimer's disease, and amyloid plaques and abnormal lipoproteins. The techniques of modern cell biology and biochemistry and techniques used in structural biology, particularly high resolution cryoelectron microscopy and image reconstruction, protein and lipid X-ray diffraction, 2D and classical NMR spectroscopy, are coupled with classical physical chemical techniques such as microcalorimetry, circular dichroic and fluorescence spectroscopy, ultra-centrifugation, and immunochemistry make it possible to study thermodynamic and kinetic processes as structure changes during function. Supporting these systems is a modern computer laboratory for image analysis and reconstruction and molecular modeling. Classic and cryoelectron microscopy allow the determination of the structures of macromolecular complexes down to 10 to 20 Å resolution, whereas X-ray crystallography and 2D NMR allow structures of the components to be determined at atomic resolution. Applying biophysical and structural

biological rationale and techniques has helped the medical profession understand more fully the structure of the nuclear pore complex, receptor-ligand complexes, membrane structure, lipoprotein structure and, in pathology, the structure of the lipid lesions of atherosclerosis, gallstones, and abnormal lipoproteins.

Admission

Students who have completed an undergraduate degree usually with a major in the biological, chemical, or physical sciences can enter either the MA program or the PhD program, depending on their achievements. Students with a master's degree can enter the PhD program. Students in the MD/PhD program also qualify for admission. Post-MD students are eligible for the PhD degree program only.

Course Requirements

For the MA program, graduates with degrees in the biological or physical sciences will complete 32 credits of coursework including the required course GMS BY 771



Dr. Small and a postdoctoral fellow prepare a manuscript for publication.

Biophysics of the Macromolecular Assemblies. A written thesis summarizing research carried out under the direction of a member of the Biophysics Program faculty will complete the requirements.

For the PhD program, students will complete 64 credits of coursework, including the required courses GMS BY 771 Biophysics of Macromolecular Assemblies and GMS BY 871, 872 Biophysics Seminar. Students with a strong background in the biological sciences will take courses designed to improve their knowledge of the biophysical sciences. Post-master's degree students will complete 32 course credits. The PhD program will also be available to qualified MD/PhD students after completion of two preclinical years of medical school. All students will submit a written thesis describing their research carried out under the direction of a member of the Biophysics Program faculty.

CURRICULUM

Required Courses

The course curriculum consists of the following required core didactic courses, plus supplementary courses selected from the following list of graduate school courses:

GMS BY 771	Biophysics of Macromolecular Assemblies (4 cr)
GMS BY 871, 872	Biophysics Seminar (2 cr)
GMS BY 945, 946	Research in Department of Biophysics

Elective Courses

Biophysics

GMS BY 772	NMR Spectroscopy in Biology and Biochemistry
GMS BY 774	Metabolism and Cellular Functions of Complex Lipids

Medical and Dental Sciences

GMS MS 703	Neuroscience
GMS MS 753	Cell Biology

Biochemistry

GMS BI 555	Biochemistry A
GMS BI 556	Biochemistry B
GMS BI 751	Biochemistry
GMS BI 782	Molecular Biology
GMS BI 763	Structure and Function of Proteins
GMS BI 766	Techniques in Biochemistry
GMS BI 851, 852	Special Topics in Biochemistry
GMS BI 789	Physical Biochemistry
GMS BI 790	Receptors and Signal Transduction

Microbiology

GMS MI 513	Basic Immunology
GMS MI 718	Virology

Physiology

GMS PH 843	Cellular Physiology I
GMS PH 844	Cellular Physiology II

Biology

CLA BI 552	Molecular Biology I
CLA BI 553	Molecular Biology II
GRS BI 645	Neurobiology
GRS BI 650	Biophysics
GRS BI 711	Biological Transport Mechanisms

Chemistry

GRS CH 551	Chemical Dynamics
GRS CH 553, 554	Molecular Structure Determination
GRS CH 651, 652	Molecular Quantum Mechanics
GRS CH 722	Protein Chemistry
GRS CH 723	Physical Chemistry of Biological Macromolecules
GRS CH 724	Special Topics in Biochemistry
GRS CH 751	Advanced Topics in Physical Chemistry

Physics

GRS PY 771	Biophysics
GRS PY 897, 898	Special Topics in Experimental Physics

Language Requirements

The candidate must complete a written or oral examination in French or German. In special cases, the candidate may substitute another language.

Graduation Requirements

1. All candidates must pass a comprehensive/qualifying examination by the end of their second year in the program. The examination will consist of both written and oral parts.
2. The student must achieve passing grades in the required courses and maintain a B average in all courses.
3. The candidate must pass a language examination.
4. During the first year, students meet with individual faculty members of the Biophysics Program and perform laboratory research rotations with program faculty. The student must select a PhD research topic and research advisor by the end of his or her first year in the program. Thesis research must be conducted under the guidance of the research advisor who is a member of the Biophysics Program faculty. In consultation with the advisor, the student selects a committee of four faculty members to act as a thesis committee.

5. The candidate submits a written thesis describing original research and demonstrating an ability for independent creative scholarship.

6. The candidate defends his or her thesis at a final oral examination. The student must demonstrate mastery of the chosen field of specialization and show that the research contributes significantly to the body of scientific knowledge. The oral examination is conducted by a committee composed of at least five members of the Division faculty. In some cases, at the discretion of the Dean of Graduate Medical Sciences, one of the five committee members may be appointed from outside the graduate faculty of Boston University.

COURSES

GMS BY 771 Biophysics of Macromolecular Assemblies Prereq: MED ME 763, GRS CH 713, CLA CH 535, CH 536, or MED ME 751, and consent of instructor. Advanced course. Assembly of biomacromolecules, their structure and stabilizing forces; biological function as related to structure, with examples drawn from assemblies of proteins, lipids, lipoprotein systems, and membranes. *Atkinson, Shipley, Small.* 1st sem.

GMS BY 772 Nuclear Magnetic Resonance Spectroscopy in Biology and Biochemistry Prereq: consent of instructor. An introduction to the basic theory and the fundamental measurements of NMR spectroscopy using the predominant biological nuclei, ¹H, ²H, ¹³C, and ³¹P, and applications to structure and metabolism; NMR studies of pathological processes and NMR imaging. *Hamilton.* 2 cr, 2nd sem.

GMS BY 774 Metabolism and Cellular Function of Complex Lipids Prereq: consent of instructor. In-depth description of selected areas of lipid metabolism. Emphasis on functional roles of specific lipid species in cellular processes (e.g., cell activation, protein transport and function). Use of timely articles to discuss newly developed techniques and concepts. *Zoeller.* 2 cr, 2nd sem.

GMS BY 871, 872 Biophysics Seminar A program combining seminars by the faculty, student presentations of current research, and in-depth research lectures by visiting scientists. *Small.* 2 cr, 1st & 2nd sem.

GMS BY 945, 946 Research Biophysics Variable cr

DEPARTMENT OF MICROBIOLOGY

Chairman Ronald B. Corley
Director of Graduate Studies Ann Marshak-Rothstein

Faculty

Paul H. Black, MD, Professor
Selwyn A. Broitman, PhD, Professor
Iih-Nan (George) Chou, PhD, Professor
Ronald B. Corley, PhD, Professor
Susan H. Fisher, PhD, Associate Professor
Eva R. Kashket, PhD, Professor
Herbert Z. Kupchik, PhD, Professor
Elinor M. Levy, PhD, Associate Professor
Ann Marshak-Rothstein, PhD, Professor
Frederick L. Moolten, PhD, Associate Professor
Glen B. Zamansky, PhD, Associate Professor

Joint Faculty

Robert D. Arbeit, MD, Associate Professor (Associate Professor of Medicine)
David I. Beller, PhD, Associate Research Professor (Associate Research Professor of Medicine)
Donald E. Craven, MD, Professor (Professor of Medicine)
Douglas T. Golenbock, MD, Assistant Professor (Assistant Professor of Medicine)
Stuart M. Levitz, MD, Associate Professor (Associate Professor of Medicine)
Joel Maslow, MD, Assistant Professor (Assistant Professor of Medicine)
John R. Murphy, PhD, Research Professor (Research Professor of Medicine)
Peter A. Rice, MD, Associate Professor (Associate Professor of Medicine)
Thomas L. Rothstein, MD, PhD, Professor (Professor of Medicine)

Programs of Study

The Department of Microbiology of the Boston University School of Medicine offers PhD and MA programs in the fields of cell and molecular biology, bacteriology, virology, immunology, and tumor cell biology. Students in the graduate program participate in formal coursework, seminars, and directed research. Participant may also take courses within other basic science departments of the Medical School as well as at Boston University's Charles River Campus. Students are also encouraged to attend additional seminars and classes offered by the universities in the Boston area.

The research interests of the faculty in the Department of Microbiology range from studies of bacteriology, virology, and immunology to those of gene expression and function. PhD training is available in microbiology and through the interdepartmental program in immunology. Specific research areas include: eukaryotic cell growth control

and carcinogenesis, mechanisms of eukaryotic cell injury, regulation of gene expression in pathogenic and sporulating bacteria, mechanisms of drug resistance in bacteria, protein structure/function analysis, pathogenesis of acquired immune deficiency syndrome, regulation of humoral and cell mediated immunity, dysregulation of lymphocyte function in autoimmunity, signal transduction and gene expression in lymphocytes, interactions between the neuroendocrine and immune systems.

IMMUNOLOGY TRAINING PROGRAM

Several members of the Department of Microbiology participate with faculty in the Departments of Pathology, Biochemistry, and Medicine in an Interdepartmental Immunology Training Grant Program. The program consists of training both pre- and post-doctoral students. Pre-doctoral students are prepared for a career in immunological research and teaching through formal coursework, seminars, and laboratory research.

Conventional Microbiology Track

Required Courses

GMS BI 753[†] Cell Biology*, 4 cr
GMS BI 755 ✓ General Biochemistry I, 4 cr
GMS BI 756 ✓ General Biochemistry II, 4 cr
CLA AH 520 Microbiology, 4 cr
GMS MI 513 Basic Immunology*, 4 cr
GMS MI 518 Virology, 4 cr
GMS MI 714 Genetics of Microorganisms, 4 cr
GMS MI 812 Microbiology Seminar, 2 cr
GMS MI 911, Research, var cr
912
Seminars in Ethics in Biomedical Research

[†]Either GMS MI 513 or GMS MI 753 are required.



Dr. Eva Kashket and graduate student Hui Zhou examine the alcohol produced by *Chostridium* (using a gas chromatograph).



Dr. David Panka and graduate student Padma Channavajhala analyze changes in gene expression in lymphocyte subsets by RT-PCR.

Elective Courses

Choose three of the following:

- GMS MI 715 Advanced Immunology—Cellular Aspects, 2 cr
- GMS MI 716 Bacterial Physiology, 4 cr
- GMS MI 717 Growth Control and Cell Transformation, 4 cr
- GMS MI 718 Advanced Virology, 4 cr
- GMS PA 726 Host Defenses in Pathogenesis, 2 cr

Immunology/Microbiology Track

Required Courses

- GMS BI 755 General Biochemistry I, 4 cr
 - GMS BI 756 General Biochemistry II, 4 cr
 - GMS MI 511 Microbiology, 4 cr
 - GMS MI 513 Basic Immunology, 4 cr
 - GMS MI 518 Virology (recommended), 4 cr
 - GMS MI 714 Genetics of Microorganisms, 4 cr
 - GMS MI 715 Advanced Immunology—Cellular Aspects, 2 cr
 - GMS MI 812 Microbiology Seminar, 2 cr
 - GMS MI 911 Research, var cr
 - GMS PA 725 Advanced Immunology—Molecular Aspects, 2 cr
- Seminars in Ethics in Biomedical Research

Elective Courses

Choose eight credits of the following:

- GMS BI 782 Molecular Biology, 4 cr
- GMS BI 852 Special Topics in Biochemistry, 2 cr
- GMS MI 717 Growth Control and Cell Transformation, 4 cr
- GMS MI 718 Advanced Virology, 4 cr
- GMS MS 753 Cell Biology, 4 cr
- GMS PA 823 Special Topics in Pathology, 2 cr
- GMS PH 843 Cellular Physiology, 4 cr
- SPH EB 702 Biostatistics—Introduction to Statistical Computing, 2 cr
- SPH EB 703 Intermediate Biostatistics, 3 cr

COURSES

GMS MI 511 Medical Microbiology Prereq: consent of instructor. Introduction to the structure, physiology, genetics, and mechanisms of disease production by bacteria and fungi of medical importance. Introduction to virology. Three lectures and three hours of lab per week. *Kashet, staff.* 1st sem.

GMS MI 513 Basic Immunology Prereq: consent of instructor. Introduction to immunologic principles and applications. *Levy.* 1st sem.

GMS MI 518 Virology and Parasitology

Prereq: consent of instructor. The structure, replicative cycles, human immune response, and pathogenesis of medically important viruses and parasites are presented. *Zamansky, staff.* 2nd sem.

GMS MI 711 Microbiology Prereq: consent of instructor. A medical microbiology course consisting of a brief introduction to bacterial physiology, bacterial genetics, and principles of immunology; a survey of medically important bacteria, fungi, parasites, and viruses. A clinical perspective is offered by infectious disease specialists. *Kupchik.* 6 cr, 1st sem.

GMS MI 714 Genetics of Microorganisms

Prereq: biochemistry and consent of instructor. Genetics and biochemical methodology for studying control of gene expression. Theory of operon and regulatory genes. Genetic transfer of chromosomal DNA and plasmids by conjugation, transformation, and transduction. Use of recombinant DNA technology to study gene expression. *Fisher.* 2nd sem.

GMS MI 715 Advanced Immunology—Cellular Aspects

Prereq: consent of instructor. Analysis of the roles played by T and B lymphocytes and by antigen-presenting cells, in the development of the immune response, with emphasis on the in-class discussion of primary research papers. *Marshak-Rothstein.* 2nd sem.

GMS MI 716 Bacterial Physiology

Prereq: consent of instructor. Advanced topics in microbial physiology, bioenergetics, and membrane function and regulation. Seminar format. *Kashket.* 1st sem.

GMS MI 717 Growth Control and Cell Transformation

Prereq: one biochemistry course or consent of instructor. Lectures and student presentation of topics in: growth of animal cells in culture, serum and other growth factors, oncogenes and tumor suppressor genes, cytoskeleton, mechanisms of growth regulation, cellular and molecular basis of transformation and the biochemistry of transformed cells, biological response modifiers, tumorigenicity, multiple drug resistance, and metastasis. *Chou.* 1st sem.

GMS MI 718 Virology

Prereq: consent of instructor. Current topics in virology are discussed. An emphasis is placed on the molecular mechanisms by which viral gene transcription is regulated. *Black, Zamansky.* 2nd sem.

GMS MI 719 Clinical Microbiology Not offered 1994/95

GMS MI 812 Microbiology Seminar Presentation and discussion of problems of current interest. *Kupchik.* 2 cr, 2nd sem.

GMS MI 813 Immunobiology of Cancer Not offered 1994/95

GMS MI 814 Radiation Biology Not offered 1994/95

GMS MI 911, 912 Research Microbiology Variable cr

DEPARTMENT OF PATHOLOGY AND LABORATORY MEDICINE

Chairman Leonard S. Gottlieb
*Associate Chairman and Director of
Graduate Studies* Adrienne E. Rogers

Faculty

Charles F. Arkin, MD, Professor
Jan K. Blusztajn, PhD, Associate Professor
Steve Bogen, MD, PhD, Assistant Professor
Nancy L. R. Bucher, MD, Research Professor
Bohdana F. Burke, MD, Assistant Professor
Thomas Christensen, PhD, Associate Professor
Leonard S. Gottlieb, MD, Professor
John Hayes, MD, PhD, Professor
David Larson, PhD, Assistant Professor
Richard Mandel, PhD, Associate Professor
Mary J. Murnane, PhD, Associate Professor
Michael J. O'Brien, MD, Professor
Adrienne E. Rogers, MD, Professor
Hugues J.-P. Ryser, MD, Professor
Lucia Schuger, MD, Assistant Professor
Jacqueline Sharon, PhD, Professor
Joseph J. Vitale, ScD, Professor

Joint Faculty

David I. Beller, PhD, Associate Research Professor (Medicine)
Selwyn A. Broitman, PhD, Professor (Microbiology)
Iih-Nan (George) Chou, PhD, Professor (Microbiology)
Douglas V. Faller, MD, PhD, Professor (Medicine)
Patricia L. Foster, PhD, Assistant Professor (Environmental Health)
Thomas F. Freddo, PhD, Associate Professor (Ophthalmology)

Shyr-Te Ju, PhD, Associate Research Professor (Medicine)

Thomas L. Kemper, MD, Professor (Neurology)

Hardy Kornfeld, MD, Associate Professor (Medicine)

Ann Marshak-Rothstein, PhD, Professor (Microbiology)

Aubrey Milunsky, MD, Professor (Pediatrics)

David J. Salant, MD, Professor (Medicine)

David H. Sherr, PhD, Professor (Environmental Health)

Alfred I. Tauber, MD, Professor (Medicine)

Programs of Study

The Department of Pathology and Laboratory Medicine offers a doctoral program in pathology and also in a pathology-immunology track for students with a strong interest in immunology. The doctoral program is broadly based, offers research training in both clinical and basic investigations of disease and encourages students to integrate the two areas where appropriate in their doctoral research. Integration of basic research prin-

ciples with knowledge of pathophysiology in humans and laboratory animals is a major goal of the training program and is achieved by the close affiliations with the pathology departments at Boston City Hospital and University Hospital (Mallory Institute of Pathology) and Boston Veterans Administration Medical Center.

Understanding the predisposing factors and pathological processes leading to disease, at the molecular, cellular, organ, and whole body levels, should ultimately lead to better strategies for prevention and therapy of disease. For example, areas of great interest in current research are the mechanisms that underlie normal development and development of cancer and degenerative diseases, the workings of the immune system in defense against disease, and the genetic bases of many diseases.

The research interests of the faculty include the following: mechanisms of chemical carcinogenesis and mutagenesis and of tumor cell responses to drugs; molecular and cellular immunology, including structure-function analysis and engineering of model and therapeutic antibodies and T cell receptors, characterization and study of factors



Drs. Leonard Gottlieb and Adrienne Rogers discuss curriculum.

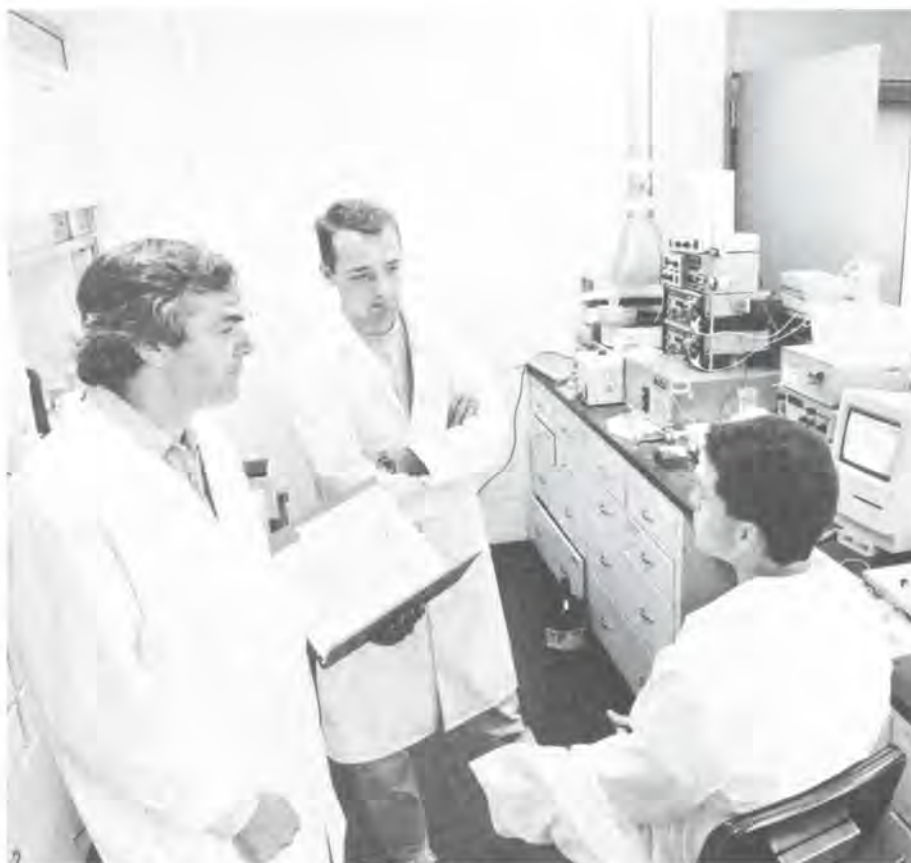
that determine lymphocyte migration and activity and immunotoxicology; human somatic cell, molecular and cancer genetics; cancer of the gastrointestinal tract; nutritional effects on toxicity and carcinogenicity of chemicals; mechanisms of cell signalling; roles of growth factors and extracellular matrix in growth and differentiation of tissues; neurochemistry; pathogenesis of atherosclerotic and other vascular diseases; ophthalmological diseases; and development of animal models of human disease. Methods of investigation, in addition to morphologic procedures used in classical pathology and ultrastructural studies, include culture and study of bacterial and mammalian cells and tissues; biochemical and molecular analyses of cell constituents; recombinant DNA technologies; immunological manipulation of animals; immunological and other methods for identification of cell components and of genetic and other biological markers.

Curriculum and Requirements for the PhD Degree

The curriculum comprises study in formal courses and laboratory experience extending over one to two years, followed by a comprehensive written and oral qualifying examination, taken within one semester after completion of required coursework. Within the following year a proposal for dissertation research is prepared and presented to the student's individual dissertation committee.

The research is then performed under the guidance of the major advisor with the help and advice of the committee over the ensuing one or more years. Ultimately the student writes and defends a dissertation based upon the research performed.

The required courses are listed in the table below. The track chosen (pathology or pathology-immunology) and the degree program (PhD or MD/PhD) determine the specific curriculum. Laboratory rotations are performed as early as possible in the course of studies to: (1) acquaint the students with research opportunities in the program; (2) teach a variety of approaches to research; (3) teach specific research methods; and (4) permit choice of an area for dissertation research. Rotations can be taken in the summer before beginning formal coursework, during the first year of study, or the following summer. The dissertation research advisor should be chosen and preliminary work in the area of research begun early in the second year of study.



Dr. Jan Blusztajn and students in a laboratory discussion.

COURSES

GMS PA 500 Introduction to Pathology

Lectures and discussion sessions presenting the basic morphologic and functional changes of major disease processes: cell injury and death, inflammation, cell and tissue response to microbial organisms, atherosclerosis, cancer, etc. *Pathology faculty.* 4 cr, 2nd sem.

GMS PA 700 Basic and Experimental Pathology

Prereq: MED ME 755, 756 or equivalent, and status of PhD candidate or higher. Basic principles of pathology and immunology are presented through lectures. Related research articles and basic histology are discussed in small group sessions that complement the lectures. Note: The immunology requirement is satisfied prior to registration by the medical immunology lecture series and examination (2nd sem.), or an equivalency examination offered by the instructor, or MED ME 513. *Sharon.* 6 cr, 1st sem.

GMS PA 701 Advanced Immunology—Molecular Aspects

Prereq: MED ME 755, 756 or equivalent. An examination of molecules of immunological interest through discussion of research articles and occasional lectures. Topics include gene structure, control of gene expression, and the structure-function relationship of these molecules. Emphasis is placed on the use of recombinant DNA and immunological

methods. Offered alternate years. *Sharon.* 2 cr, 2nd sem.

GMS PA 703 Host Defenses in Pathogenesis: Infectious Disease and Neoplasia

Prereq: microbiology, MED ME 511, or equivalent, and consent of instructor. Host defense mechanisms in infectious diseases and neoplasia and basic chemotherapeutic approaches to these diseases are considered in lectures and class discussions. The role of nutrition in both pathogenesis of and protection against these disease is presented. *Broitman.* 2 cr, 2nd sem.

GMS PA 800 Pathology Seminar Weekly research seminar presented by faculty, students, and guests. *Blusztajn, Murnane.* 2 cr, 1st & 2nd sem.

GMS PA 801 Special Topics in Pathology

Detailed examination of one specific area of research each term, presented in readings, discussions, and lectures. Presents significant background information, current knowledge, research approaches, and laboratory methodology in each area. *Pathology faculty.* 2 cr, 1st & 2nd sem.

Directed Study or Research

GMS PA 900 Laboratory Rotations in Pathology

GMS PA 901 Research in Pathology

**Department of Pathology and Laboratory Medicine Graduate School
Course Requirements for PhD and MD/PhD Students**

Course	Credit	PhD Students		MD/PhD Students	
		Pathology Track	Pathology-Immunology Track	Pathology Track	Pathology-Immunology Track
General Biochemistry I and II	8	required ¹	required	fulfilled by medical school courses	
Basic and Experimental Pathology	6	required	required		
Biostatistics—Introduction to Statistical Computing or Intermediate Biostatistics	4	required	required	required	required
Special Topics/Pathology	2	required ²	required ²	required ²	required ²
Basic Immunology	4		required	fulfilled by medical school courses	
Advanced Immunology—Molecular Aspects	2	elective	required	elective	required
Advanced Immunology—Cellular Aspects	4		required		required
Pathology Seminar	2	required ¹	required ³	required ³	required ³
Pathology Laboratory Rotations	2 per rotation	required ⁴	required ⁴	required ⁴	required ⁴
Pathology Research	variable	required	required	required	required
Seminars in Ethics in Biomedical Research	—	required ⁵	required ⁵	required ⁵	required ⁵
Human Genetics	4	elective		elective	
Cell Biology	4	elective	elective	elective	elective
Nucleic Acids	4	elective	elective	elective	elective
Pathobiochemistry	2	elective		elective	
Special Topics/Biochemistry	2		elective		elective
Growth Control and Cell Transformation	4		elective		elective
Advanced Virology	4		elective		elective
Genetics of Microorganisms	4		elective		elective
Cellular Physiology	2		elective		elective

¹ GMS BI 555 and BI 556 (Biochemistry A and B, each 4 credits) can be substituted.

² The Special Topics course is required in three of the first four semesters in the conventional track and for one semester in the immunology track.

³ Attendance at departmental seminars is required through all terms of study and research.

⁴ Three rotations for PhD students and two rotations for MD/PhD students.

⁵ Presented by the Medical Center and the Division of Graduate Medical Sciences.

DEPARTMENT OF PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS

Chairman David H. Farb

Faculty

Mark Alexander, PhD, Assistant Professor

Norman D. Boyd, PhD, Associate Professor

J. Worth Estes, MD, Professor

David H. Farb, PhD, Professor

Terrell T. Gibbs, PhD, Assistant Professor

Tohru Ikuta, MD, PhD, Assistant Professor

Kevin A. Jarrell, PhD, Assistant Professor

Conan Kornetsky, PhD, Professor

Susan E. Leeman, PhD, Professor

Ruth R. Levine, PhD, Professor Emerita (University Professor)

Isabelle M. Mintz, PhD, Assistant Professor

L. Bruce Pearce, PhD, Assistant Professor

Edward W. Pelikan, MD, Professor

Shelley J. Russek, PhD, Instructor

Ladislav Volicer, MD, PhD, Professor

Carol T. Walsh, PhD, Associate Professor

Joint Appointments

Thomas R. Browne, III, MD, Associate Professor (Professor of Neurology)

Charles R. Cantor, PhD, Professor (Professor of Biomedical Engineering)

Alan S. Cohen, MD, Professor (Professor of Medicine)

Robert G. Feldman, MD, Professor (Professor of Neurology)

Gladys Friedler, PhD, Associate Professor (Associate Professor of Psychiatry)

Benjamin Gerson, MD, Professor (Professor of Pathology)

Judith K. Marquis, PhD, Adjunct Associate Professor (Director, Preclinical Development, Procept, Inc.)

S. Alex Mitsialis, PhD, Assistant Research Professor (Assistant Professor of Medicine)

Susan P. Perrine, MD, Professor (Professor of Pediatrics)

Hugues J.-P. Ryser, MD, Professor (Professor of Pathology)

Sirir K. Sengupta, PhD, Associate Research Professor (Associate Research Professor of Obstetrics and Gynecology)

Cassandra L. Smith, PhD, Professor (Professor of Biomedical Engineering)

Temple F. Smith, PhD, Professor (Professor of Biomedical Engineering)



Carl E. Rosow, MD, PhD, Adjunct Associate Professor (Associate Professor of Anesthesia, Harvard Medical School)

Steven M. Paul, MD, Adjunct Professor (Vice President for CNS Research and Clinical Investigation, Lilly Research Laboratories)

W. Mark Vogel, PhD, Adjunct Associate Professor (Research Scientist, Hoffmann-LaRoche, Inc.)

Programs of Study

The Department of Pharmacology and Experimental Therapeutics at Boston University School of Medicine offers graduate training programs that lead to the MA, PhD and MD/PhD degrees in pharmacology. The training program is directed toward preparing students for future careers in pharmacologic research in academic, industrial, and governmental settings. Advanced research in pharmacology requires an understanding of the principles of a broad range of disciplines. The curriculum encompasses the interdisciplinary nature of this field and prepares students to study chemical interactions with biological systems on multiple levels, from the behavior of atoms in macromolecules to the effect of molecules on the behavior of organisms. A major focus of research training is in areas of molecular, cellular, and behavioral neuroscience. Newly renovated and expanded research facilities provide students with state-of-the-art opportunities for training in molecular genetics, molecular modeling, electrophysiology, biophysical methods, psychophysical methods, and other tools for elucidating the interaction of drugs with biological targets. Current research projects include: gene therapy; functional and structural mapping of receptors; regulation of receptor gene expression; theoretical analysis of ligand binding; computer-based structure analysis; neurotransmitter release mechanisms; transcriptional regulation of gene expression in development and aging; peptides in neuroendocrine and inflammatory processes; excitotoxicity in aging and disease; protein engineering of microbial toxins; neural substrates of drug abuse and analgesia; ribozyme mechanisms and function; and optical imaging of synaptic activity.

Admission Procedures

The procedures for admission to the graduate programs in pharmacology are described in the section of this bulletin on admissions procedures of the Division of Graduate Medical Sciences. Interviews are encouraged for applicants to the MA/PhD programs and

are required for applicants to the MD/PhD program. Admissions and other matters relating to graduate programs are reviewed by the Graduate Education Committee of the department.

Research Assignment

As soon after admission into the program as possible, students should choose an area of research interest and select an appropriate faculty member as supervisor of their research training. The chairman of the Graduate Education Committee serves as advisor until a research supervisor is selected. During the first year of study, students who have not chosen a research area should familiarize themselves with research projects of the faculty through laboratory rotations.

MA DEGREE PROGRAM

Curriculum

MA candidates are required to take GMS BI 755, 756 General Biochemistry I and II, GMS BI 753 Cell Biology, and GMS PM 700 Molecular Neurobiology and Pharmacology. Students may elect to take GMS PH 740 Physiology and GMS PM 720 General Medical Pharmacology rather than Molecular Neurobiology and Pharmacology. In addition, students are required to attend departmental seminars and to satisfactorily complete two advanced courses offered by the department (800 level courses, see below). The Graduate Education Committee considers written requests from students to substitute or place out of courses. MA candidates who already possess a doctoral-level degree (e.g., the MD) should plan curricula suited to their needs in consultation with their advisors and the Graduate Education Committee. After satisfactory completion of the first-year curriculum with a GPA of B (3.0) or higher, an MA candidate may submit a request for transfer into the PhD program to the Graduate Education Committee.

Thesis or Comprehensive Examination

The MA degree requirements include either: (1) A thesis prepared under the supervision of first and second readers or, (2) A comprehensive written and oral examination. The written portion requires the student to prepare a critical synthesis of the research literature on a pharmacological subject. The oral portion of the exam covers the

general and advanced pharmacology covered in the courses taken by the student. Students are urged to complete the comprehensive examination by the end of the second curricular year.

PHD DEGREE PROGRAM

Curriculum

The curriculum for PhD candidates is designed to provide a broad-based foundation in pharmacology, as well as flexible opportunities to individually tailor a program that meets the individual student's background and research interests. Students are expected to consult with their advisors to plan a sequence of coursework that best suits their needs. Specific departmental requirements include regular attendance at departmental seminars and the satisfactory completion of four advanced courses (800-level courses). A minimum of twenty-six credits of formal coursework is required of all PhD candidates. Courses offered by other departments of Boston University may be substituted for advanced Department of Pharmacology courses with the permission of the student's advisor and the Graduate Education Committee. Students concentrating in Biomolecular Pharmacology are especially encouraged to consider curricular offerings of the Department of Biochemistry, Biophysics, and the College of Biomedical Engineering.

Most PhD candidates enroll in basic courses in biochemistry, cell biology, neuroscience, biostatistics, physiology, and pharmacology (700 level). Usually, the specific courses for a specialization in Neuropharmacology include GMS PM 755, 756 General Biochemistry I and II, GMS PM 753 Cell Biology, GMS PM 703 Neuroscience, and GMS PM 700 Molecular Neurobiology and Pharmacology. Students are also encouraged to register for a course in biostatistics such as SPH EB 700 Beginning Statistics or CLA MA 614 Statistical Methods II. These courses provide both the necessary background study in the basic sciences and an introduction to the discipline of pharmacology. This subject matter is generally a prerequisite to more in-depth study in the advanced courses listed below. For MD/PhD candidates this introductory sequence is satisfied by the first and second year medical curriculum; students are encouraged however to take GMS PM 700 Molecular Neurobiology and Pharmacology. MD/PhD students are required to take three advanced (800-

level) courses. Students enrolled in the PhD program in pharmacology are expected to maintain a GPA of B (3.0) or higher.

Qualifying Examination

The qualifying examination for PhD candidates consists of a written and oral examination. Students are expected to take the qualifying exam no later than the end of the third curricular year. Preparation for the examination should be made in close consultation with the candidate's advisor, the four other members of the examining committee, and the committee chairman. The written portion of the qualifying examination tests a student's understanding of the fundamental principles of pharmacology and covers subject matter presented in the recommended curriculum for PhD students. The oral examination, usually taken within two weeks of passing the written, is designed to assess the student's ability to synthesize and correlate information, develop hypotheses and design experiments to solve research-related problems in the pharmacological sciences.

Dissertation

Each PhD candidate chooses a Boston University faculty member as advisor for the dissertation project, preferably before the second curricular year. The student and advisor designate a five-person dissertation committee (which includes the advisor) with the approval of the department chairman. At least three members of the committee must have primary appointments in the department. The committee must include at least one member from outside the department or Boston University. PhD candidates are expected to prepare a ten-page progress report and thesis proposal on the dissertation project and present a departmental seminar approximately one year before the dissertation defense. Following the seminar, the student meets with committee members to discuss the research progress.

The PhD candidate prepares a dissertation that documents the accomplishment of original independent research of significance to the pharmacological sciences. The research is expected to meet publication standards of peer-reviewed journals in the candidate's area of specialization. A draft of the dissertation, approved by the advisor, is submitted to the second reader and, after revision, to all committee members. A committee meeting with the student is held no sooner than two weeks after distribution of the dissertation for recommendations regarding final revisions. With the approval of the committee,

the PhD candidate arranges for the formal dissertation defense, which begins with a seminar presentation and is followed by a discussion of the work with the committee members.

COURSES

GMS PM 700 Molecular Neurobiology and Pharmacology Prereq: consent of instructor. Examines a spectrum of topics ranging from the regulation of gene expression in the nervous system to the structure and function of receptors and ion channels. Emphasis is placed on theoretical foundations of pharmacological methods in neurobiology. *Farb, staff.* 4 cr, 2nd sem.

GMS PM 710 Laboratory Techniques in Modern Pharmacology Prereq: consent of instructor. Supervised laboratory rotation emphasizing modern research techniques in molecular, cellular, and behavioral pharmacology. Problems of collection, summary, and interpretation of data are addressed. *Farb, staff.* 2 cr, either sem.

GMS PM 720 General Medical Pharmacology Prereq: GMS BI 751, GMS PH 740, GMS MS 703 or equivalent, and consent of instructor. Pharmacologic principles and properties of chemical agents of interest to human medicine are presented in lectures and workshops. Lectures provide a complete survey of drug classes affecting organ systems such as the nervous system, as well as antimicrobial and cancer chemotherapeutic agents. Workshops emphasize interpretation of pharmacologic data and patient-oriented problem solving. *Walsh, staff.* 8 cr, 1st sem.

GMS PM 730 Introduction to Medical Pharmacology Prereq: Premedical courses in the sciences. Principles of pharmacology are covered and several major classes of therapeutic agents, with attention to their mechanisms of action. Issues of current and future concern in medical pharmacology are addressed including problems of drug abuse, the ethics of human experimentation, the pricing of new drugs, and new biotechnological approaches to drug design and development. *Walsh, Staff.* 4 cr, 1st sem.

GMS PM 800 Advanced General Pharmacology Prereq: consent of instructor. Lectures and discussions on the major classes of pharmacologic agents, with special attention to molecular, cellular, and physiological mechanisms of therapeutic effects. *Walsh, staff.* 2 cr, 1st sem.

GMS PM 810 Current Topics in Pharmacological Sciences Prereq: consent of instructor. Given in conjunction with the weekly seminar program of the department. Students present and discuss research papers with the visiting scientist working on the cutting edge of pharmacology. *Gibbs.* 2 cr, 2nd sem.

GMS PM 820 Behavioral Pharmacology Prereq: consent of instructor. Emphasizes phar-

macologic basis of drug action in the central nervous system, stressing aspects of behavioral pharmacology and problems of drug addiction. *Kometsky.* 2 cr, 1st sem.

GMS PM 830 Principles of Pharmacokinetics Prereq: consent of instructor. Lectures and discussion on basic factors determining absorption, distribution, biotransformation, and excretion of drugs. Includes methods of analysis and interpretation of pharmacokinetic data. *Walsh.* 2 cr, 2nd sem.

GMS PM 840 Neuroendocrine Pharmacology Prereq: consent of instructor. Covers the basic principles of neuroendocrinology with special emphasis on pharmacologic aspects. Topics include the biochemistry, physiology, and pharmacology of the neural hormones which regulate anterior and posterior pituitary function, as well as selected other peptides such as substance P, neurotensin, and some cytokines. *Leeman.* 2 cr, 1st sem.

GMS PM 850 Biochemical Aspects of Neurotransmitters and Chemical Mediators Prereq: consent of instructor. Lectures and discussions on biosynthesis, inactivation, receptors, and signaling mechanisms of neurotransmitters and chemical mediators including acetylcholine, catecholamines, purines, peptides, prostaglandins, histamines, and other autacoids. *Pearce.* 2 cr, 2nd sem.

GMS PM 860 Principles of Chemical Toxicology Prereq: consent of instructor. Lectures and discussions of events occurring at the molecular level when toxic compounds interact with living organisms, including the uptake, distribution, biotransformation, sites of action, and excretion of toxicants; a "first" course in toxicology that builds on basic biochemical knowledge. *Walsh.* 2 cr, 2nd sem.

GMS PM 870 Clinical Pharmacology Prereq: GMS PM 720. Lectures and discussions on the properties of drugs in humans with emphasis on therapeutic applications. Special attention to problems in drug therapy and clinical studies. *Estes, staff.* 2 cr, 2nd sem.

GMS PM 880 Gene Regulation and Pharmacology Prereq: consent of instructor. Focuses on fundamental aspects on gene control with emphasis on the dual role of RNA as both an informational and a catalytic molecule. Topics range from discussions of gene transcription and RNA splicing, to discussions of ribozymes as therapeutic agents. The relevance of these topics to the understanding, and potential treatment, of disorders that result from altered patterns of gene expression is stressed. *Jarrell, staff.* 2 cr, 1st sem.

GMS PM 890 Seminar in Pharmacology and Society Prereq: consent of instructor. Case histories in pharmacology and medicine and in social aspects of drug use and abuse, to provide insight into causes and consequences of past and future changes and problems in pharmacology and medicine. *Estes.* 2 cr, 1st sem.

GMS PM 931, 932 Research Pharmacology

DEPARTMENT OF PHYSIOLOGY

Chairman Benjamin Kaminer

Faculty

- Karen N. Allen**, PhD, Assistant Professor
M. Carter Cornwall, PhD, Professor
Alvin Essig, MD, Professor Emeritus (Research Professor of Medicine)
J. Fernando Garcia-Diaz, PhD, Associate Professor
James F. Head, PhD, Professor
Gregor Jones, PhD, Assistant Professor
Benjamin Kaminer, MB, BCh, Professor
William J. Lehman, PhD, Professor
Simon Levy, PhD, Associate Professor
Hector Lucero, PhD, Assistant Professor
Edward F. MacNichol, Jr., PhD, Professor
Enrico Nasi, PhD, Associate Professor
Paul M. O'Bryan, PhD, Associate Professor
Judith Dana Saide, PhD, Associate Professor
Barbara Seaton, PhD, Associate Professor
Raymond E. Stephens, PhD, Professor
Douglas L. Tillotson, PhD, Associate Professor

Joint Faculty

- Edward Alexander**, MD, Research Professor (Professor of Medicine)
Carl S. Apstein, MD, Research Professor (Professor of Medicine)
Rama Bansil, PhD, Associate Professor (Associate Professor of Physics)
Victoria Bolotina, PhD, Assistant Research Professor (Assistant Research Professor of Medicine)
Stuart R. Chipkin, MD, Assistant Research Professor (Assistant Professor of Medicine)
Richard A. Cohen, MD, Research Professor (Professor of Medicine)
Ferenc I. Harosi, PhD, Adjunct Associate Pro-

fessor (Senior Scientist, Marine Biological Laboratory, Woods Hole, MA)

- Michael F. Holick**, PhD, MD, Professor (Professor of Medicine)
Andrew C. Jackson, PhD, Associate Research Professor (Professor of Biomedical Engineering)
Ronald A. Laing, PhD, Associate Professor (Research Professor of Ophthalmology)
Norman G. Levinsky, MD, Professor (Chairman and Professor of Medicine)
James C. Melby, MD, Professor (Professor of Medicine)
Robert B. Moreland, PhD, Assistant Research Professor (Assistant Professor of Urology)
Rahul Ray, PhD, Assistant Research Professor (Assistant Professor of Medicine)



Dr. James Head and student Debbie McDermott evaluate an HPLC run.

Kenneth J. Rothschild, PhD, Professor (Professor of Physics)

Neil B. Ruderman, MD, Professor (Professor of Medicine)

Inigo Saenz de Tejada, MD, Associate Research Professor (Associate Professor of Urology)

Osamu Shimomura, PhD, Adjunct Professor (Senior Scientist, Marine Biological Laboratory, Woods Hole, MA)

H. Eugene Stanley, PhD, Professor (University Professor and Professor of Physics)

Ete Szuts, PhD, Adjunct Associate Professor (Senior Scientist, Medisense, Waltham, MA)

William C. Ullrick, PhD, Professor Emeritus

Programs of Study

Graduate studies in the Department of Physiology provide the student with opportunities to be trained in interdisciplinary approaches in molecular and cellular physiology. The principal goal of the Department of Physiology is to understand, at the cellular and molecular levels, the normal and diseased-state functioning of the organ systems of the human body. The major areas being addressed and the technologies being employed by the faculty are as follows:

Calcium regulation of molecular and cellular processes is investigated by using a variety of experimental techniques such as electrical recording of single channels, optical imaging, and X-ray diffraction. Calcium regulation is being approached through studies of the endoplasmic reticulum, an intracellular communication network which both sequesters and releases calcium, of cytoplasmic calcium-binding modulator proteins, of proteins binding phospholipids in membranes, and of regulatory proteins in muscle thin filaments and in epithelial cilia and sperm flagella. Physiological mechanisms are being elucidated in a variety of cell types through studies on the excitation-secretion coupling process in adrenal cells, on the excitation and adaptation of photo-

receptors, and on the modulation of ion channel behavior and second messenger responses. Precise spatial and temporal measurements of calcium levels in single nerve and adrenal cells are being carried out by optical imaging, using both fluorescent probes and the genetically-engineered photoprotein aequorin, and also with calcium-sensitive microelectrodes.

Another major emphasis concerns *visual transduction* mechanisms, combining electrophysiology, microspectrophotometric, and imaging technologies. The photochemistry of light and dark adaptation of vertebrate rods and cones is being approached from the viewpoint of intracellular second messengers and their modulation of ion channel function. The molecular basis for color vision is being explored through microspectrophotometric analysis of the characteristic pigments of single vertebrate photoreceptors and also through biophysical studies of isolated retinal pigments and reconstituted membranes, using a variety of spectroscopic methods. At an integrative level, neuron-glia interactions, peptidergic neurons, and comparative phototransduction mechanisms are being studied in several systems.

Membrane transport and ion channel studies focus on the application of nonequilibrium thermodynamics to ion channel function and reaction-diffusion systems, approached from a theoretical viewpoint, while other studies deal with the expression of ionic channels in developing cochlear neurons and their regulation by growth factors such as neurotrophins.

Structural biological research, combining biochemical, electron microscopic, and X-ray diffraction approaches, is aimed at understanding diverse physiological processes at the angstrom level. The organization of Z-band proteins in muscle is being established by monoclonal antibody localization to determine assembly mechanisms for myofibrillar proteins in normal muscles and in mutants with abnormal myofibrils. The specific arrangement of calcium regulatory proteins on skeletal and smooth muscle thin filaments is being elucidated by 3-dimensional image reconstruction to compare regulation in different muscle types. The structure of the annexins (a class of calcium-dependent phospholipid membrane binding proteins) and the structures of a variety of ligand binding proteins, protein-peptide complexes (such as calmodulin-target peptides) and enzymes (such as ornithine transcarbamylase and acetoacetate decarboxylase)

are being determined by X-ray crystallography to identify the molecular modifications related to changes in physiological states.

Molecular biological techniques are being used to better understand the functions of physiologically relevant proteins. Examples are the cloning, sequencing, and expression of a calcium storage protein from the endoplasmic reticulum, the cloning and expression of Z-band proteins in *Drosophila* mutants, the differential expression and regulation of tubulin and microtubule-associated protein genes during ciliogenesis, the expression of miRNAs for various ion channels and rhodopsin in frog oocytes, and the bacterial expression of mammalian structural proteins, calcium regulatory proteins, and a number of enzymes.

Additional strengths are represented by faculty with joint appointments in other departments. These areas include: the physical properties of biopolymers; vitamin D function and metabolism; glucose transport and insulin action; cardiac function and the control of coronary vessels and erectile tissue; renal function; and respiratory system mechanics and modeling.

The department has a flexible program that takes into account the background and special interests of individual students. Typical coursework in the first year consists of two semesters each of human physiology, experimental methods in physiology, and biochemistry. In the second year, one semester courses in cell biology, cell physiology, biostatistics, and various electives are taken. Students also register for one semester of Physiology Seminar each year. During this time, MA students fulfill 3 months of laboratory research while PhD students fulfill 6 months, each consisting of 6-8 week rotations. MA students complete their requirements with either a thesis or a comprehensive exam. PhD students take a qualifying exam at the end of the second year, at which point an advisory committee is appointed to aid the student in outlining a thesis project and to monitor the student's progress. Upon satisfactory completion of the project, a thesis is submitted to the committee and a final oral examination is held.

COURSES

GMS PH 542 Human Physiology A Prereq: consent of instructor. Cellular and organ physiology. Lectures, laboratories, and discussions examine function and regulation of organ systems.

Integrative aspects of human physiology include topics in environmental physiology. *Saide*. 4 cr, 1st sem.

GMS PH 543 Human Physiology B Prereq: consent of instructor. See MED ME 542 Human Physiology I. *Saide*. 4 cr, 2nd sem.

GMS PH 740 Physiology Lectures cover functional activity of various organ systems, excepting endocrine and central nervous systems. Emphasis on regulatory homeostatic mechanisms. Selected laboratory exercises as introduction to experimental approach for study of physiological mechanisms. *O'Bryan, staff*. 6 cr, 2nd sem.

GMS PH 741 Experimental Methods in Physiology A Prereq: consent of instructor. A practical approach to electrophysiology techniques. *Garcia-Diaz, staff*. 2 cr, 2nd sem.

GMS PH 742 Experimental Methods in Physiology B Prereq: MED ME 751 and consent of instructor. Current research methods in cellular and molecular physiology, as applied to the study of macromolecular function, motility, ligand binding phenomena, and membrane function. Develops problem-solving skills and awareness of current approaches to research problems. *Seaton, staff*. 2 cr, 1st sem.

GMS PH 745, 746 Special Topics in Physiology Prereq: consent of instructor. Current and classical papers in a given area of physiology are assigned for reading and later discussion with students. Topics include mechanics of muscle, cell motility, membrane transport, sensory physiology, and instrumentation in physiological research. Variable cr, 1st & 2nd sem.

GMS PH 841, 842 Physiology Seminar Students present seminars on their research and/or review literature related to their research. Students attend the seminars presented by staff and other students. *Levy, staff*. 2 cr each, 1st & 2nd sem.

GMS PH 843, 844 Cellular Physiology I and II Prereq: consent of instructor. Lectures and discussion on: (1) membrane transport, thermodynamic and kinetic analysis; (2) electrophysiology of cell membranes, excitable membrane properties, electrical coupling, synaptic transmission; and (3) cell motility, molecular mechanism, and regulation of contraction of muscle and other cells; mechanisms of transduction of photoreceptors. *Garcia-Diaz, staff*. 4 cr, 1st & 2nd sem.

GMS MI 941, 942 Research Physiology Variable cr

DOCTOR OF PHILOSOPHY PROGRAM IN BEHAVIORAL NEUROSCIENCE

Program Director Marlene Oscar Berman

Faculty

Martin L. Albert, MD, PhD, Professor of Neurology

Marlene Oscar Berman, PhD, Professor of Psychiatry, Professor of Neurology, and Director, PhD Program in Behavioral Neuroscience

Hiram Brownell, PhD, Adjunct Associate Research Professor of Neurology

Laird Cermak, PhD, Professor of Neurology

Raymon Durso, MD, Associate Professor of Neurology

Deborah Fein, PhD, Associate Professor of Psychiatry

Robert G. Feldman, MD, Professor of Neurology

Gladys Friedler, PhD, Professor of Pharmacology

Janina R. Galler, MD, Professor of Psychiatry

Harold Goodglass, PhD, Professor of Neurology

Nancy Helm-Estabrooks, ScD, Professor of Neurology

Davis H. Howes, PhD, Professor of Neurology

Edith Kaplan, PhD, Associate Professor of Neurology and Psychiatry

Conan Kornetsky, PhD, Professor of Pharmacology

Margaret Naeser, PhD, Associate Research Professor of Neurology

Penny Prather, PhD, Assistant Professor of Neurology

Louis Vachon, MD, Professor and Chairman, Department of Psychiatry

Mieke H. Verfaellie, PhD, Assistant Professor of Neurology (Neuropsychology)

Roberta F. White, PhD, Associate Professor of Neurology (Neuropsychology)

Joint Faculty

Marilyn Albert, PhD, Associate Professor of Neurology and Psychiatry (Harvard Medical School)

Sanford H. Auerbach, MD, Associate Professor of Neurology

Helen Barbas, PhD, Associate Professor of Anatomy and Neurobiology

Jane Holmes Bernstein, PhD, Assistant Clinical Professor of Psychiatry (Harvard Medical School)

Michael Biber, MD, Medical Director and Neurologist, Neurocare Inc., Brookline, MA

Paul Black, MD, Professor of Microbiology and Medicine

Gene Blatt, PhD, Research Assistant Professor of Anatomy and Neurobiology

Cynthia Chase, PhD, Assistant Professor of Psychiatry and Pediatrics

Helen Denison, PhD, Assistant Professor of Psychiatry (Psychology)

Richard Fine, PhD, Professor of Biochemistry and Neurology

Bernard Fox, PhD, Professor of Psychiatry

David Gansler, PhD, Assistant Professor of Psychiatry (Behavioral Neuroscience)

Stephen Heisel, MD, Associate Professor of Psychiatry

Gary Kamen, PhD, Associate Professor of Physical Therapy and Health Sciences (Boston University)

Richard F. Kaplan, PhD, Adjunct Assistant Professor of Neurology (Neuropsychology)

Marcel Kinsbourne, MD, Adjunct Professor of Neurology

Francesca LaVecchio, PhD, Adjunct Assistant Professor of Psychiatry

Charles Levy, PhD, Professor of Biology (Boston University)

Elinor Levy, PhD, Associate Professor of Physiology

Simon Levy, PhD, Associate Professor of Physiology

Jacqueline Liederman, PhD, Associate Professor of Psychology (Boston University)



Dr. Marlene Berman discusses brain functions with PhD students.

Raymond Maciewicz, MD, PhD, Associate Professor of Neurology (Harvard Medical School)

Barbara Morse, PhD, Associate Professor of Psychiatry

Neal McGrath, PhD, Neuropsychologist (Private Practice)

Mark Moss, PhD, Associate Professor of Anatomy and Neurobiology

Loraine Obler, PhD, Adjunct Professor of Neurology

Clare O'Callaghan, RN, EdD, Assistant Professor of Psychiatry, and Associate Clinical Professor of Nursing

Merle M. Orren, PhD, Research Instructor of Psychiatry (Neuropsychology) and Neurology

James Otis, MD, Assistant Professor of Neurology

Deepak Pandya, MD, Professor of Neurology

Richard C. Pillard, MD, Professor of Psychiatry

Whitney Powers, PhD, Professor of Health Sciences (Boston University)

Oscar Resnick, PhD, Professor of Psychiatry

Douglas L. Rosene, PhD, Associate Professor of Anatomy and Neurobiology

Larry Seidman, PhD, Associate Professor of Psychiatry (Psychology)

Daniel Shaw, MD, Assistant Professor of Psychiatry

Paul Spiers, PhD, Adjunct Assistant Professor of Neurology

Babette Stanton, PhD, Associate Research Professor of Psychiatry

Robert A. Stern, PhD, Adjunct Assistant Professor of Behavioral Neuroscience

Joseph Tecce, PhD, Professor of Psychology (Boston College)

John Tonkiss, PhD, Assistant Professor of Psychiatry

Ladislav Volicer, MD, PhD, Professor of Pharmacology and Psychiatry, and Assistant Professor of Medicine

Program of Study

The PhD program in behavioral neuroscience at Boston University School of Medicine is administered by faculty members of the Department of Neurology and/or the Division of Psychiatry (many of whom hold joint appointments at the Department of Veterans Affairs [VA] Medical Centers in Boston and Bedford, Massachusetts). The focus of the program is on the delineation and analysis of perceptual, cognitive,

linguistic, affective, and behavioral disorders observed in neurological disease, as these disorders contribute to an understanding of normal brain function and its modification by pathology, both structural and metabolic. The subject matter derives chiefly, but not exclusively, from clinical populations with neurological disorders affecting higher processes, particularly from the study of syndromes involving selective impairment of functional systems such as memory, language, or purposeful movement. In addition, nonhuman animal models are applied toward understanding brain mechanisms of reinforcement, developmental anomalies, and intracerebral neuroanatomical connections. Current methods of clinical assessment, cognitive psychology, experimental design, and the neuroscience are integrated into a broad program of clinical and basic research leading to the PhD degree.

Admission

Only the doctoral program is offered (no master's degree). Students entering the doctoral program are expected to have met the requirements for the baccalaureate degree, and to have completed the courses required for admission to the Division. Entering students are also expected to have completed special course requirements for the Behavioral Neuroscience Program. These courses (or their equivalents) are: biology (one year); introductory psychology (one year); experimental psychology (one year); physiological psychology or neuropsychology (one semester); abnormal psychology (one semester); and statistics (one semester). Prerequisite courses not completed before registration may be completed while the candidate is in residence at Boston University School of Medicine, but may not be presented for graduate credit.

Degree Requirements

The program of study for the PhD degree includes the equivalent of a minimum of sixteen semester courses (64 credits) at the graduate level, of which half may be satisfied by the MA degree or its equivalent and half of which must come from the Department of Behavioral Neuroscience and other graduate course offerings at the School of Medicine (including GMS BN 991, 92 Research in Behavioral Neuroscience). Candidates with a master's degree or its equivalent in psychology are required to complete the equivalent of a minimum of eight graduate-level semester courses (32 credits). If a student's background requires more than the minimum of eight courses, the student may trans-

fer the number of courses corresponding to that required in excess of the eight. Normally no more than four courses may be taken concurrently, and students register for at least one course each semester until completion of all departmental course requirements unless granted an authorized leave of absence. Specific course requirements are determined on an individual basis by the student's faculty advisor with the approval of the Behavioral Neuroscience Doctoral Committee administering the program (see the "Administration" section).

In addition to the general requirements of the Division of Graduate Medical Sciences, each candidate must fulfill the minimum requirements corresponding to the major area of specialization: GMS BN 775, 6 Human Neuropsychology I and II; GMS BN 796 Neuropsychological Assessment; GMS BN 779 Basic Neuroscience; statistics; and GMS BN 991, 92 Research in Behavioral Neuroscience.

The student, working with an advisor, develops a plan of coursework tailored to the student's background experience and ultimate career goals. The intent of the course requirements is to provide students with a firm foundation in basic principles and methods of experimental neuropsychology. Students also display in-depth preparation (see the "Qualifying Examination" section) in *at least five* areas, of which the following are examples: language disorders; disorders of purposeful movement; pathology of learning and memory; dementias; visuospatial and other perceptual problems; affective disorders; developmental disorders; neuropsychology of alcohol abuse and alcoholism; neuropharmacology; and behavioral pharmacology.

The student, working with an advisor, must design a plan that meets these course requirements. The curriculum plan is subject to the approval of the Behavioral Neuroscience Doctoral Committee.

The program is not, by itself, designed to meet requirements for certification as to clinical competence in psychology nor in any discipline having a certification procedure, or requiring licensing. However, it accepts students enrolled elsewhere in clinical programs to take some or all of the offerings.

Qualifying Examination

As one of the requirements for admission to degree candidacy, the student, upon nearing completion of coursework, must satisfactorily pass a written and an oral examination demonstrating proficiency in basic principles and methods of human experimental neuropsychology and in five areas such as

those listed above. The examination is prepared by five faculty members (each representing one of the five required areas). At least two of the faculty giving questions in the qualifying examination must be from the Division of Graduate Medical Sciences.

Dissertation Proposal

Before embarking on his/her dissertation research (usually in the third year), the student must develop a dissertation proposal outlining clearly and distinctly the nature of the research to be undertaken. The dissertation proposal should include a background and introduction, brief review of the pertinent literature, specific aims, methods of procedure, and an assessment of the importance of the research when completed.

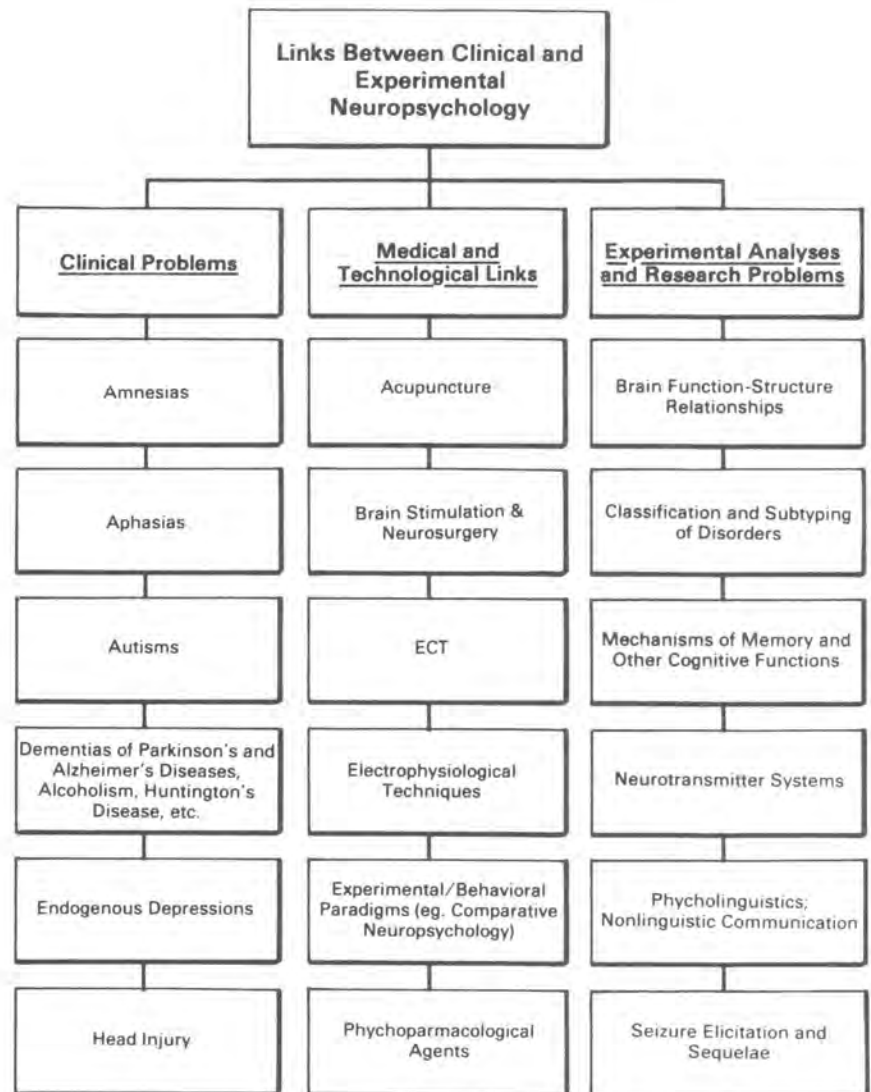
The student proposes a principal dissertation advisor and may suggest possible readers for the dissertation (the principal dissertation advisor may be the same or different from the student's academic advisor). The dissertation proposal is reviewed by the Behavioral Neuroscience Doctoral Committee, and an oral defense of the proposal may be required by the committee. When the proposed research involves human participants, the proposal also is submitted to the Institutional Review Boards of all cooperating institutions for their approval. The principal advisor and the two readers become the student's dissertation committee.

Dissertation

The dissertation must, in general, provide documentation of a student's creative scholarship and ability to design, conduct, and report on independent research in behavioral neuroscience. The completed dissertation will approximate (but not be substituted by) research papers meeting current standards of publication in refereed journals (e.g., *Neuropsychologia*, *Cortex*, *Neuropsychology*, *Brain and Cognition*, *Archives of Neurology*, and *Behavioral Neuroscience*). The dissertation research involves collection, processing, and analyses of original data.

Oral Defense

Subsequent to approval of the dissertation by the student's dissertation committee, the student must present an oral defense of the dissertation to the Behavioral Neuroscience Doctoral Committee in accordance with the rules of the Division of the Graduate Medical Sciences. The student's oral defense committee must consist of the dissertation advisor, the two readers, and two additional persons to be appointed by the Behavioral Neuroscience Doctoral Committee.



The purpose of the final oral defense is to demonstrate the student's abilities: to design and execute an original research project, the results of which must signal progress in a significant area of behavioral neuroscience; to describe this dissertation research clearly and succinctly in oral and written contexts; to exercise mastery of methods in defending the methodological approaches employed; and to place in perspective the advance in knowledge achieved by the dissertation research. As a final goal, the defense of the dissertation and the dissertation itself serve as an indicator of the student's ability to embark on a career as an experimental neuropsychologist and behavioral neuroscientist.

Curriculum

The curriculum for the doctoral program consists mainly of existing courses in neuropsychology within the Division of Graduate Medical Sciences. These courses are: BN 775 Human Neuropsychology Seminar I; BN 776 Human Neuropsychology Seminar II; BN 796 Neuropsychological Assessment; BN 793 Neuropsychology of Language; BN 794 Brain Asymmetry: Functional and Structural Differences Between Hemispheres; BN 795 Neuropsychology of Perception and Memory; BN 798 Functional Neuroanatomy in Neuropsychology; BN 821 Seminar in Neuroimaging; BN 891 Case Studies in Neuropsychology (Sections A, B, and C); BN 893 Child Clinical Neuro-

psychology; and BN 778 (and 779) Basic Neuroscience (and Beginning Basic Neuroscience).

The first three courses listed above are required for all incoming students in the program. Another course, BN 778 Basic Neuroscience, is required for incoming PhD students.

An important feature of the program is a research apprenticeship with a core faculty member, and course credits are offered as Research in Behavioral Neuroscience. This arrangement is intended as preparation for independent research careers. Students also have the opportunity to assist resident and staff neurologists/psychiatrists in providing consultative services, to participate in daily and grand rounds, and to attend didactic seminars and hospital lectures at Boston University School of Medicine and the Boston and Bedford VA Medical Centers.

With permission of the major advisor and/or program director, other graduate-level courses from the Division of Graduate Medical Sciences may be selected for credit in the proposed doctoral program, as well as courses offered in the Graduate School (e.g., the Departments of Mathematics, Psychology, and Cognitive and Neural Systems) and in the Sargent College of Allied Health Professions.

Courses

GMS BN 775 Human Neuropsychology I

Prereq: consent of instructor. Relationship of the field of neuropsychology to other medical and scientific disciplines. Includes electrical activity of the brain, the study of consciousness and emotions, cerebral dominance, and the pathologies of language. *Oscar-Berman, staff.* 1st sem.

GMS BN 776 Human Neuropsychology II

Prereq: consent of instructor. Relationship of the field of neuropsychology to other medical and scientific disciplines. Includes psychiatric aspects of neurological disease and the pathologies of memory, intelligence, perception, and motor function. *Oscar-Berman, staff.* 2nd sem.

GMS BN 778 Basic Neuroscience Survey

Prereq: consent of instructor. Overview to include neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the cellular and physiological levels are related to known central nervous system dysfunction. May not be taken concurrently with MED ME 779. *Oscar-Berman, staff.* 1st sem.

GMS BN 779 Beginning Basic Neuroscience

Prereq: consent of instructor. Overview to include neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the

cellular and physiological levels are related to known central nervous system dysfunction. *Oscar-Berman, staff.* 1st sem.

GMS BN 793 Neuropsychology of Language

Prereq: consent of instructor. The phenomena of aphasia, alexia, and associated disorders of language are considered in relation to theories of the storage and processing of verbal information. Relevant models dealing with phonology, word selection, syntax, and semantics are discussed. *Helm-Estabrooks, Howes.* 1st sem.

GMS BN 794 Brain Asymmetry: Functional and Structural Differences Between Hemispheres

Prereq: consent of instructor. The distinctive roles of the left and right hemispheres are reviewed; first by examining alterations in language and nonverbal behavior under conditions of brain damage; and second, by examining techniques used to investigate functional asymmetry in the normally intact brain. *Goodglass.* 1st sem.

GMS BN 795 Neuropsychology of Perception and Memory

Prereq: consent of instructor. The study of normal and abnormal perception and memory is related to brain structure and function. *Cermak, Verfaellie.* 2nd sem.

GMS BN 796 Neuropsychological Assessment I

Prereq: consent of instructor. Overview of structure and function of the central nervous system. Emphasis on quantitative and qualitative analysis of standardized and experimental tests of cognitive functions useful in differential diagnosis of neurological syndromes. *Kaplan.* 1st sem.

GMS BN 797 Neuropsychological Assessment II

Continuation of GMS BN 796 Neuropsychological Assessment I. *Kaplan.* 2nd sem.

GMS BN 798 Functional Neuroanatomy in Neuropsychology

Prereq: consent of instructor. Overview of central nervous system, structure and function; basic understanding of neurobehavioral symptoms and their relationship to neuropathology, including vascular infections, and congenital, degenerative, and toxic insults to the central nervous system. Appropriate for psychologists, speech pathologists, or other students in the behavioral sciences. *LaVecchio.* either sem.

GMS BN 821 Seminar in Neuroimaging.

Prereq: consent of instructor. Overview of neuroimaging techniques available as adjuncts to neuropsychological measures of human brain damage. *Oscar-Berman, staff.* 1st sem.

GMS BN 891, 892 Case Studies in Neuropsychology

Prereq: consent of instructor. Individual patients with perceptual/cognitive/affective symptomatology concomitant with brain damage are examined intensively through the use of a variety of behavioral assessment procedures. Test results are reviewed for the differential diagnosis of neurological syndromes. Emphasis on qualitative and quantitative analyses of standardized and experimental tests. *Albert, Cermak, White.* 2 cr, 1st & 2nd sem.

GMS BN 893 Child Clinical Neuropsychology

Prereq: consent of instructor. Covers general theoretical issues, e.g., intrauterine and postnatal development of the brain, handedness and lateralization of function, and recovery of function and neurobehavioral plasticity; diagnostic entities, e.g., attention deficit disorder, effect of early brain damage, developmental language disorders, dyslexia, and effects of malnutrition; and assessment and treatment. *Fein, Kinsbourne.* 2nd sem.

GMS BN 991, 992 Research in Behavioral Neuroscience

variable cr

Administration

The individuals with overall responsibility for the program are Dr. Marlene Oscar Berman, Director of the Laboratory of Neuropsychology, Division of Psychiatry and Department of Neurology; Dr. Harold Goodglass, Director of the Aphasia Research Center; Dr. Edith Kaplan, Boston Neuropsychological Foundation; Dr. Martin Albert, Director of Behavioral Neuroscience, Boston VA Medical Center.

All core faculty hold appointments in the Medical School of Boston University, and many are senior research or clinical staff members of the psychology, neurology, psychiatry, or research services of the Boston or Bedford VA Medical Centers; Drs. Albert, Berman, Brownell, Cermak, Durso, Fein, Feldman, Friedler, Galler, Goodglass, Helm-Estabrooks, Howes, Kaplan, Kornetsky, Naeser, Prather, Vachon, Verfaellie, and White.

External Accreditation

The program is not designed to meet requirements for accreditation as to clinical competence in psychology nor in any discipline which has a certification procedure. It does, however, accept students in the MD/PhD program at Boston University School of Medicine, or other students enrolled elsewhere in related programs (including the Master of Medical Sciences Program), to take some or all of the offerings. Boston University School of Medicine is an accredited institution. Behavioral Neuroscience is a degree-granting program having the same representation as other PhD-granting Departments in the Division of Graduate Medical Sciences.

MD/PHD DUAL DEGREE PROGRAM

Coordinating Committee:

Carl Franzblau
Selwyn A. Broitman
David Farb

Program of Study

The combined degree program is conducted under the auspices of the School of Medicine and is designed for and open to highly qualified individuals who are strongly motivated toward an education and a career in both medicine and research. The purpose of the program is to provide students with the opportunity to obtain advanced education and research training in one of the medical sciences, while providing exposure to and training in clinical medicine. The program requires six to seven years of study and leads to both the MD and PhD degrees.

Application

The applicant must meet the requirements for admission both to the Medical School as a candidate for the MD degree and as a candidate for the PhD degree, as outlined above. The minimum entrance requirements and the prerequisite courses for the MD degree are the same as those for the PhD degree. Applicants for the MD/PhD Combined Degree Program are required to submit the results of the Medical College Admission Test only and not those of the Graduate Record Examination, which are normally required for admission to the PhD program. The applicant must also have completed the special prerequisites of the major department or program. The latter prerequisite courses may be completed while the candidate is in residence as a graduate student but may not be presented for graduate credit. Applicants must also have carried out research during their undergraduate program or have research experience.

Most applicants apply for admission to enter the program as first-year students, without any previous medical school or graduate school experience. In certain

instances applications are accepted from students who are already in residence in the School of Medicine.

Applicants must apply simultaneously to the School of Medicine (via American Medical College Application Service, 1776 Massachusetts Avenue, N.W., Washington, DC 20036) and the Division of Graduate Medical Sciences. The applicant is also asked to notify the School of Medicine, Boston University Medical Center, 80 East Concord Street, Boston, MA 02118, in writing, that the student has completed both applications and is applying for the combined MD/PhD degree program.



Degree Requirements

The degree requirements for the combined MD/PhD program are the separate degree requirements for the Doctor of Medicine and the Doctor of Philosophy in the School of Medicine. For the MD degree, the student must be at least 21 years of age; have been enrolled in the School of Medicine for at least four full academic years; have passed all required courses and examinations; and have discharged all financial obligations to Boston University. For the PhD degree, the student must have fulfilled all the requirements for admission to the Division of Graduate Medical Sciences and have been enrolled in the Division for the equivalent of at least two full academic years. In addition, the candidate must have fulfilled all the requirements for the major (and in some cases minor) fields of specialization, qualifying examination, and dissertation, as described above. Interdisciplinary programs, such as the MD/PhD program in Biomedical Engineering can also be arranged. Students enrolled in the combined MD/PhD program must complete the requirements for both degrees before any degree will be awarded. Upon petition, a student admitted into the combined degree program on entering Boston University may drop out of the combined degree program and elect to receive one or the other degree upon completion of the appropriate requirements.

For further information contact the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118; 617/638-5120.

MASTER OF ARTS IN MEDICAL SCIENCES

Program Chairman Ruth R. Levine
Program Co-Chairmen Selwyn A. Broitman
and Carl Franzblau

Program of Study

The Master of Arts in Medical Sciences Degree Program of the Division of Graduate Medical Sciences of Boston University School of Medicine responds to the recognized need for generalist graduate study in the medical sciences to provide students with the background essential for the pursuit of a variety of careers in the health professions. The program is conducted at the School of Medicine.

Although the MA in Medical Sciences is a broad-based program, opportunities to specialize at an advanced level are available; (1) through combined programs in such areas as public health, health care administration, and science or medical reporting; or (2) by preparing the way to doctoral programs in research and clinical medicine.

The MA in Medical Sciences Degree Program consists of the equivalent of two semesters of fundamental coursework and two semesters of directly supervised research. Since the latter two semesters can be taken during the summer, the program can be completed within a 12-month period.

Boston University School of Medicine conducts the required and elective courses of the program and awards the MA degree in Medical Sciences.

Boston University School of Medicine faculty from the Departments of Anatomy, Biochemistry, Biophysics, Microbiology, Pathology, Pharmacology, and Physiology serve as advisors to students in the program.

Admission

The requirements for admission to the MA in Medical Sciences are the same as those for admission to the other MA programs of the Division of Graduate Medical Sciences. All applicants for admission are required to: (1) submit the results of the Medical College

Admissions Test or the Graduate Record Examination General Test (in some cases the Advanced Test in either chemistry or Biology may be required); and (2) have met the requirements for the baccalaureate degree, including the following courses: general chemistry, organic chemistry, biology, and physics.

Degree Requirements

Candidates are required to complete the equivalent of a minimum of eight semester courses (32 credits) at the graduate level. Students wishing to complete all the requirements of the program in 12 months must register full-time (12–16 credits) in the fall and spring semesters and for at least two credits in both summer semesters, or pay the

continuing student fee for each of the two summer semesters.

The program features a structured set of course requirements and several groups of courses from which electives may be chosen. The core courses required of all students in the program are medical biochemistry, medical physiology, and biometrics.

Students who have completed one or more of the required courses may substitute one or more electives. The equivalent of at least two courses (8 credits) of electives must be taken and a candidate for the MA in Medical Sciences may register for not more than a total of three semester courses (12 credits) in directed study/research.

The thesis that is required must be based on research carried out by the candidate under direct supervision of a member of the faculty selected by the candidate. The research project must be well-conceived and the thesis of modest scope. The research project may involve only library research, or a combination of library and laboratory research. The completed thesis must be approved by the major advisor and a second reader who is a faculty member.

The following core courses are required of all students in the MA in Medical Sciences Program:

GMS BI 751	Biochemistry	6 cr, either sem.
GMS BI 753	Biochemical Aspects of Clinical and Research Problems	2 cr
GMS PH 740	Physiology	6 cr, 2nd sem.
SPH EB 701	Elementary Biostatistics	2 cr, either sem.

Elective Courses

This program does not offer its own courses but does accept as electives any graduate courses of the Division of Graduate Medical Sciences or of other Schools and Colleges of Boston University which are taken with the consent of the course instructor and after consultation with the student's major advisor.



RESEARCH AND TRAINING PROGRAM IN BIOMOLECULAR PHARMACOLOGY

Program Director David H. Farb

Faculty

Mark Alexander, PhD, Assistant Professor of Pharmacology

David Atkinson, PhD, Professor of Biophysics

Norman D. Boyd, PhD, Associate Professor of Pharmacology

Charles R. Cantor, PhD, Professor of Biomedical Engineering (Professor of Pharmacology)

Charles De Lisi, PhD, Professor, Department of Biomedical Engineering

J. Worth Estes, MD, Professor of Pharmacology

David H. Farb, PhD, Professor and Chairman, Department of Pharmacology

Richard Fine, PhD, Professor of Biochemistry

Terrell T. Gibbs, PhD, Assistant Professor of Pharmacology

James A. Hamilton, PhD, Professor of Biophysics

Gerhard Heinrich, MD, Associate Professor of Medicine

Tohru Ikuta, MD, PhD, Assistant Professor of Pharmacology

Kevin A. Jarrell, PhD, Assistant Professor of Pharmacology

Conan Kornetsky, PhD, Professor of Pharmacology and Psychiatry

Susan E. Leeman, PhD, Professor of Pharmacology

Isabelle M. Mintz, PhD, Assistant Professor of Pharmacology

S. Alex Mitsialis, PhD, Assistant Professor of Medicine and Pharmacology

John R. Murphy, PhD, Professor of Medicine

L. Bruce Pearce, PhD, Assistant Professor of Pharmacology

Susan P. Perrine, MD, Professor of Pediatrics

Douglas Rosene, PhD, Associate Professor of Anatomy and Neurobiology

Shelley J. Russek, PhD, Instructor of Pharmacology

G. Graham Shipley, PhD, Professor of Biophysics

Cassandra L. Smith, PhD, Professor of Biomedical Engineering (Professor of Pharmacology)

Temple F. Smith, PhD, Professor of Biomedical Engineering (Professor of Pharmacology)

Carol T. Walsh, PhD, Associate Professor of Pharmacology

Program of Study

Pharmacology has historically been an interdisciplinary field, positioned at the point of convergence of physiology, biochemistry, organic chemistry, behavioral science, and medicine. The pharmacology of the next century will bring together an even wider range of disciplines, combining tradition-

al aspects of pharmacology with novel approaches drawn from other disciplines, such as biophysics, biomedical engineering, and molecular genetics.

The predoctoral training program in Biomolecular Pharmacology is based on a training partnership among faculty in the Departments of Pharmacology, Anatomy, Biochemistry, Biophysics, Pathology, Physiology, Microbiology, Biomedical Engineering, and the Section of Biomolecular Medicine. The curriculum formalizes interdisciplinary predoctoral training in molecular pharmacology. Students receive formal training in the principles of molecular pharmacology, as well as in molecular genetic, biophysical, and structural approaches to the study of drug-receptor interactions. A major benefit of the program is to expand opportunities for students to carry out research in these areas.

Oversight and coordination is provided by a Program Advisory Committee composed of faculty representatives from the participating components in the School of Medicine and the College of Engineering. The structure of the program catalyzes continued and expanded collaborations among the participating faculty, and fosters interactions among students and faculty of the participating components. This program produces scientists who have an understanding of and firsthand experience with a broad range of technologies at the cutting edge of research in molecular pharmacology.

TRAINING

Overall Structure

A major component of the training program for PhD candidates is *basic research*. The average tenure of PhD candidates is five years. Although the emphasis is on didactic coursework for the first year, students in the



Biomolecular Pharmacology Training Program are expected to do four laboratory rotations during the first year. The laboratory rotations provide students with the opportunity to investigate potential areas for their dissertation research, while enhancing the breadth of their training. During the last three years in the program, the major emphasis is on dissertation research. Students are also required to complete advanced level coursework, report on their dissertation research, and participate in activities consistent with their development as future scientists. Details of these activities are provided below. Graduates from the program will have received essential training in pharmacology with special emphasis on molecular pharmacology. The training program builds on current graduate programs in pharmacology, biophysics, biomedical engineering, biochemistry, pathology, anatomy, and microbiology.

Students may be accepted into the program through any of the Medical School basic science departments or through the Department of Biomedical Engineering. Each of these PhD programs requires 64 credit hours for completion plus a qualifying examination, a dissertation, and a successful oral defense. Each of the programs has specific requirements, and individual programs of study for the PhD degree are determined by each student in consultation with a faculty advisor and the Program Advisory Committee. Students complete the following core courses: GMS PM 755, 756 General Biochemistry I and II, GMS PM 700 Molecular Neurobiology and Pharmacology, GMS PM 710 Laboratory Techniques in Modern Pharmacology, GMS PM 800 Advanced General Pharmacology, GMS PM 810 Current Topics in Pharmacological Sciences, GMS BY 771 Biophysics of Macromolecular Assemblies, and three advanced electives. The proposed training plan has been approved by the participating departments as fulfilling their requirements. Students generally spend summers engaged in full-time research.

Course Requirements

Core Courses (24 credits)

- GMS PM 700 Molecular Neurobiology and Pharmacology (4 cr)
- GMS PM 710 Laboratory Techniques in Modern Pharmacology (2 cr)*

*Two semesters required in the first year; students may elect to complete additional laboratory rotations during the summer of the first year.

- GMS BI 755 General Biochemistry I (4 cr)
- GMS BI 756 General Biochemistry II (4 cr)
- GMS BY 771 Biophysics of Macromolecular Assemblies (4 cr)
- GMS PM 800 Advanced General Pharmacology (2 cr)
- GMS PM 810 Current Topics in Pharmacological Sciences (2 cr)

Program electives (6 credits minimum)

- CLA CN 510 Principles and Methods of Cognitive and Neural Modeling (4 cr)
- CLA MA 614 Statistical Methods II (4 cr)
- ENG BE 500 Genome Analysis (2 cr)
- ENG BE 560 Biomolecular Architecture and Design (4 cr)
- GMS MS 703 Neuroscience (4 cr)
- GMS MS 753 Cell Biology (4 cr)
- GMS AN 709 Neural Development and Plasticity (2 cr)
- GMS PM 720 General Medical Pharmacology (8 cr)
- GMS PM 820 Behavioral Pharmacology (2 cr)
- GMS PM 830 Principles of Pharmacokinetics (2 cr)
- GMS PM 850 Biochemical Aspects of Neurotransmitters and Chemical Mediators (2 cr)
- GMS BI 782 Molecular Biology (4 cr)
- GMS BI 783 Proteins (2 cr)
- GMS BI 789 Physical Biochemistry (2 cr)
- GMS BI 790 Receptors and Signal Transduction (2 cr)
- GMS BY 772 Nuclear Magnetic Resonance Spectroscopy in Biology and Biochemistry (2 cr)
- GMS PH 843 Cellular Physiology I (4 cr)
- GMS PH 844 Cellular Physiology II (2 cr)

Seminar Courses (2 credits minimum)

- GMS BY 871, Biophysics Seminar (2 cr)
- 872
- GMS PM 810 Current Topics in Pharmacological Sciences (2 cr)

Laboratory Rotations

During the first year, predoctoral trainees complete four laboratory rotations of about eight weeks each. This provides exposure to a variety of experimental approaches to the study of pharmacology. Trainees are encouraged to select rotations in laboratories that approach problems from different perspectives, in keeping with the fundamental goal of providing them with a broad and more complete understanding of research strategies that have been developed to address questions of pharmacological importance. Each student submits a paper summarizing his or her research experience. The Graduate Education Committee reviews papers, provides evaluations to students, and maintains feedback to the faculty.

Seminars

The Biomolecular Pharmacology seminar program has been expanded recently through support provided by the endowed Sterling Drug Visiting Professorship, and an award from the Burroughs Wellcome Foundation. All students are expected to attend programmatic seminars given by highly distinguished speakers from around the world. In addition, students register for one semester of Current Topics in Pharmacological Sciences. In this course, the guest lecturer attends student presentations of research paper(s) related to the lecturer's research. This course has proved to be highly successful in providing students with essential background to the seminar speaker's work and thereby preparing the students to participate actively in the department seminar. Trainees are also given a list of seminars in all participating departments and encouraged to attend those seminars relating to their area of research.

Presentation of Research Findings

It is expected that trainees will present their research findings at national research meetings. Although graduate students tend to prefer the poster mode of presentation at meetings, all trainees are encouraged to give at least one slide presentation at a national meeting. They are also encouraged to present research findings at regional and local meetings, such as the Boston Area Neuroscience Group (BANG), the Boston Area Graduate Student Symposium, the New England Pharmacologists meetings, and the Boston University Graduate Student Science Day. These are yearly meetings at which there are, in addition to plenary speakers, both oral and poster presentations.

Group Meeting Presentations

Both faculty and trainees meet every other month to discuss ongoing projects. At these meetings trainees give informal presentations of their current research and discuss results of recent papers from the literature. This forum also gives trainees the opportunity to discuss with faculty issues related to the training, as well as suggestions for improvement in the program.

RESEARCH AND TRAINING PROGRAM IN HUMAN GENETICS

Director, Center for Human Genetics
Aubrey Milunsky

Faculty

Chris T. Amemiya, PhD, Research Assistant
Professor of Pediatrics

Jean A. Amos, PhD, Assistant Professor of
Pathology and Laboratory Medicine

Clinton T. Baldwin, PhD, Research Assistant
Professor of Pediatrics and Biochemistry

Christine E. Briggs, PhD, Research Assistant
Professor of Pediatrics

Lindsay A. Farrer, PhD, Associate Professor of
Neurology

Marc F. Hansen, PhD, Associate Professor of
Pediatrics

Richard H. Meyers, PhD, Associate Professor
of Neurology

Aubrey Milunsky, MD, Professor of Pediatrics
and Pathology and Laboratory Medicine

Devaki N. Sadhu, PhD, Research Assistant
Professor of Pediatrics

Faina Schwartz, PhD, Research Assistant Pro-
fessor of Pediatrics

Herman E. Wyandt, Jr., PhD, Associate Pro-
fessor of Pathology and Laboratory Medicine

Genes control the basis of all life, govern the development of all species, influence the response or susceptibility to all disease, affect the body's response to all environmental agents (e.g., drugs, microorganisms, toxins), and are causally related to, modulate or influence all the common diseases of man, and, when defective, cause a major disease burden for society.

The advent of the "New Genetics" has brought heretofore undreamt of horizons to science and medicine. Remarkable advances in genetics have affected diverse scientific fields including agriculture, farming, entomology, the pharmaceutical industry, engineering, computer science, informatics, and medicine. Human genetics is at the vortex of this ever-widening circle of discovery and

spans all basic sciences and virtually all the clinical disciplines. Dramatic advances have already occurred through the Human Genome Project through which an escalating number of genes causing specific serious genetic diseases have already been cloned. Expectations are that the vast majority of defective genes causing serious genetic disease will have been cloned by the turn of the century. Over 3,500 specific monogenic diseases have been catalogued. As a consequence of these continuing advances, new precise DNA-based diagnostic methods have emerged and are in use in the Center for Human Genetics. Detection of gene carriers, presymptomatic or predictive diagnosis and prenatal diagnosis have all assumed key roles in the application of new knowledge in human genetics. Advances in genetic biotechnology will facilitate determination of genetic predisposition and susceptibility to disease and have already facilitated the development of gene therapy.

The interdisciplinary program in human genetics provides a wide ranging perspective on human genetic disease and the science and technology used to map and clone genes. As a prerequisite to understanding the molecular analysis of DNA, course selections focus on the development of a thorough understanding of molecular ge-

netics, biochemical genetics, cytogenetics, immunogenetics, genetic epidemiology, pharmacogenetics, and somatic cell genetics. Thesis work in all these subject areas will equip successful candidates with knowledge, training, and experience suitable for major careers in medicine, science, industry, and government.

Program in Human Genetics

The interdisciplinary program in Human Genetics has been established primarily for the graduate student who seeks a career presenting diverse opportunities in academe, industry, or government in which teaching, research, diagnostics, industrial production, and regulatory affairs figure most prominently. This course of study prepares students for careers in industry or, through postdoctoral programs, in a whole range of specialties and opportunities within the vast arena encompassed by human genetics. For example, the Center for Human Genetics at the School of Medicine is accredited by the American Board of Medical Genetics for postdoctoral training and board certification for PhDs in human genetics in the specialties of medical genetics, clinical cytogenetics, and clinical molecular genetics. These certifications lead to careers in academe, gene-



Graduate student John Michle (left) and Cris Amemiya, PhD, discuss DNA results with DNA Diagnostic Laboratory Director Jean Amos, PhD.

tics research, diagnostic laboratories, and industry.

Students in the Human Genetics program who enter with a bachelor's degree may choose from new courses in human genetics. The intent of these courses is to provide a firm foundation in molecular biology, molecular genetics, and biostatistics.

Courses in Human Genetics

The following are full-semester 4-credit courses required for all candidates for the PhD in Human Genetics:

- GMS HG 781 Introduction to Human Genetics
- GMS HG 881 Human Genetics I
- GMS HG 882 Human Genetics II
- GMS HG 850 Human Genetics Seminar (2 cr)
- GMS HG 901, 902 Research in Human Genetics
- ENG BE 565 Introduction to Biochemical and Genetic Engineering

COURSES

GMS HG 781 Introduction to Human

Genetics Prereq: general biology, genetics, biochemistry, cell biology, molecular genetics or the equivalent, and consent of instructor. The basic principles and research methods of human genetics, including the study of genes at the molecular, chromosomal, organismal, and population levels. Emphasis is on classical genetic examples of human disease. Applications of the technology in gene identification, genetic testing, and forensic science are presented. *Farrer*. 1st sem.

GMS HG 881, 882 Human Genetics I and II

Prereq: MED HG 781 or consent of the instructor. Explores strategies for gene mapping, sequencing and cloning, and includes detailed consideration of genetic and physical mapping, aspects of immunogenetics, and the basic principles that underpin the development of gene therapy. Key additional aspects covered include gene organization and expression, genetic recombination, mutation, genotype and phenotype association, cytogenetics, genetic epidemiology, advanced topics in human genetics, forensic genetics, evolutionary genetics, the biochemical basis of genetic disease, and the basics of DNA diagnostics. *Amos, Milunsky*. 8 cr, 1st and 2nd sem.

GMS HG 850 Human Genetics Seminar

Prereq: (MED ME 781) Introduction to Human Genetics and consent of instructor. Students are required to attend weekly seminars in human genetics and to present two seminars in a semester. *Staff*. 2 cr.

GMS HG 901, 902 Research in Human

Genetics Provide students with opportunities to undertake independent or directed research in subjects on human genetics approved by the appropriate faculty member and program committee. 4 cr.



Aubrey Milunsky, MD, DSc, Center Director, discusses DNA sequence results with Clinton Baldwin, PhD, and Faina Schwartz, PhD.

RESEARCH AND TRAINING PROGRAMS IN IMMUNOLOGY

Program Director David I. Beller
Program Codirector Ann Marshak-
Rothstein
Program Codirector Jacqueline Sharon

Faculty

David I. Beller, PhD, Associate Research
Professor of Medicine

Steven A. Bogen, MD, PhD, Assistant Profes-
sor of Pathology and Laboratory Medicine

David Center, MD, Professor of Medicine

Ronald B. Corley, PhD, Professor of
Microbiology

Douglas V. Faller, PhD, MD, Professor of
Medicine

Matthew J. Fenton, PhD, Assistant Professor
of Medicine

Dana Graves, DDS, MD, Associate Professor
of Periodontology and Oral Biology

Shyr-Te Ju, PhD, Professor of Medicine

Joseph H. Korn, MD, Professor of Medicine

Hardy Kornfeld, MD, Assistant Professor of
Pathology and Laboratory Medicine

Ann Marshak-Rothstein, PhD, Professor of
Microbiology

John R. Murphy, PhD, Research Professor of
Medicine

Thomas L. Rothstein, PhD, MD, Professor of
Medicine

Jacqueline Sharon, PhD, Professor of Pathol-
ogy and Laboratory Medicine

David Sherr, PhD, Professor of Environmen-
tal Health

Gail E. Sonenshein, PhD, Professor of
Biochemistry

Objectives of the Program

The Research and Training Program in Immunology offers predoctoral candidates coursework, seminars in contemporary immunology, and research training suitable to prepare them for careers in immunology research. In addition to their required

departmental and immunology coursework, students select from supplemental offerings in related disciplines. Full-time research in the laboratory of one of the training faculty is the principal mechanism to develop and enhance creative research skills for those trainees who have completed formal coursework and passed their qualifying exams. The program stresses prior research accomplishment as an important attribute in selecting candidates.

Departmental Affiliation and General Requirements

Students who wish to study immunology at the Boston University Medical Center are accepted for admission by one of the two participating basic science departments (microbiology or pathology). Each department offers a special curriculum for Immunology Training Program trainees (described below). Prospective students should select a department based on their own background and interests. More detailed information about requirements in each department may be obtained from Dr.

Adrienne Rogers (pathology) or Dr. Glen Zamansky (microbiology).

Students are required to (1) undertake three laboratory rotations (2 cr each), at least two of which must be with Immunology Training Program faculty; (2) take a qualifying examination with both written and oral components, and (3) select a PhD thesis advisor from among the program faculty (this choice is not restricted by departmental affiliation). All students are required to participate in the Pathology or Microbiology Seminar (depending on their department), the Immunology Seminar, and Immunology Journal Club. Students in pathology without a background in histology or pathology are required to take a six-week, non-credit course in those subjects.

Course Requirements

GMS BI 755,	Biochemistry I and II	8 cr,
756	1st & 2nd sem.	
GMS MI 713	Microbiology	4 cr, 1st sem.
	or	
GMS PA 722	Special Pathology	4 cr, 1st sem.



Dr. Ann Marshak-Rothstein reviews a FAC scan profile with **Alex Monroy** and **Dr. Cheryl Chancellor-Freeland**.

- GMS MI 513 Introductory Immunology
4 cr, 1st sem.
- GMS MI 715 Advanced Immunology—
Cellular Aspects
Offered alternate years. 4 cr
- GMS MI 812 Microbiology Seminar* 2 cr
or
- GMS PA 821, Pathology Seminar 2 cr
822
- GMS PA 725 Advanced Immunology—
Molecular Aspects
Offered alternate years. 2 cr

An additional 8 elective credits are chosen from the following list:

- SPH EB 702 Biostatistics—Introduction to
Statistical Computing** 4 cr
or
- SPH EB 703 Intermediate Biostatistics 4 cr
- GMS MS 753 Cell Biology 4 cr, 1st sem.
- GMS BI 872 Molecular Biology
Offered alternate years. 4 cr,
2nd sem.
- GMS BI 823, Special Topics in Pathology**
824 (one semester is required) 2 cr
- GMS BI 788 Enzyme Mechanisms Offered
alternate years. 2 cr, 2nd sem.
- GMS BY 771 Biophysics of Macromolecular
Assemblies Offered alternate
years. 4 cr, 1st sem.
- GMS MI 714 Genetics of Microorganisms
Offered alternate years. 4 cr, 2nd
sem.
- GMS MI 717 Growth Control Offered
alternate years. 4 cr, 2nd sem.
- GMS MI 718 Virology Offered alternate
years. 4 cr, 1st sem.
- GMS MI 813 Immunobiology of Cancer
Offered alternate years. 4 cr, 2nd
sem.
- GMS PH 843, Cellular Physiology I, II
844 Offered alternate years. 4 cr, 1st
sem.

Suggested Schedule

First year

Fall semester:
Biochemistry
Introductory Immunology
up to 8 credits of electives/research

Spring semester:
Advanced Immunology
up to 8 credits of electives/research
Lab rotations (research)

*Required of microbiology students.

**Required of pathology students.

Second year

Fall semester:
Special Pathology or Microbiology
up to 12 credits of electives/research

Spring semester:
Pathology or Microbiology Seminar
Advanced Immunology
up to 12 credits of electives/research

Principal Research Directions in the Program

As the focus of immunology at Boston University Medical Center, the Immunology Training Program has fostered the development of specific areas of interest and excel-

lence, including: *autoimmunity* (Beller, Fenton, Ju, Marshak-Rothstein, Murphy, Rothstein); *gene regulation* (Beller, Corley, Fenton, Korn, Murphy, Rothstein, Sonenshein); *human disease/animal models of disease* (Beller, Center, Faller, Korn, Kornfeld, Marshak-Rothstein, Murphy); *cell adhesion* (Beller, Center, Faller, Graves, Korn, Kornfeld); and *cancer biology/lymphocyte transformation* (Faller, Rothstein, Sonenshein). These foci foster interaction within the program and provide valuable training opportunities for students interested in these areas.



RESEARCH AND TRAINING PROGRAM IN MOLECULAR AND CELLULAR BIOLOGY

Program Director Ellen Berkowitz

The Graduate Program

The interdisciplinary program in Molecular and Cellular Biology takes advantage of the individual resources of seven academic departments in the Division of Graduate Medical Sciences at the Boston University School of Medicine. This program focuses on basic scientific as well as clinical issues related to molecular and cellular biology. The participation of over 75 faculty members offers a diversity of research opportunities and a wealth of productive interactions. Areas of expertise include molecular mechanisms regulating gene expression and developmental programs, cell structure/function relationships, molecular characterization of receptors and signal transduction processes, structural analyses of macromolecules, and the impact of health and disease on all of these areas. The availability of core facilities (i.e., FACS cell sorter, confocal microscope, microscopic imaging, transgenic mouse colony, university-wide computer network) allows for the state-of-the-art technological approaches to address critical research issues. Students are simultaneously admitted to this program and a participating basic science department. Each student, in consultation with his/her thesis advisor and advisory committee, designs an individual program of specialized coursework built upon a core program of molecular and cellular biology. Financial support is available in the form of federally funded traineeships and fellowships and University fellowships. There are currently 90 students enrolled in the fields of molecular and cellular biology in the Division of Graduate Medical Sciences.

Faculty

Participating as research advisors and teachers in the Program in Molecular and Cellular Biology are over 75 faculty members each with a primary or secondary appointment in one of the basic science departments (anatomy and neurobiology, biochemistry, bio-

physics, microbiology, pathology and laboratory medicine, pharmacology and experimental therapeutics, and physiology). A list of these faculty members along with their research interests may be obtained from the program chairman or from the Division Office.

Requirements for Admission

Applicants for either MA or PhD training in molecular and cellular biology should have a bachelor's degree with emphasis in the biochemical, biological, or chemical sciences. Post-master's graduate students and MD/PhD students also qualify for admission. Acceptance into the Program in Molecular and Cellular Biology requires acceptance into one of the basic science departments which are the degree granting entities in the Division of Graduate Medical Sciences.

Programs of Study

Students entering the Program of Molecular and Cellular Biology select the basic science department and coursework which best suit their needs and interests. Candidates for the

MA degree are required to complete 32 credits at the graduate level, of which at least 16 credits must be in formal coursework, and a laboratory research thesis. Postbachelor's PhD candidates must complete 64 credits of graduate work, of which a minimum of 24 credits must be in formal coursework. Post-master's PhD candidates and MD/PhD candidates must complete 32 credits, with a minimum of 8 credits in formal coursework. Masters students are required to participate in two laboratory rotations and doctoral students must complete four laboratory rotations prior to selecting a research advisor. All PhD degree students are required to submit a dissertation which demonstrates their abilities for independent study, original research, and creative scholarship. The Dissertation Advisory Committee will consist of five faculty members and will represent at least two (2) departments of the Division. Please refer to the "Academic Policies and Procedures" section of this bulletin for details relating to programs of study.



Dr. Deborah Dobson.



Students in the laboratory of Dr. Gail Sonenshein.

Curriculum

Each student participating in the Program in Molecular and Cellular Biology must satisfy the course requirements and qualifying examinations established by the student's basic science department and the program. The following courses form the Core Curriculum and are required for all students in the program (total of 16 credits).

Required Courses

- GMS MS 753 Cell Biology 4 cr
 GMS BI 755, General Biochemistry 4 cr
 756 each
 (GMS BI 555, 556 Biochemistry A and B or GMS BI 751 Biochemistry may be substituted)
 GMS BI 782 Molecular Biology 2 cr
 or
 GMS MI 714 Genetics of Microorganisms 4 cr

(Students choosing GMS BI 782 as a required course may take GMS MI 714 as an elective. The opposite also applies.)

Elective Courses

Elective requirements of the student's basic science department and the program must be completed. Often, courses taken to fulfill the elective requirements of the program can also be used to fulfill the department requirements. MA students must complete a minimum of one 2-credit course chosen from the following list of electives. PhD students must complete a minimum of 8 additional credits from the following course options. These courses are frequently conducted as seminars which stress critical and creative thinking and active participation in class discussion.

Medical and Dental Sciences

- GMS MS 781 Introduction to Human Genetics 4 cr

Anatomy and Neurobiology

- GMS AN 709 Neural Development and Plasticity 2 cr
 GMS AN 808 Quantitative Methods for Biological Investigations 2 cr

Biochemistry

- GMS BI 782 Molecular Biology 2 cr (if not taken as a required course)
 GMS BI 787 Molecular Mechanisms of Growth and Development 2 cr
 GMS BI 790 Receptors and Signal Transduction 2 cr

Biophysics

- GMS BY 771 Biophysics of Macromolecular Assemblies 4 cr
 GMS BY 774 Metabolism and Cellular Function of Complex Lipids 2 cr

Microbiology

- GMS MI 714 Genetics of Microorganisms 4 cr (if not taken as a required course)
 GMS MI 717 Growth Control and Cell Transformation 4 cr
 GMS MI 718 Virology 4 cr

Pharmacology and Experimental Therapeutics

- GMS PM 700 Molecular Neurobiology and Pharmacology 2 cr

Physiology

- GMS PH 742 Experimental Methods in Physiology B 2 cr
 GMS PH 843, Cellular Physiology I and II 4 cr
 844

Seminar

Each student is expected to fulfill the seminar requirements of the specific basic science department.

Research

All students register for research credits using the research course numbers for the basic science department in which they are enrolled. The precise number of research credits depends on the student's needs and background.

Additional PhD Requirements

Information concerning qualifying examinations, the Dissertation Advisory Committee, dissertations, the final oral dissertation defense, and seminars can be found in the "Academic Policies and Procedures" section in this bulletin.

RESEARCH AND TRAINING PROGRAM IN NEUROSCIENCE

Program Codirector Susan E. Leeman
Program Codirector Carmela R. Abraham

Faculty

Carmela R. Abraham, PhD, Associate Professor of Medicine and Biochemistry

Martin L. Albert, MD, Professor of Neurology

Mark Alexander, PhD, Assistant Professor of Pharmacology

Sanford H. Auerbach, MD, Assistant Professor of Neurology and Psychiatry

Clinton Baldwin, PhD, Assistant Professor of Pediatrics and Biochemistry

Paul H. Black, MD, Professor of Microbiology

Gene J. Blatt, PhD, Assistant Research Professor of Anatomy and Neurobiology

Jan Krzysztof Blusztajn, PhD, Associate Professor of Pathology

Norman D. Boyd, PhD, Associate Professor of Pharmacology

Thomas R. Browne, MD, Professor and Vice-Chairman of Neurobiology

Laird S. Cermak, PhD, Professor of Neurology

Douglas A. Cotanche, PhD, Associate Professor of Anatomy and Neurobiology

Theresa A. Davies, PhD, Assistant Research Professor of Biochemistry

Raymon Durso, MD, Associate Professor of Neurology

Ross B. Edwards, PhD, Associate Professor of Ophthalmology

David H. Farb, PhD, Professor and Chairman of Pharmacology

Lindsay A. Farrer, PhD, Associate Professor of Neurology and Public Health

Deborah Fein, PhD, Associate Professor of Psychiatry; Professor of Psychology

Martin L. Feldman, PhD, Professor of Anatomy and Neurobiology

Robert G. Feldman, MD, Professor and Chairman of Neurology

Richard Fine, PhD, Professor of Biochemistry

Janina Galler, MD, Professor of Psychiatry

J. Fernando Garcia-Diaz, PhD, Associate Professor of Physiology

Haralambos Gavras, MD, Professor of Medicine

Terrell Gibbs, PhD, Assistant Professor of Pharmacology

Ferenc I. Harosi, PhD, Adjunct Associate Professor of Physiology

James F. Head, PhD, Professor of Physiology

Gerhard Heinrich, MD, Associate Professor of Medicine

Nancy Helm-Estabrooks, ScD, Professor of Neurology (Speech Pathology)

Robin Johnson, PhD, Assistant Research Professor of Biochemistry

G. J. Jones, PhD, Assistant Professor of Physiology

Thomas L. Kemper, MD, Professor of Neurology

Conan Kornetsky, PhD, Professor of Pharmacology

Neil W. Kowall, Associate Professor of Neurology and Pathology

Susan E. Leeman, PhD, Professor of Pharmacology

Simon Levy, PhD, Associate Professor of Physiology

Edward F. Macnichol, Jr., PhD, Professor of Physiology

Aubrey Milunsky, MD, DSc, Professor of Human Genetics, Pediatrics, Obstetrics, and Gynecology, Pathology and Biology

Mark B. Moss, PhD, Associate Professor of Anatomy and Neurobiology



Dr. Carmela Abraham in her office.



Richard H. Myers, PhD, Associate Professor of Neurology

Margaret Naeser, PhD, Associate Research Professor of Neurology

Enrico Nasi, Associate Professor of Physiology

Marlene Oscar Berman, PhD, Professor of Neurology

Deepak N. Pandya, MD, Professor of Anatomy and Neurology

Bertram Payne, PhD, Associate Professor of Anatomy and Neurobiology

Alan Peters, PhD, Chairman and Professor of Anatomy and Neurobiology

Charalabos Pothoulakis, MD, Research Associate Professor of Medicine and Biochemistry

Penny Prather, PhD, Research Assistant Professor

Douglas L. Rosene, PhD, Associate Professor of Anatomy and Neurobiology

Julie H. Sandell, PhD, Assistant Professor of Anatomy and Neurobiology

Elizabeth R. Simons, PhD, Professor of Biochemistry

F. Marott Sinex, PhD, Professor of Biochemistry

Donald M. Small, MD, Professor of Biophysics, Medicine, and Biochemistry

Raymond E. Stephens, PhD, Professor of Physiology

Ete Z. Szuts, PhD, Adjunct Associate Professor of Physiology

Abdulmageed M. Traish, PhD, Associate Professor of Biochemistry

Mieke Verfaellie, PhD, Assistant Professor of Neurology

Ladislav Volicer, MD, PhD, Professor of Pharmacology and Psychiatry

Roberta F. White, PhD, Associate Professor of Neurology

Neuroscience is a broad discipline that encompasses many experimental approaches toward understanding the functions of the nervous system. There are many investigators in the basic sciences at Boston University School of Medicine who can serve as mentors to students who wish to specialize in neuroscience. A directory is available upon request that lists these faculty members and includes a brief summary of their research interests and selected publications. Students who participate in the Interdepartmental Neuroscience Program must fulfill depart-

mental requirements in a basic science department at the medical school. In order to receive a Ph.D. with a concentration in neuroscience each student will be expected to complete 12 credits in the area of neuroscience. Two required courses (8 credits) are:

GMS MS 703 Neuroscience Integrated treatment of anatomy and physiology of the nervous system. In anatomy classes, brains and spinal cords are dissected and microscopic slides examined to study cytology and projection of neurons. Other practical classes and demonstrations cover physiology, neurology, ophthalmology, and otolaryngology. Five-week course. 4 cr, 2nd sem.

GMS PM 700 Molecular Neurobiology and Pharmacology Examines a spectrum of topics ranging from the regulation of gene expression in the nervous system to the structure and function of receptors and ion channels. Emphasis is placed on theoretical foundations of pharmacology and neurobiology and the use of molecular and pharmacological methods in neurobiology. 4 cr, 2nd sem.

Another recommended course is:

GMS MS 783, 784 Molecular Basis of Neurologic Diseases Molecular mechanisms of stroke, multiple sclerosis, Huntington's disease, Alzheimer's disease, amyotrophic lateral sclerosis, muscular dystrophy, and neoplasia are considered. Fundamentals and current research of molecular biology are reviewed. Current publication seminar discussion is held with student participation. Keynote lectures are given monthly by distinguished guest speakers. 2 cr each, 1st & 2nd sem.

It is also recommended that students attend the biweekly Neuroscience Seminar Series.

At least two faculty members from the Neuroscience Program must participate in the qualifying examination of each student. See section on "Academic Policies" for specifics on the qualifying examination. The participation of a mentor as an examiner at the qualifying exams is at the discretion of the department.

Anyone interested in applying please contact the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118; (617) 638-5120. For specific information please feel free to contact Dr. Susan E. Leeman, at (617) 638-4364, Dr. Carmela Abraham at (617) 638-4308 or the individual investigators.

PROGRAM IN INTERDISCIPLINARY STUDIES

Program Director Carl Franzblau

The Graduate Program

The PhD Program in Interdisciplinary Studies is designed to give a small number of qualified students the opportunity to pursue doctoral-level studies in areas that are not available in the existing departments or programs of the Division of Graduate Medical Sciences. There is no Master of Arts program. The individualized programs of study combine the academic resources of two or *more departments* in the Division and require a scholarly focus that cannot be achieved within a single discipline. Because an advanced level of competence in at least one discipline is necessary for interdisciplinary study, the student is normally expected to possess a relevant master's degree or to demonstrate a command of one discipline by completing the equivalent of one year of graduate-level work in an appropriate department. In any event, the student should be prepared to do graduate-level work in all areas selected for study. The student is expected to fulfill all Division requirements for the PhD degree described in the "General Requirements for the PhD" section of this bulletin.

In choosing an interdisciplinary program of study, students must realize they are not members of any one department and, therefore, may relinquish the close association with fellow students and the support of departmental affiliation and normal department-based sources of graduate aid. The nature of the program requires that its students possess a great degree of clarity of intellectual purpose, maturity, and motivation. The admission standards for the program are very high. Students considering an interdisciplinary program should be aware that the nontraditional character of their studies may place them at a disadvantage when seeking postdoctoral employment.

Further information is available from the Division Office at 80 East Concord Street, Room L 317, Boston, MA 02118; 617/638-5120.

Program Authority and Advising The Associate Dean of the Division acts as the coordinator for the Interdisciplinary PhD Program and is assisted by members of the Division graduate faculty who serve on the supervisory committees of enrolled students. Other faculty members act in a consultative role

and provide advice on general matters of policy, particularly on issues relating to admissions. Each student arranges for direct supervision throughout the course of study by an advisory committee of three or more faculty members, one of whom is the major advisor. Admission to the program is, in part,





contingent upon the agreement of these three faculty members to serve on the advisory committee. Of the three, only one may be a faculty member of a School at Boston University other than the Division of Graduate Medical Sciences and only one may be a junior (nontenured) faculty member.

PhD in Interdisciplinary Studies

Admissions and Prerequisites As for all other Division programs, applicants must submit results of the Graduate Record Examination General Tests and hold at least a bachelor's degree in a relevant discipline. Applicants with master's degrees are preferred. The application process is more extensive than for other Division programs, requiring more consultation and planning. A student interested in applying to the program should prepare a brief statement of purpose and a proposed program of study using courses listed in this bulletin. The director should then be consulted as to the feasibility of the proposal. The director will include coordinating committee members in preliminary

discussions. The student will be directed to faculty members who may be willing to serve on the advisory committee. After development of the advisory committee, and with its approval, the student must prepare a five to seven-page detailed proposal to be submitted with the formal application for admission to the Division of Graduate Medical Sciences. This proposal should include the following:

1. the area of scholarly interest and specific Division departments involved (usually the advisory committee will include a faculty member from each of these) and the possible topic of the dissertation
2. a justification for following an interdisciplinary program rather than a traditional program of graduate study and a statement addressing the long-term goals to be achieved by the program
3. a list of advisory committee members, and accompanying letters indicating their formal consent to serve

4. a list of specific Division (and other Boston University) courses to be included in the program
5. if the applicant does not hold a relevant master's degree, a proposal for fulfillment of the master's equivalency requirement, described below

The completed application must be submitted to the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord, Room L 317, Boston, MA 02118. The deadline for submission of applications for September admission is March 1.

All inquiries and requests for application forms should be addressed to the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Room L 317, Boston MA 02118.

Course Requirements Students with a relevant master's degree must complete eight semester courses (32 credits). Students with a bachelor's degree must complete 16 semester courses (64 credits). The general plan for coursework must be proposed as part of the application (see the previous section on "Admission and Prerequisites"), and this plan should be reviewed and approved by the advisory committee each semester.

Master's Equivalency Requirement Every student admitted to the 16-course postbachelor's program must satisfy *both* the advisory committee and the coordinating committee as to competency at the master's level in one of his or her program disciplines. The method of satisfying this requirement must be proposed as part of the application (see "Admissions and Prerequisites" above); the advisory committee must report to the coordinating committee when this requirement has been satisfied.

Language Requirement, Qualifying Examination, PhD Candidacy, Residency Requirement, Dissertation Prospectus, Dissertation, and Final Oral Examination See "General Requirements for the PhD" in this bulletin. The prospectus, format, and substance of the examinations must be approved by *both* the advisory and the coordinating committees.

Degree Title The degree is awarded in Interdisciplinary Studies with major field specified, "Interdisciplinary Studies (major field)."

Courses This program does not offer its own courses but does accept all courses described in this bulletin.

ADMINISTRATION AND FACULTY

Richard H. Egdahl, MD *Director, Boston University Medical Center; Academic Vice President for Health Affairs, Boston University; Vice Chairman of the Board, Boston University Medical Center Hospital*

Aram Chobanian, MD *Dean, School of Medicine*

Carl Franzblau, PhD *Associate Dean, Graduate Medical Sciences; Director, Division of Graduate Medical Sciences*

Selwyn A. Broitman, PhD *Programs Coordinator*

Lorraine M. Josof *Associate Director for Administration*

Sheila A. Welch *MD/PhD Program Coordinator*

Mildred M. Agosto *Records and Financial Aid Coordinator*

Michelle A. Hall *Admissions Coordinator*

Faculty (1993/94)

Carmela R. Abraham Associate Professor of Medicine, Assistant Research Professor of Biochemistry. BSc, Tel Aviv University; PhD, Harvard University. The role of proteases and their inhibitors in Alzheimer's disease.

Christopher W. Akey Assistant Professor of Biophysics. BS, University of Richmond; PhD, Cornell University

Martin L. Albert Professor of Neurology. BS, Tufts University; MD, Tufts School of Medicine; Doctorat en Psychologie (Neuropsychologie), University of Paris (France). Language disorders; aging/developmental disorders; bilingualism.

Edward Alexander Professor of Medicine and Research Professor of Physiology. BA, Rutgers University; MD, Northwestern University. Analysis of the mechanisms that control renal acidification at the cellular level.

Mark J. Alexander Assistant Professor of Pharmacology. BS, Iowa State University; PhD, University of Washington. Regulation of neuropeptide gene expression in neuroendocrine systems.

Karen N. Allen Assistant Professor of Physiology. BS, Tufts University; PhD, Brandeis University. Protein structure and function using techniques of X-ray crystallography and kinetics.

Chris T. Amemiya Research Assistant Professor of Pediatrics. BS, Purdue University; PhD, Texas A & M University

Jean A. Amos Assistant Professor of Pathology and Laboratory Medicine and Director of DNA Diagnostic Laboratory. BSc, MSc, PhD, Ohio State University

Carl S. Apstein Professor of Medicine and Research Professor of Physiology. BA, Cornell University; MD, New York University. Contractility and relaxation in isolated cardiac muscle during ischemia and reperfusion.

Robert D. Arbeit Associate Professor of Medicine and Microbiology. BA, Williams College; MD, Yale University School of Medicine. Bacterial pathogenesis and population genetics.

Charles F. Arkin Professor of Pathology and Laboratory Medicine. BS, MD, Northwestern University Medical School

David Atkinson Professor of Biophysics, Research Professor of Biochemistry. BSc, PhD (hon), City University (London); PhD, Council for National Academic Awards (England)

Sanford H. Auerbach Assistant Professor of Neurology. BA, Cornell University; MD, New York Medical College. Sleep studies; head trauma.

George T. Bain Assistant Research Professor of Psychiatry. BA, Northeastern University; PhD, Boston University



Clinton T. Baldwin Assistant Research Professor of Pediatrics and Biochemistry. BS, University of Connecticut; MS, Northeastern University; PhD, Boston University. Molecular basis of Waardenburg Syndrome; examination of cDNA and gene structure of proteins expressed in cartilage cells.

Rama Bansil Associate Professor of Physics, College of Liberal Arts; Assistant Professor of Physiology. BSc, MSc, University of Delhi (India); PhD, University of Rochester. Diffusion and structure; biological gels; fluid flow and gelatin in gastric mucus; aggregation of biomacromolecules; phase separation and electrophoresis.

Helen Barbas Associate Professor of Anatomy and Neurobiology; and Associate Professor of Health Sciences, Sargent College of Allied Health Professions

David I. Beller Associate Research Professor of Medicine, Pathology, and Laboratory Medicine and Microbiology. BA, Wesleyan University; MS, PhD, Princeton University. Regulation of cytokine expression and antigen presentation in autoimmunity.

Peter R. Bergethon Assistant Research Professor of Biochemistry. BA, Williams College; MD, Jefferson Medical College

Ellen Berkowitz Associate Professor of Biochemistry. AB, MS, PhD, New York University. Regulation of gene expression in neural cells during development.

Marlene Oscar Berman Professor of Neurology (Neuropsychology) and Psychiatry; Director, Laboratory of Neuropsychology; Director, Program in Behavioral Neuroscience. BA, University of Pennsylvania; MA, Bryn Mawr College; PhD, University of Connecticut. Pathology of learning and memory; aging/developmental disorders; alcoholism.

Jag Bhawan Professor of Dermatology and Pathology. MD, Maulana Azad Medical College, University of Delhi (India)

Paul H. Black Professor of Microbiology and Medicine; Research Professor of Surgery. AB, Dartmouth College; MD, Columbia University. Psychoneuroimmunology or the mechanisms whereby the brain (mind) affects the immune system; neuromediators/neurohormones/neurotransmitters which may mediate this effect.

Gene J. Blatt Assistant Professor of Anatomy and Neurobiology. BA, Temple University; MS, Bloomsburg University; PhD, Jefferson Medical College, Thomas Jefferson University. Connections and physiological properties of limbic system neurons, and effects of malnutrition on development.

Jan K. Blusztajn Associate Professor of Pathology and Laboratory Medicine, and Psychiatry. MS, University of Warsaw (Poland); PhD, Massachusetts Institute of

Technology. Regulation of acetylcholine synthesis and release; regulation of membrane phospholipid turnover.

Steven A. Bogen Assistant Professor of Pathology and Laboratory Medicine. BS, University of Illinois; PhD, Weizmann Institute of Science (Israel); MD, University of Chicago Pritzker School of Medicine. Antigen-specific lymphocyte migration to inflammatory or immune sites.

Victoria Bolotina Assistant Research Professor of Physiology and Medicine. BSc, PhD, Moscow State University (Russia). Regulation of vascular smooth muscle with particular reference to potassium channels.

Norman D. Boyd Associate Professor of Pharmacology. BSc, University of Glasgow (Scotland); PhD, University of Chicago. Characterization of the substance P receptor.

Peter Brecher Professor of Biochemistry and Research Professor of Biophysics and Medicine. BS, Ohio University; MA, PhD, Boston University. Molecular and cellular aspects of intracellular lipid transport.

Christine E. Briggs Research Assistant Professor of Pediatrics. BA, Boston University; MA, PhD, Boston University.

Jerome S. Brody Professor of Medicine and Associate Professor of Biochemistry. BS, MD, University of Illinois

Selwyn A. Broitman Assistant Dean for Admissions; Professor of Microbiology, and Pathology and Laboratory Medicine; Professor of Nutritional Sciences, Goldman School of Graduate Dentistry. BS, MS, University of Massachusetts, Amherst; PhD, Michigan State University. Nutrition, gastrointestinal flora, diet-regulated cancer.

Thomas R. Browne III Associate Professor of Pharmacology; Professor and Vice-Chairman, Department of Neurology. Associate Chief, Neurology Service; Chief, Seizure Unit and EEG Laboratories, Boston Veterans Administration Medical Center. AB, Princeton University; MD, University of Rochester School of Medicine. Stable isotope studies of absorption, distribution, biotransformation, pharmacokinetics and drug interaction; efficacy and toxicity of antiepileptic drugs.

Hiram Brownell Adjunct Associate Research Professor of Neurology (Neuropsychology). BA, Stanford University; MA, PhD, Johns Hopkins University

Nancy L. R. Bucher Research Professor of Pathology and Laboratory Medicine. AB, Bryn Mawr College; MD, Johns Hopkins University. Liver regeneration; growth factor effects in hepatocyte cultures; role of extracellular matrix.

Bohdana Fialova Burke Assistant Professor of Pathology and Laboratory Medicine, MD, University J.E. Purkinje (Czechoslovakia).

Tumor markers; immunocytochemistry of hormone receptors.

Charles R. Cantor Professor of Pharmacology; Professor of Biomedical Engineering; Director, Center for Advanced Biotechnology, College of Engineering. AB, Columbia University; PhD, University of California, Berkeley. Molecular biophysics and molecular genetics.

David R. Cave Assistant Professor of Medicine. MBBS, PhD, University of London (England)

David Center Professor of Medicine and Research Professor of Biochemistry. AB, MD, Boston University. Function of CD₄; T cell chemotaxis and adhesion.

Laird Cermak Professor of Neurology (Neuropsychology); Adjunct Professor of Occupational Therapy, Sargent College. BA, Ohio Wesleyan University; MA, PhD, Ohio State University. Pathology of learning and memory; alcoholism.

Cynthia Chase Assistant Professor of Psychiatry and Pediatrics. MA, PhD, University of Cincinnati. Studies in aging/developmental disorders; AIDS.

Sati C. Chattoraj Professor of Biochemistry, Obstetrics, and Gynecology; Director, Research Laboratories, Obstetrics and Gynecology; BSc, MSc, University of Calcutta (India); PhD, Boston University. Biochemical aspect of reproductive endocrinology; infertility, implantation, and parturition.

Stuart R. Chipkin Assistant Professor of Medicine and Assistant Research Professor of Physiology. BS, Emory University; MD, State University of New York, Downstate Medical Center. Glucose transport in insulin-resistant states, focusing on cardiovascular tissue.

Aram V. Chobanian Dean; Professor of Medicine and Pharmacology. AB, Brown University; MD, Harvard University. Cardiovascular research.

Iih-Nan (George) Chou Professor of Microbiology, Pathology and Laboratory Medicine. BS, National Taiwan University; PhD, University of Illinois. Cell biology; cellular and molecular toxicology; cell injury by environmental carcinogenic metal compounds.

Thomas G. Christensen Associate Professor of Pathology and Laboratory Medicine. BS, Rutgers University; PhD, University of Vermont. Ultrastructural changes in chronic inflammatory diseases of the lung; biology and pathology of secretory cells.

Alan S. Cohen Conrad Wesselhoef Professor of Medicine; Professor of Pharmacology. AB, Harvard College; MD, Boston University. Pathogenesis, genetics, biochemistry, and clinical aspects of amyloid and amyloidosis.

Richard A. Cohen Professor of Medicine and Associate Research Professor of Physiology. AB, Bowdoin College; MD, Johns Hopkins



University. Vascular smooth muscle reactivity with focus on the influence endothelium and autonomic control mechanisms and their alteration with diseases.

Theodore Colton Professor of Sociomedical Sciences and Community Medicine; Professor of Public Health (Epidemiology and Biostatistics), School of Public Health. AB, Brooklyn College; MS, University of North Carolina; ScD, Johns Hopkins University

Barbara E. Corkey Associate Professor of Medicine and Associate Research Professor of Biochemistry. PhD, University of Pennsylvania

Ronald B. Corley Professor and Chairman of Microbiology. BS, PhD, Duke University. Regulation of gene expression during B lymphocyte differentiation; mechanisms regulating the assembly, secretion, and function of antibodies.

Melvin C. Cornwall Professor of Physiology. BS, PhD, University of Utah. Mechanism of visual transduction which relate to light adaptation in rods and cones of the vertebrate retina.

Douglas A. Cotanche Associate Professor of Anatomy and Neurobiology. BA, University of New Hampshire; PhD, University of North Carolina, Chapel Hill. Isolation of developmental factors that regulate the growth of receptor cells in the cerebellum.

Donald E. Craven Professor of Medicine and Microbiology; Professor of Epidemiology and Biostatistics, School of Public Health. BA,

Wesleyan University; MD, Albany Medical College. Nosocomial pneumonia and infection in critical care patients; AIDS in intravenous drug users; AIDS in women; pathogenesis and prevention.

Arthur J. Culbert Associate Professor and Associate Chairman, Department of Sociomedical Sciences and Community Medicine; Associate Professor of Social and Behavioral Sciences, School of Public Health, School of Medicine; Director, Early Medical School Selection Program; Associate Dean for Student Affairs and Educational Programs. BA, LaSalle College; MS, PhD, Boston University

Theresa Davies Assistant Research Professor of Biochemistry. BA, University of Virginia; PhD, Boston University. Platelet activation and Alzheimer's disease.

Helen Denison Assistant Professor of Psychiatry (Psychology). MA, University of Minnesota; PhD, State University of New York, Stony Brook. Studies in affective disorders; aging/development disorders.

Daniel Deykin Professor of Medicine and Biochemistry; Professor of Public Health (Epidemiology and Biostatistics), School of Public Health. AB, Harvard College; MD, Harvard University

Richard D. Diamond Professor of Medicine and Research Professor of Biochemistry. BA, Brooklyn College; MD, Harvard University

Deborah E. Dobson Assistant Professor of Biochemistry. BS, University of Illinois,

Urbana; PhD, University of California, Berkeley. Comparative biochemistry, physiology, and molecular biology of digestion.

Raymon Durso Associate Professor of Neurology. BS, State University of New York, Stony Brook; MD, State University of New York, Buffalo. Parkinsonism.

Ross B. Edwards Associate Research Professor of Ophthalmology and Biochemistry. BA, University of California, Berkeley; PhD, University of California, Los Angeles. Synthesis and effects of retinoic acid (RA) and other forms of vitamin A in the nervous system.

Alvin Essig Professor Emeritus of Physiology and Research Professor of Medicine. SB, Harvard College; MD, Ohio State University. Application of non-equilibrium thermodynamics to ion channel function and reaction-diffusion systems.

J. Worth Estes Professor of Pharmacology (History of Pharmacology) and Instructor of Medicine; Associate Professor of Sociomedical Science, School of Public Health. AB, Harvard College; MA, MD, Boston University. Factors governing drug treatment of the past, especially in the eighteenth century; influence of federal regulation on introduction of new drugs since 1950.

Douglas V. Faller Professor of Medicine, Pediatrics, Pathology, and Laboratory Medicine and Research Professor of Biochemistry. BS, PhD, Massachusetts Institute of Technology; MD, Harvard Medical School. Leukocyte adhesion and cytokine-mediated cell signaling.

David H. Farb Chairman, Department of Pharmacology; Professor of Pharmacology. BA, Long Island University; PhD, Brandeis University. Pharmacology and regulation of gene expression of the GABA/benzodiazepine receptor in the vertebrate central nervous system; mechanism of action of neuro-modulators, structure, function, and cellular dynamics amino acid receptors in the brain and spinal cord.

Barbara A. Faris Assistant Research Professor of Biochemistry. AB, Salve Regina College. Regulation of elastin fiber formation and elastin accumulation in the extracellular matrix.

Stephen R. Farmer Professor of Biochemistry. BSc, Liverpool University (England); PhD, National Institute of Medical Research (England). Expression of the major cytoskeletal protein (i.e., tubulin and actin) genes in mammalian nonmuscle cells, modulation of these genes by changes in cell configuration in normal and transformed cells.

Lindsay A. Farrer Associate Professor of Neurology, School of Medicine and School of Public Health (Epidemiology and Biostatistics). BA, University of North Carolina; PhD, Indiana University School of Medicine. Genetic risk factors for familial neurodegenerative diseases.

Deborah Fein Associate Professor of Psychiatry. BA, Cornell University; MS, PhD, Rutgers University. Autism and aging/developmental disorders.

Martin L. Feldman Professor of Anatomy and Neurobiology; Professor of Psychology, College of Liberal Arts. AB, Brown University; MA, PhD, Boston University. Morphological changes that affect neurons during aging of the auditory system.

Robert G. Feldman Chairman, Department of Neurology; Professor of Neurology and Pharmacology; Professor of Public Health, School of Public Health. AB, MD, University of Cincinnati. Aging/developmental disorders; neuropharmacology and neurotoxicology.

Matthew J. Fenton Assistant Professor of Medicine and Assistant Research Professor of Biochemistry. BS, University of Connecticut; PhD, Boston University. Molecular biology and immunology of macrophages activation.

Alan Fine Assistant Professor of Medicine; Assistant Research Professor of Biochemistry; BA, MD, University of Michigan

Richard E. Fine Professor of Biochemistry; Research Professor of Neurology. AB, University of California, Berkeley; PhD, Brandeis University. Intracellular route of ceptor trafficking in differentiated cells, including liver and brain; mechanism of calcium mobilization in the brain mediated by hormones that stimulate phosphoinositide turnover.

Edward Fischer Associate Professor of Neurosurgery. BS, MD, University of Toronto

Susan H. Fisher Associate Professor of Microbiology. BA, Washington University; PhD, Tufts University. Regulation of nitrogen metabolism in gram-positive bacteria.

Judith A. Foster Professor of Biochemistry. BA, Newton College of the Sacred Heart; PhD, Boston University. Regulation of elastic fiber gene expression in the development and repair of pulmonary and cardiovascular tissues.

Patricia L. Foster Assistant Professor of Environmental Health; Assistant Professor of Pathology and Laboratory Medicine, School of Medicine. MA, Harvard University; PhD, Cambridge University (England)

Carl Franzblau Associate Dean, Graduate Biomedical Science Studies; Chairman, Division of Graduate Medical Sciences; Chairman, Department of Biochemistry; Professor of Biochemistry. BS, University of Michigan; PhD, Yeshiva University, Albert Einstein College of Medicine. Chemistry, biosynthesis, and turnover of extracellular matrix proteins, including elastin and collagen.

Thomas F. Freddo Associate Professor of Ophthalmology, Anatomy, Neurobiology, Pathology, and Laboratory Medicine. BA, University of Connecticut; OD, Massachusetts College of Optometry; PhD, Boston University. Ultrastructural and physiological investigation of anterior uveitis and glaucoma.

Balz Frei Associate Professor of Medicine; Associate Research Professor of Biochemistry. PhD, Swiss Federal Institute of Technology (Switzerland)

Gladys Friedler Associate Professor of Psychiatry and Pharmacology. BA, University of Maine; AM, University of Pennsylvania; PhD, Boston University. Effects of paternal exposure to addictive substances on reproductive outcome.

Robert H. Friedman Assistant Research Professor of Neurology. AB, Harvard College; MD, Stanford University School of Medicine

Stephen Gacheru Assistant Research Professor of Biochemistry. BS, Nairobi University (Kenya); PhD, Boston University. Characterization and isolation of human lysyl oxidase promoter.

Janina R. Galler Professor of Psychiatry; Professor of Public Health (Epidemiology and Biostatistics), School of Public Health. BS, Newcomb College, Tulane University; MD, Albert Einstein College of Medicine. Nutrition and the central nervous system.

David Gansler Adjunct Assistant Professor of Psychiatry (Behavioral Neuroscience). BA, PhD, State University of New York, Albany. Studies in psychiatric disorders and head trauma.

J. Fernando Garcia-Diaz Associate Professor of Physiology. Licenciado en Ciencias, Universidad de Zaragoza (Spain); Doctor en Ciencias, Universidad de Malaga (Spain); MS, Indiana University. Expression of ion channels in developing cochlear ganglion neurons; role of membrane potential and voltage- and receptor-gated ion channels in intracellular calcium response to angiotensin II by adrenal cells.

Haralambos P. Gavras Professor of Medicine. MD, Athens University Medical School (Greece). Pathogenesis and mechanisms of hypertension.

Benjamin Gerson Professor of Pathology and Pharmacology; Director, Laboratory of Analytical Toxicology. BS, Ursinus College; MD, Jefferson Medical College of Thomas Jefferson University. Analytic techniques for drug detection.

Terrell T. Gibbs Assistant Professor of Pharmacology. BS, Massachusetts Institute of Technology; PhD, Harvard University. Regulation and turnover of the GABA/benzodiazepine receptor; theoretical analysis of ligand binding and dose-effect curves.

Douglas T. Golenbock Assistant Professor of Medicine and Microbiology. BS, University of Michigan; MD, University of Michigan School of Medicine. Gram negative bacterial septicemia; endotoxin receptors and endotoxin receptor inhibitors.

Wayne Gonnerman Assistant Professor of Biochemistry. BA, MA, PhD, University of Missouri, Columbia. Mineral and connective tissue metabolism; hormonal and dietary effects on inflammatory diseases.

Harold Goodglass Professor of Neurology (Neuropsychology). BA, City University of New York, City College; MA, New York University; PhD, University of Cincinnati. Language, purposeful movement, visuospatial and perceptual disorders.

Leonard S. Gottlieb Chairman, Department of Pathology and Laboratory Medicine; Professor of Pathology and Laboratory Medicine; Director, Mallory Institute of Pathology. AB, Bowdoin College; MD, Tufts University; MPH, Harvard University. Pathology of gastrointestinal cancer; pathogenesis of alcohol-induced liver disease.

Dana Graves Associate Professor of Periodontology and Oral Biology. Goldman School of Graduate Dentistry; Assistant Research Professor of Biochemistry, School of Medicine. BA, State University of New York, Binghamton; DDS, MD, Harvard University. Growth factor and monocyte chemoattractants.

Miklos Gyenes Assistant Research Professor of Pharmacology. MS, PhD, Moscow State University (USSR)

James A. Hamilton Professor of Biophysics and Associate Research Professor of Medicine and Biochemistry. BS, Juniata College; PhD, Indiana University

Marc F. Hansen Associate Professor of Pediatrics. BA, Macalester College; MS, University of Wisconsin, Madison; PhD, University of Cincinnati College of Medicine

Ferenc I. Harosi Adjunct Associate Professor of Physiology. ME, Cooper Union; PhD, Johns Hopkins University. Vertebrate visual pigments and cone-mediated color vision.

Keven Hartshorn Assistant Professor of Medicine. BA, MA, Williams College; MD, Albert Einstein College of Medicine

John A. Hayes Professor of Pathology and Laboratory Medicine. MB, ChB, MD, University of Bristol (England); FRC Path, Royal College of Pathologists (England)

James F. Head Professor of Physiology. BS, University of Manchester (England); PhD, University of Birmingham (England). Relationship between protein structure, dynamics and function; regulatory role of high affinity intracellular calcium binding proteins.

Gerhard Heinrich Associate Professor of Medicine and Biochemistry. BA, Oberlin College; MD, Case Western Reserve School of Medicine. Genetic mechanisms that regulate vertebrate development.

Nancy Helm-Estabrooks Professor of Neurology (Speech Pathology and Laboratory Medicine). BA, University of Massachusetts; MEd, Northeastern University; ScD, Boston University. Language, purposeful movement, visuospatial and perceptual disorders.

Michael F. Holick Professor of Medicine and Physiology. BS, Seton Hall University; MD, PhD, University of Wisconsin. Biochemistry, physiology, and molecular biology of the skin and bone with special emphasis on vitamin D and peptide hormones.

William Hollander Professor of Medicine, Physiology, and Biochemistry; Professor of Nutrition, Goldman School of Graduate Dentistry. AB, New York University; MD, State University of New York, Downstate Medical Center

Donna K. Housman Assistant Clinical Professor of Psychiatry. BS, University of Massachusetts, Amherst; MEd, CAGS, EdD, Boston University

David H. Howes Research Professor of Neurology (Neuropsychology). BA, Yale University; PhD, Harvard University. Language and purposeful movement disorders.

Richard F. Hoyt, Jr. Associate Professor of Anatomy and Neurobiology. BS, Bates College; PhD, Harvard University. Development and maturation of cells in the pulmonary system.

Tohru Ikuta Assistant Professor of Pharmacology. MD, PhD, Kyushu University School of Medicine (Japan). Molecular mechanisms for reactivating γ -globin genes with butyrates in human subjects with β -thalassemia and sickle cell disease.

Kevin A. Jarrell Assistant Professor of Pharmacology. BS, PhD, Ohio State University. Catalytic RNA.

Andrew C. Jackson Professor of Biomedical Engineering, College of Engineering; Associate Research Professor of Physiology. BSME, MSME, University of Nevada; PhD, University of Mississippi. Mechanical properties of the lungs including development of non-invasive pulmonary function tests.

Bruce Jackson Adjunct Assistant Research Professor of Biochemistry. PhD, University of Massachusetts, Lowell.

Robin Johnson Assistant Research Professor of Biochemistry and Anatomy. BS, State University of New York, Stony Brook; PhD, Boston University. Regulation of intracellular calcium in neurons.

Gregor Jones Assistant Professor of Physiology. BA, Exeter College, Oxford University (England); PhD, University College, London (England). Retinoid transport and the role of interphotoreceptor retinoid-binding protein during light and dark adaptation.

Shyr-Te Ju Associate Professor of Pathology and Laboratory Medicine and Associate Research Professor of Medicine. BS, MS, National Taiwan University; PhD, University of Illinois. CD₄⁺ cell cytolytic activity.

Herbert M. Kagan Professor of Biochemistry; Research Professor of Medicine. BS, MS, University of Massachusetts; PhD, Tufts University. Mechanisms of action, regulation, and molecular biology of amine oxidases, with emphasis on connective tissue lysyl oxidase.

Benjamin Kaminer Chairman, Department of Physiology; Professor of Physiology. MB, BCh, University of Witwatersrand (South Africa). Properties and role of endoplasmic reticulum and constituent proteins as an intracellular communication network.

Konstantin Kandror Assistant Research Professor of Biochemistry. BS, Moscow State University (Russia); PhD, USSR Academy of Science (Russia). Translocation of glucose transporter containing vesicles to the cell surface in response to insulin.

Edith Kaplan Associate Professor of Neurology (Neuropsychology) and Psychiatry, School of Medicine. BA, Brooklyn College; MA, PhD, Clark University. Language disorders, disorders of purposeful movement, visuospatial, aging/developmental disorders.

Richard Kaplan Adjunct Assistant Professor of Neurology. BA, PhD, University of Connecticut. Studies in neurophysiology.

Eva Kashket Professor of Microbiology. BSc, MSc, McGill University (Canada); PhD, Harvard University. Physiology and regulation of sporulation and solvent production by the anaerobic bacterium, *Clostridium*.

Robert B. Katz Assistant Research Professor of Neurology. AB, Brown University; PhD, University of Connecticut

Herbert L. Kayne Associate Professor of Physiology and Biometrics; Associate Professor of Sociomedical Sciences and Community Medicine and Public Health (Epidemiology and Biostatistics), School of Public Health. BS, MS, PhD, University of Illinois

Thomas L. Kemper Professor of Neurology (Neuropathology), Pathology and Laboratory Medicine (Neuropathology), and Anatomy and Neurobiology. BS, Northwestern University; MD, University of Illinois. The effects of aging and pathological changes on neurons of the primate brain.

Marcel Kinsbourne Adjunct Professor of Neurology. BA, Oxford University (England); BM, Bch, Oxford University Medical School (England); MA, DM, Oxford University (England). Studies in language disorders, pathology of learning and memory, and attention deficit disorder.

Michael D. Klein Associate Professor of Medicine. AB, Harvard College; MD, New York University

Joseph H. Korn Professor of Medicine and Biochemistry. BS, City College of New York; MD, Columbia University College of Physicians and Surgeons. Regulation of cell adhesion and cytokine production; scleroderma.

Conan Kornetsky Professor of Pharmacology and Psychiatry (Psychology). BA, University of Maine; MS, PhD, University of Kentucky. The neural-behavioral bases of the euphoria caused by drugs of abuse, of the antinociceptive effects of analgesic drugs, and of the behavioral effects of psychotherapeutic drugs; drug-induced behavioral alterations elicited by discrete CNS stimulation.

Hardy Kornfeld Assistant Professor of Medicine and Pathology and Laboratory Medicine. BA, Bennington College; MD, Boston University School of Medicine. HIV envelope glycoprotein function and its microbicidal activity.

Neil W. Kowall Associate Professor of Neurology and Pathology. BS, MD, University of British Columbia (Canada). Development and use of histological methods to study the normal and pathological anatomy of humans.

Herbert Z. Kupchik Professor of Microbiology and Pathology and Laboratory Medicine. BS, Bethany College; MS, PhD, Wayne State University. Human tumor development, identification, and therapy.

Ronald A. Laing Associate Professor of Physiology and Research Professor of Ophthalmology. BA, Reed College; MA, PhD, Rice University. Blood flow in the retina; transport across the cornea.

John Thomas LaMont Professor of Medicine. BS, Canisius College; MD, University of Rochester

Wayne W. LaMorte Assistant Research Professor of Biochemistry and Surgery. BA, Rutgers University; MD, College of Medicine and Dentistry of New Jersey; PhD, Boston University

David M. Larson Assistant Professor of Pathology and Laboratory Medicine. BS, PhD, University of Minnesota. Communication and cytoskeletal organization of endothelial and vascular smooth-muscle cells.

Francesca LaVecchio Adjunct Assistant Professor of Psychiatry. BA, MS, University of Rhode Island; PhD, Tufts University. Assessment and rehabilitation.

Susan E. Leeman Professor of Pharmacology. BA, Goucher College; PhD, Radcliffe College. Physiological effects of the peptides substance P and neurotensin; regulation of gene expression of these peptides and their receptors.

William J. Lehman Professor of Physiology. BS, State University of New York, Stony Brook; PhD, Princeton University. Role of calcium regulatory systems in skeletal and smooth muscle; three-dimensional image reconstruction of skeletal and smooth muscle thin filaments.

Howard M. Leibowitz Chairman, Department of Ophthalmology; Professor of Ophthalmology. AB, MD, Johns Hopkins University

Robert H. Lerman Assistant Professor of Medicine. BS, Stevens Institute of Technology; MD, Jefferson Medical College; PhD, Massachusetts Institute of Technology

Crystal Leslie Assistant Research Professor of Biochemistry. BS, Queen's University (Northern Ireland); MS, PhD, London University (United Kingdom). Role of gender in modulating immune function.

Ruth R. Levine Associate Dean Emerita for Graduate Biomedical Science Studies; Chairman, Program in Medical Sciences; University Professor Emerita and Professor of Pharmacology Emerita. BA, City University of New York; MA, Columbia University; PhD, Tufts University

Norman G. Levinsky Chairman, Division of Medicine; Wade Professor of Medicine; Professor of Physiology. AB, Harvard College; MD, Harvard University. Renal physiology.

Stuart M. Levitz Associate Professor of Medicine and Microbiology. BA, New York University; MD, New York University School of Medicine.

Elinor M. Levy Associate Professor of Microbiology. AB, Brandeis University; PhD, Emory University. Lymphocyte activation during AIDS.

Simon Levy Associate Professor of Physiology. ETS, Ecole Technique Supérieure de Genève (Switzerland); MA, Université Scientifique et Médicale de Grenoble (France); PhD, Boston University. Intracellular calcium; effects of second messengers on internal calcium; neuroglial interactions in invertebrate retina.

Jacqueline Liederman Associate Professor of Psychology, College of Liberal Arts and School of Medicine. BA, City University of New York, Queens College; PhD, University of Rochester. Visuospatial, perceptual disorders; aging/developmental disorders.

Joseph Loscalzo Director of the Whitaker Cardiovascular Institute; Professor of Medicine and Research Professor of Biochemistry. MD, PhD, University of Pennsylvania.

Hector Alberto Lucero Assistant Professor of Physiology. Lic. Biochem., National University of Rosario (Argentina); PhD, University of Buenos Aires (Argentina). Molecular biology of a high capacity, low affinity calcium-binding protein in the endoplasmic reticulum.

Ronald P. McCaffrey Professor of Medicine. AB, Boston College; MD, Tufts University

Edward F. MacNichol, Jr. Professor of Physiology. AB, Princeton University; PhD, Johns Hopkins University. Microspectrophotometric studies in isolated vertebrate photoreceptors.

Richard Mandel Associate Professor of Pathology and Laboratory Medicine and Assistant Research Professor of Biochemistry. BA, State University of New York, Binghamton; MS, PhD, University of Chicago. Environmental carcinogenesis and mutagenesis; somatic-cell mutations; genetics.

Ann Marshak-Rothstein Professor of Microbiology and Pathology and Laboratory Medicine; Assistant Professor of Public Health (Environmental Health), School of Public Health. BA, Washington University; PhD, University of Pennsylvania. Lymphoid engraftment and autoantibody production in MRL mice.

Judith Marquis Adjunct Associate Professor of Pharmacology. BS, Trinity College; PhD, University of Vermont College of Medicine. Preclinical drug development.



Bernice M. Martin Assistant Research Professor of Biochemistry. BA, City University of New York; PhD, State University of New York, Downstate Medical Center

Joel Maslow Assistant Professor of Medicine and Microbiology. BA, LaSalle University; MS, Drexel University; PhD, University of Virginia; MD, Jefferson Medical College. Microbial pathogenesis of *E. coli* and *M. Avium*.

Robert F. Meenan Professor of Medicine, Chairman and Professor of Socio-Medical Sciences; Director of the School of Public Health and Professor of Public Health. AB, Harvard College; MD, MBA, Boston University; MPH, University of California, Berkeley

James C. Melby Professor of Medicine and Physiology. BS, MD, University of Minnesota. Endocrinology of adrenal cortex and blood pressure regulation.

Aubrey Milunsky Professor of Pediatrics, Obstetrics and Gynecology and Pathology and Laboratory Medicine; Director, Center for Human Genetics, Boston University Medical Center; Professor of Biology, College of Liberal Arts. MC, BCh, University of Witwatersrand (South Africa). Genetic disorders of neurological interest.

Isabelle M. Mintz Assistant Professor of Pharmacology. PhD, University of Paris (France). Optical imaging of synaptic activity.

S. Alex Mitsialis Assistant Professor of Medicine and Pharmacology. AB, Princeton University; MA, PhD, Columbia University. Transcriptional regulation of development processes and molecular biology of nuclear hormone receptors.

Edward J. Modest Research Professor of Biochemistry. AB, AM, PhD, Harvard University

Frederick L. Moolten Associate Professor of Microbiology. AB, Harvard College; MD, Harvard University. Cancer molecular biology.

Robert B. Moreland Assistant Professor of Urology and Physiology. BS, Southeastern Louisiana University; PhD, University of Tennessee. Kidney function.

Peter J. Morgane Visiting Professor of Psychiatry (Neurophysiology). BS, Tulane University; MS, PhD, Northwestern University

Shirley Morris Assistant Research Professor of Biochemistry. BA, PhD, Boston University

Mark B. Moss Associate Professor of Anatomy and Neurobiology. BS, University of Massachusetts; MA, PhD, Northeastern University. Neurobiological basis of memory in primates.

Mary Johanna Murnane Associate Professor of Pathology and Laboratory Medicine and Assistant Research Professor of Biochemistry. BA, College of New Rochelle; MPhil, PhD, Yale University. Somatic-cell and molecular genetics of human proteases; gene structure and regulation.

John R. Murphy Research Professor of Medicine, Microbiology and Biochemistry. BA, MS, PhD, University of Connecticut. Structure and function of cytokine-toxin fusion proteins.

Richard Hepworth Myers Associate Professor of Neurology. BA, University of Kansas; MEd, MA, PhD, Georgia State University. Genetic component in neurological disorders of mid-life and late life, such as Huntington's disease.

Margaret Naeser Associate Research Professor of Neurology (Psycholinguistics). BA, Smith College; PhD, University of Wisconsin. Language disorders and brain imaging.

Kalidas Nandy Professor of Anatomy and Neurobiology. MD, University of Calcutta (India); PhD, Emory University. Mammalian aging in vivo and in vitro; neurobiology of aging; nutritional and pharmacological manipulation of the aging process.

Enrico Nasi Associate Professor of Physiology. BA, Universidad de los Andes (Colombia); MA, PhD, Bryn Mawr College. Light-dependent ionic channels; role of intracellular calcium in regulation of photoreceptor cells.

Matthew Nugent Assistant Professor of Biochemistry and Ophthalmology. BA, PhD, Brandeis University. Regulation of cell proliferation by growth factors and the extracellular matrix.

Michael J. O'Brien Professor of Pathology and Laboratory Medicine; Associate Director, Mallory Institute. MB, BCh, BAD, National University of Ireland, Galway Medical School; BSc, National University of Ireland; MRC (Pathology and Laboratory Medicine), Royal College of Pathologists (England). Pathology; early detection and progression of gastrointestinal malignancy; tumor markers.

Paul M. O'Bryan Assistant Dean, Health Science Programs, College of Liberal Arts; Associate Professor of Physiology. BS, Brescia College; PhD, Tulane University

Clare O'Callaghan Assistant Professor of Psychiatry (Nursing). RN, Georgetown University; EdD, Boston University

Gwynneth D. Offner Assistant Research Professor of Biochemistry; Associate Research Professor of Medicine. BA, Wellesley College; PhD, Boston University

Jane S. O'Hern Professor of Education, School of Education; Associate Professor of Psychiatry (Psychology). BS, EdD, Boston University; MA, Michigan State University

Frank Oppenheim Professor of Oral Biology and Periodontology, Goldman School of Graduate Dentistry; Associate Professor of Biochemistry. DMD, MS, University of Zurich (Switzerland); PhD, Boston University

Deepak N. Pandya Professor of Anatomy and Neurobiology and Research Professor of Neurology. MD, Gujarat University (India). Investigation of the cortical and subcortical connections in the primate brain.

Hee Young Park Assistant Research Professor of Biochemistry. PhD, Massachusetts Institute of Technology

Steven M. Paul Adjunct Professor of Pharmacology; Director, IRP, NIMH, Bethesda, MD. BA, MS, MD, Tulane University. Mechanisms of action of centrally acting pharmacologic agents, neurotransmitters, and hormones.

Bertram Payne Associate Professor of Anatomy and Neurobiology. BSc, PhD, University of Durham (England). Anatomical and functional organization of the visual system.

L. Bruce Pearce Assistant Professor of Pharmacology. BA, University of Massachusetts, Boston; PhD, State University of New York, Buffalo. Neuropharmacological and biochemical studies of the mechanisms underlying presynaptic receptor regulation of neurotransmission in brain, heart, and peripheral nerve preparations.

Edward W. Pelikan Professor of Pharmacology; Professor of Sociomedical Sciences and Community Medicine, School of Public Health. BS, MS, MD, University of Illinois. Evaluation of curriculum, and development and evaluation of teaching materials; history of the interpretation of dose-effect relationships.

Susan P. Perrine Professor of Pediatrics (Boston City Hospital) and Pharmacology. BA, Mills College; SM, Harvard University School of Public Health; MMS, Rutgers University Medical School; MD, Tufts University School of Medicine. Development of new drugs for treatment of hemoglobinopathies.

Alan Peters Chairman, Department of Anatomy and Neurobiology; Professor of Anatomy and Neurobiology. BSc, PhD, University of Bristol (England). Organization of the neurons in the cerebral cortex and the effects of aging on these neurons.

Constance Phillips Research Assistant Professor (Biotechnology). MPH, Boston University School of Public Health

Paul F. Pilch Professor of Biochemistry and Research Professor of Biophysics. BA, Temple University; PhD, Purdue University. Cell biology and biochemistry of growth factor receptors; cell biology of insulin action.

Richard C. Pillard Professor of Psychiatry. BA, Antioch College; MD, University of Rochester. Psychiatric and gender disorders.

Peter R. Polgar Professor of Biochemistry. BA, University of California, Los Angeles; MS, Tufts University; PhD, Boston University. Interaction between effector molecules and cellular response in terms of phosphatidylinositol turnover and the effect of GTP-binding proteins.

Charalabos Pothoulakis Assistant Research Professor of Medicine; Research Instructor of Biochemistry. MD, Aristotelian University of Thessaloniki, (Greece)

Penny Prather Assistant Professor of Neurology (Neuropsychology) and Psychiatry. AB, Mount Holyoke College; MS, PhD, Tufts University. Studies in visuospatial, attention, and other perceptual disorders; aging/developmental disorders.

Katya Ravid Assistant Professor of Biochemistry. BS, DSc/PhD, Technion, Israel Institute of Technology (Israel). Genetic and signaling factors regulating the development and function of hemopoietic lineages, using transgenic mice models.

Rahul Ray Assistant Professor of Medicine and Assistant Research Professor of Physiology. BSc, Presidency College (India); PhD, Washington State University. Structure-function studies of molecular interactions between metabolites of vitamin D and respective receptor proteins; vitamin D analogs with potential therapeutic applications.

V. B. Reddy Associate Research Professor of Biochemistry. PhD, Indian Institute of Science (India). Structure function studies of lysyl oxidase.

Oscar Resnick Visiting Professor of Psychiatry (Neurochemistry). AB, Clark University; MA, Harvard University; PhD, Boston University. Aging/developmental disorders; nutrition and the central nervous system.

Peter A. Rice Associate Professor of Medicine and Microbiology. BA, Yale University; MD, University of Pennsylvania. Immunologic mechanisms of human antibody interactions with bacterial cell surfaces.

Adrienne E. Rogers Associate Chairman, Department of Pathology and Laboratory Medicine; Professor of Pathology and Laboratory Medicine and Director, Office of Medical Education; Professor of Public Health (Environmental Health), School of Public Health. AB, Radcliffe College; MD, Harvard University. Nutritional influence on carcinogenesis and chemical toxicity.

Douglas L. Rosene Associate Professor of Anatomy and Neurobiology. AB, Stanford University; PhD, University of Rochester. Morphology and connections in the olfactory and limbic system.

Nadia A. Rosenthal Adjunct Associate Professor of Biochemistry. BA, Harvard College; PhD, Harvard Medical School

Carl E. Rosow Adjunct Associate Professor of Pharmacology. AB, Oberlin College; MD, PhD, Boston University. Clinical evaluation of opioids.

Kenneth J. Rothschild Professor of Physiology; Professor of Physics, College of Liberal Arts. BS, Rensselaer Polytechnic Institute; PhD, Massachusetts Institute of Technology. Raman spectroscopy; advanced techniques for selective incorporation of isotope labels into membrane proteins.

Thomas L. Rothstein Associate Professor of Medicine and Assistant Professor of Microbiology. MD, PhD, Duke University. Molecular mechanisms underlying B cell activation.

Neil B. Ruderman Professor of Medicine and Physiology. BA, Columbia College; MD, University of Pittsburgh; DPhil, Oxford University (England). Insulin action in mammalian tissues and cultured cells; insulin action, gene expression, and diacylglycerol protein kinase C signaling in skeletal muscle.

Shelley J. Russek Instructor of Pharmacology. AB, University of California, San Diego; PhD, Boston University. Transcriptional regulation of ligand-gated ion channels in the CNS.

Hugues J. P. Ryser Professor of Pathology and Laboratory Medicine, Pharmacology, and Biochemistry; Professor of Sociomedical Sciences and Community Medicine and Public Health (Environmental Health), School of Public Health. MD, University of Berne (Switzerland). In vitro investigation of tumor-cell response to drugs, endocytosis, and processing of macromolecular drug carriers.

Devaki N. Sadhu Research Assistant Professor of Pediatrics. BS, MSc, PhD, Osmania University

Inigo Saenz de Tejada Associate Research Professor of Physiology and Associate Professor of Medicine. MD, Universidad Autonoma de Madrid (Spain). Renal physiology.

Judith Dana Saide Associate Professor of Physiology. AB, Vassar College; PhD, Boston University. Organization of Z-band proteins in *Drosophila* flight muscle.

David J. Salant Professor of Medicine and Pathology and Laboratory Medicine. MB, BCh, University of Witwatersrand Medical School (South Africa). Cellular and molecular basis of immunologic glomerular injury.

Julie H. Sandell Assistant Professor of Anatomy and Neurobiology. AB, Princeton University; PhD, Massachusetts Institute of Technology. Anatomy and development of the vertebrate retina.

Karl Schmid Professor Emeritus of Biochemistry. MA, PhD, University of Basel (Switzerland)

David Sassoon Assistant Professor of Molecular Biology, Mt. Sinai Medical Center; Adjunct Assistant Professor of Biochemistry. PhD, Columbia University

Barbara M. Schreiber Assistant Research Professor of Biochemistry. BA, State University of New York, Buffalo; PhD, Boston University. The effect of hyperlipoproteinemic conditions on cultured aortic smooth muscle cells.

Lucia Schuger Assistant Professor of Pathology and Laboratory Medicine. MD, Buenos Aires University Medical School (Argentina). Developmental biology; epitheliomesenchyma organogenesis.

Faina Schwartz Research Assistant Professor of Pediatrics. BA, Washington University; PhD, University of Illinois at Chicago

John H. Schwartz Assistant Professor of Laboratory Medicine and Medicine. BA, Boston University; MD, New York University School of Medicine

Barbara Seaton Associate Professor of Physiology. BS, Brooklyn College; PhD, Massachusetts Institute of Technology. Relationship of macromolecular structure and cellular function, using X-ray crystallography.

Larry Seidman Assistant Professor of Psychiatry (Psychology). BA, City College of New York; MA, PhD, Boston University. Psychiatric disorders.

Sisir S. Sengupta Associate Research Professor of Pharmacology, Obstetrics, and Gynecology. BSc, MSc, Calcutta University (India); PhD, Jadavpur University (India). Development of actinomycin D analogues for chemotherapy.

Jacqueline Sharon Professor of Pathology and Laboratory Medicine. BA, MA, Queens College; MPhil, PhD, Columbia University. Molecular engineering of therapeutic antibodies and T cell receptors.

Daniel Shaw Associate Clinical Professor of Psychiatry. BS, City University of New York, City College; MD, New York University Medical School

David Sherr Assistant Professor of Pathology and Laboratory Medicine; Assistant Professor of Public Health (Environmental Health), School of Public Health. BA, Brandeis University; PhD, Cornell University. Carcinogens and B cell development.

Michael A. Shia Assistant Professor of Medicine and Assistant Research Professor of Biochemistry. BA, Reed College; PhD, Boston University

Osamu Shimomura Adjunct Professor of Physiology. BS, Nagasaki College of Pharmacology (Japan); PhD, Nagoya



University (Japan). Aequorins for calcium assay; mechanism of bioluminescence.

G. Graham Shipley Professor of Biophysics and Biochemistry. BSc, PhD, DSc, University of Nottingham (England). Structure-function relationships in lipid-containing biological systems, particularly cell membranes, serum lipoproteins, and arterial and brain tissue.

Elizabeth R. Simons Professor of Biochemistry and Research Professor of Biophysics. BChE, Cooper Union; MS, PhD, Yale University. Stimulus-response coupling in secretory cells; identification of specific receptors and mechanisms of information transduction in platelets, in phagocytic cells, and in their precursor cells; role of platelets and endothelial cells in the progression of Alzheimer's disease.

F. Marott Sinex Professor of Biochemistry, BA, DePauw University; AM, Indiana University; PhD, Harvard University. Environmental factors in early development that affect incidence of dementia.

Jean D. Sipe Research Professor of Biochemistry. BS, Iowa State University; MS, University of Washington; PhD, University of Maryland. Role of the apoSAA acute phase response proteins in host defense.

Donald M. Small Chairman, Department of Biophysics; Professor of Biophysics, Biochemistry, and Medicine. AB, Occidental College; BA, MA, Oxford University (England); MD, University of California, Los Angeles. Physical properties of fats, oils, detergents, lipids, proteins, and lipid-protein interactions.

Barbara Smith Professor of Biochemistry. BS, Simmons College; MA, PhD, Boston University. Changes in gene expression of connective tissue components associated with transformation and differentiation.

Bernard Smith Associate Professor of Medicine. AB, Fordham University; MD, New York University Medical School

Cassandra L. Smith Professor of Pharmacology; Professor of Biomedical Engineering, Deputy Director, Center for Advanced Biotechnology, College of Engineering. BA, West Virginia University; MS, West Virginia University School of Medicine; PhD, Texas A & M University. Gene engineering.

Temple F. Smith Professor of Pharmacology; Professor of Biomedical Engineering and Director of Biomolecular Engineering Research Center (BMERC), College of Engineering. BS, Purdue University; MS, PhD, University of Colorado. Syntactic and semantic structure of genetic information in biomolecular sequences, application of computer science, and mathematical methods for genome sequencing and analysis.

Gordon L. Snider Professor of Medicine and Associate Professor of Biochemistry. MD, University of Toronto (Canada)

Gail E. Sonenshein Professor of Biochemistry. BS, Brooklyn Polytechnic Institute; PhD, Massachusetts Institute of Technology. Role of oncogenes and growth-related genes in control of cell proliferation; relationship between growth and collagen gene expression in aortic smooth muscle cells.

Sergei P. Sorokin Research Professor of Anatomy and Neurobiology. AB, Harvard College; MD, Harvard University. Cell biology of the respiratory system with emphasis on morphological and functional connections.

H. Eugene Stanley Director, Center for Polymer Studies; University Professor; Professor of Physics, College of Liberal Arts; Professor of Physiology, School of Medicine. BA, Wesleyan University; PhD, Harvard University. Properties of gels and other systems that form molecular networks, using laser Raman spectroscopy, Fourier transform infrared spectroscopy, dynamic light scattering, microscopy, and measurements of bulk properties such as viscosity.

Raymond E. Stephens Professor of Physiology. BS, Geneva College; MS, University of Pittsburgh; PhD, Dartmouth College. Tubulin and associated proteins in microtubule assembly and membrane dynamics; neuronal, hormonal, and ionic control of ciliary and flagellar movement.

Robert A. Stern Adjunct Assistant Professor of Behavioral Neuroscience. BA, Wesleyan University; PhD, University of Rhode Island. Psychiatric disorders; aging/developmental disorders; AIDS.

Phillip J. Stone Professor of Biochemistry. BS, Swarthmore College; MS, University of Pennsylvania; PhD, Temple University. The connective tissue protein, elastin; its enzymatic destruction and repair in vitro and in vivo.

Alan Sugar Assistant Professor of Medicine. MD, Jefferson Medical College

Kathy K. H. Svoboda Associate Professor of Anatomy and Neurobiology. BS, MS, PhD, University of Nebraska. Functional and structural relationships between the basement membrane, epithelial cytoskeleton, and epithelial metabolism.

Ete Szuts Adjunct Associate Professor of Physiology. BA, Houghton College; MA, Columbia University; PhD, Johns Hopkins University. Signal transduction in sensory receptor cells; biophysical properties of retinoids in aqueous environment.

Alfred I. Tauber Professor of Medicine and Pathology and Laboratory Medicine. BS, MD, Tufts University. Biochemical characterization of the activated human neutrophil; definition of pathways of activation.

Linda Taylor Assistant Research Professor of Biochemistry. AB, Brown University; PhD, Boston University. Molecular biology of receptors.

Douglas L. Tillotson Associate Professor of Physiology. BA, PhD, University of California, Los Angeles. Role of intracellular calcium in secretory response of adrenal cortex cells.

Keith Tornheim Associate Professor of Biochemistry. BS, Antioch College; PhD, Brandeis University. Regulation of fuel and energy metabolism.

Paul A. Toselli Associate Professor of Biochemistry. BA, La Salle College; PhD, University of Pennsylvania; MD, Hahnemann School of Medicine. Cellular responses of cultured arterial smooth muscle cells to laser injury, using ultrastructural and biochemical methods.

Philip C. Trackman Assistant Research Professor of Biochemistry; Assistant Professor of Periodontology and Oral Biology. BA, College of Wooster; PhD, Boston University.

Abdulmaged M. Traish Associate Professor of Biochemistry. BSc, University of Tripoli (Libya); MA, PhD, Boston University. Mechanism of action of steroid hormones.

Vickery Trinkaus-Randall Associate Professor of Ophthalmology and Associate Research Professor of Biochemistry. BS, Kenyon College; PhD, University of Wisconsin. Synthetic response (i.e., integrins and proteoglycans) of cells in injury and repair.

Robert F. Troxler Professor of Biochemistry. BA, Grinnell College; MS, Pennsylvania State University; PhD, University of Chicago. Structure and function of proteins, including fatty acid-binding proteins from heart and skeletal muscle, phycobiliproteins from photosynthetic eukaryotes, and histidine-rich salivary proteins.

William C. Ullrick Professor Emeritus of Physiology. BS, Northwestern University; MS, PhD, University of Illinois

Louis Vachon Chairman and Professor, Division of Psychiatry. BA, MD, University of Montreal (Canada). Psychiatric disorders; psychoanalysis; asthma.

Deborah W. Vaughan Associate Professor of Anatomy and Neurobiology. BA, University of Vermont; PhD, Boston University. Effects of aging on the neurons of the motor system.

Mieke H. Verfaellie Assistant Professor of Neurology (Neuropsychology). BA, MA, PhD, University of Louvain (Belgium). Pathology of learning and memory; visuospatial and perceptual disorders.

Joseph J. Vitale Professor of Pathology and Laboratory Medicine and Sociomedical Sciences (Nutrition). BS, Northeastern University; MS, New York University; ScD, Harvard University. Infectious disease; nutrition and immunology.

W. Mark Vogel Adjunct Associate Professor of Pharmacology and Assistant Professor of Medicine. BA, Temple University; PhD, University of Michigan. Pulmonary and cardiovascular pharmacology.

Ladislav Volicer Professor of Pharmacology and Psychiatry and Assistant Professor of Medicine. PhD, Academy of Sciences (Czechoslovakia); MD, Charles University (Czechoslovakia). Neurotoxic effects of free radicals and formation of endogenous neurotoxins by free radical reactions, effects of partially oxidized serotonin, a potent inhibitor of GTP-binding proteins; role of neurotoxins in normal aging and in pathological conditions such as stroke and Alzheimer's disease.

Carol T. Walsh Associate Professor of Pharmacology. AB, Radcliffe College; PhD, Boston University. Pharmacokinetics, metal toxicology.

Mary T. Walsh Assistant Professor of Biophysics and Research Instructor of Biochemistry. BS, Simmons College; PhD, Brown University.

Roberta F. White Assistant Professor of Neurology (Neuropsychology). BA, Michigan State University; MA, PhD, Wayne State University. Pathology of learning and memory; visuospatial and perceptual disorders.

Allan F. Wiechmann Associate Professor of Anatomy and Neurobiology. BS, University of California, Davis; PhD, University of California, Los Angeles. Role of the hormone melatonin in the retina and brain.

Celeste R. Wirsig-Wiechmann Assistant Professor of Anatomy and Neurobiology. BA, Wells College; PhD, University of Florida. Relationship between gonadotropin releasing hormone (GnRH) system and the chemosensory systems.

Leslie Wolfe Instructor, Biochemistry. BS, PhD, Boston University.

Herbert H. Wotiz Professor Emeritus of Biochemistry; Professor of Urology. BSc, Providence College; PhD, Yale University.

Herman E. Wyandt, Jr. Associate Professor of Pathology and Laboratory Medicine and Director, Cytogenetics Laboratory. BA, Western Washington State College; MS, PhD, Oregon State University.

Qiang Yu Assistant Research Professor of Biochemistry. PhD, Brandeis

Glen B. Zamansky Associate Professor of Microbiology. BA, Brandeis University; PhD, Harvard University. Photobiology/system lupus erythematosus/virology.

Ken Zaner Associate Professor of Medicine; Assistant Research Professor of Biochemistry. BS, Brooklyn College; MD, PhD, State University of New York Downstate Medical Center

Vassilis I. Zannis Professor of Biochemistry and Medicine. BS, University of Athens (Greece); PhD, University of California, Berkeley. Transcriptional regulation of the apolipoprotein genes; structure and function of human apoB and apoA-I; genetic variation and posttranslational modification of apolipoproteins.

Raphael A. Zoeller Assistant Professor of Biophysics and Assistant Research Professor of Medicine. BS, University of Maine; PhD, Texas A&M University

Lawrence C. Zoller Associate Professor of Anatomy and Neurobiology. BA, University of Pennsylvania; PhD, Rutgers University. Development and modulation of hormonal systems.

ACADEMIC POLICIES AND PROCEDURES

The following general regulations concern all graduate students in the Division of Graduate Medical Sciences at Boston University School of Medicine. Each student is responsible for becoming familiar with the general regulations of the Division and the more specific requirements of the individual departments or programs, which may supplement the Division regulations.

Admission

Qualifications for Admission Any person who has completed all requirements for a baccalaureate degree from a recognized college or university, or with equivalent education, may apply for admission to the Division of Graduate Medical Sciences. The student may be required to make up any deficiencies in academic background by completion of specified courses without credit.

Admissions Requirements All applicants for admission to one of the basic science departments are required to submit the results of the Graduate Record Examination (GRE) General Test. The Subject Test in Biochemistry and Molecular Biology, Biology, Chemistry, or another pertinent subject is also required for PhD applicants. This requirement may be waived only under special circumstances and only for an applicant with a superior academic record. Other tests may be substituted for the GRE with special permission. The candidate must have met the requirements for a baccalaureate degree with a strong background in the biological and physical sciences (a minimum of 28 credits or the equivalent). A 4-credit course is defined as 4 lecture hours per week for one semester. The candidate must also have completed the special prerequisites of the department or program in which the student is matriculating. Prerequisite courses not completed before registration may be completed while the candidate is in residence as a graduate student, but may not be presented for graduate credit. The candidate is subject to examination on any of these prerequisite

courses at the option of the major department. Further information is available from the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118; 617/638-5120.

Application Applications and instructions for submission of complete credentials may be obtained from the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Bos-

ton, MA 02118. A nonrefundable application fee of \$50 *must* be submitted with each application. Applicants must also submit the credentials listed below. These materials become the property of the University; neither originals nor copies will be returned.

1. *Official transcripts or records* of each college or university attended. A college senior should submit an official report of the work completed through the first semester of the senior year as early as possible.



2. Letters of recommendation from three faculty members.
3. Official test results of the Graduate Record Examination (GRE) (General Test and Subject Test where required). Results of the Medical College Admissions Test (MCAT) may be substituted with prior approval.

The GRE is given in October, December, February, April, and June (General Test only) of each year and should be taken no later than October for consideration for admission the following fall semester. For GRE application materials and information, contact the Educational Testing Service, P.O. Box 6000, Princeton, NJ 08541-6000; 609/771-7670.

In addition to the above, applicants who have twice been rejected for admission *must* submit a letter of approval for application from the current Director of Graduate Studies for the department or program to which they seek admission.

Deadlines All applications and credentials for admission to doctoral degree programs for the fall semester should normally be submitted by March 31. Late applications will be considered with prior approval. Because applications for admission with financial aid are reviewed as they are received, early application is recommended. The deadline for masters candidates is normally March 31, except for the MA in Medical Science which has no deadline. Contact the Director of Graduate Studies for the department or program of interest to determine the status of the admissions process. For those departments that accept new students in the spring semester, applications should be submitted by *October 15*.

Applicants from Other Countries Application materials may be obtained from the Division of Graduate Medical Sciences, Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118. A nonrefundable application fee of \$50 *must* be submitted with each application. All credentials must be in English. The following credentials are required in order to complete an application:

1. The completed, signed admissions application.
2. The completed, signed International Student Data Form and a declaration of financial support including supporting documentation.
3. At least three letters of recommendation from faculty members in biomedical sciences.

4. Certified copies and certified English translations of all academic achievements in each college or university attended.
5. The results of the Test of English as a Foreign Language are required for each student whose native language is not English. The Test of English as a Foreign Language is administered once each month throughout the year. The *TOEFL Bulletin of Information* and registration form can be obtained at American embassies and consulates, offices of the United States Information Service (USIS), U.S. education commissions and foundations abroad, binational centers, and certain private organizations. Applicants who cannot obtain a *TOEFL Bulletin* and registration form locally should write for them well in advance to TOEFL/TSE Services, P.O. Box 6151, Princeton, NJ 08541-6151, USA; 609/951-1100.
6. The results of the Graduate Record Examinations (General and Subject Test). The Graduate Record Examination is administered in October, December, February, April, and June (General Test only). To take this test, write for information and registration materials to Graduate Record Examinations, Educational Testing Service, P.O. Box 6000, Princeton, NJ 08541-6000, USA; 609/771-7670.

International students must provide evidence of financial resources adequate to cover travel to and from Boston and for tuition and living costs for at least one full year at Boston University. Immigration regulations prohibit international students from accepting any employment except University appointments during the first year of study in the United States. Information and assistance regarding governmental regulations and University services may be obtained by writing to the International Students and Scholars Office, 19 Deerfield Street, Boston, MA 02215. For further advice and assistance in seeking admission, international students should consult the nearest U.S. embassy, consulate, or information center.

Nondegree Applicants A person with an accredited bachelor's degree or its foreign equivalent who is qualified for graduate work, but who does not wish to enter a degree program, may apply to a department or program in the Division of Graduate Medical Sciences for admission as a special student with nondegree status. The com-

pleted application and a transcript of the most recent degree awarded should be submitted along with the application fee. Results of the Graduate Record Examination are not required.

Application for a change from nondegree to degree status must be made before the admission deadline for the semester of intended enrollment. Except under unusual circumstances, no more than 8 credits for an MA degree program or 16 credits for a PhD degree program may be credited toward the degree, and only if the grades received are B or higher.

General Policies and Procedures Governing Graduate Study

Research Advisor A candidate for the MA or PhD degree is required to have, as a research advisor, a full member of the Division of Graduate Medical Sciences faculty. This advisor must be a member of the major department, if the major department so requires. The research advisor is always the first reader of the MA thesis/PhD dissertation. Under certain circumstances, a Special Faculty Appointee may serve as first reader. When the first reader/research advisor only has a Special Faculty Appointment in the Division, then the second reader of the thesis/dissertation must be, at a minimum, a full member of the Division, or depending upon departmental requirements, a full member of the major department or program.

Directed Study or Research Students may register for directed study or research with the approval of the faculty member concerned. The minimum registration is a 2-credit course. A candidate for the MA degree may register for not more than 16 credits in directed study or research.

Transfer of Credit Graduate-level courses in other accredited graduate schools or in other Schools or Colleges of Boston University not used toward the awarding of any other degree, may be transferred on recommendation of the major advisor and the chairman of the department with the approval of the Committee on Academic Standards of the Division. Credit for work to be taken concurrently with studies in the Division must be approved before registration for such courses; all such courses must be taken for a letter grade (not pass/fail). No transfer of credit for courses taken before the senior year of college will be accepted. Forms for transfer of credit petitions are available from the Division of Graduate Medical Science.

MA degree program No more than 8 credits may be transferred from other universities, unless a department or program requires more than 32 credits. A student may transfer additional courses corresponding to that number required in excess of the eight.

Postbachelor's PhD program No more than 16 credits may be transferred from other universities. Of these, only 8 credits may be credited toward a master's degree. If a department or program requires more than the minimum of 64 credits, a student may transfer an additional number of courses corresponding to that number required in excess of the 64.

Post-master's PhD program No courses may be transferred from other universities, unless a department requires more than the minimum of 32 credits. A student may transfer the number of courses corresponding to that number required in excess of the 32.

Summer Term Certain courses taken during the summer term at Boston University may be credited toward the MA and PhD degrees if prior approval is obtained from the candidate's major department or program. The number of credits that can be earned in one session is limited to 6 credits. Graduate students who do not wish to enroll for courses but wish to complete a departmental requirement such as comprehensive, qualifying, or dissertation examination, or to use the University facilities must register for one summer term by paying the Continuing Student fee.

Continuing Students MA and PhD candidates who have completed all departmental course requirements must register each subsequent semester as continuing students until all requirements for the degree have been completed. Payment of the Continuing Student fee each semester entitles the student to appropriate access to and use of the libraries, research laboratories, academic staff, and other academic facilities of the University for the purpose of completing such requirements as examinations, research, and thesis or dissertation work. Continuing students who are PhD candidates are entitled to audit officially one course each semester without further tuition charge. Graduate courses at the 900 level may not be audited. A student who, in any semester, fails to register and has not been granted an official leave of absence will be considered a continuing student and will be charged the usual fee for such status. Failure to register for two consecutive regular semesters without having been granted an authorized leave of absence may result in termination of degree status.



Transfer Between Departments Students may, under certain circumstances, transfer between departments if they (1) are in good academic standing, (2) have received written approval from the chairman or director of graduate studies in the present department prior to applying for a transfer, (3) have received written approval of the Chairman or Director of Graduate Studies in the new department, and, (4) have received written approval from the Associate Director of the Division of Graduate Medical Sciences.

Grades The Division of Graduate Medical Sciences uses the following system of letter grades for evaluation. Graduate courses at the 900 level will be graded by Pass/Fail only.

Grade	Explanation
A to B-	Pass with credit
C+ or below	Considered failure
P	Pass with credit
F	Fail
I	Incomplete, with additional work required
X	Unresolved status
J	Registration in same or continuing course in the following semester necessary (excluding summers)
AU	Audit
N	No credit granted toward a graduate degree
W	Withdrew after five weeks
MG	Missing grade

Credits Credit toward a degree will only be obtained from a passing grade.

Incomplete Coursework and Failing Grades

When the work of a course has not been completed within the semester of registration, the grade of I is used. A grade of I can only be given if a student is doing passing work. This automatically becomes a permanent I (unsatisfactory grade) unless the coursework is completed within the following calendar year. Grades of I and C+ or lower are interpreted as failures. A student receiving such grades in total of 8 credit hours is terminated. A student receiving a failing grade will not be permitted to take a make-up examination.

Grade Changes Grades, including incompletes, may not be changed after a period of one year from the time the original grade is recorded.

Suspension or Dismissal Boston University, through its various faculties or appropriate committees, may suspend or dismiss any student from the University for reasons of unsatisfactory scholarship or conduct.

Petitions In presenting any request to the faculty or to its several committees, students will use the prescribed form, obtainable from the Division of Graduate Medical Sciences.

Leave of Absence Normally, students must register for each regular semester until completion of all degree requirements. Upon written petition and for appropriate cause, a student is allowed up to two semesters of

leave of absence without the necessity of committee consideration. Leaves of absence beyond two semesters are granted only in exceptional cases, such as substantiated illness, one-semester maternity or paternity leave, or military service. The student should petition the Associate Dean of the Division of Graduate Medical Sciences with approval of the chairman of the department or program of concentration.

All requests for leave of absence must be submitted within the first three weeks in the semester in which the leave is intended to begin. If leave is granted, a certificate of authorized leave of absence is issued and a copy included in the student's record.

The period of authorized leave of absence is counted as a part of the time allowed for completion of degree requirements. Students may not complete any degree requirements in a semester for which they have been granted leave of absence. Students must be registered in the semester in which the degree requirements are completed and in the preceding semester.

Absence for Religious Reasons According to Chapter 151C of the General Laws, Commonwealth of Massachusetts, any student in an educational or vocational training institution, other than a religious or denominational educational or vocational training institution, who is unable, because of religious beliefs, to attend classes or to participate in any examination, study, or work requirements on a particular day, shall be excused from any such examination or study or work requirement, and shall be provided with an opportunity to make up such examination, study, or work requirement that may have been missed because of such absence on any particular day; provided, however, that such makeup examination or work shall not create an unreasonable burden upon such school. No fees of any kind shall be charged by the institution for making available to the said students such opportunity. No adverse or prejudicial effects shall result to any students because of their availing themselves of the provisions of this section.

Readmission to a Degree Program Students applying for readmission to the Division of Graduate Medical Sciences are subject to the following regulations: a minimum of two years must elapse from the time of withdrawal or termination before enrollment; reapplication must be accompanied by an application fee; if readmitted, the student may be asked to retake examinations or demonstrate knowledge in current issues in the field of specialization; readmitted stu-

dents will be subject to the rules and regulations set forth in the *Graduate Bulletin* at the time of readmission; students who have outstanding financial obligations to the University at the time of withdrawal or termination will be required to meet those obligations as a condition of readmission; at the time of readmission, the student must provide a detailed schedule of plans for completing the remaining degree requirements within specific time limits.

Payment of Student Accounts A student with an outstanding balance with Student Accounting Services will not receive a grade report, transcript, or diploma until payment has been made.

Registration

An officially registered student is one who has submitted course selections on a registration form, paid or settled all charges, and received an approved receipt from the Office of Student Accounting Services.

Candidates for admission may not register until they receive a formal statement of acceptance. Registration is conducted under the direction of the Division of Graduate Medical Sciences. Graduate students should consult the Division Office, 80 East Concord Street, for detailed instruction concerning the procedure to be followed during the announced registration period. Students must be registered for any regular semester or summer term during which a degree requirement is completed or University facilities are used.

Registration must be completed within the official registration period, the dates for which are given in the semester's class schedule.

Students may register by mail or in person, in any of the following categories:

Full-Time Students

By enrollment: A student enrolled in 12 to 18 credits will be considered full-time and will be charged full tuition and fees. A student may register for more than 16 credits only with approval of the Committee on Academic Standards.

By certification: A student registered for fewer than three courses or 12 credits (a minimum of 4 credits must be taken until all coursework requirements have been completed) but engaged otherwise in full-time study, research pertinent to the completion of degree requirements, or gaining competence in the field of study, may be certified as a full-time student. Such a student must pay tuition on a per-course basis and full-time fees. A student desiring full-time certification must

submit to the Division of Graduate Medical Sciences, during the official registration period, a completed full-time certification form approved by the advisor and department chairman or director of graduate studies.

Part-time Students All part-time students who are candidates for degrees must register each regular semester for no less than 4 credits until all departmental course requirements are completed. Continuing students (see below) may register for less than one 4-credit course.

Continuing Students A degree candidate, after completing all departmental course requirements, must register each regular semester as a continuing student until all remaining degree requirements are completed. Payment of the fee for this status makes available to the student all academic facilities of the University and entitles PhD candidates to audit officially one course per semester. Students may not audit 900-level courses. Registration and payment of regular tuition and fees for at least one course exempts the student from the Continuing Student fee. Continuing students may qualify as full time according to the above regulations. Normal part- and full-time fees are also applicable.

Registration Deadlines The dates of the official registration period are given in the semester's *Class Schedule*. Late fees are charged to students who do not register or settle their tuition account during the official period. Students may not register later than one week after the start of classes without written approval from the Associate Dean of the Division. Students who are not registered by the deadline will have their financial assistance offers revoked.

No students, including those with continuing-student status, will be allowed to register after the first week of classes. Students in special programs that commence later in a semester will not be allowed to register later than the end of the first week of the program.

Cross-Registration *Within Boston University:* A student in an MA degree program normally may elect not more than one graduate-level semester course given by a School or College at Boston University other than the Division of Graduate Medical Sciences, unless the courses are listed in this bulletin. A student in a PhD degree program may elect not more than two such courses. All courses must be approved by the student's major advisor and department.

With Other Academic Institutions: Graduate School students who wish to cross-register for a graduate course at another academic institution should obtain a cross-registration permit from the Division of Graduate Medical Sciences. Students must consult with their advisors, receive advisor approval on the permit, and receive approval from the Division. They must then present this permit to the graduate school registrar of the host institution. During any academic year, students normally may receive only one registration permit. Cross-registrants should expect to satisfy all prerequisites and requirements for courses as indicated by the host institution. Tuition for such courses is charged at Boston University rates in the usual manner.

Adding or Dropping a Course Students wishing to change their courses must fill out the appropriate form from the Office of Graduate Medical Sciences, obtain their advisor's signature, and return the completed form to the Division Office. A request for late registration in courses ordinarily cannot be granted after the first full week of classes. *No course may be added after the first two weeks of class.*

A course dropped during the first five weeks of class will not appear on the student's permanent record. After the first five weeks, a dropped course will appear on the student's record as W, and the student will be charged for the course. Courses may be dropped up to three weeks prior to the start of final examinations. After that point, no course may be dropped. Students who register for any course are held responsible for its completion unless they officially withdraw by the deadline date or change to the status of auditor before mid-semester.

Auditing Courses An auditor is a student who attends a class to acquire knowledge, but not to earn credits or a grade. Audited courses do not count toward completing degree requirements. A student may not change auditing status after the fifth week of classes. Auditors must attend classes regularly, do assigned reading, and participate in discussions, but they are excused from examinations.

Auditors are admitted to a course on a space-available basis and in accordance with the rules of the School or College offering the course. Auditors are subject to the full tuition and fees of the course.

Graduation MA degrees are awarded in September, January, and May. PhD degrees are awarded in January and May. Commence-

ment exercises are held in May only. Students planning to receive their degrees at the May commencement must submit diploma applications by February 1. Students must submit diploma applications by July 1, for September graduation, and by November 1, for January graduation. The diploma application is valid only for the graduation date specified; a new application must be filed if the student does not graduate as planned. Diploma applications and copies of the regulations on the preparation of theses and dissertations are available in the Division of Graduate Medical Sciences.

Transcripts To request an academic transcript of grades and coursework, a student should submit a Transcript Request form to the Division of Graduate Medical Sciences. Letter requests will be honored if they are signed and give complete information about attendance, including enrollment dates, College(s) of registration, and degree(s) earned. Official transcripts are mailed approximately two weeks after receipt of the request. The transcript fee is \$3 per copy, and payment must accompany the request. For transcripts sent express mail, add \$7 per address. The express mail charge is subject to change depending on the carrier used. Unofficial transcripts for student use may be obtained from Division of Graduate Medical Sciences on a walk-in basis, Monday through Friday, 9 a.m. to 5 p.m.

Identification Cards and Numbers Generally, ID numbers are the same as Social Security numbers. Students not possessing a Social Security number are assigned an ID number by the University. To change an incorrect ID number, a student should present proof of the correct number (e.g., a Social Security Card or driver's license) to the Division Office. Full-time students are issued a photo ID card by the Registrar. Part-time students receive a nonphoto ID from the Registrar. Photo ID cards are made during on-campus registration. Paid receipts must be shown before any card can be issued. A student is entitled to a new card only when there are changes to the information on the card. A fee is charged for replacing a lost card.

Name Changes or Corrections Misspelled names can be corrected simply by presenting a current driver's license or University ID card to the Registrar.

Currently enrolled students who wish to change their names must present sufficient reason and identification to the Registrar. Upon approval, the student will be asked to complete an ID/Name Change form. For

students who are no longer registered or who have graduated, legal documentation (e.g., a marriage license or court order) must be submitted to the Registrar along with the request for the change. Massachusetts residents are required to submit a notarized letter stating the reason for the change, and the old and new legal names.

Address Changes Students must notify the Division of any local or home address changes. To do this, a student should complete a Personal Data Change form, available from the Registrar.

Administrative Policies Relating to Federal Guidelines

Veterans' Information In cooperation with the Veterans' Administration, the University participates in numerous veterans' benefits programs, including educational assistance, Work-Study, rehabilitation, deferred payment, and tutorial programs.

Any student who is eligible for veterans' benefits or would like more information about VA rules and veterans' programs should contact the Boston University Office of Veterans' Affairs, 881 Commonwealth Avenue, Boston, MA 02215; 617/353-2390.

Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act ensures confidentiality of student educational records and restricts disclosure to or access by third parties, except as authorized by law. Parents of dependent students, as defined in Section 152 of the Internal Revenue Code of 1954, are accorded full access by the University to their dependents' educational records, with certain exceptions, and they may receive, each semester, copies of their dependents' grade reports from the Office of the University Registrar. The University assumes that its undergraduate students are financially dependent unless the parent or the student informs the University Access Officer, in the Office of the University Registrar, that the student is financially independent. Students may provide this notification to the Access Officer via the Financially Independent Student form, a copy of which may be secured from the Access Officer in the Office of the University Registrar.

Students have the right to inspect their educational records, with certain exceptions. If they believe these records are inaccurate, they may request an amendment and, if denied, have the right to a hearing and to place a letter of disagreement in their file if the outcome of that hearing is negative.

Students are eligible under the Act to file a complaint with the U.S. Department of Education Family Policy and Regulations Office, Federal Office Building, Number 6, Room 3021, 400 Maryland Ave., S.W., Washington, DC 20202, if they believe Boston University failed to comply with the requirements of the Act.

The University's policies and procedures for implementation of this Act are enumerated in the *Compliance Manual*, and copies are available to students at the Office of the University Registrar, 881 Commonwealth Avenue, Second Floor, Boston, MA 02215.

The University does not release personally identifiable information contained in student educational records, except as authorized by law. Boston University has designated certain types of personally identifiable information as "directory information." It includes the student's name, local or dorm address and telephone number, College of registration, degree program and major and minor, dates of attendance, part- and full-time status, degrees, honors, and awards received, and hometown for press releases. Students may restrict release of this information, if they wish, and this data will not be released by the University, except as authorized by law.

The Student Activities Office (Associate Director, GSU, 775 Commonwealth Avenue) and the Athletics Department (Director, 285 Babcock Street) may release or publish personally identifiable information on students who participate in officially recognized activities and sports. If students wish to restrict release and/or publication of this information, they should contact the Student Activities Office and the Athletics Department directly.

Students are informed of their rights under this law by the University Registrar. The parents of incoming freshmen and transfer students each year are informed of their rights under this law, and how to exercise them, by the Provost.

Equal Opportunity Policy Boston University prohibits discrimination against any individual on the basis of race, color, religion, sex, age, national origin, physical or mental disability, marital, parental, or veteran status. This policy extends to all rights, privileges, programs, and activities, including admissions, financial assistance, employment, housing, athletics, and educational programs. Boston University recognizes that nondiscrimination does not ensure that equal opportunity is a reality. Because of

this, the University will continue to implement affirmative action initiatives that promote equal opportunity for all students, applicants, and employees. Inquiries regarding the application of this policy should be addressed to Executive Director, Personnel and Affirmative Action, 25 Buick Street, Boston, MA 02215; 617/353-4477.

Grievance and Arbitration Procedures under Title IX Students who believe they have been discriminated against because of their race, color, creed, religion, ethnic origin, sex, age, or physical disability may file, in writing, a formal grievance with the Dean of Students. The written statement should be as specific as possible regarding the action that precipitated the grievance: date, place, and people involved; efforts made to settle the matter informally; and the remedy sought.

Within one week of receiving the statement, the Dean of Students will send a copy to the appropriate person. If the complaint raises an academic question, the statement is sent to the dean of the School or College involved; if a nonacademic unit is concerned, the statement is sent to the administrative head of that unit. Individuals whose actions or inactions are the subject of the grievance receive a copy from their dean or administrative head and have an opportunity to respond in writing.

The dean or administrative head will try to meet with all concerned parties within two weeks of receiving the statement. He or she may receive both oral and written presentations and may make independent inquiry.

Within one week after such a meeting, the dean or administrative head makes a decision as to the merits of the statement and appropriate resolution of the grievance. Copies of this decision are sent to the student, the individuals whose actions are the subject of the grievance, the Dean of Students, and the Provost. If dissatisfied with the decision, the student may appeal to the Dean of Students, and from there to the Provost.

A record of all formal grievances is kept in the Office of the Vice President and Dean of Students, East Tower of the George Sherman Union, 775 Commonwealth Avenue, Boston, MA 02215. Copies of all written statements, letters, etc., relating to a grievance should be sent to that office.

Student Retention Information Statistics for the student retention rate at Boston University are available on request from the Office of the Registrar, 881 Commonwealth Avenue, in accordance with the Education Amendments of 1976, Section 493A.



FINANCIAL INFORMATION

Tuition, fees, residence and board charges, and any previous balance must be paid in full each semester before the official registration deadline. Invoices are mailed to preregistered students' permanent addresses several weeks before the start of the semester. Payments made in advance of registration should be directed to the Office of the Comptroller, P.O. Box 4105, Boston, MA 02215, at least three weeks before classes start.

The University accepts MasterCard, Discover Card, and VISA. Checks must be made payable to Boston University.

Although the University does not offer its own deferred payment plan for full-time students, parents may arrange for financing through private agencies. This should be done well before the start of the academic year. Information on such plans may be obtained by contacting Student Accounting Services, 881 Commonwealth Avenue, Boston, MA 02215; 617/353-2264. The Office of Financial Assistance, 881 Commonwealth Avenue, also provides information on meeting college costs in their booklet, *Financial Assistance: General Information*.

Deposits made on acceptance of the University's offer of admission are credited to the student's semester bill.

The University assumes no liability for failure to provide educational or related services arising out of or due to causes beyond the reasonable control of the University. The University will exert reasonable efforts to provide comparable or substantially equivalent services, but its inability to do so shall not subject it to liability. The Trustees of the University reserve the right to change tuition rates, fees, and residence and board charges at their discretion when it is deemed advisable.

Tuition and Mandatory Fees

It has been and remains the policy of Boston University to withhold all diplomas, degrees, official transcripts, and other official recognition of work done at the University from students with respect to whom there

are any outstanding overdue debts to the University, including, but not limited to, amounts owed in satisfaction of tuition, loan agreements, fees, and charges as well as monies owed for occupancy in University-owned or -operated residences and for dining service. No student may withdraw from the University in good standing or graduate from the University unless all current obligations to the University are paid in full.

Full-Time Students (1995-1996)

(enrolled for 12 to 18 credits)

Tuition: \$19,420 per year.

Graduate Program Fee:

Full-time students: \$25 per semester.

Part-time students: \$10 per semester.

Please note that all students in the MD programs are assessed \$375 in the fall semester.

In figuring total expense, the student must add to the above tuition and fees his or her residence and board charges, medical

insurance, and any special fees, personal expenses, or other charges the student may incur. Current costs for such items are given in the pages that follow.

Part-Time Students (1995-1996)

(enrolled for 1/2 to 11 1/2 credits)

Tuition: \$607 per credit.

Registration Fee: \$40 per semester.

Medical Insurance

The 1994/95 cost for full-time students (U.S. citizens and international) is \$509 per year. The 1995/96 rate has not been determined.

Massachusetts law requires all students carrying at least 75 percent of the full-time curriculum to be covered under a qualifying medical insurance plan. If the student does not wish to participate in the Boston University Medical Insurance plan, he or she must annually file a Medical Insurance



Waiver form that certifies coverage under a comparable medical insurance plan. The Medical Insurance Waiver form should be returned to Student Accounting Services, 881 Commonwealth Avenue, Boston, MA 02215-1390.

Part-time students are also eligible to purchase the medical insurance. For information, contact Student Accounting Services, 881 Commonwealth Avenue, Boston, MA 02215-1390.

The insurance premium is subject to change.

Other Expenses

The estimated cost of books and supplies is \$775 per year. Approximately \$1,025 to \$2,725 should be allowed for incidental expenses, which vary with individual circumstances, such as transportation, laundry, clothing, recreation, and miscellaneous expenditures.

Following are other charges that may form part of the cost of attending Boston University:

Application for Admission: \$50.

Late Fee: A minimum late fee of \$100 for full-time students and \$50 for part-time students may be assessed to those students who complete their official registration during the late registration period.

Transcripts: To request an academic transcript of grades and coursework, a student should submit a Transcript Request form to the Office of the University Registrar. Letter requests will be honored if they are signed and give complete information about attendance, including enrollment dates, College(s) of registration, and degree(s) earned. Official transcripts are mailed approximately two weeks after receipt of the request. The transcript fee is \$3 per copy, and payment must accompany the request. For transcripts sent express mail, add \$7.50 per address. The express mail charge is subject to change depending on the carrier used. Unofficial transcripts for student use may be obtained from the Office of the University Registrar on a walk-in basis, Monday through Friday, 9 a.m. to 5 p.m.

Replacement of Student Identification Cards: \$20; \$5 for nonphoto ID cards.



Room and Board Charges

Students assigned to dormitory-style residences are provided dining service as an integral part of the Residence License Agreement and are required to select a meal plan when signing this agreement. Students assigned to apartment-style residences have the option of contracting for a dining plan. Those students electing this option must complete a separate Optional Dining Plan Contract. Payment or proof of payment is required at the time the contract is completed. Further information on dining plans and the dining program is mailed to students with the Residence License Agreement. Optional Dining Plan Contracts will be available for University apartment residents and off-campus students during on-campus registration in the fall.

The Trustees of the University reserve the right to change residence and board fees and to assess students for special services when such action is deemed necessary. Current fees for the full academic year are listed below.

Residence Charges

Double, triple, and quad room: \$4,110 per year.
Multiple-occupancy room in suite: \$4,380 per year.

Suite in Shelton Hall: \$4,620 per year.
Suite in 1019 Commonwealth Avenue: \$4,620 per year.
Single without private bath: \$5,420 per year.
Single with private bath: \$5,710 per year.
Apartment with two or more students: \$5,180 per year.
Single room in an apartment (9 months, single occupancy): \$6,270 per year.
Apartment with one student: \$6,970 per year (9 months, single occupancy).

Board Charges—Dining Plans (residence or contract)

Ultimate—276 Meal Plan (63,000 points)*: \$2,990
Dynamic Diner—230 Meal Plan (93,000 points)*: \$2,990
Flexible Diner—166 Meal Plan (150,000 points)*: \$2,990
Social Light—10 Meal Plan (50,000 points)*: \$2,990
Square Mealer—14 Meal Plan (22,000 points)*: \$2,990
Traditional—20 Meal Plan (15,000 points)*: \$3,198

*Points listed for FY-96 only.

Apartment Rentals

Following are average monthly rates for privately owned, unfurnished apartments in the Boston University area. Generally, no utilities are included in the rental rate.

Studios: \$575–\$675.

One bedroom: \$675–\$775.

Two bedroom: \$950–\$1,300.

Withdrawals and Refunds

A student who submits a Registration form for a semester and who decides not to attend must file an official Withdrawal/Leave of Absence form.

Part-time students who reduce their course loads, but remain registered during the first five weeks of the fall or spring semester, will have their accounts adjusted for the difference between the original and reassessed tuition charges.

Part- and full-time students who find it necessary to withdraw completely from the University must file an official Withdrawal/Leave of Absence form with the Office of the Dean of Students, 775 Commonwealth Avenue, East Tower, within five days of the withdrawal. Mere absence from classes does

not reduce a student's financial obligation or guarantee that a final grade will not be recorded.

A student who withdraws from the University before classes start is eligible to receive full credit of tuition and fees, excluding nonrefundable deposits and the application fee. No fees are returned after classes start. Students withdrawing during the first two weeks of classes are eligible to receive a credit of 80 percent of their tuition only; during the third week, 60 percent; during the fourth week, 40 percent; and during the fifth week, 20 percent. After the fifth week of classes, there will be no credit.

A credit balance (overpayment) resulting from withdrawal, cash payment, and/or other adjustment will be refunded upon written request or a personal visit to Student Accounting Services, 881 Commonwealth Avenue, Fourth Floor, Boston, MA 02215-1390.

All students with financial aid or student loans should contact the Office of Financial Assistance about their eligibility for a refund. Students who received federal funds and who are attending Boston University for the first time are eligible for a prorated refund of all

University charges. The pro rata refund policy permits Boston University to retain the amount of charges that is proportional to the portion of the enrollment period that was completed by the student. The policy is in effect for any withdrawal that occurs before the 60 percent point in the semester.

FINANCIAL AID

Federal regulations restrict all federal funds to citizens or permanent residents of the United States. Boston University therefore requires international students applying for admission to present evidence of sufficient funds to cover all tuition, fees, books, and living expenses for their study at Boston University. International students applying to the Graduate School may apply for the University funds listed below.

Financial aid awarded by Boston University may be used for course requirements toward the degree. **It may not be used for courses taken as corequisites, prerequisites, audits, or no credit, withdrawn with a "W" grade, GSU Fee or Registration Fee and may not exceed the cost**





of required tuition and fees. **Financial aid does not cover the Health Services Fee.**

Fellowships, Assistantships, and Scholarships

The application for admission also serves as the application for financial aid when the "yes" box is checked. Applications for the appointments listed below, with the exceptions noted, must be received no later than January 15 for fall, or October 15 for spring. Applications received after those dates are considered as departmental funds allow. Currently enrolled degree candidates must submit a separate GRS Financial Aid application each year by February 1. Forms are available in the Graduate School Office.

Presidential University Graduate Fellowships

These fellowships provide, for exceptionally well-qualified entering PhD students, one full year of support. This award requires no service; it includes a substantial stipend and full tuition scholarship. Students may not apply directly for these awards. Nominees are proposed by the Graduate School departments, divisions, and programs, and are reviewed by the Graduate School Presidential University Fellowship Committee, which makes final recommendations for awards to the Associate Dean of the Graduate School. Nominations are proposed early in

the admission application processing cycle. Applicants who wish to be considered should, therefore, submit their admissions applications well before the January 15 deadline.

Presidential University Teaching Fellowships

These teaching fellowships are awarded to continuing students who received Presidential University Graduate Fellowships in their first year of study and who have been nominated by their departments. Recipients provide teaching support in undergraduate instruction, and for this service receive a generous stipend and tuition scholarship for up to eight courses. The University is required to report the stipend portion of the award as income to the federal and state government, and the student is subject to appropriate federal tax laws.

Graduate Assistantships Graduate assistantships are available in several departments and programs. Inquiries regarding the availability of graduate assistant support may be made at the offices of the various departments and programs. Duties vary according to the needs of individual departments and require up to 15 hours of service per week. Each assistant receives tuition to a maximum of four full courses per semester. In most cases, fees are also included with the award, which is applied directly to the student's account, less withholding taxes. The student

is then obligated to settle all remaining charges. Because services are performed by the student, the University must report the award to the federal government as income. The student is then subject to appropriate federal and state tax laws.

Department Traineeships, Research Assistantships, and Research Fellowships

Awards are available in many departments. Duties vary but stipends are generally comparable to those of teaching fellowships. For information, consult the department chairman.

Martin Luther King Jr. Fellowship This fellowship is available to African American students who are new to Boston University and beginning graduate studies in any department. It provides a scholarship for full-time tuition and fees plus a stipend for living expenses. Students may not apply directly for this fellowship, but are nominated by the department of admission. To be considered for this fellowship, a student should indicate in the appropriate place on the application for admission that he or she is an African American.

Whitney M. Young, Jr., Fellowship This fellowship is open to African American citizens of the United States. Applicants may be entering and continuing graduate students who have displayed academic proficiency in

a field related to race relations or urban problems. The fellowship provides a stipend for living expenses plus a scholarship for full tuition and fees. Application forms are available from the Graduate School beginning November 1.

Loans and Work-Study

Applicants for both Federal Stafford Loans and Federal College Work-Study are required to file a Free Application for Federal Student Aid (FAFSA) with the College Scholarship Service or other processor.

Federal Stafford Loans Federal Stafford Loans are government subsidized and unsubsidized, guaranteed educational loans. Graduate students may be eligible for up to \$8,500 per year in a subsidized loan and up to \$10,000 per year in an unsubsidized loan. However, the annual loan amount cannot exceed a student's calculated need. Total outstanding Stafford Loans may not exceed \$138,500 for undergraduate and graduate study. Stafford Loan applications are available from the Boston University Office of Financial Assistance, the Graduate School Financial Aid Office, or participating Massachusetts lenders.

Annual interest for first-time borrowers will be a variable rate (T-Bill plus 3.1 percent) capped at 8.25 percent. For subsidized Federal Stafford Loans, repayment is deferred until six months after the student ceases to be enrolled at least half-time. The Federal government pays the annual interest for subsidized Federal Stafford Loans while a student is enrolled.

Federal Work-Study The Federal Work-Study Program is a government-funded program that promotes access to employment for students who demonstrate financial need. The Graduate School Financial Aid Office selects as many applicants for this program as funding allows. If you wish additional information, request a copy of the *College Work-Study Program* brochure from the Division of Graduate Medical Sciences. Applications are available at the Division Office and are due February 1 for summer Work-Study and May 1 for academic year Work-Study.

External Sources of Financial Support

In addition to these internal programs, there are many external sources of financial support for which Graduate School students are eligible. Usually these are extremely competitive. Because applications must be submitted as much as a year in advance, students should investigate early and plan ahead.

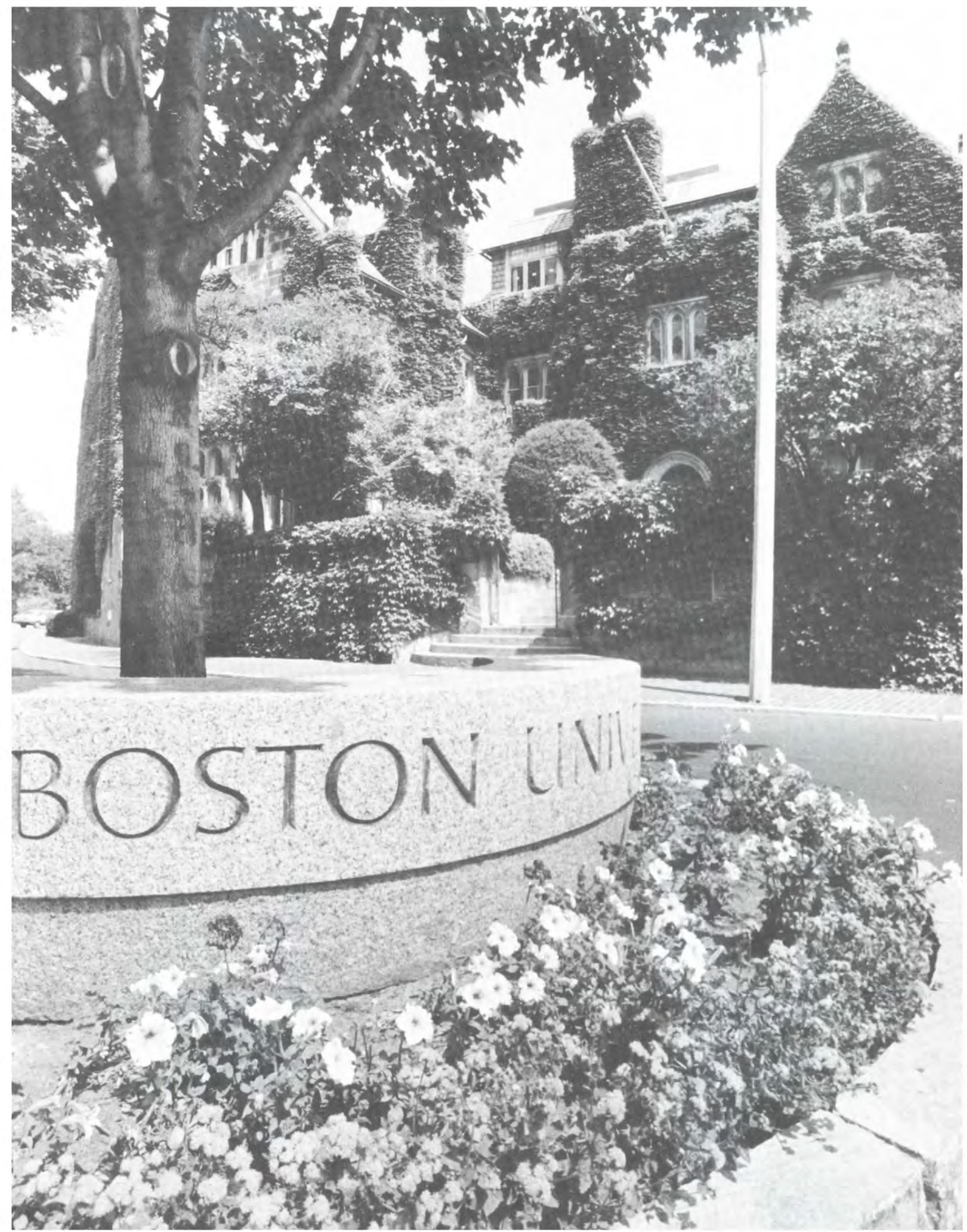
Many deadlines are in the fall. Department chairmen receive copies of current award opportunities that are received by the Dean's Office. It is also advisable to consult the *Grants Register*, *Annual Register of Grant Support*, and the *Foundation Directory*.

Fulbright-Hays Study Abroad Grants These grants provide funds for study and research abroad to students with at least a bachelor's degree who have not received a PhD. The applicant submits a proposal for study in a foreign country in whose language he or she is proficient. Applicants without prior study abroad are given preference. On a national basis, approximately 500 grants are awarded annually, providing for study and research in at least 50 countries. Applications, which are available in mid-August for the October 15 deadline, may be obtained from the Division office.

National Science Foundation Fellowships The NSF Graduate Fellowship and the NSF Minority Graduate Fellowship are three-year fellowships open to those U.S. citizens who are at or near the beginning of their graduate study in science or engineering. These fellowships provide a cost-of-education allowance and a stipend for living expenses. Applications are available from The Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418. The deadline is in November.

United Methodist Fund Scholarships ranging from \$500 to \$2,500 are provided by the Board of Education of the Methodist Church to those who have been members of that church for three years and who intend to teach in liberal arts colleges. These awards are available to qualified students in any department. Application forms are available by writing to P.O. Box 871, Nashville, TN 37202.

Methodist Loan Fund The Board of Education of the Methodist Church lends financial aid to qualified students on interest-bearing promissory notes. Descriptive material may be secured by writing to P.O. Box 871, Nashville, TN 37202.



THE UNIVERSITY

Boston University, the third-largest independent university in the United States, is a hub of intellectual, scientific, and cultural activity. With more than 2,500 faculty members and more than 29,000 students, it pursues the ideal of a research university—that knowledge is best acquired in the pursuit of new knowledge, and that both undergraduate and graduate students benefit by learning from individuals who are actively engaged in original research.

The University traces its roots to a school founded in Vermont in 1839, which moved to Boston in 1867 to become the first American university to be modeled on the European system. Today the University retains its dual character: Yankee independence combined with a cosmopolitan outlook. Within the University, 15 Schools and Colleges offer a total of more than 250 degree programs. Academic departments and research institutes serve as small communities for students and scholars, who also participate fully in the excitement and variety of the larger University community.

Boston University is coeducational and nonsectarian. Its campus extends over 71 acres from the historic Back Bay section of Boston westward along the south bank of the Charles River. From the townhouses of Bay State Road to state-of-the-art laboratories and classrooms, and from peaceful parks and esplanades to the city life of Commonwealth Avenue, the University offers a clean, safe, and attractive environment in which students live and study. A separate medical campus in the South End of Boston is home to world-renowned medical researchers and teaching physicians.

Founded by a group of Methodist lay leaders, Boston University has always been strongly committed to equality in opportunity, without regard to race, color, creed, sex, or national origin. It was the first institution of higher education in Massachusetts to grant degrees to women, and it graduated the first African American woman MD and the first woman PhD. It stood nearly alone

in its early years when it opened its doors to African Americans and international students from all continents. The University's commitment to the recruitment of minorities and women continues today within the student body and the faculty.

The University is a progressive, recognized innovator in health care, science, engineering, communications, management, and education. The two-year College of General Studies introduced the first college program in the country organized around a team method of instruction. The University initiated accelerated programs in liberal arts/medical education, liberal arts/dental education, and liberal arts/law education. Numerous interdisciplinary programs offer broad possibilities for combining career goals and personal interests.

Boston University is accredited by the New England Association of Schools and Colleges, Inc. Individual Schools and programs are accredited by other professional associations. Please see School bulletins for information.

An urban institution from its inception, Boston University has always recognized that its future is linked with the future of its city. The University fosters programs that promote the well-being of Boston's citizens and improve its environment. Major undertakings, such as the Chelsea Schools initiative, illustrate the University's commitment to the community.



OTHER SCHOOLS AND COLLEGES OF BOSTON UNIVERSITY

From innovative, two-year, basic study programs to its world-famous graduate schools, Boston University offers a student at any academic juncture a wide variety of options. The other Schools and Colleges of Boston University are briefly described below. If you would like further details regarding any program of the University, write to Boston University Graduate Programs, P.O. Box 886, or Boston University Undergraduate Programs, P.O. Box 887, Boston, MA 02215.

School for the Arts The School for the Arts encompasses the Music Division, Theatre Arts Division, and Visual Arts Division. Each provides its students with intensive training for professional careers, teaching, or research. Studies are augmented by courses in language, the humanities, and other areas through the various Schools and Colleges of the University. Bachelor's and master's degrees are awarded in each of the divisions. In addition, the Music Division offers the Doctor of Musical Arts (MusAD) degree, the Artist Diploma in Performance, and the Certificate in Opera. The Theatre Arts Division offers the Certificate Program for Artisans and Technicians.

College of Communication The College's undergraduate program leads to the Bachelor of Science (BS) in Broadcasting and Film, Journalism, or Communication. The Master of Science (MS) is offered in Broadcasting, Broadcast Administration, Broadcast Journalism, Business and Economics Journalism, Film, Journalism, Mass Communication, and Public Relations. There are two dual degree programs. One leads to the MS in Broadcast Administration and MBA from the School of Management, and the second leads to the MS in Mass Communication and Juris Doctor (JD) from the School of Law. There is also a joint MA in International Relations and International Communications through the Graduate School.

School of Education Programs of study are offered for the Bachelor of Science (BS), Master of Arts in Teaching (MAT), Master of Education (EdM), Certificate of Advanced Graduate Study (CAGS), and the Doctor of Education (EdD). Professional specialization is available in more than 20 areas within four departments: Administration, Training, and Policy Studies; Curriculum and Teaching; Developmental Studies and Counseling; and Special Education.

College of Engineering The program of study for the Bachelor of Science (BS) degree prepares students not only for a career in engineering but also for further study in other areas. Degree programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) and are available in Aerospace, Biomedical, Computer, Electrical, Manufacturing, Mechanical, and Systems Engineering. A major in Interdisciplinary Engineering is also available for student-planned studies. The Cooperative Education–Professional Practice Program integrates the student's academic studies with a paid professional work experience. The ENGMEDIC program allows students to earn a BS in Biomedical Engineering from the College of Engineering and an MD from the School of Medicine. Programs are also offered leading to the Master of Science (MS) and Doctor of Philosophy (PhD) degrees. The MS program in Manufacturing Engineering may be combined with the MBA program from the School of Management.

College of General Studies The College of General Studies offers a two-year, general education core curriculum taught through a team system of instruction and oriented toward students whose traditional admission credentials, such as scholastic aptitude scores and high school grade averages, may make them ineligible for direct admission into the University's four-year programs. Students who satisfactorily complete the prescribed 56 credit hours of the general education core curriculum and 8 credit hours of approved elective courses are eligible for continuation into nearly all of the University's four-year Schools and Colleges.

Goldman School of Graduate Dentistry

The School offers a four-year predoctoral program leading to the Doctor of Dental Medicine (DMD). In cooperation with the College of Liberal Arts, the School offers the Seven-Year Liberal Arts/Dental Education program, Postdoctoral programs in all the

dental specialties lead to the Certificate of Advanced Graduate Study (CAGS). In addition, the School offers the Master of Science in Dentistry, the Doctor of Science in Dentistry, the Master of Science and Doctor of Science in Nutritional Sciences, and the Master of Science in Dental Public Health.

The Office of Continuing Education provides short, intensive courses of interest to general practitioners, dental auxiliaries, and specialists in all phases of dental science.

Graduate School The Graduate School offers Master of Arts (MA) and Doctor of Philosophy (PhD) programs in close to 40 fields in the humanities, social sciences, natural sciences, and in interdisciplinary programs.

A joint PhD program is offered with the School of Social Work (in Sociology and Social Work), and a joint MA in International Relations and International Communications is offered through the College of Communication.

Dual degree programs with other Schools allow students simultaneously to earn the MA in International Relations or Preservation Studies and the JD from the School of Law; the MA in Economics, Economic Policy, or International Relations, and the MBA from the Graduate School of Management; or the MA in Economics and the MPH from the School of Public Health.

School of Law The School of Law offers a three-year program of full-time study leading to the Juris Doctor (JD) degree. Particular strengths of the School in Intellectual Property Law and Health Law allow students to pursue concentrations in those areas. Students also have a choice of six dual degrees with other Schools of Boston University. These programs allow students to combine a JD degree with an MBA; an MBA in Health Care Management; an MS in Mass Communication; a Master of Public Health; an MA in Historic Preservation Studies; or an MA in International Relations. Students interested in International Law also have the opportunity to study abroad for a semester under exchange programs with Oxford University in England and the Université Jean Moulin–Lyon III in Lyon, France.

School of Law clinics include both defender and prosecutor programs, a Legal Aid Clinic, a Legal Externship Program, a Judicial Internship Program, a program in Legislative Services, and a program aiding hospitalized and mentally-ill clients.

The School offers two graduate programs: the Master of Laws (LLM) in Taxation and the Master of Laws in Banking Law Studies.

Five research centers have formed around

areas of scholarship at the School: the Morin Center for Banking Law Studies; the Center for Law and Health Sciences; the Center for Law and Technology; the Institute of Jewish Law; and the N. Neal Pike Institute on Law and Disability.

College of Liberal Arts The College of Liberal Arts provides BA and, in conjunction with the Graduate School, BA/MA programs in the natural sciences, humanities, and social sciences, offering more than 50 concentrations in 23 departments and numerous interdisciplinary centers. Students in the University's other four-year undergraduate Colleges take their required and elective liberal arts courses in the College of Liberal Arts.

School of Management Undergraduate and graduate degree programs prepare individuals for management positions in corporations, small businesses, government, health, and nonprofit organizations. The Bachelor of Science in Business Administration (BSBA) provides students with a core of skills and concepts applicable to management careers. The Master of Business Administration (MBA) program, which includes concentrations in *Health Care Management*, *Public Management*, and *Business Administration and Management*, is offered on a part- or full-time basis. There is also an executive MBA program offered at Boston University's Tyngsboro, Massachusetts, campus. The MBA curriculum prepares students for leadership positions in the management of business, health, and public-sector institutions. Dual degree MBA programs are offered with the JD at the School of Law; the MA in Economics, the MA in Economic Policy, and the MA in International Relations at the Graduate School; the MS in Manufacturing Engineering at the College of Engineering; the MA in Medical Sciences at the School of Medicine; and the MS in Broadcast Administration at the College of Communication. The School of Management's Master of Science in Management Information Systems (MSMIS) program prepares graduates of accredited undergraduate management programs for careers that integrate the needs of management and computerized information systems capabilities. The Doctor of Business Administration (DBA) program leads to professional research and consulting positions in industry, government, and nonprofit settings.

School of Medicine The School of Medicine offers multiple pathways leading to the MD degree, including a four-year program. A

seven-year program, which began in 1960, leads to the BA and MD degrees; students also have the option of completing this program in six years. The Modular Medical Integrated Curriculum (MMEDIC), a non-accelerated, eight-year program leading to the BA and MD degrees, began in 1977. It was expanded in 1990 to allow early selection of qualified Biomedical Engineering students (The Engineering/Medical Integrated Curriculum—ENGMEDIC). The Early Medical School Selection program offers early admission to candidates at participating minority colleges and universities to increase the minority physician population. The School of Medicine also provides an alternative curriculum that allows students the option of completing the first year of medical school in two academic years. A program leading to the MD/MPH degree is offered through the School of Medicine and the School of Public Health.

The School of Medicine also offers the Master of Arts (MA) in Anatomy, Biochemistry, Biophysics, Medical Sciences, Microbiology, Pharmacology, and Physiology. The Doctor of Philosophy (PhD) is offered in Anatomy, Behavioral Neuroscience, Biochemistry, Biophysics, Microbiology, Pathology, Pharmacology, and Physiology.

In the fall of 1992, on-campus housing became available to medical students in Harrison Court, a completely renovated, elegant nineteenth-century structure on Harrison Avenue.

The School of Public Health. This School, within the School of Medicine, offers part- and full-time programs leading to the Master of Public Health (MPH) degree with concentrations in Environmental Health; Epidemiology and Biostatistics; Health Law; Health Services; and Social and Behavioral Sciences. Doctoral (DSc) programs in Epidemiology and Environmental Health are also offered. The School also offers the Doctor of Philosophy (PhD) and the Master of Arts (MA) in Biostatistics jointly with the Mathematics Department in the Graduate School. Five dual degree programs are available: MD/MPH, MA (in Economics)/MPH, MA (in Medical Sciences)/MPH, MSW/MPH, and JD/MPH. A Nurse Midwifery/MPH program has recently been instituted. The School has also established an MPH program incorporating Peace Corps experience. In addition, the School's Center for International Health offers several short-term certificate programs in international health. For further information, call or write the Office of Admissions, Boston University



School of Public Health, 80 East Concord Street, A-403, Boston, MA 02118; 617/638-4640; Fax: 617/638-5299.

The Program in Biomedical Laboratory and Clinical Sciences, offered jointly with Metropolitan College, provides part- and full-time certificate and degree programs that prepare high school graduates and college students for positions in clinical or biotechnology laboratories. A unique Work/Tech program provides degree candidates with jobs in Boston-area biomedical companies that offer both salary and tuition benefits. Call 617/541-5622 for details and information on other programs offered to high school science teachers and high school students.

Metropolitan College Since 1965, Metropolitan College has been serving working adults who might not otherwise have the opportunity to take courses or earn degrees. With the exception of the Science and Engineering Program, classes are scheduled for evening sessions. In addition to the Charles River Campus, some courses are offered at the Tyngsboro Campus; and other programs are offered overseas.

The Associate of Science (AS) degree is offered in Accounting, Biomedical Laboratory and Clinical Sciences, Computer Science, Criminal Justice, and Management Studies. The Bachelor of Science (BS) degree

is offered in Biology, Biomedical Laboratory and Clinical Sciences, Computer Science, Economics, Engineering Management, Interdisciplinary Studies, Management Studies, Mathematics, Paralegal Studies, Psychology, Sociology, and Urban Affairs. The Bachelor of Liberal Studies (BLS) degree program offers a traditional liberal arts education in Art History, English, History, Interdisciplinary Studies, and Philosophy.

There are two special undergraduate credit programs: an Accelerated Program designed to accelerate the process of obtaining a bachelor's degree, and the Science and Engineering Program, a two-year, full-time curriculum for students whose preparation for science and engineering should be enhanced.

Graduate degree programs offered are the Master of Science (MS) in Actuarial Science; MS in Administrative Studies; MS in Computer Science; MS in Computer Information Systems; Master of Liberal Arts (MLA) in Interdisciplinary Studies; Master of Criminal Justice (MCJ); Master of Urban Affairs (MUA); and Master of City Planning (MCP). For more information, write to Metropolitan College, 755 Commonwealth Avenue, Boston, MA 02215; 617/353-6000.

The College also maintains the Corporate Education Center, a 220-acre satellite cam-

pus in Tyngsboro, about 30 miles north of Boston, where instruction is offered in several MET graduate programs in Computers and Management. The Corporate Education Center offers many professional development seminars in business, computers, and other technical areas, offered through the Center for Management Development, the Center for Information Technology, and the Computer Career Programs. These programs are also offered in Boston at 930 Commonwealth Avenue. The Corporate Education Center offers meeting and conference facilities as well as on-site training programs for business and industry.

Sargent College of Allied Health Professions

Sargent College offers programs leading to the Bachelor of Science (BS) in Athletic Training, Clinical Exercise Physiology, Communication Disorders, Health Studies, Human Physiology, Occupational Therapy, and Rehabilitation and Human Services. It is possible for students to enter the College with an undeclared major. During the first two years, faculty members and advisors help undeclared students select a major.

The Bachelor of Science in Health Studies and Master of Science in Physical Therapy program includes three years of preprofessional study and two and a half years of professional preparation. Performance will be reviewed during the third year of study; those meeting the established criteria will continue directly into the professional portion of the program. The Master of Science in Physical Therapy (MSPT) program, designed for those possessing a baccalaureate degree in another area, requires two and a half years of professional study. Both programs lead to eligibility for professional certification.

The Combined Bachelor of Science and Master of Science (BS and MS) degree program, leading to eligibility for professional certification, is an option for qualified students in Speech-Language Pathology and Rehabilitation Counseling. These departments also offer a two-year MS program that enables students to fulfill professional entry requirements. The Master of Science in Occupational Therapy (MSOT), a two-year program, provides professional education to men and women who hold bachelor's degrees in a variety of fields.

Advanced education for experienced health professionals includes programs leading to the MS in Nutrition, Exercise Science, Occupational Therapy, Rehabilitation

Counseling, Speech-Language Pathology, and Physical Therapy. The Certificate of Advanced Graduate Study (CAGS) is offered in Speech-Language Pathology and Audiology, Occupational Therapy, and Rehabilitation Counseling.

The Doctor of Science (ScD) can be earned in Applied Kinesiology, Audiology, Speech-Language Pathology, Applied Anatomy and Physiology, Rehabilitation Counseling, and Therapeutic Studies.

School of Public Health See "School of Medicine" listing.

School of Social Work The School offers part- and full-time programs leading to the Master of Social Work (MSW), with major method options in Clinical Social Work Practice (with individuals, families, and groups) and Macro Social Work Practice (community organization, human services, management, and social planning). Students may elect a subconcentration, such as Aging, Children and Youth, Health and Mental Health, Family Studies, or a program in Human Service Management. Dual degrees are available leading to the MTS/MSW or MDiv/MSW (with the School of Theology), the MPH/MSW (with the School of Public Health), or the MSW/EdM or MSW/EdD (with the School of Education). The PhD in Sociology and Social Work is offered in conjunction with the Graduate School.

School of Theology The School of Theology provides college and university graduates with professional education for ministry in the Christian Church and related vocations. Degree programs lead to the Master of Divinity (MDiv), Master of Theological Studies (MTS), Master of Sacred Music (MSM), Master of Sacred Theology (STM), Doctor of Theology (ThD), and Doctor of Ministry (DMin). Programs for the MA and PhD are available through the Division of Religious and Theological Studies of the Graduate School. Dual degree programs are offered within the School (MSM/MDiv) and with the School of Social Work (MSW/MDiv and MSW/MTS).

The University Professors (UNI) The teaching program of The University Professors is designed to respond to the need for rigorous and well-founded cross-disciplinary studies apparent in our cultural centers. This elusive, but principal, objective is achieved partly by emphasizing the fundamental humanistic values inherent in all academic endeavors.

The blurring of the deceptively distinct boundaries between the conventional disciplines has not passed unnoticed by many students, who have shown an interest in courses that integrate several disciplines around a central theme, frequently with challenging and illuminating results. Most courses taught by The University Professors are open to all Boston University students, and they can be taken either as electives or in order to meet degree requirements, always with the approval of the student's advisor.

The responsibility of teaching in The University Professors program is precisely associated with the mastery of several disciplines. Each member of the faculty has experience in a number of disciplines normally linked by current research commitments that better enable them to serve students who are themselves interested in extending, modifying, or integrating established fields of study around a flexible academic program.

The Bachelor of Arts (BA), Master of Arts (MA), combined Bachelor of Arts and Master of Arts (BA/MA), and the Doctor of Philosophy (PhD) degrees are offered by The University Professors.

International Graduate Centers Boston University's Metropolitan College and Graduate School operate graduate degree programs in six cities abroad. Metropolitan College offers the Master of Science in Management (MSM) in Beer Sheva, Israel; Brussels, Belgium; London, England; Paris, France; Rome, Italy; and Zaragoza, Spain. The Graduate School offers the Master of Arts (MA) in International Relations in Brussels, London, and Paris. Information is available from Boston University, International Graduate Centers, 755 Commonwealth Avenue, Boston, MA 02215-1783; 617/353-2982.

SPECIAL ACADEMIC UNITS OF THE UNIVERSITY

Center for Law and Health Sciences

The Center for Law and Health Sciences, a component of the School of Law, organizes and conducts research and educational programs that examine selected relationships between the legal and health-care systems. The center provides the School of Law with a vehicle for focusing research on interactions between law and health care. Center staff accomplish this function by teaching School of Law courses and seminars; providing consulting and guest-lecture services to other Schools of the University; performing research into selected health/law issues; contributing articles, reports, and other writings to scholarly publications of the center, the University, and other organizations; and organizing and conducting conferences and symposia on current medical/legal topics. Most current activities concern rights of individuals with mental or physical disabilities. Further information is available from the interim director, Professor Henry A. Beyer, School of Law, 765 Commonwealth Avenue, Boston, MA 02215; 617/353-2904.

Center for Psychiatric Rehabilitation

The Center for Psychiatric Rehabilitation, a part of Sargent College, conducts research directly relevant to the rehabilitation of persons with psychiatric disabilities and develops and disseminates preservice and in-service training programs. Jointly funded by the National Institute on Disability and Rehabilitation Research, and the Center for Mental Health Sciences, the center provides technical assistance, consultation, evaluation, and training for mental health and rehabilitation programs. Further information is available from the director, William A. Anthony, PhD, Center for Psychiatric Rehabilitation, 730 Commonwealth Avenue, Boston, MA 02215; 617/353-3549.

Gerontology Center

The Boston University Gerontology Center's focus is on research, consultation, and education in all aspects of the aging process

and the health and welfare of older persons. The center is University-wide, coordinating efforts to promote understanding and professional competence in the biological, medical, and social aspects of aging.

In addition to sponsoring lectures, workshops, and conferences, the center awards the Louis Lowy Certificate in Gerontological Studies to students in any University degree program who have completed a specified number of approved courses focusing on gerontology. The center awards the Certificate of Recognition for the Study of Aging to nondegree students wishing to increase their knowledge and skills through academic work in gerontology.

The annual Summer Institute in Gerontology offers academic courses and continu-

ing education workshops on a variety of timely topics pertaining to aging. A Certificate of Continuing Education in Gerontology is available to practicing professionals taking continuing education courses in the summer institute.

The Gerontology Center Library, at 53 Bay State Road, houses more than 3,000 books, periodicals, newsletters, government documents, reports, statistical data, and training aids. The library is open to the public Monday through Friday, 1:30 p.m. to 4:30 p.m.

Another integral part of the training and research capability of the Gerontology Center is the Home Medical Service, providing comprehensive health care to approximately 700 of Boston's homebound inner-city





elders. For further information on medical programs, contact Dr. Patricia Barry, Geriatrics, Doctors Office Building, 720 Harrison Avenue, Suite 1101, Boston, MA 02118. For more information on educational and certificate programs, contact Elizabeth Markson, PhD, Boston University Gerontology Center, 53 Bay State Road, Boston, MA, 02215; 617/353-5045.

Health Policy Institute

The Boston University Health Policy Institute conducts research, runs demonstration projects, convenes conferences, and publishes studies and reports on issues related to the efficiency, effectiveness, and availability of health services in the United States and abroad, and on entrepreneurship in health care. Through its director, who is the academic vice president for health affairs, the Health Policy Institute is linked with the School of Medicine and Public Health, the Henry M. Goldman School of Graduate Dentistry, the School of Social Work, the Sargent College of Allied Health Professions, and the Gerontology Center. For more information, write the director, Richard H. Egdahl, MD, 53 Bay State Road, Boston, MA 02215.

Boston University Cancer Research Center

Director, Douglas V. Faller

A major focus of Dr. Faller's laboratory is the study of the basic molecular and cellular biology of virus- and oncogene-transformed cells and tumors. He is involved in determin-

ing the mechanisms by which retroviruses and their oncogenes cause tumors, through defining the ways in which viruses control host cell gene expression.

A special interest concerning the laboratory involves viral regulation of those cellular genes encoding biologically important molecules and cytokines. Dr. Faller is analyzing the molecular mechanisms by which oncogene-transformed cells become autonomous of growth factor requirements. This work involves the elucidation of growth-factor signal transduction pathways in normal and transformed mesenchymal and lymphoid cells and study of the ways in which this signalling pathway is disrupted or circumvented in tumor cells. This work has resulted in new information regarding the transduction of growth-factor signals by second messenger systems in both normal and transformed cells.

A related area of the center's research is the interaction of retroviruses and the tumors they induce with cellular immune defense mechanisms. The means by which virus- or tumor-specific cytotoxic T lymphocytes, natural killer cells, and monocytes recognize and destroy infected cells and tumors is under investigation.

Dr. Faller is also studying the molecular mechanisms by which tumors escape from immune surveillance; the mechanisms of aberrant control of Class I Major Histocompatibility Antigen gene expression in oncogene-transformed cells, retrovirus-infected cells, and naturally occurring tumors are being determined; the direct sites of oncogene action on MHC gene transcription are

being mapped; a new transactivation property of murine leukemia viruses has been elucidated; the biological consequences of oncogene control of MHC expression are being studied by examining the interaction of these transformed cells with the cytotoxic T lymphocytes and natural killer cells of the cellular immune system.

Two other projects in Dr. Faller's laboratory are more clinically oriented. In addition to studying the abnormal regulation of growth factor expression in oncogene-expressing tumors, the regulation of production of these growth factors in normal cells in healthy or diseased states is being investigated. He has discovered that the production of potent vasoconstrictors and smooth muscle mitogens by human endothelial cells is transcriptionally regulated in response to environmental oxygen tension. In normal physiology, this local production of cytokines may account for the fine regulation of ventilation and perfusion in the lung. Under states of chronic hypoxia, this mechanism may account for the pathological changes of chronic pulmonary artery hypertension or sickle cell chronic lung disease. The oxygen-sensing molecule, second messenger systems, and oxygen-responsive promoter elements of the cytokine genes are being characterized and animal models are being used to test his hypothesis.

Factors regulating fetal globin transcription and production in man are also being studied to develop a pharmacologic therapy for the beta hemoglobinopathies of sickle cell anemia and thalassemia. In collaboration with Dr. Susan Perrine, Dr. Faller has developed transcriptional activators of human fetal globin genes. These agents are able to reverse the developmental globin gene switch in animals and significantly increase fetal globin expression in primates and in cultures of human erythroid cells. The transcriptional mechanisms affected by these agents are being elucidated and the drugs themselves are under development for clinical trials now under way.

Humanities Foundation

The Humanities Foundation administers special humanities programs and activities through a major National Endowment for the Humanities Challenge Grant awarded in 1981. The Humanities Foundation consists of several endowments to support graduate and undergraduate scholarships, visiting faculty, conferences, colloquia, lecture series, library acquisitions, and general program enrichment. It serves as a forum for dis-

cussing and shaping the future of the humanities at Boston University. Among its most important programs is the Society of Humanities Fellows, which makes it possible for junior faculty to have time off for research and provides a structure in which both junior and senior faculty can present and discuss research in progress. For further information, call or write the director, Katherine T. O'Connor, c/o the Department of Modern Foreign Languages, 718 Commonwealth Avenue, Boston, MA 02215; 617/353-6253.

Center for the Study of Communication and Deafness

The Center for the Study of Communication and Deafness, directed by Dr. Robert Hoffmeister, was established in 1982 to conduct research in parent-child interaction, the assessment of educational placements for deaf children, and the acquisition and use of American Sign Language by deaf children, in an effort to assist parents and professionals concerned with the education of the Deaf. Further information is available from Dr. Hoffmeister at the School of Education, 605 Commonwealth Avenue, Boston, MA 02215.

Center for Applied Research in Language

The Center for Applied Research in Language, directed by Dr. Paula Menyuk, was established to study the underlying processes of language and literacy, the development of oral and written language ability, and the role of environmental health factors in language development. Further information is available from Dr. Menyuk at the School of Education, 605 Commonwealth Avenue, Boston, MA 02215.

Morin Center for Banking Law Studies

Established in the School of Law in 1978, the Morin Center for Banking Law Studies administers the School of Law's graduate programs in American banking law studies and in international banking law studies. These unique, multidisciplinary programs, leading to the Master of Laws degree, train lawyers in the full range of banking law subjects as well as the economic and managerial aspects of the domestic and international financial services industry. The center also publishes the *Annual Review of Banking Law*, a scholarly publication edited by a staff of select law students, and conducts conferences and research studies in the legal areas affecting financial institutions. Information is

available from the director, Professor Thomas W. Cashel, Morin Center for Banking Law Studies, 765 Commonwealth Avenue, Boston, MA 02215; 617/353-3023.

Arthritis Center

The Medical Center serves to coordinate and organize the diverse arthritis and connective tissue activities, as well as develop new activities throughout the University. The center has developed an integrated program at Boston City Hospital, University Hospital, and the Boston Veterans' Administration Medical Center. The center has been designated a Multipurpose Arthritis Center by the National Institutes of Health since 1977. It occupies the fifth floor of the Conte Building of the Boston University School of Medicine, has health care research activities in a separate space, and other offices at the Boston Veterans' Administration Hospital.

The center's mission is to encourage and develop basic research and clinical investigations in arthritis and connective tissue diseases and to organize the undergraduate, graduate, and outreach education and clinical training programs. The center has been a national pioneer and referral center for studies of all types of amyloidosis with current emphasis on hereditary forms and on aspects of Alzheimer's disease using modern immunologic and molecular genetic techniques. It is a center for the study of scleroderma and fibroblast molecular biology as well. Investigations of cellular immunity in arthritis; studies of systemic lupus erythematosus, epidemiology of osteoarthritis, and of osteopo-

rosis; metaanalysis of treatment regimens in rheumatoid arthritis and lupus; economic impact of arthritis and other evaluations of health care outcomes all form part of the program. For further information contact Joseph H. Korn, MD, Arthritis Center, Conte Building 5th Floor, 80 East Concord Street, Boston, MA 02118; 617/638-4310.

Whitaker Cardiovascular Institute

The Whitaker Cardiovascular Institute is a broad-based multidisciplinary center designed to develop and encourage cardiovascular research, to promote educational programs in the University and in clinical and community settings, and to coordinate cardiovascular activities within the University. The institute assists in formulating research projects, developing grant applications, providing information on sources of funding, and critically reviewing grant and contract proposals in the cardiovascular area. For further information, write to Director, Whitaker Cardiovascular Institute, Boston University School of Medicine, 700 Albany Street, Boston, MA 02118; 617/638-4018.

Affiliated Institutions

Cooperative Agreements Students may receive credit for certain courses at Hebrew College of Brookline, which offers undergraduate and graduate degree programs in Hebrew and Jewish Studies. Consortium arrangements permit cross-registration with Boston College, Brandeis University, and Tufts University.



RESOURCES AND SERVICES

Boston University provides a variety of residence settings and social opportunities to contribute to students' educational and personal development. Listed below are some of the many campus facilities and resources designed to help students academically, socially, and medically; many of the important academic and administrative areas of the University are also listed.

There are many important University publications available. Boston University's *Lifebook* provides information about the details of daily life, from University regulations concerning bicycles, drugs, and fire safety to student organizations and ideas of what to do in the city. Copies of this guide are available from the Office of the Dean of Students in the George Sherman Union. The *Code of Student Responsibilities*, which affects all students, is also available from the dean's office.

Students are expected to be familiar with and abide by University regulations set forth in the *Lifebook*, in the *Code of Student Responsibilities*, and in any other official University publication or notice. Individual Schools, Colleges, and residence halls may have specific information and regulations that apply to their students, and these are usually available from their administrative offices.

Libraries

The staff of the Boston University libraries provides extensive service to the entire University community. The libraries contain a collection of 5.1 million volumes in paper and microform, thousands of current subscriptions, and hundreds of bibliographic, numeric, and full-text databases.

There are several specialized libraries with professional staff at the University: the School of Law, the Medical Center, the School of Theology; *Educational Resources*, *Communication*, and *Science/Engineering*.

The major research library is Mugar Memorial Library at 771 Commonwealth Avenue, offering, in addition to traditional

reference assistance, computerized literature searching through compact disc and on-line systems. An on-line catalog maintained here links the several major libraries at the University, with access to the catalog available through the University's campus dial-up modems.

Mugar's several unusual holdings and services include a strong African documents collection; a music section with listening stations for more than 200 people; and a Department of Special Collections containing rare books and historical manuscripts, the University's unique Twentieth-Century Archives, and other important resources. Exhibits from this fine special collection are regularly displayed throughout the library.

As a founding member of the Boston Library Consortium, the Boston University libraries provide access to the holdings of many other research collections in the area, more than 16 million volumes in paper and as many in microform.

Mugar Memorial Library is open 8 a.m. to midnight, Monday through Thursday; 8 a.m. to 11 p.m., Friday and Saturday; and 10 a.m. to midnight, Sunday; 617/353-3736.



Stone Science Library In 1987/88, the academic departments and centers that moved to the renovated Stone Science Building consolidated their collections. These now form a noncirculating research library that includes 10,000 volumes, 125 current journals, the University's map library, the Archaeological Institute of America archives, and the photographic archive of the NASA Apollo missions to the moon. Reference, course reserves, on-line databases, and photocopy services are provided. The library has professional staff and maintains an on-line catalog accessible through the University network. For more information contact David Sauer or Nasim Momen, Stone Science Library, 675 Commonwealth Avenue, Room 440; 617/353-5679.

Office of Information Technology (IT)

Students and faculty at Boston University have access to a variety of computing facilities through the Office of Information Technology. These facilities include a central UNIX timesharing system; a high-speed campus network; training facilities; the Personal Computing Support Center; a sophisticated scientific computing and visualization laboratory; and a Connection Machine CM 5, a massively parallel supercomputer. Students at all levels of computer sophistication are encouraged to take advantage of these facilities. Assistance is always available at the Office of Information Technology.

All students and faculty may open accounts on the shared academic system free of charge. Currently a cluster of IBM RS/6000's supports a wide range of applications under the UNIX operating system. The X Window System and Motif provide a graphical user interface to UNIX analogous to the familiar Macintosh user interface. In addition to a standard complement of programming languages, a variety of statistical packages, mathematical subroutine libraries, text processors, graphics packages, and a spreadsheet package are also available.

Boston University's Campus Network employs the latest technology to route communications among computing systems throughout the Charles River Campus. Thousands of ports supporting communications rates up to 10 million bits per second are interconnected via optical fiber and high-speed routers. Over 150 dial-in modems provide students and faculty with remote access to the Campus Network from their residences at speeds of up to 14400 bits per second. Additional links connect the Charles River Campus to the Boston University Medical Center campus, Harvard University, and Massachusetts Institute of Technology. The Campus Network is also connected to all major regional, national, and international research and educational networks, providing students and faculty with electronic access to people and facilities throughout the world.

Information Technology's Consulting Services department provides consulting support in most areas of computing. *Consulting Services* maintains Help Desks at the public clusters located at 111 Cummington Street and on the third floor of Mugar Memorial Library. Information Technology staff present a comprehensive series of free training sessions during the fall and spring semesters. Topics range from general "getting started" sessions for the computing novice to in-depth sessions on specific application software packages.

Information Technology's Personal Computing Support Center (PCSC) is dedicated to helping Boston University students, faculty, and academic staff use their Macintosh and IBM personal computers effectively. The PCSC provides consulting, hands-on training for many popular applications, technical support, product demonstration, file recovery, and file translation. Reference and software evaluation libraries are also maintained by the PCSC.

Central timesharing facilities are available 24 hours daily except during system backup (Sunday and Wednesday, 5 a.m. to 10 a.m.) and scheduled holidays. Direct any questions regarding computing services to the Office of Information Technology. The main office, at 111 Cummington Street, is open Monday through Friday, 9 a.m. to 5 p.m.; 617/353-2780. The PCSC is open Monday through Friday, 9 a.m. to 4:30 p.m.; 617/353-7272.

Student Health Services

General Information Top-notch health care is available to all full-time students at Student Health Services, located at 881 Common-

wealth Avenue, West Entrance. Student Health Services consists of the Medical Walk-in Clinic, the Mental Health Clinic which includes a Crisis Counselor, and the 14-bed Infirmary. In general, there is no charge to full-time students for services provided at Student Health Services by staff physicians, psychiatrists, psychologists, and nurses, or for staying at the Infirmary. However, students are responsible for certain tests and medications provided at either the Infirmary or the Medical Clinic. The cost of services obtained outside the Medical Clinic, such as doctors' bills, X rays, lab tests, ambulance services, hospitalization, and surgery, are the student's responsibility.

Massachusetts law requires students at institutions of higher education in the state to have adequate health insurance. Those persons affected by this law include full-time students, or part-time students who participate in at least 75 percent of the full-time curriculum. The student health insurance plan offered through the University is a qualifying insurance program. Students who do not accept the school health insurance must certify in writing before each academic year that they are participating in a comparable health insurance program.

In order to be officially registered, students must submit to Student Health Services a Medical History and Physical Examination form and an immunization form that have been filled out and signed by a physician. The immunization form must include the day, month, and year of the following required immunizations: tetanus, diphtheria, measles (two shots), mumps, and rubella. This form is sent to each student who has been accepted for admission and may also be obtained at Student Health Services.

Medical Walk-in Clinic Medical consultation is available for diagnosis and treatment on a walk-in basis with staff physicians and nurses. At its discretion, the clinic may administer allergy shots for a fee of \$100 per semester to students who supply their vaccine with clear, precise instructions by their physicians. Hours: the clinic is open year-round, Monday through Friday, 9 a.m. to 4:30 p.m. It is closed on University holidays. For further information, call 617/353-3575.

Mental Health Clinic Consultation with either a psychologist or psychiatrist is by appointment and confidential. Hours: the Mental Health Clinic is open from 9 a.m. to 5 p.m. during the academic year, and closed on University holidays. Emergency mental

health care is available 24 hours a day during the academic year by calling 617/353-3569 or 617/353-3575, and during the summer (commencement through September school opening) by calling 617/353-2121.

Infirmary The Infirmary admits students who are too ill to care for themselves properly in their dormitories or apartments, but who are not ill enough to be hospitalized. Hours: visiting hours are from 1 to 8 p.m.; the Infirmary is open 24 hours a day during the academic year, and provides emergency treatment by nurses during non-Clinic hours. Please call 617/353-3578 for further information.

Crisis Intervention A crisis intervention counselor is on call to help students with serious problems that arise at any time. These problems may include emotional stress, alcohol or drug abuse, crime, or any other crises that a student may encounter. The counselor can be contacted on an emergency basis 24 hours a day, including weekends, by telephoning the University Police at 617/353-2121.

The Sargent Clinic at Boston University

The Sargent Clinic at Boston University provides services in audiology, occupational therapy, physical therapy, speech-language pathology, and vocational rehabilitation for clients from the Boston University community and the Greater Boston area. The clinic also offers comprehensive cardiovascular fitness testing through its Fitness Evaluation Center. The staff is made up of certified clinicians licensed by the Massachusetts Department of Public Health. The clinic is located at 635 Commonwealth Avenue, 6th Floor, Boston, MA 02215; 617/353-8383.

Alcohol, Drugs, and Narcotics

Massachusetts law provides, in general, that no alcoholic beverages can be sold, delivered, or given in any way to a person under 21 years of age. State law neither permits nor condones the possession, use, or sale of illegal drugs and narcotics. The University supports these laws without exception.

In addition, University policies restrict the quantity of alcoholic beverages that may be brought into residences and provide for sanctions against students who violate these policies. While students 21 years or older may bring limited quantities of alcoholic beverages into residences, the University strongly encourages students not to do so.



The Martin Luther King Jr. Center

The King Center celebrates its twenty-fifth anniversary in 1994. Dedicated to the values and memory of alumnus Martin Luther King, Jr. (1929–68), the King Center addresses the personal, educational, and career development needs of Boston University's students. The center is a centralized source of comprehensive professional services and programs for undergraduate and graduate students seeking counseling, career planning, or placement assistance. These services, as well as those provided by the center's Multicultural Affairs and Disability Services Offices, can help students gain the maximum benefit from their academic efforts. Information and appointments can be obtained by telephoning or visiting the second floor reception desk at 19 Deerfield Street (in Kenmore Square); for phone numbers see King Center departments listed below.

Office of Career Services The office is a resource center designed to help students obtain career and internship information, clarify short- and long-term goals, and develop and implement their career plans. The internship program can assist students in finding learning and working opportunities in the community that will also help them

academically. On-Campus Recruiting offers assistance in the job search when a student has selected a probable career path and is within an academic year of graduation. The Credentials Service lets the student establish a file for potential employers that contains letters of recommendation and unofficial copies of transcripts. The Career Resource Library maintains current job listings and a collection of books and literature on a wide variety of careers and employers. For further information, please call 617/353-3590.

The Counseling Center Individual and group counseling is offered to students who have personal, interpersonal, career, or life-decision concerns. Testing Services, in conjunction with counseling, enables students to obtain information about personality, interests, and skills. In addition, the Class of '93 has contributed to the establishment of a Rape Awareness and Response Program. Services are short-term-based and strictly confidential. For more information, please call the center at 617/353-3540.

Disability Services Boston University employs mainstreaming, which means that physically and learning-disabled students can expect to use the same campus facilities (in

some cases with enabling accommodations) as students who are not disabled. Therefore, most of the facilities and the programs described in this bulletin make no mention of separate services for the disabled. Consultations with the Disability Services staff are available to individuals or groups requesting assistance or having questions or concerns about campus accessibility. Auxiliary aids, such as interpreters for hearing-impaired students, are available for all of the University's educational programs. Disability Services may be reached at 617/353-3658 (Voice or TDD).

Disability Services has recently expanded its services to students with documented learning disabilities (LD). Students are able to choose between two levels of LD support services. Students who need extensive support and who would like to meet with a learning specialist on a regular basis for up to two hours a week may opt for "comprehensive" services. These comprehensive services carry an additional tuition charge of \$1,200 per semester. Extended financial aid packages are available to students who meet the University financial aid guidelines. Students with learning disabilities who do not need individualized support may seek "basic" support services, such as taped textbooks, additional time on exams, or assistance in arranging for "reasonable accommodations," at no charge. Another aspect of this expansion effort is the addition of an optional, six-week summer orientation program for students who will be attending Boston University in the fall. All students will enroll in a 4-credit course, participate in a daily learning strategies seminar, and attend workshops on self-advocacy, using the library, and word processing with Macintosh computers. Enrollment is limited. For more information, contact the LD Support Services Office at 617/353-6880.

Multicultural Affairs Boston University's ethnically diverse community includes African American, Hispanic American, Asian American, and Native American (AHANA) students at both the graduate and undergraduate levels. They are the primary beneficiaries of Multicultural Affairs' efforts, although the office serves the entire campus community on issues of diversity and multiculturalism. The mission of Multicultural Affairs is to enhance the quality of life and to monitor students' academic and career success. This is accomplished by cooperating with Schools, Colleges, and the University Student Affairs offices.

Through effective planning and coordination with graduate and undergraduate student organizations, Multicultural Affairs facilitates and encourages students' personal and educational development. This goal is accomplished through implementing academic, educational, cultural, and social programs. Among them is Common Ground, a component of Summer Orientation that introduces the issue of diversity awareness to incoming students and their parents. This program serves to empower its participants by moving through stages of recognition, tolerance, acceptance, internalization, and celebration of the unity and beauty of diversity. Celebrating Diversity is a Multicultural Orientation program designed to acquaint students and parents with Boston University, the city of Boston, and the richness of its diversity. This program includes panels and workshops that address student life issues along with a number of social activities to foster community spirit among incoming freshmen, transfer students, and family members. This program annually occurs during opening weekend. In Search for Common Ground is a lecture series that enhances the collective understanding of issues that are important and timely to further understanding of diversity and multiculturalism. Through the AHANA Empowerment Council, mentoring programs are available that enable participating students to meet with students, faculty, and staff who have ethnic or cultural backgrounds similar to their own. The office also sponsors an annual Martin Luther King, Jr., holiday observance and houses a collection of materials documenting the AHANA experience. Multicultural Affairs can be reached at 617/353-3791.

Important Offices

Office of the Vice President and Dean of Students

Among the offices most concerned with students' success at the University is the Office of the Vice President and Dean of Students, located in the East Tower, 3rd floor, of the George Sherman Union. This office coordinates the programs of the Office of Residence Life, the George Sherman Union, the Student Activities Office, Orientation and Off-Campus Services, the University Resource Center, the Wellness Center, and the offices of the Martin Luther King Jr. Center: Career Services, the Counseling Center, Disability Services, and Multicultural Affairs.

The dean and his staff work to establish goals and operational standards for these student-oriented departments. This office also provides the *Lifebook*, mentioned earlier. Individual students and parents are encouraged to contact the office for assistance or information on any aspect of student or University life. The office is located at 775 Commonwealth Avenue; 617/353-4126.

Office of the University Registrar This office, located at 881 Commonwealth Avenue, maintains student records; issues transcripts, verifications of attendance, diplomas, and ID cards for nondormitory students; produces the class schedule; and supervises registration, grades, withdrawals, and veterans' affairs.

Student Accounting Services This office addresses inquiries regarding billing and payment and/or settlement of tuition, fees, residence, and other applicable charges. If a student's account reflects a valid credit balance not resulting from financial aid, he or she may apply for refunds here. Student Accounting Services is located on the fourth floor of 881 Commonwealth Avenue, and can be reached at 617/353-2264.

The University Resource Center (URC) The University Resource Center provides specialized services and programs designed to support and improve academic success and achievement, and to assist a student's smooth transition into University life.

A major component of the URC is the Academic Success and Achievement Program (ASAP). ASAP offers tutoring in most undergraduate courses. In addition, ASAP offers seminars in time management, speed reading, presentation and testing skills, and other relevant success strategies.

The center oversees several other services, such as the Writing Center, staffed with graduate students to assist in all aspects of writing; a Macintosh Lab; the Freshman Peer Support program that helps freshmen adapt to University life; the Career Advisory Network, offered in conjunction with the Alumni Office, that helps students explore career options by putting them in touch with a network of over 1,200 alumni; and the Financial Assistance program that exposes students to options of alternative funding. For more information, please call 617/353-7077.

Parking Services Resident students are eligible for overnight parking. Commuting students may secure day or evening parking

permits. For information about parking or vehicle registration, contact Parking Services at 617/353-2160.

Orientation and Off-Campus Services Information about new student orientation and Parents Weekend can be obtained at 775 Commonwealth Avenue, 617/353-3555. Services, programs, and other information are provided for commuting and off-campus students, as well as listings for off-campus housing. For more information, call 617/353-3523.

Admissions Reception Center The Admissions Reception Center coordinates a variety of programs for visitors to the campus, including personal interviews, tours, lunches with currently enrolled undergraduates, and Meet Boston University programs. For more information, visit 121 Bay State Road or call 617/353-2318.

Office of Information Services Information Services is the direct connection between students and the University. Information Services knows which office or person to contact for the answers to questions and solutions to problems. The office publishes the University directory and campus map, and operates the NEXUS/Bulletin Board system and the Information Center, both of which are described below. For more information about the office, call 617/353-2752.

Boston University Information Center The Information Center provides accurate information on such topics as events, University services and resources, office locations and personnel, procedures, deadlines, and hours of operation. The center posts the Master Calendar of University Events, a computerized listing of all events sponsored by the University on- and off-campus, or any event taking place in University facilities. The calendar is updated daily.

Hours during the academic terms are 8:30 a.m. to 8 p.m. weekdays; 9 a.m. to 8 p.m. Saturday; and 12 noon to 8 p.m. Sunday. Summer hours are 9 a.m. to 6 p.m. Monday through Friday. It is located at 771 Commonwealth Avenue; 617/353-2169.

NEXUS and Bulletin Board Information is available to you twenty-four hours a day through the NEXUS System and Bulletin Board. To find out about University services, offices, events, and deadlines, call 353-4000 and press 1 for Bulletin Board or press 2 for NEXUS. For a brochure with complete listings of all topics available, visit the University Information Center at 771 Commonwealth Avenue.



Shops and Supplies

B.U. Bookstore Mall The B.U. Bookstore Mall is a unique six-level shopping center combining books, general merchandise, and specialty shops. The mall features the Charlesbank Bookshops and the Boston University Bookstore—winner of *Boston Magazine's* "Best of Boston" award in 1993. Located at 660 Beacon Street in Kenmore Square, the B.U. Bookstore Mall is open Monday through Friday, 9:30 a.m. to 9:00 p.m.; Saturday, 9:30 a.m. to 6 p.m.; and Sunday, 12 noon to 6 p.m. Rush hours at the beginning of each semester also supplement the regular opening and closing times. Phone the B.U. Bookstore Mall at 617/267-8484.

Charles Bank Health Science Book Shop, located at 700 Albany Street, provides course books and reference books for the medical, dental, and public health programs in addition to medical instruments, study aids, emblematic sportswear, school and office supplies, and sundries. Open Monday through Friday, 8:30 a.m.–7 p.m.; Saturday, 10 a.m.–6 p.m. Phone 617/638-5496.

Campus Convenience—Medical Center
700 Albany Street
Open Monday through Friday,
6 a.m.–8 p.m.
617/638-5695

Campus Convenience—Union Court
775 Commonwealth Avenue
Open Monday through Friday,
7 a.m. to 11 p.m.; Saturday, 9 a.m. to 11 p.m.;
Sunday, 11 a.m. to 11 p.m.
617/353-3680

Campus Convenience—Warren Towers
700 Commonwealth Avenue
Open seven days a week, 6 a.m. to 4 a.m.
617/353-5305

Campus Convenience—Kenmore Square
541 Commonwealth Avenue
Open seven days a week, 6 a.m. to 12
midnight
617/353-2284

Campus Convenience—Sleeper Hall
275 Babcock Street
Open seven days a week, 6 a.m. to 12
midnight
617/353-6640

Campus Convenience stores are full-service convenience stores carrying grocery items, insignia gifts, health and beauty aids, school supplies, newspapers, magazines, sundries, and much more.

International Student Services

The International Students and Scholars Office (ISSO) provides a variety of services to the more than 4,000 international students and 450 international faculty members and scholars at the University representing approximately 130 countries. The Office also informs students and staff about regulations concerning U.S. immigration, employment, and taxes.

To assist new students in adjusting to the University, the city of Boston, and life in the United States, ISSO conducts special orientation programs every September and January. The Office also advises students on such matters as housing, cultural adjustment, and personal and financial problems. Other ser-

vices include an International Hospitality Program, a Wives' Program, intercultural programs, assisting International Clubs, and a World Fair each spring.

ISSO publishes a newsletter, coordinates an emergency loan fund, and sponsors numerous activities to promote intercultural awareness. Its basic mission is to act as a resource for the entire international population at Boston University. The office is located at 19 Deerfield Street, and the telephone number is 617/353-3565; Fax: 617/353-5891.

Center for English Language and Orientation Programs (CELOP) The center offers intensive, noncredit English as a Second Language courses for internationals who wish to improve their English proficiency for business, scientific, academic, or personal reasons. In addition, the faculty and staff at the center prepare qualified, academically admissible participants to enter Boston University and other institutions of higher learning in the United States.

Twelve-week courses are offered in both September and January. During the summer three separate courses are available, each lasting 6, 9, or 12 weeks. Classroom instruction consists of work in all skill areas of language learning, including speaking, listening, analytical reading, writing, grammar, and vocabulary. Besides coursework, some programs include monitored computer laboratory, language laboratory, and reading laboratory. Students also choose from a variety of academic elective courses, such as business, TOEFL preparation, research, writing, American culture, and others. In the most advanced English language sections, students may receive permission to audit a regular University course while attending CELOP.

Students enrolled at CELOP are considered regular, full-time Boston University students and, as such, enjoy the use of all University library and athletic facilities, as well as all medical and counseling services. Through a variety of school activities, projects, trips, clubs, and volunteer opportunities, participants are integrated into daily University life. Students may also participate in the Conversation Partners program, in which there is a language exchange between CELOP students and American university students who are studying a foreign language.

All CELOP courses are considered full-time programs of study and a Certificate of Eligibility (Form I-20) is sent to each applicant so that a Student Visa (F-1) may be

obtained from the U.S. Consul in his or her home country. Housing and dining arrangements are available on campus for all summer programs, and for the 24-hours-per-week fall and spring programs. Students who wish to enroll at the Center should apply directly to: CELOP/Boston University, 730 Commonwealth Avenue, Boston, MA 02215, or for more information call 617/353-4870; Fax: 617/353-6195.

Fellowships

The University Office of Fellowships coordinates student and faculty applications to fellowships and scholarships requiring University nomination or endorsement. Faculty opportunities are announced through the Office of Sponsored Programs, and student competitions are publicized in the University's campus weekly, *Boston University Today*. To be eligible, students must be enrolled in a degree program at the University.

Students are invited to apply for scholarships and fellowships appropriate to their year of matriculation (application materials available as indicated in parentheses):

Undergraduates

Sophomores and Juniors: Goldwater Scholarship in Sciences (October)

Juniors: Truman Scholarship for Public Service Careers (September); Case and Melville Scholarships (January)

Seniors: Rhodes Scholarship to Oxford and Marshall Scholarship to U.K. Universities (April/May of junior year); Luce Scholar Program to Asia (September); Fulbright Grants for Research/Study Abroad (May of junior year); Wiesel Prize Essay Contest (September)

Graduate Students

Fulbright Grants for Research Abroad (summer—one year prior)

Luce Scholar Program to Asia (September)
IWM International Summer School in Cortona, Italy (January)

Information about fellowships, scholarships, and grants is also available at the reference desk at Mugar Library and, for graduate study, through the financial assistance office of the Graduate School. Students may reach the Office of Fellowships at 145 Bay State Road; 617/353-2230.

Military Education Division

Reserve Officer Training Corps (ROTC)

Boston University is one of only forty-four universities nationwide offering its students ROTC programs for all four services: Army,

Navy, Air Force, and Marine Corps. ROTC is a program that provides college-trained officers for the Armed Forces. The ROTC program is traditionally a four-year program of instruction culminating in a commission in the Army, Navy, Air Force, or Marine Corps. The ROTC program is also available to students who desire a military commission and who have at least two academic years remaining before graduation. Some courses and laboratories can be taken without military service obligation. Most students complete the training and pursue a military officer career on active duty, in the Reserve, or in the National Guard.

Today's ROTC trains students through hands-on leadership training unlike any other college programs. These programs build strong bonds of team spirit and camaraderie while they boost the individual's self-confidence. ROTC training develops self-discipline, physical stamina, poise, and general management skills basic to success in any career.

The ROTC programs also provide some financial assistance in the form of scholarships and stipends. ROTC scholarships include partial or full tuition, textbooks, education-related fees, and a living allowance of \$100 each month of the academic year for the duration of the scholarship. All Air force three- and four- year, 100 percent ROTC scholarship recipients, and all Navy four-year, 100 percent ROTC scholarship recipients are eligible for free room and board from Boston University. Army and Navy ROTC 80 percent tuition scholarship recipients receive a Boston University grant to cover the remaining 20 percent. Supplemental financial assistance is also awarded on a case-by-case basis, and current programs can be discussed with the ROTC representatives at the numbers listed below. The ROTC programs provide nonscholarship students enrolled in the Advanced course (the last two years of ROTC) with a monthly tax-free subsistence allowance of \$100, and up to a maximum of \$1,000 per year.

Students interested in the ROTC programs should contact the appropriate department: Army ROTC, 128 Bay State Road, 617/353-4025; Naval Marine Corps ROTC, 116 Bay State Road, 617/353-4232; and Air Force ROTC, 118 Bay State Road, 617/353-4705.

Gerontology Center

The University's commitments to research, education, and service in the field of aging are coordinated by the Boston University

Gerontology Center. For those who wish to document an interest in gerontology, the center awards the Louis Lowy Certificate in Gerontological Studies to students in any Boston University degree program who have completed a specified number of approved courses (24 credits for bachelor's degree students, 16 credits for graduate degree candidates). For nondegree students and working professionals, a 20-credit Certificate of Recognition for the Study of Aging is available. The annual Summer Institute in Gerontology offers a variety of academic courses, and continuing education workshops attended by faculty, staff, students, and community service providers. The Gerontology Center Library, with over 3,000 books, journals, government publications, and bibliographies, is open to the public for research needs. Contact the Gerontology Center at 53 Bay State Road, Boston, MA 02215; 617/353-5045.

International Study Opportunities

International Programs coordinates overseas study, work, and scholarship programs for students in all the University's Schools and Colleges. Students may study overseas through a Boston University program, through one of the many programs sponsored by other American institutions, or by enrolling directly in a foreign institution. Programs sponsored by Boston University allow students to study language, liberal arts, and the social sciences in England, France, Israel, Italy, Niger, and Spain; to intern in London, Paris, Sydney, Madrid, Moscow, and Washington, D.C.; to enroll in a professional study abroad program in England or Australia; or to participate in summer programs offered in Beijing, Greece, London, Madrid, Moscow, Padova, Paris, St. Petersburg, Sydney, and Washington, D.C. Students in most disciplines—from the humanities to the natural sciences and business—should be able to study abroad if they plan ahead. Students who wish to study overseas should consult an advisor at the Division of International Programs, 232 Bay State Road, Boston, MA 02215; 617/353-9888.

HOUSING

On-campus

On-campus residence accommodations, within walking distance of academic, administrative, and recreational facilities on the Charles River Campus, are available to graduate students. Students residing on campus are provided with quality support services, including 24-hour on-call security, provided by the Boston University Police Department, and maintenance.

The Office of Housing offers dormitory-style accommodations to graduate students in small brownstones on Bay State Road and in Danielsen Hall, the graduate residence center on Beacon Street. Residences are coeducational with single and double rooms in each. Graduate students residing in dormitory-style residences must choose one of the six meal plans available. There are a limited number of apartment-style accommodations offered by the Office of Housing. Total room and base board costs range from \$7,100 to \$10,168 for the 1995/96 academic year. For an application and more information, contact the Office of Housing, Assignments Area, 985 Commonwealth Avenue, Room 105, Boston, MA 02215; 617/353-3511.

The Office of Rental Property Management offers furnished and unfurnished apartments for graduate students. Standard rents that include heat and hot water are as follows: Studio apartments: \$575-\$675 per month; one-bedroom apartments: \$675-\$775 per month; two-bedroom apartments: \$950-\$1,300 per month. For an application and more information contact the Office of Rental Property Management, 19 Deerfield Street, Boston, MA 02215; 617/353-9085.

Harrison Court is an elegant nineteenth-century building providing 60 modern apartments for students, visiting faculty, and other members of the Medical Center community. In the heart of Boston's South End, Harrison Court is located across the street from the Medical Center campus, which includes the School of Medicine, the School of Public Health, the Goldman School of

Graduate Dentistry, the Boston University Alumni Medical Library, and The Boston University Medical Center Hospital. Secure and convenient studios and one- and two-bedroom apartments are available. Each unit has a modern kitchen and bathroom. A coin-operated laundry and an exercise room are located in the building. Monthly rents for shared units range from \$440 to \$810 depending on the type of unit and number of students occupying it. For more information call the Medical Center Office of Rental Property Management at 617/638-4973 or 1-800-344-BUMC (1-800-344-2862).

Office of Residence Life Resident Assistants

Resident Assistants are Office of Residence Life and Office of the Vice President and Dean of Students student staff members living within campus residence areas. Each resident assistant is responsible for working twenty hours each week as a community manager, role model, peer advisor, and resource and referral agent to students. Resident assistants are selected for their intellec-



tual and interpersonal skills, their leadership capabilities, and their willingness to meet the challenges and expectations of the position to the best of their abilities. The position is enjoyable and educational, but it is very demanding in terms of the required quality of time and energy that a successful candidate must commit.

Qualified juniors, seniors, and graduate students receiving resident assistantships may receive room and board as compensation. Additional information and application materials are available from the Office of Residence Life, 985 Commonwealth Avenue, Boston, MA 02215; 617/353-3852.

Costs for the 1994/95 Academic Year

Total room and board costs are as follows: multiple-occupancy room: \$7,100*; multiple-occupancy room in suite: \$7,370*; single room with shared bath: \$8,410*. Apartments for married students are available through the Office of Rental Property Management. For more information, please call 617/353-4101.

Applications and Information

Dormitories: Office of Housing, 985 Commonwealth Avenue, Boston, MA 02215; 617/353-3511.

Housing Policy and Regulations

The University reserves the right for its designees to enter and to inspect a student's room, to reassign students in the University's residential system, to revoke and terminate a student's Residence License Agreement for any reason set forth in that Agreement, and to implement any other measures necessary and advisable for health, safety, or in the interest of the residence program. Any resident whose conduct does not meet the standards established by the University may be denied on-campus residence accommodations.

*These figures are based on the standard meal plan rate of \$2,990.

STUDENT ACTIVITIES

Boston University is dedicated to providing an unmatched climate for growth. Most of this development takes place in the classrooms, the libraries, and the laboratories. But Boston University is equally committed to supporting a complete environment for academic, physical, social, and spiritual learning. A few of these centers of activity are described below.

Recreation

Facilities and Programs The Department of Physical Education, Recreation, and Dance offers a broad spectrum of programs to interested students, alumni, faculty, and staff. Intramural sports, club sports, workshops, special events, and open recreation are offered to provide opportunities involving different levels of participation and commitment. Students are encouraged to pursue fitness activities in formats that meet their interests, abilities, and schedules.

Physical Education (PDP) credit courses provide a structured experience in more than 80 activities, ranging from swimming and aerobics to rock climbing and downhill skiing. Noncredit instruction is also available through the Fitness, Lifestyle, Exercise, and Dance (FLEXD) Program.

Facilities for informal recreation are located at the Case Physical Education Center, 285 Babcock Street, and the Sargent Gymnasium Building, 1 University Road. The Case Center includes a Nautilus and free-weight room, a fitness room with sophisticated exercise equipment, gymnasium, saunas, locker rooms, a swimming pool, a dance studio, and an ice-skating rink. Adjoining the center are tennis courts, a tartan track, and Nickerson Field (AstroTurf). The Sargent Gymnasium facility contains a gymnasium, a fitness center with weight training machines and cardiovascular conditioning equipment, and a dance studio/theatre. Sailing and canoe docks are located on the Charles River.

For more information about the Department of Physical Education, Recreation, and Dance, stop by the administrative offices at 300 Babcock Street, or call 617/353-2748.

Sargent Camp Sargent Camp is a University facility located in the beautiful Monadnock region of southwestern New Hampshire, only 90 minutes from the main campus. The camp covers 850 acres of forest and fields, including the 60-acre Halfmoon Pond that features a floating glacial bog, and 25 miles of trails for hiking and ski touring. Facilities include two lodges (with dining), comfortable, rustic, winterized cabins, and recreational equipment. Sargent Camp offers orientation, team-building, and leadership development programs for students, faculty, and staff on a year-round basis. The facility is also available for retreats and conferences. For more information, contact Sargent Camp at 603/525-3311.



Student Union

George Sherman Union The Boston University George Sherman Union (GSU), located at the center of campus, is headquarters for student activities and services. The Student Center, on the lower level of the GSU, has a lounge, private study rooms that students may sign up to use, student organization offices, and a vending area. On Friday and Saturday evenings, the lounge is often transformed into a club featuring coffeehouses, comedy nights, and social activities sponsored by student organizations.

In addition to the Student Center, the GSU offers a variety of services, including the Games Area, the Ziskind Lounge on the second floor, a U.S. Post Office, a bank, several dining areas, meeting rooms, a quiet study lounge on the third floor, an art gallery, and the GSU Information Center and Ticket Office. The GSU Information Center, located on the second floor, supplies information on Union activities and sells candy, gum, and sundries. The Ticket Office serves as an outlet for tickets to theatrical events and various student organization-sponsored activities.

The GSU Student Activities Office, located on the fourth floor, coordinates the activities of approximately 300 student organizations, student governments, and the fraternity and sorority system. In addition, the office sponsors several all-University programs, such as Homecoming, Senior Week, and Summerfest. The Student Activities Office is also responsible for providing professional services and resources on all aspects of program planning and development to student organizations. It directs the Student Leadership Development Program, which offers training workshops, educational courses, and seminars addressing leadership issues.

For further information regarding these and other George Sherman Union activities, stop by 775 Commonwealth Avenue, or phone the GSU Information Center at 617/353-2921.

Boston University Music Organizations

Boston University Music Organizations (BUMO) provides opportunities for students to participate in musical groups while attending any of the Schools and Colleges at Boston University. These groups offer a creative outlet for students of all levels and abilities. Groups include the Marching Band, which performs at football games, the Pep Band, which performs at hockey and basketball games, the All-University Orchestra, the Concert Band, the Jazz Ensemble, and the Symphonic Chorus. BUMO provides the groups with support, including access to sheet music and some instruments. The Boston University Music Organizations office is located at 855 Commonwealth Avenue, Room 260, Boston, MA 02215; 617/353-3358.

Religion

Boston University recognizes that spiritual development is as vital to its community as academic, cultural, physical, and social development. The University actively sponsors a wide variety of programs and options to help facilitate that development. A few of these programs are outlined below. For a more comprehensive list of religious programs and denominations served on campus, please consult the *Lifebook*.

Marsh Chapel, at the heart of the Charles River Campus, 735 Commonwealth Avenue, offers programs of Christian worship, Bible study, counseling, music, and educational and outreach programs. An all-University service of worship is held each Sunday morning at 10:45 a.m., and is broadcast over WBUR-FM (90.9). The Chapel is open from 7 a.m. to 11 p.m. The Chapel office is open from 9 a.m. to 9 p.m. on weekdays. The Dean of the Chapel, Robert Watts Thornburg, and other campus ministers in the Marsh program, are available daily. Feel free to contact them or obtain further information by calling Marsh Chapel at 617/353-3560.

Hillel House, located at 233 Bay State Road, is the center for Jewish life at Boston University. Students, faculty, and staff are involved in the cultural, religious, and social activities sponsored by Hillel throughout the year. Services are held on weekends, holidays, and weekday mornings. A wide variety of programs relating to *Israel and contemporary moral issues* occur weekly. In addition, counseling by two rabbis and the program director is provided. Boston University



maintains a kosher dining facility at Hillel, with two meals served on most days. For further information about Hillel, call 617/353-7200. For information about kosher dining, call 617/353-2947.

Newman House, at 211 Bay State Road, is the Roman Catholic Center for the University community, offering weekday and Sunday worship, retreats, social events, Bible study, and other classes. Sunday Mass is celebrated at Marsh Chapel at 12:30 p.m. (organ and cantor), 6 p.m. (contemporary music), and 10 p.m. (candlelight with instrumental music and cantor). Liturgy is also celebrated weekdays as follows: Monday, Tuesday, Thursday, and Friday at 12:10 p.m. at Newman House and Wednesday at 12:10

p.m. at Robinson Chapel (Marsh Chapel, downstairs). For further information, call Newman House at 617/353-3632.

Other Protestant Campus Ministries

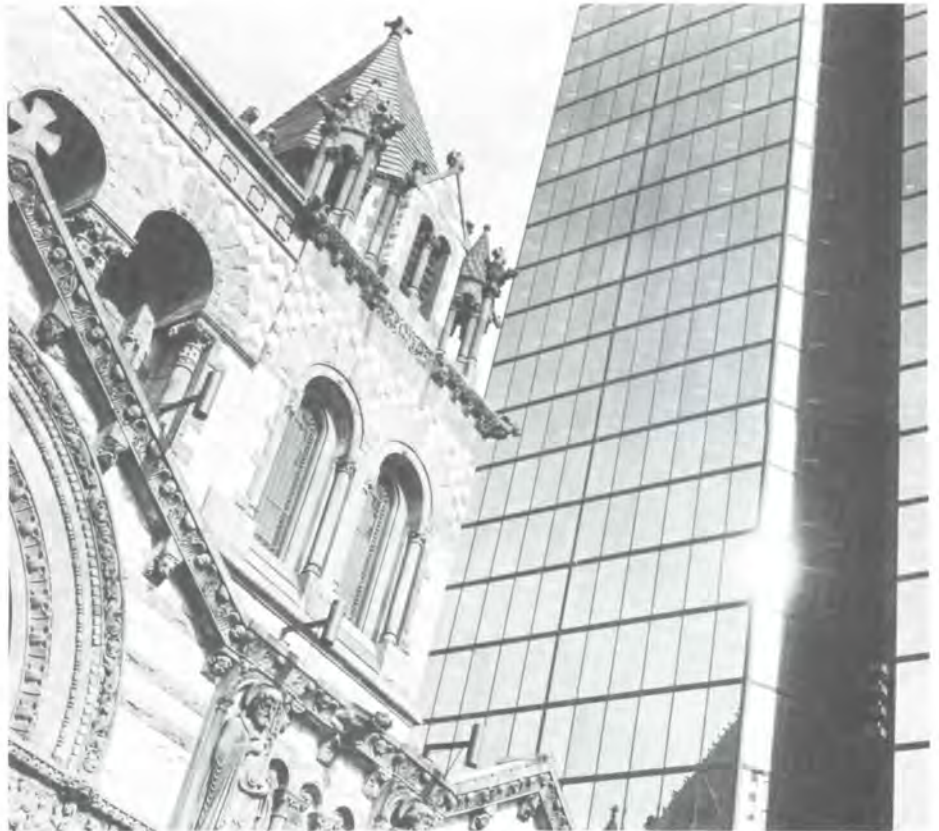
Individuals to contact and their phone numbers include: the Episcopal Ministry, the Rev. John P. Streit, Jr., 617/277-5523; the Lutheran Ministry, the Rev. Michael Thomas, 617/353-5269; and the Boston/Cambridge Ministry in Higher Education, the Rev. Carol Dittes, 617/353-5269. A number of Evangelical churches are also affiliated with the campus ministries. For general information or guidance relating to these or other religious groups at Boston University, call 617/353-3560.

THE CITY OF BOSTON

Boston is a city rich in history, old-world charm, and modern vitality. Home to more than 60 colleges and universities, it is an intellectual and cultural center, diverse in its people, stimulating in its opportunities, yet relaxed and accessible.

Boston is the largest city in New England and the site of many significant events in early American Colonial and Revolutionary history. Much of that early flavor remains today in its cobbled streets, in its historic landmarks that bring alive Paul Revere's ride and the Boston Tea Party, and in the Federalist row houses on Beacon Hill. A historic seaport that grew to prominence in the days of the China trade and the whaling industry, the city maintains a thriving and picturesque waterfront. The New England Aquarium, one of the foremost in the world, shares the harborside with sightseeing cruise ships, traditional New England fishermen unloading their catches, international cargo traffic, and the U.S.S. *Constitution*, "Old Ironsides." Here, historic treasures intermingle with contemporary skyscrapers, evidence of the city's thriving business and financial community and its leading role in research and technology.

Boston University is perfectly situated to enjoy both the charm and beauty of the city and its cultural and recreational attractions. The campus stretches along the banks of the Charles River, bringing boating and canoeing, as well as jogging and sunning, to its doorstep. Yet it is only minutes from the downtown theatre, shopping, government, and financial districts. A short ride on the streetcar brings one to the elegant shops of Copley Square, the sporting events at Boston Garden, the endless diversions of the restored Faneuil Hall market area. The city's rich cultural and ethnic mix is evident in its varied neighborhoods. The North End boasts superb Italian cuisine, Chinatown has a wealth of restaurants, and smaller enclaves offer Portuguese, Indian, Thai, Vietnamese, Middle Eastern, Jewish, and soul food. This is in addition, of course, to world-class pizza,



tacos, and other fast foods necessary to student survival.

Boston is the home of the world-famous Boston Symphony Orchestra, the Boston Pops, and a wealth of music from opera to rock, jazz, and reggae. Many dance and theatre groups perform regularly, and students can take special advantage of the many annual performances at the Boston University School for the Arts and the highly acclaimed resident Huntington Theatre Company. Dozens of museums include the world-renowned Museum of Fine Arts, the Isabella Stewart Gardner Museum, and the Institute of Contemporary Art. Galleries intermingle with elegant boutiques on Newbury Street, and visitors participate in a variety of interactive exhibits at the Museum of Science.

An enthusiastic sports city, Boston supports the Red Sox, the New England Patriots, the Celtics, and the Bruins. Each April, the Boston Marathon passes through the Boston University campus. Beaches to the north and south, including the famous shores of Cape Cod, are within easy reach by car or bus. For the hiker or skier, the mountains of New Hampshire and Vermont are but a few hours' drive, as are the picturesque shores of Maine.

A splendid place to study, work, or just relax, Boston is consistently voted one of the most desirable U.S. cities in which to live. Few cities in the world can offer so much to every individual.

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Boston University

(USPS 061-540)

Volume LXXXIII, Number 19

School of Medicine

Division of Graduate Medical Sciences

August 24, 1994

Published by Trustees of Boston University,
147 Bay State Road, Boston, MA 02215.

Issued 19 times a year: one in March, one in April, three in May, five in June, four in July, and five in August.

Second-class postage paid at Boston, Massachusetts 02109, and additional mailing offices.

Production coordinated by the Boston University Bulletins Office, 985 Commonwealth Avenue, Boston, MA 02215.

Cover Photograph by Boston University Photo Services.

Information in this bulletin is accurate as of September 2, 1994. The University reserves the right to change course content, fees, program requirements, plans of study, class schedules, and the academic calendar, or to make other changes deemed necessary or desirable, giving advance notice of change where possible.

Postmaster: Send address changes to Boston University, School of Medicine, Division of Graduate Medical Sciences, 80 East Concord Street, Room L 317, Boston, MA 02118.

For information and a bulletin, write to Boston University, P.O. Box 886 (graduate), or P.O. Box 887 (undergraduate), Boston, MA 02215.

Bulletins are available for:

School for the Arts
Graduate Program in Banking Law Studies
College of Communication
School of Education
College of Engineering
College of General Studies
Goldman School of Graduate Dentistry
Graduate Medical Sciences, School of Medicine
Graduate School, Arts and Sciences
Graduate Tax Program
School of Law
School of Management
School of Medicine
Metropolitan College
Overseas Programs
School of Public Health
Sargent College of Allied Health Professions
School of Social Work
Summer Term
School of Theology
Undergraduate Programs

Degree and Certificate Programs

Boston University has fifteen Schools and Colleges and one independent program and offers the degree and certificate programs listed below.

College of General Studies

A two-year general education program, with preparation for continuation in the undergraduate programs listed below.

School for the Arts

BFA, BFAT, MusB, MFA, MFAT, MusM, MusAD, Artist Diploma, Certificate of Opera Performance, Certificate in Theatre Crafts and Technical Production

College of Communication

BS, MS

Goldman School of Graduate Dentistry

MS, DMD, CAGS, MSD, DSc

School of Education

BS, MAT, EdM, CAGS, EdD

College of Engineering

BS, MS, PhD

Graduate School

MA, PhD

School of Law

JD, LLM

College of Liberal Arts

BA

School of Management

BSBA, MBA, MSMIS, DBA

School of Medicine

MA, MPH, MS, MD, DSc, PhD

School of Public Health

See the School of Medicine

Metropolitan College

AS, BLS, BS, MCJ, MCP, MLA, MS, MSM, MUA

Sargent College of Allied Health Professions

BS, MS, MSOT, MSPT, CAGS, ScD

School of Social Work

MSW

School of Theology

MDiv, MSM, MTS, STM, DMin, ThD

The University Professors

BA, MA, PhD

Boston University also offers a number of dual degree programs. Please see specific School or College bulletins for information.

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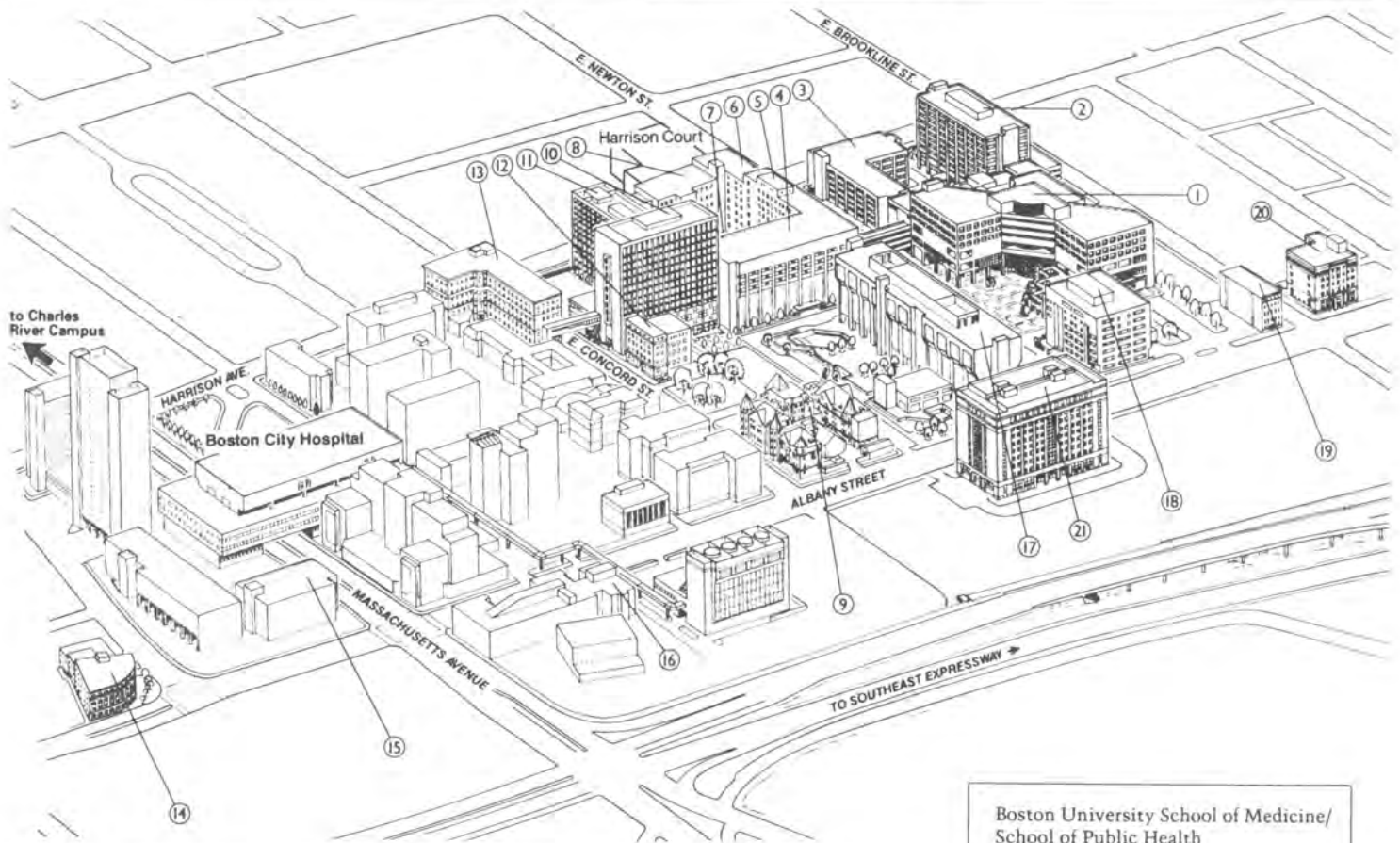
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Boston University Medical Center



Legend

- 1 - Atrium Pavilion
(Hospital main entrance)
- 2 - Doctors Office Building
(Including public parking garage)
- 3 - Preston Family Building
- 4 - Evans Building
- 5 - Old Evans Building
- 6 - Collamore
- 7 - Vose Hall
- 8 - Robinson Building
- 9 - Talbot Building
- 10 - Instructional Building
(School of Medicine main entrance)
- 11 - Housman Medical Research Center
- 12 - School of Public Health
- 13 - Silvio O. Conte Medical Research Center
- 14 - 801 Albany Street
- 15 - Nurses Education Building
(Boston City Hospital)
- 16 - Maxwell Finland Laboratory
(Boston City Hospital)
- 17 - Solomon Carter Fuller Mental Health
Center (Commonwealth of
Massachusetts)
- 18 - Goldman School of Graduate Dentistry
(Goldman School main entrance)
- 19 - Naval Blood Research Center
- 20 - 609 Albany Street
- 21 - Center for Advanced Biomedical Research

Dining Facilities

- Cafeteria-Atrium Pavilion, 2nd floor
- Cafeteria-Instructional Building, Basement
- Cafeteria-Goldman School
1st floor
- Cafe-Doctors Office Building,
1st floor

Public Parking

- Doctors Office Building
Parking Lot A

Major Conference Rooms

- C/D Conference Room, Atrium Pavilion,
2nd floor
- Function Rooms A, B and C,
Atrium Pavilion, 2nd floor
- Bakst Auditorium, 1st floor, School of
Public Health
- L-110, L-112, 1st floor, Instructional Building
- Keefe Auditorium, 1st floor, Evans Building
- Preston Conference Room, 1st floor,
Preston Building

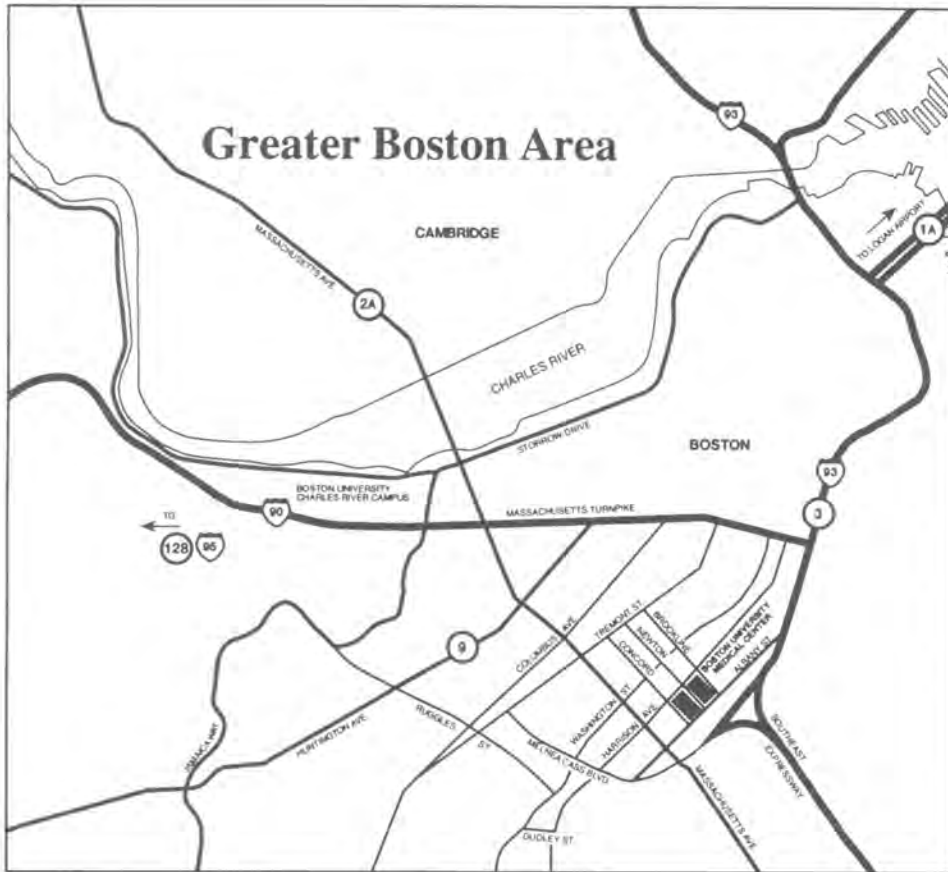
Boston University School of Medicine/
School of Public Health
80 East Concord Street

Boston University
Medical Center Hospital
88 East Newton Street

Boston University Goldman School of
Graduate Dentistry
100 East Newton Street

Boston, MA 02118

- Whitelaw Conference Room, 5th floor,
Old Evans
- Wilkins Board Room, 1st floor,
Evans Building
- Goldman Auditorium, 3rd floor,
Goldman School of
Graduate Dentistry
- Auditorium/Audiovisual Center,
7th floor, Goldman School of
Graduate Dentistry



Getting to Boston University Medical Center

From North: Follow Routes 1 (via Mystic/Tobin Bridge) or I-93 to Rte. 3 (I-93) (Southeast Expressway or Central Artery) south. Take Exit 19 (Albany Street/East Berkeley Street; turn right on East Newton Street.

From Logan Airport: Go through Sumner Tunnel (Rte. 1A South) to Expressway south. Take Exit 19 (Albany Street/East Berkeley Street). Follow Albany Street; turn right on East Newton Street.

From South Shore: Take Expressway (Rte.3) North to Exit 18 (Massachusetts Ave. off ramp.) Turn right on Massachusetts Ave, take first right on to Albany Street. Turn left at second intersection on to East Newton Street.

From West: Take Rte. 90 (Massachusetts Turnpike) east to end. Take Expressway I-93/Rte. 3 south to Exit 19 (Albany Street/East Berkeley Street). Follow Albany Street; turn right onto East Newton Street.

Public Transportation to the Medical Center

The MBTA provides the following bus service to Boston University Medical Center:

Bus 1: Harvard Sq. to Dudley Sq. via Boston City Hospital, connecting Massachusetts Avenue Station (Orange Line) with BUMC. Buses travel along Massachusetts Avenue as far as Albany Street, then continue to Dudley Square. Service is provided every 10 minutes.

Bus 8: University of Massachusetts, Harbor Point Campus, to Kenmore Square via BUMC. It connects BUMC with the Orange Line at Ruggles Station and with the Green Line at Kenmore. Buses generally run every 25 to 30 minutes during peak hours. An abbreviated schedule is available on weekends and holidays.

Bus 10: Copley Square (Green Line) to City Point, connecting Back Bay Station (Orange Line) and Andrew Station (Red Line) with BUMC. Buses provide service approximately every 30 minutes during peak hours, with added Saturday service.

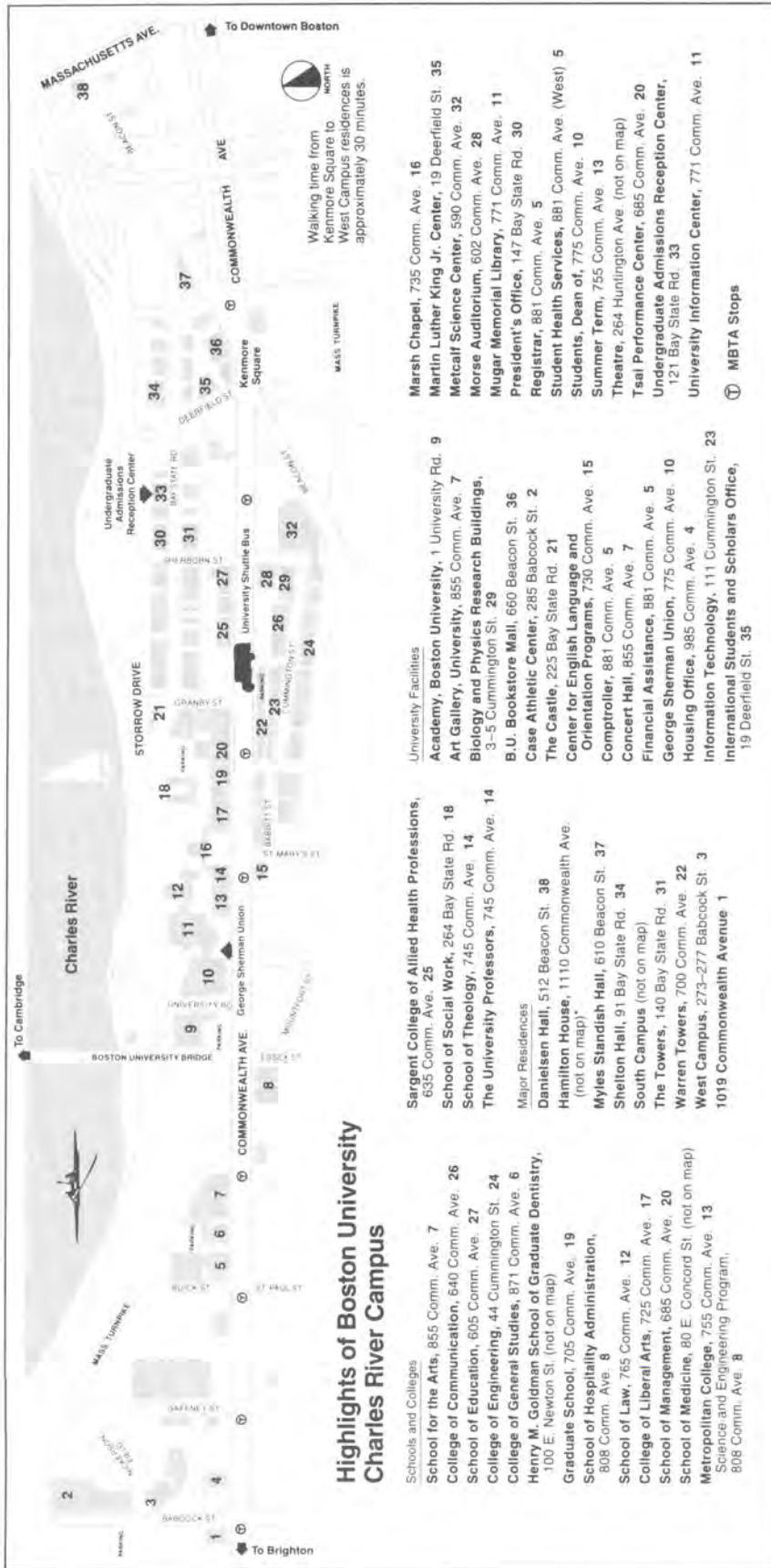
Bus 47: Service From Central Square, Cambridge (Red Line), to Andrew Station connects Ruggles Station (Orange Line) and Dudley Square with BUMC. Buses run every 20 minutes during peak hours. A shorter "loop" to the Longwood Medical Area and Dudley Square via Harrison Avenue also will run every 10 minutes during peak hours.

Bus 49: Service on Washington Street runs directly from Dudley Square to Downtown

Crossing via Washington Street and provides service every seven minutes during peak hours.

Shuttler Bus Service: The Medical Center operates a shuttle bus service to and from the Medical Center and Broadway Station on the Red Line approximately every 15 minutes weekdays during peak morning and late afternoon/evening traffic hours.

For more information about shuttle busses or other transportation services to and from the Medical Center, please call the BUMC Transportation Coordinator at 617/638-7430.



Highlights of Boston University Charles River Campus

Schools and Colleges

- School for the Arts, 855 Comm. Ave. 7
- College of Communication, 640 Comm. Ave. 26
- School of Education, 605 Comm. Ave. 27
- College of Engineering, 44 Cummington St. 24
- College of General Studies, 871 Comm. Ave. 6
- Henry M. Goldman School of Graduate Dentistry, 100 E. Newton St. (not on map)
- Graduate School, 705 Comm. Ave. 19
- School of Hospitality Administration, 808 Comm. Ave. 8
- School of Law, 765 Comm. Ave. 12
- College of Liberal Arts, 725 Comm. Ave. 17
- School of Management, 685 Comm. Ave. 20
- School of Medicine, 80 E. Concord St. (not on map)
- Metropolitan College, 755 Comm. Ave. 13
- Science and Engineering Program, 808 Comm. Ave. 8

Sargent College of Allied Health Professions,

- 635 Comm. Ave. 25
 - School of Social Work, 264 Bay State Rd. 18
 - School of Theology, 745 Comm. Ave. 14
 - The University Professors, 745 Comm. Ave. 14
- Major Residences
- Danielson Hall, 512 Beacon St. 38
 - Hamilton House, 1110 Commonwealth Ave. (not on map)
 - Myles Standish Hall, 610 Beacon St. 37
 - Shelton Hall, 91 Bay State Rd. 34
 - South Campus (not on map)
 - The Towers, 140 Bay State Rd. 31
 - Warren Towers, 700 Comm. Ave. 22
 - West Campus, 273-277 Babcock St. 3
 - 1019 Commonwealth Avenue 1

University Facilities

- Academy, Boston University, 1 University Rd. 9
- Art Gallery, University, 855 Comm. Ave. 7
- Biology and Physics Research Buildings, 3-5 Cummington St. 29
- B.U. Bookstore Mall, 660 Beacon St. 36
- Case Athletic Center, 285 Babcock St. 2
- The Castle, 225 Bay State Rd. 21
- Center for English Language and Orientation Programs, 730 Comm. Ave. 15
- Comptroller, 881 Comm. Ave. 5
- Concert Hall, 855 Comm. Ave. 7
- Financial Assistance, 881 Comm. Ave. 5
- George Sherman Union, 775 Comm. Ave. 10
- Housing Office, 985 Comm. Ave. 4
- Information Technology, 111 Cummington St. 23
- International Students and Scholars Office, 19 Deerfield St. 35

MBTA Stops

- Marsh Chapel, 735 Comm. Ave. 16
- Martin Luther King Jr. Center, 19 Deerfield St. 35
- Metcalf Science Center, 590 Comm. Ave. 32
- Morse Auditorium, 602 Comm. Ave. 28
- Mugar Memorial Library, 771 Comm. Ave. 11
- President's Office, 147 Bay State Rd. 30
- Registrar, 881 Comm. Ave. 5
- Student Health Services, 881 Comm. Ave. (West) 5
- Students, Dean of, 775 Comm. Ave. 10
- Summer Term, 755 Comm. Ave. 13
- Theatre, 264 Huntington Ave. (not on map)
- Tsai Performance Center, 685 Comm. Ave. 20
- Undergraduate Admissions Reception Center, 121 Bay State Rd. 33
- University Information Center, 771 Comm. Ave. 11

BOSTON UNIVERSITY DIVISION OF GRADUATE MEDICAL SCIENCES APPLICATION FOR ADMISSION

General Instructions

Before you complete this application, you should consult the **Division of Graduate Medical Sciences (GMS) Bulletin** for current general School policies and those of the various departments and programs. Attention to details will facilitate processing this application. All parts of the application must be completed, including address labels. **Please note that the application for admission also serves as the application for financial assistance from Boston University.** By checking the "Yes" box on the application, you will be considered for all University sources of financial aid. For details of types of University aid available, consult the "University Sources of Aid" section of this bulletin. If insufficient space is provided for any items, attach supplementary pages.

Application Fee

Include with your application a check or money order payable to Boston University for the nonrefundable application fee of \$50. Your application will not be considered without payment of the application fee.

Application Deadline

The complete application packet must be sent by the applicant to the School to be received no later than January 15 for fall admission and October 15 for spring admission if student is applying for financial aid. Otherwise, the Division of Graduate Medical Sciences programs have no deadlines.

Applications submitted with all supporting credentials will be given priority.

Credentials Required

A complete application packet consists of the completed School and Department copies of the application, Personal Statement, completed address labels, sealed letters of reference, and official transcripts from every college or university attended. A college senior should submit an official transcript of work completed in the first semester of the senior year as soon as it is available. **Note:** If you have a bulletin with an application bound in the back, you will also find enclosed four envelopes; three are for letters of reference. They are designed to enable you to maintain control over the application process while assuring evaluators of confidentiality. Send the recommendation form to your evaluator (be sure to complete the top portion of the form first), with an envelope addressed to yourself. **Please request that all**

references be returned to you in these envelopes, sealed and signed across the seal.

Enclose with these, in the larger envelope addressed to the Division, your application for admission, address labels, and personal statement.

Test Scores

The Graduate School requires that all official test score results be sent directly to the Division from the testing center. To determine which test scores are required, please consult the Department/Program Information Sheet.

Nondegree Applicants

Persons with an accredited bachelor's degree or its international equivalent who do not wish to enter a degree program may apply to the Division for admission as a special student with nondegree status. Applicants must submit the School and Department copies of the application; on the reverse side of the Department copy, please indicate the specific objectives of the studies/courses sought. In addition, the applicant must submit an official transcript of the most recent studies leading to a degree and must submit the nonrefundable application fee. No test score results are required.

Applicants previously enrolled as nondegree students who are interested in change of status must refer to the current **Division of Graduate Medical Sciences Bulletin** for rules regarding nondegree-to-degree application policies and transfer of credit policies.

Nondegree applicants are not eligible for University sources of financial aid or aid that requires matriculation in a degree program.

International Applicants

The following credentials must be received before an application will be considered for admission: a nonrefundable application fee of \$50; the completed and signed School and Department copies of the application; Personal Statement; completed address labels; letters of reference from faculty members in your field of proposed study who are familiar with your work and the American system of higher education; certified copies and **official English translations of all records of academic achievement** in each college or university attended; completed, signed International Student Data form and appropriate financial and visa documentation. In addition, all applicants whose native language is not English are required to submit results of the Test of English as a Foreign

Language (TOEFL). A score of 550 or better is required. International applicants are also required to submit results of the appropriate Graduate Record Examination (GRE); consult the Department/Program Information Sheet to determine what test scores are required.

All materials and credentials are to be mailed directly to the Division of Graduate Medical Sciences; confidential envelopes are not provided to international applicants living outside the United States. **International students must make arrangements for travel to and from Boston and for adequate financial resources, including tuition and living expenses, for at least one year at Boston University.**

A limited number of teaching fellowships and assistantships are available to qualified international students with superior fluency in English. U.S. immigration regulations generally prohibit international students from accepting employment during the first year of study in the United States unless the University offers an appointment together with admission. Information and assistance regarding governmental and University regulations may be obtained by writing to the Boston University International Students and Scholars Office, 19 Deerfield Street, Boston, MA 02215, USA. For further advice and assistance in seeking admission, international students are advised to consult the nearest United States embassy, consulate, or information center.

Please send your application form and all credentials to:

Boston University
School of Medicine
Division of Graduate Medical Sciences
Graduate Admissions Office
80 East Concord Street, Room L317
Boston, Massachusetts 02218
USA

If you need additional information, call 617/638-5120.

Applicants should note that all materials submitted in support of an application become the sole property of the University and neither originals nor copies will be provided to the applicant for other uses.

University Sources of Aid

If you wish to be considered for financial assistance from Boston University, be sure to check the "Yes" box on your application for admission. Your application will then be considered for an award from any of the following University resources.

Presidential University Graduate Fellowship

These fellowships provide, for exceptionally well-qualified entering PhD students, one full year of support. This award requires no service; it includes a substantial stipend and full tuition scholarship. Students may not apply directly for these awards. Nominees are proposed by the Graduate School departments, divisions, and programs, and are reviewed by the Graduate School University Fellowship Committee, which makes final recommendations for awards to the Associate Dean of the Graduate School.

Presidential University Teaching Fellowship

These teaching fellowships are awarded to continuing students who received University Graduate Fellowships in their first year of study and who have been nominated by the department. Recipients provide teaching support in undergraduate instruction, and for this service receive a generous stipend and tuition scholarship for up to full tuition and fees for a maximum of four courses per semester. The University is required to report the stipend portion of the award as income to the federal government and the student is subject to appropriate federal tax laws.

Teaching Fellowship

A Teaching Fellowship provides a stipend for a superior student who assists the faculty in carrying out the teaching mission of the University; approximately 20 hours of service per week are required. Payments are made in four monthly installments each semester. In addition, a scholarship is provided for tuition and fees during the academic year; no service is required for the scholarship. Ordinarily, recipients are not permitted to carry more than three courses in a semester. Partial awards may be given. Because this appointment involves service to a department of the University, it is required that the stipend be reported to the federal government as income; taxes are withheld from the stipend portion of the award.

Graduate Assistantship

A Graduate Assistant receives up to full tuition and fees for a maximum of four courses per semester. Duties vary according to the needs of individual departments and require up to 15 hours of service per week. Partial awards may be given. Because this appointment involves service to a department of the University, it is required that this award be reported to the federal government as income; taxes are withheld from this award.

Research Assistantship

Research assistants assist individual faculty members on specific research projects. The positions are generally funded by faculty research grants and thus their availability varies from year to year. Although duties vary, stipend amounts are generally comparable to those associated with a Teaching Fellowship and may be awarded up to a 12-

month period. Research Assistantship stipends are taxable. In some cases, tuition scholarships may be included as part of the award.

Martin Luther King, Jr., Fellowship

The Martin Luther King, Jr., Fellowship is available to African American students beginning graduate study in any department or program of the University. It provides tuition and fees for full-time study plus a stipend. Students are nominated for this award by their academic department and may not apply directly. Interested students should specify on the application for admission that they wish to be nominated by their department for this fellowship.

Other Sources of Aid

Application requests for college work-study and Whitney M. Young, Jr., Fellowships should be directed to Boston University Graduate School, Financial Aid Office, 705 Commonwealth Avenue, Boston, MA 02215; 617/353-2697.

Federal College Work-Study (CWS)

Work-Study is a federally-funded, need-based program for U.S. citizens and permanent residents, designed to promote part-time and summer employment to help students meet educational expenses. Students are placed at the University or in nonprofit off-campus organizations during the academic year and in full-time assignments during the summer. This program provides students with the opportunity not only to earn money but also to develop skills that may be related to their courses of study. To apply, students must file a Free Application for Federal Student Aid (FAFSA) through the College Scholarship Service (CSS). An application for Federal College Work-Study can be requested from the Graduate School Financial Aid Office. The deadline for receipt of applications is February 1 for summer work-study and May 1 for academic year work-study.

Whitney M. Young, Jr., Fellowship

The Whitney M. Young, Jr., Fellowship is available for an entering or continuing African American student who has displayed academic proficiency in a field related to race relations or urban problems. This fellowship provides a scholarship for full tuition and fees plus a stipend. The deadline for receipt of the application with all supporting documents is March 1.

Federal Stafford Loans

Federal Stafford loans are need-based, long-term educational loans to U.S. citizens and permanent residents available through banks, credit unions, savings and loan associations, Boston University, and other lending institutions. Repayment of subsidized loans begins when the student has graduated, terminated study, or enrolled on a less than half-time basis. Students who wish to borrow funds through this loan program must obtain an application from their lending institution or Boston University. In addition, loan applicants must file the Free Application for Federal Student Aid (FAFSA).

See other awards, loan information, etc., in the **Graduate Medical Sciences Bulletin** section on financial assistance.

Under the provisions of the 1974 Family Educational Rights and Privacy Act you should be aware that the University is authorized to disclose personally identifiable information from your educational records to approved financial aid agencies to which you have applied for aid if access to that information is needed by these agencies to determine your eligibility for, the conditions of, and/or maintenance of aid, or to enforce terms connected with the receipt of such aid.



Boston University
 Division of Graduate Medical Sciences
 School of Medicine
 80 East Concord Street, Room L317
 Boston, Massachusetts 02118

**APPLICATION FOR ADMISSION
 SCHOOL COPY**

Department Name _____ Date of Intended Enrollment September or January

Specialization _____ Prior application to this school? September or January
 circle one or circle one year

Degree Program: Master of Arts (M.A.) (Post-bachelor's) Doctor of Philosophy (M.A./Ph.D.) (Post-master's) Doctor of Philosophy (Ph.D.) Nondegree

Last (Family) Name _____ First _____ Middle _____ Former Name _____ U.S. Social Security Number or Boston University I.D. Number _____

Reply Address (good until _____ / _____ / _____ date) _____ Zip (Postal) Code _____ Telephone Number (days) _____ (eves) _____

Permanent Address _____ Zip (Postal) Code _____ Telephone Number (permanent) _____

Marital Status* _____ Circle one* Male Female _____ Date and Place of Birth* _____ Country of Citizenship _____ If not U.S. citizen, has Permanent Residency in the U.S. been issued? Yes No

Give dates the Graduate Record Examination and/or the Miller Analogies Test and/or the Test of English as a Foreign Language were (will be) taken.
 GRE Date _____ MAT Date _____ TOEFL Date _____

Persons writing letters of recommendation on your behalf:
 1. _____ 2. _____ 3. _____

Colleges or Universities attended (most recent first)	Location	Dates (from/to)	Major field	Name of degrees awarded and date awarded or expected

Do you wish to be considered for financial aid from Boston University? Yes No Are you a U.S. veteran? Yes No
 If a U.S. citizen, do you wish to be considered a member of an ethnic group? Yes No If so, which? _____

Signature _____ Date _____

THE APPLICANT SHOULD NOT WRITE BELOW

DEPARTMENTAL RECOMMENDATIONS	FINANCIAL AID	PREREQUISITES	INTEROFFICE
RATING: 1 2 3 4 5 (circle one) high low <input type="checkbox"/> Admit <input type="checkbox"/> MA <input type="checkbox"/> Post-Bachelor's PhD <input type="checkbox"/> Post-Master's PhD <input type="checkbox"/> NonDegree <input type="checkbox"/> <input type="checkbox"/> Place on Alternate List <input type="checkbox"/> Reject Basis _____	<input type="checkbox"/> Aid Not Requested <input type="checkbox"/> Recommendation for Aid Attached <input type="checkbox"/> Aid Decision Pending <input type="checkbox"/> No Aid	_____ _____ _____ COREQUISITES _____ _____ _____	# _____ Fee _____ GRE: V _____ / _____ % Q _____ / _____ % A _____ / _____ % SUB _____ / _____ % MAT _____ / _____ TOEFL _____ TWE _____

Chairman's Signature _____ Date _____

COMMITTEE ON ADMISSIONS
 ADMIT
 REJECT

 Graduate School Review Date

*This information is requested for statistical information and not required. Failure to provide this information will not prevent your application from being considered.



Boston University
 Division of Graduate Medical Sciences
 School of Medicine
 80 East Concord Street, Room L317
 Boston, Massachusetts 02118

**APPLICATION FOR ADMISSION
 DEPARTMENT COPY**

Department Name _____ Date of Intended Enrollment _____ Full Time
 Part Time

Specialization _____ Prior application to this school? September or January
 circle one year

Degree Program: Master of Arts (M.A.) (Post-bachelor's) Doctor of Philosophy (M.A./Ph.D.) (Post-master's) Doctor of Philosophy (Ph.D.) Nondegree

Last (Family) Name	First	Middle	Former Name	U.S. Social Security Number or Boston University I.D. Number
Reply Address (good until _____ / _____ / _____ date)			Zip (Postal) Code	Telephone Number (days) (eves)
Permanent Address			Zip (Postal) Code	Telephone Number (permanent)
Marital Status*	Circle one* Male Female	Date and Place of Birth* Month/Day/Year	Country of Citizenship	If not U.S. citizen, has Permanent Residency in the U.S. been issued? <input type="checkbox"/> Yes <input type="checkbox"/> No

If the department to which you are applying requires the Graduate Record Examination (GRE) or the Miller Analogies Test, provide the following information:

General Test scores and percentage ranks				Subject Test score and percentage rank	
GRE	_____ / _____ %	_____ / _____ %	_____ / _____ %	_____ / _____ %	_____ / _____ %
	Test date	Verbal	Quantitative	Analytical	Subject Name Score/Rank
Test of English as a Foreign Language:	TOEFL _____	Sec. 1 _____	Sec. 2 _____	Sec. 3 _____	Total Score _____
	Test date				TWE _____
MAT	_____	_____			
	Test date	Score			

Persons writing letters of recommendation on your behalf:

1. _____ 2. _____ 3. _____

Colleges or Universities attended (most recent first)	Location	Dates (from/to)	Major field	Name of degrees awarded and date awarded or expected

Do you wish to be considered for financial aid from Boston University? Yes No Are you a U.S. veteran? Yes No

Do you wish to be considered a member of a minority group? Yes No If so, which? _____

List all courses that you are currently enrolled in that do not appear on your current transcript.

INSTITUTION	DEPT.	TITLE OF COURSE (If possible, give name of instructor)	NO. OF CREDITS

List below all courses in your intended area of study that have been or will be completed prior to enrollment. Then list all foreign language courses you have taken or are taking, and describe your speaking and reading competence in each language. Mark graduate-level courses with a "G" after the grade. Any graduate-level courses for which you anticipate requesting transfer of credit should be marked with an asterisk (*).

Institution	Department	Title of Course (If possible, give name of instructor)	No. of Credits	Grade

Employment Information

List all jobs held since you began undergraduate studies, starting with the most recent (a résumé may be submitted as a replacement or supplement to this section).

Dates	Employer	Location	Title	Full- or Part-time

Optional: Have you been in contact with a member of the Boston University faculty or staff in your chosen department of study?
 Yes No
 If so, with whom? _____

Personal Statement

Write a statement on a separate page of not less than 200 words describing your qualifications and the objectives of your educational program. Report any research activities, publications, independent studies, and memberships in academic, professional, or honorary societies. Account for time that has elapsed between formal studies. Applicants for teaching fellowships should indicate previous teaching experience. If any physical or emotional factors will affect your program of study, please include an explanation in your statement. Please be sure to write your name on this sheet. Please be advised that under certain circumstances, this evaluation may be reviewed by someone other than a member of the admissions committee of the department indicated above.

Remember to Attach your Personal Statement



Boston University

Division of Graduate Medical Sciences
School of Medicine
80 East Concord Street, Room L317
Boston, Massachusetts 02118

Recommendation for Admission

The applicant should complete all relevant sections below and submit this form to the person providing a recommendation. Materials submitted in support of an application become the property of the University, and neither originals nor copies will be provided. (Please type or print.)

Applicant's name _____
(Family Name) (Given Name) (Middle)

Applicant for Master of Arts Nondegree
 (Post-bachelor's) Doctor of Philosophy MD/PhD Dual Degree
 (Post-master's) Doctor of Philosophy

Department name _____ **Specialization** _____

Evaluator's name _____ **Title or Position** _____

Institution/Company _____

Address _____

Telephone Number _____

To the Applicant: This recommendation will become part of your Admissions file. It will not be disclosed to any unauthorized individual without your consent. If you matriculate at Boston University, you will be accorded access to its contents unless you voluntarily waive your right of access. Please check one of the boxes and sign the statement below.

I have read the information above and I hereby waive do not waive my right of access to this document should I matriculate at Boston University.

Signature _____ **Date** _____

TO THE PERSON MAKING THE RECOMMENDATION: Under the 1974 Family Educational Rights and Privacy Act, the applicant named above will have access to this recommendation unless he/she has waived that right. If you choose not to use this form for your recommendation, please return the form with your letter so that the above waiver may apply to such letters. Please be advised that under certain circumstances, this evaluation may be reviewed by someone other than a member of the admissions committee of the department indicated above.

The Committee on Admissions of the Graduate School will greatly appreciate your cooperation in providing an evaluation of the applicant's potential as a graduate student.

1. How well do you know the applicant? (Check as many as apply)
 as reported by junior staff members
 as a student in a large lecture course
 as a student in a small class
 as a student in laboratory courses
 as a student engaged in research or independent study under my direction
 as my advisee
 other (state) _____

2. How long have you known the applicant? _____

3. For what level of graduate study do you recommend the applicant?
 a program leading to the master's degree only
 a program leading to the Ph.D. degree
 a program leading to the MD/PhD dual degree

4. Would you accept this student to work with you toward a Ph.D. degree? If no, please comment.
 Yes
 No _____

5. Please summarize your evaluation by checking your estimate on the following items. ("Exceptional" should indicate that the applicant is comparable to the best-qualified student you have known. "Good" should indicate a positive recommendation with no reservation.)

a.	General Qualifications	Exceptional	Good	Fair	Doubtful	Poor	No basis for judgment
	Ability to engage in independent inquiry						
	Ability to express self in writing						
	Breadth of general knowledge						
	Analytical skills—science and mathematics						
	Emotional stability and maturity						
	Intellectual ability						
	Motivation						
	Perseverance						
	Potential as a creative scholar						
	Responsibility in assignments and undertakings						
b.	Potential as a Teacher						
	Ability to stimulate interest						
	Breadth of perspective on field of study						
	Interest in teaching						
	Poise and clarity of expression						
	Proficiency and experience in working with groups						
c.	Laboratory Skills						

6. What is your overall ranking of this applicant as compared with other students you have known at his or her educational level?
 Upper 5% Upper 10% Upper 25% Upper 50% Lower 50%

7. In a brief statement, describe the major strengths and weaknesses of the applicant as a potential graduate student.

Signature _____ Date _____

Please return to: BOSTON UNIVERSITY
Division of Graduate Medical Sciences
School of Medicine
Graduate Office
80 East Concord Street
Boston, Massachusetts 02118



Boston University

Division of Graduate Medical Sciences
School of Medicine
80 East Concord Street, Room L317
Boston, Massachusetts 02118

Recommendation for Admission

The applicant should complete all relevant sections below and submit this form to the person providing a recommendation. Materials submitted in support of an application become the property of the University, and neither originals nor copies will be provided. (Please type or print.)

Applicant's name _____
(Family Name) (Given Name) (Middle)

- Applicant for**
- Master of Arts
 - (Post-bachelor's) Doctor of Philosophy
 - (Post-master's) Doctor of Philosophy
 - Nondegree
 - MD/PhD Dual Degree

Department name _____ **Specialization** _____

Evaluator's name _____ **Title or Position** _____

Institution/Company _____

Address _____

Telephone Number _____

To the Applicant: This recommendation will become part of your Admissions file. It will not be disclosed to any unauthorized individual without your consent. If you matriculate at Boston University, you will be accorded access to its contents unless you voluntarily waive your right of access. Please check one of the boxes and sign the statement below.

I have read the information above and I hereby waive do not waive my right of access to this document should I matriculate at Boston University.

Signature _____ **Date** _____

TO THE PERSON MAKING THE RECOMMENDATION: Under the 1974 Family Educational Rights and Privacy Act, the applicant named above will have access to this recommendation unless he/she has waived that right. If you choose not to use this form for your recommendation, please return the form with your letter so that the above waiver may apply to such letters. Please be advised that under certain circumstances, this evaluation may be reviewed by someone other than a member of the admissions committee of the department indicated above.

The Committee on Admissions of the Graduate School will greatly appreciate your cooperation in providing an evaluation of the applicant's potential as a graduate student.

1. How well do you know the applicant?
(Check as many as apply)
- as reported by junior staff members
 - as a student in a large lecture course
 - as a student in a small class
 - as a student in laboratory courses
 - as a student engaged in research or independent study under my direction
 - as my advisee
 - other (state) _____

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4. Would you accept this student to work with you toward a Ph.D. degree? If no, please comment.

- Yes
- No _____

5. Please summarize your evaluation by checking your estimate on the following items. ("Exceptional" should indicate that the applicant is comparable to the best-qualified student you have known. "Good" should indicate a positive recommendation with no reservation.)

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 Upper 10%
 Upper 25%
 Upper 50%
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7. In a brief statement, describe the major strengths and weaknesses of the applicant as a potential graduate student.

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Division of Graduate Medical Sciences
 School of Medicine
 Graduate Office
 80 East Concord Street
 Boston, Massachusetts 02118



Boston University

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Applicant's name _____
(Family Name) (Given Name) (Middle)

- Applicant for**
- Master of Arts
 - (Post-bachelor's) Doctor of Philosophy
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TO THE PERSON MAKING THE RECOMMENDATION: Under the 1974 Family Educational Rights and Privacy Act, the applicant named above will have access to this recommendation unless he/she has waived that right. If you choose not to use this form for your recommendation, please return the form with your letter so that the above waiver may apply to such letters. Please be advised that under certain circumstances, this evaluation may be reviewed by someone other than a member of the admissions committee of the department indicated above.

The Committee on Admissions of the Graduate School will greatly appreciate your cooperation in providing an evaluation of the applicant's potential as a graduate student.

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(Check as many as apply)
- as reported by junior staff members
 - as a student in a large lecture course
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- a program leading to the Ph.D. degree
- a program leading to the MD/PhD dual degree

4. Would you accept this student to work with you toward a Ph.D. degree? If no, please comment.

- Yes
- No _____

5. Please summarize your evaluation by checking your estimate on the following items. ("Exceptional" should indicate that the applicant is comparable to the best-qualified student you have known. "Good" should indicate a positive recommendation with no reservation.)

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- Upper 5%
 Upper 10%
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 Upper 50%
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Signature _____ Date _____

Please return to: BOSTON UNIVERSITY

Division of Graduate Medical Sciences
 School of Medicine
 Graduate Office
 80 East Concord Street
 Boston, Massachusetts 02118

Instructions for International Applicants

The Division of Graduate Medical Sciences (GMS) offers programs leading to the Master of Arts (MA) and the Doctor of Philosophy (PhD) degrees in the fields of study as listed. If you do not find the graduate program you want here, another School in the University may offer it. Please be sure to check everything carefully, especially application deadlines and special departmental requirements, before submitting your application.

Academic Regulations

Requirements for the completion of the *Master of Arts* degree include a minimum of eight graduate-level courses and a thesis or comprehensive examination if specified by the department or division of major study. Each student who has not previously completed at least two years of study in a foreign language shall make up the deficiency by coursework or examination (an international student may not offer his/her native language in fulfillment of the language requirement.) The program must be completed within three years of the first registration in the Division of Graduate Medical Sciences.

Requirements for the completion of the *Doctor of Philosophy* degree include a minimum of 16 graduate-level semester courses for students without a master's degree or equivalent (the program must be completed within seven years of the first registration in the GMS) or eight graduate-level semester courses for students with a master's degree or equivalent (the program must be completed within five years of the first registration in the GMS). Candidates must give evidence of mastery of at least one foreign language (an international student may not offer his/her native language in fulfillment of the language requirement), pass qualifying examinations, and present and defend a dissertation. Each student must satisfy a residency requirement of at least two consecutive regular semesters of full-time study at Boston University.

Materials Required for Application for Admission to the Division of Graduate Medical Sciences

1. A nonrefundable application fee of \$50 (paid in U.S. currency or check, international money order, or an international check drawn on a bank in the United States). This fee cannot be waived. An application will not be considered without it.
2. Completed admission application (including address labels), indicating major field of study and degree program desired.
3. Completed International Student Data Form (see Estimate of Expenses for help with financial planning.) **Please complete and submit all four pages. You must attach documentation of all sources of financial support as stated in the Financial Declaration portion of the International Student Data Form.** If you are currently in the United States, it is essential to include a photocopy of your current visa.
4. Two letters of recommendation (unless your proposed department of study requires three) from faculty members in your proposed field of study who are familiar with the American system of higher education.
5. Certified official copies (not photocopies) and *certified English translations* of all academic records from every college or university you have attended.
6. All students applying to the Division of Graduate Medical Sciences, *including international students*, must submit results of the Graduate Record Examination (GRE), General and appropriate Subject tests or the Medical College Aptitude Test (MCAT). In the United States, the GRE is administered in October, December, February, April, and June. Test dates may vary in other parts of the world. To receive registration materials, write to: GRE, Educational Testing Service, P.O. Box 6000, Princeton, NJ 08541-6000, USA. International students are not required to take the Miller Analogies Test (MAT).
7. If your native language is not English, you must submit results of the Test of English as a Foreign Language (TOEFL). The TOEFL is administered monthly in major centers around the world. To receive registration materials, write to (within the United States): TOEFL/TSE Services, Box 6151, Princeton, NJ 08541-6151. Fax: 609/951-1300. Outside the United States, please write to: TOEFL/TSE Publications, Box 6154, Princeton, NJ 08541-6154, USA. Telephone: 609/951-1100.
8. By checking the "YES" box following the question about financial aid on the application for admission, you will be considered for all Boston University sources of financial aid.

Financial aid in the form of fellowships, scholarships, assistantships, etc. is available to international students, but awards are made on the basis of merit, not financial need. To be considered for financial aid, your application must be received by the Division of Graduate Medical Sciences *no later than December 31*. Otherwise, the MA in Medical Sciences in the Division of Graduate Medical Sciences programs has no deadline.

Application form and all credentials should be sent to (prior to June 1):

BOSTON UNIVERSITY
Division of Graduate Medical Sciences
School of Medicine
80 East Concord Street, Room L317
Boston, Massachusetts 02118
USA

Financial Declaration

Boston University is required by U.S. government regulations to check the availability of adequate funding for your tuition, fees, and living expenses for the duration of your studies at Boston University. We will be unable to provide you with the documents necessary to obtain your visa without verification of adequate funding. (Please refer to the accompanying estimate of expenses for the breakdown of fees and for the minimum required per annum.)

All sources of support which you submit must be:

1. Originals, not photocopies
2. Shown in U.S. dollars
3. For Boston University specifically, and no other college or university
4. No more than one year old
5. Written in English

Please check the box below which describes the type of funding you will be receiving, and **attach the appropriate official documentation** as outlined below:

If you will be funded by your *parents* or a *relative*, please submit:

1. A legalized letter of sponsorship which indicates that your sponsor is willing and able to support you financially for your academic fees and living expenses throughout the duration of your studies at Boston University.
2. A bank statement or credit reference from a bank stating the availability of the minimum estimated expenses (as indicated on the Estimate of Expense sheet enclosed). This document should be in English, and the sum should be indicated in *U.S. dollars*.

If you will be funded by your *government*, an *organization*, a *company*, etc., the sponsor must submit an official letter of sponsorship which states:

1. That your funding is valid for Boston University specifically.
 2. What expenses will be covered. For example: academic fees, living expenses (how much), health insurance, financial support for family members, travel costs, etc.
 3. The length of time of the support.
- Amounts should be in *U.S. dollars*.

If you will be funded by a *bank loan*, you must submit an official letter of certification from the lending institution. Amounts should be in *U.S. dollars*.

If you will be funded by a *Salary* or *Study-leave allowance*, you must submit an official letter from your employer validating this information. Amounts should be in *U.S. dollars*.

If you will be funded in a manner not listed above (for example, if *you will fund yourself*), you must submit official documentation (a bank statement or a credit reference from a bank) from the source of sponsorship clearly stating the amount of financial support to be provided and the length of time for which it will be available. Amounts should be in *U.S. dollars*.

Language Information

Is English your native language? Yes _____ No _____ If not, what is your native language? _____

In what other languages are you fluent? _____

If you have been enrolled, are currently enrolled, or will enroll in an intensive English-language program in the United States, please complete the following:

Name of the English-language program _____

Address _____

Dates of your enrollment: from _____ to _____

If English is not your native language, Boston University requires the Test of English as a Foreign Language (TOEFL) as proof of your proficiency in English. To apply for this test, write directly to: TOEFL, Box 6151, Princeton, New Jersey 08541-6151, U.S.A., or consult the nearest United States Embassy, Consulate, or Bi-National Center.

On what date do you plan on taking the TOEFL? _____

Have the results of the TOEFL sent *directly* from the TOEFL testing service in Princeton, New Jersey, to the Admissions Office that is reviewing your application. If it is impossible for you to take the TOEFL, Boston University will consider the results of either the Michigan or ALIGU test. The results must be sent directly from the testing center which administered the exam to the Admissions Office reviewing your application.

Educational Information

List all schools, colleges, or other institutions you have attended or are attending in your country and elsewhere, including the United States:

Secondary or Preparatory Schools	Location	Degree or diploma	Dates from to
Universities, Colleges, Institutes			

Was English the medium of instruction in any of these schools? Yes _____ No _____

If yes, which school(s)? _____

Are you now enrolled in a school or college in the United States? Yes _____ No _____

If yes, give details below:

Purpose _____

Location _____

Date started _____ Date of completion _____

Have you ever visited the United States for purposes other than school? Yes _____ No _____

If yes, give details below:

Purpose _____

Location _____ Dates _____

Visa Information

If you are now in the United States, please indicate below the type of visa you hold.

1. F-1 _____ F-2 _____ For F-1's, admission number from previous I-20 ID _____

Please attach a copy of both sides of your Form I-20 ID, your Form I-94, and your U.S. Consulate visa stamp.

2. J-1 _____ J-2 _____ **Please attach a copy of your Form IAP-66, your Form I-94, and your U.S. Consulate visa stamp.**

3. B-1 _____ B-2 _____ B-2 Prospective Student _____ **Please attach a copy of your Form I-94 and your U.S. Consulate visa stamp.**

4. Other: specify category _____ **Please attach a copy of both sides of your Form I-94 and your U.S. Consulate visa stamp as well as any other documentation verifying your immigration status (e.g., I-797).**

Are you single? _____ married? _____ If married, do you intend to bring your husband/wife to the United States?

Yes _____ No _____

If your husband/wife is already in the United States, what type of visa does he/she hold? _____

Below, please give the names of the dependents who will accompany you to the United States. (The definition of "dependents" who can be listed on your visa document includes *only* your husband/wife and your children under 21 years of age. If you wish to have other family members and/or employees accompany you to the United States, please consult the U.S. Consulate for information on which visa would be appropriate for them.)

Relationship	Family Name	First Name	Date of Birth	City and Country of Birth
Husband/Wife	_____	_____	_____	_____
Son/Daughter	_____	_____	_____	_____
Son/Daughter	_____	_____	_____	_____
Son/Daughter	_____	_____	_____	_____

If you will be accompanied by your husband/wife, what will he/she do while in the United States?

Study _____ Child care _____ Other (be specific) _____

If you are now employed in your home country, what is your official job title? _____

What is the name of the organization/company for which you work? _____

Address _____

Briefly describe your responsibilities: _____

During the summer will you be staying in the United States? Yes _____ No _____ Unsure _____

(If you have checked "yes," you must document the additional summer living expenses as indicated on the accompanying Estimate of Expenses sheet.)

Attention: Before you send your application documents to your Admissions Office, indicate by checking below that you have enclosed:

Proof of English proficiency _____
If not, why not? _____

Financial documentation _____
If not, why not? _____

I declare that the statements above are true.

Signed _____ Dated _____

**BOSTON UNIVERSITY SCHOOL OF MEDICINE
DIVISION OF GRADUATE MEDICAL SCIENCES
ESTIMATE OF EXPENSES FOR INTERNATIONAL STUDENTS**

Fall 1995–Spring 1996

Prepared by the International Students and Scholars Office

Please keep in mind that the estimates for living expenses are approximations and that, depending on your lifestyle, these costs may be higher. University tuition, fees, and living expenses will increase annually. Transportation to and from the United States is not included in these estimates.

The estimates quoted below are for students attending the Division of Graduate Medical Sciences.

Estimate for Nine-Month School Year			
Breakdown of Costs	Single Student (on-campus residence)	Single Student (off-campus)	Married Student (off-campus)
Tuition	\$19,420	\$19,420	\$19,420
Graduate Program Fee*	25	25	25
Medical Insurance**	509	509	1,600
Rent and Food	7,100***	8,385	11,037
Books and Supplies	775	775	775
Personal (clothing, miscellaneous)	1,025	2,505	3,327
TOTAL estimate for nine months	\$28,854	\$31,619	\$36,184

Estimated Expenses for Dependent Children

Add \$2,922 (for nine months) or \$3,896 (for twelve months) for the first child.

Add \$1,462 (for nine months) or \$1,949 (for twelve months) for each additional child.

Off-Campus Summer Living Expenses***

(tuition and fees not included—see reverse side):

For single students, add \$3,525. For married students, add \$4,649.

Exceptions/Additional Fees

Continuing Student Fee: \$1,214 per semester for students who are enrolled to work on a thesis but who are not registered for classes.

*Full-time students \$25; part-time students \$10. Please note that all students in the MD programs are assessed \$375 in the fall semester.

**Required for student; recommended for spouse. The rate listed is for 1994/95. The 1995/96 rate has not been announced.

***Not including vacation periods (vacation allowance is approximately \$994 based on 32 days).

SUMMER SCHOOL 1995 Tuition and Fees

Session I: May 23–July 1, 1995
Session II: July 5–August 12, 1995

<u>Tuition Costs Per Credit:</u>	Undergraduate (course Nos. 100 to 599)	\$299
	Graduate (course Nos. 600 to 999)	576
<u>Exceptions:</u>	School of Education (all courses, per credit)	\$299
	Doctor of Ministry (D.Min.) (all courses, per credit)	200
	School of Social Work (all courses, per credit)	455
	Metropolitan College (all courses, per credit)	299
	Laboratory Fee (per course)	160
	Registration Fee (per course)	40
	Medical Insurance \$157 (6 wks.); \$180 (9 wks.); \$228 (12 wks.) (student insurance rates)	

Employment

In securing a visa, an entering international student must prove to the satisfaction of Boston University, the American Consul, and the U.S. Immigration and Naturalization Service that he/she has sufficient funds for at least one year of study. Therefore, paid employment is not permitted during the first semester of one's studies.

After the first semester, international students may work on campus by securing written permission from the International Students and Scholars Office. If permission is granted, the student may work up to 20 hours per week during the academic year and full-time during the summer and vacation periods. There is often a shortage of on-campus jobs, and some students are unable to find employment.

Students on F-1 visas may apply for off-campus employment only after the first year in the United States and only after a number of conditions are met.

Those persons on J-1 visas may engage in any employment specified on the IAP-66 form. The IAP-66 form is the document used to obtain a visa. Such employment authorization is usually reserved, however, for foreign faculty, research scholars, and teaching assistants (TAs), and not for undergraduate students. If there is a clear, urgent need for employment, J-1 students may request work authorization, either on campus or off campus, from their visa sponsor (this might be an agency, or Boston University). If the sponsor believes the work will not interfere with the educational objectives being pursued, the sponsor can grant the J-1 student permission to work up to 20 hours per week during the academic year and full-time during the summer and vacation periods. No authorization is needed from the Immigration and Naturalization Service.

Usually at the completion of their academic program, students can apply at the International Students and Scholars Office for practical training authorization, which will allow them to work in their field and be paid.

In all cases, visa regulations require that foreign students maintain a full course of study each semester (minimum of 12 credit hours). Because of this requirement and because permission to work is restricted, **students should not expect to finance their studies solely by working in the United States.**

Second-class postage
paid at Boston, MA
and at additional
mailing offices.

Third-Class materials
enclosed.



Boston University
(USPS 061-540)
School of Medicine
Division of Graduate Medical Sciences
80 East Concord Street, Room L 317
Boston, Massachusetts 02118
Tel: 617/638-5120
Fax: 617/638-4842

An equal opportunity, affirmative action institution