Molecular and Cellular Biology (MCB)

Graduate Program Director: Rolf Sternglanz, Life Sciences Building Room 348, (631) 632-8565
Graduate Program Senior Staff Assistant: Carol Juliano, Life Sciences Building Room 336, (631) 632-8533

Degree awarded: Ph.D. in Molecular and Cellular Biology

The Molecular and Cellular Biology (MCB) graduate program offers a multidisciplinary course of study leading to the Ph.D. degree. Diverse biological systems of study from plants to humans are pursued in MCB research laboratories. These systems are used to investigate a variety of biological topics including Biological Membranes, Cancer, Cell Cycle, Development, DNA Replication, Gene Expression, Immune Response, Infectious Disease, Neurobiology, Protein Trafficking, Signal Transduction, and Structural Biology. The MCB program provides students with the opportunity to select an academic program in one of three specializations: Cellular and Developmental Biology, Immunology and Pathology, or Molecular Biology and Biochemistry. The goal of this approach is to provide the student with the widest range of research possibilities.

During the first year, students participate in several core courses that serve to build a scholastic foundation for further study. The core courses include Graduate Biochemistry, Molecular Genetics, and Cell Biology. In addition, students receive training to critically evaluate original research articles in a Journal Club/Readings course. Students can select an area of specialization at the time of enrollment or they can decide on a course of study during their first year. The program of study in Molecular Biology and Biochemistry includes Physical Biochemistry and any of a number of electives. Training stresses biochemical and structural approaches to solve biological problems. The program of study in Cellular and Developmental Biology includes a course in Developmental Biology and any of a number of electives. Emphasis is placed on the control mechanisms that define and regulate growing and developing systems. The program of study in Immunology and Pathology includes courses in Immunology and General Pathology. This area of specialization emphasizes the cellular and molecular basis of human disease to foster a bridge between basic and clinical research. Each of the specializations enhances knowledge within the field to ensure our graduates are well equipped for a successful career in research.

The MCB program involves students in ongoing research projects as soon as they arrive on campus. During the first academic year, students train in four different research laboratories to help in choosing a mentor for thesis dissertation. The first laboratory training, or rotation, is usually at Stony Brook University, but subsequent rotations can be performed at Cold Spring Harbor Laboratory or Brookhaven National Laboratory. The MCB program crosses departmental boundaries and institutions to offer the student thesis research training in nearly 100 different laboratories. A decision for a thesis advisor is generally made by the end of the first academic year and research studies will subsequently form the foundation of a Ph.D. thesis.

All students in the MCB program gain experience and skills in teaching and oral presentation of their research studies. During two semesters, students assist in teaching undergraduate laboratory or lecture courses. The teaching experience can include assistance in formulation/grading of examinations and individual tutoring sessions. In the third and subsequent years, graduate students present their research progress to other students and faculty in a seminar forum. The student seminars are an opportunity to gain communication skills and to learn about ongoing research of other students in different laboratories. In addition to student seminars, a number of faculty from outside the institution are invited for weekly seminars. These are opportunities to meet visiting scientists who are leaders in their field and to learn of their latest findings.

In the second year of the MCB program, students take a comprehensive qualifying exam. Following successful performance, students focus on their thesis research. In the third year, students prepare a written Ph.D. thesis proposal in consultation with their faculty thesis advisor. The proposal is defended orally before a proposal committee comprised of faculty selected by the student. Following successful defense of the proposal, the student advances to candidacy and the proposal committee along with the faculty advisor become the student's Ph.D. thesis committee. The Ph.D. thesis committee meets at least once a year with the student to assess progress and discuss research strategies. For more information, visit the MCB Web site at *www.grad.sunysb.edu/academics/brochures/molecularcell/contact.html*

Facilities

The Biological Sciences Division and Health Sciences Center are well equipped for work in developmental and cellular biology. Individual faculty laboratories and central services provide a full array of state-of-the-art equipment. These include the Flow Cytometry Facility, the Cell Culture and Hybridoma Facility, the Transgenic Mouse Facility, the University Microscopy Imaging Center, and the Center for Analysis and Synthesis of Macromolecules. The Health Sciences Library contains a comprehensive collection of biomedical journals and books and is complemented by the Melville Library on the main campus.

Admission

In addition to the minimum requirements of the Graduate School, the following are suggested requirements:

A. A bachelor's degree with the following minimal preparation: mathematics through one year of calculus, chemistry (including organic chemistry and laboratory), general physics, and one year of biology (including laboratory);

B. A minimum grade point average of 3.0 (B) in undergraduate courses including science and mathematics courses;

C. Letters from three previous instructors;

D. A report of Graduate Record Examination (GRE) General Test scores;

E. Acceptance by both the Graduate Program in Molecular and Cellular Biology and the Graduate School.

In special cases, students not meeting requirements A and B may be admitted

on a provisional basis. These students must act to remedy deficiencies within the first year according to the program's requirements.

Faculty

Distinguished Professors

Grollman, Arthur, P.,[4] M.D., 1959, Johns Hopkins Medical School: Mechanisms of chemical mutagenesis/carcinogenesis.

Lennarz, William, J.,[1] Ph.D., 1959, University of Illinois: Biosynthesis and function of glycoproteins in cell-cell interactions.

Sternglanz, Rolf,[1] Ph.D., 1967, Harvard University: Chromatin structure and function in yeast; histone modifying enzymes.

Wimmer, Eckard,[2] Ph.D., 1962, University of Gottingen, Germany: RNA virus genetics, replication, and pathogenicity; cellular virus receptors.

Professors

Benach, Jorge L.,[2] Ph.D., 1972, Rutgers University: Host response to bacterial infections.

Bingham, Paul M.,[1] Ph.D., 1979, Harvard University: Genetic control of development and gene expression in animals.

Bogenhagen, Daniel F.,[4] M.D., 1977, Stanford University: Mitochondrial DNA; mitochondrial proteomics.

Brown, Deborah,[1] Ph.D., 1987, Stanford University: Cholesterol/sphingolipid-rich membrane domains; role in endocytosis.

Bynum, David R.,[1] Ph.D., 1981 Dartmouth College: *Director, Long Island Group Advancing Science Education*, Stony Brook University.

Chen, Wen-Tien,[8] Ph.D., 1979, Yale University: Proteases and integrins in cancer invasion, metastasis, and angiogenesis.

Citovsky, Vitaly,[1] Ph.D., 1987, Hebrew University, Israel: Nuclear targeting and intercellular communication in plants.

Dean, Neta,[1] Ph.D., 1988, University of California, Los Angeles: Protein glycosylation, fungal cell wall biosynthesis; fungal pathogenesis.

Deutsch, Dale,[1] Ph.D., 1972, Purdue University: Metabolism and uptake of the endocannabinoids (anandamide and 2-AG).

Frohman, Michael A.,[4] M.D./Ph.D., 1986, University of Pennsylvania: Mammalian signal transduction development; vesicular trafficking; mitochondrial fusion diabetes.

Furie, Martha,[5] Ph.D., 1980, Rockefeller University: Interactions among pathogenic bacteria, endothelium, and leukocytes.

Futcher, Bruce,[2] Ph.D., 1981, Oxford University: Cell cycle control; microarrays; genomics.

Gergen, J. Peter,[1] Ph.D., 1982, Brandeis University: Pattern information and the regulation of gene expression during Drosophilia development.

Ghebrehiwet, Berhane,[8] D.V.M./D.Sc., 1974, University of Paris, France: Biochemistry; role of complement C1q receptors during infection and inflammation.

Halegoua, Simon,[3] Ph.D., 1978, Stony Brook University: Control of the neuronal phenotype and survival by growth factors using biochemical, molecular, and cell biological approaches.

Haltiwanger, Robert,[1] Ph.D., 1986, Duke University: Role of protein glycosylation in signal transduction.

Hayman, Michael,[2] Ph.D., 1973, Institute for Medical Research, England: Viral/cellular oncogenes; differentiation of erythroid cells.

Hearing, Patrick,[2] Ph.D., 1980, Northwestern University: Adenovirus-host cell interactions; adenovirus assembly and vectors for gene therapy.

Hollingsworth, Nancy,[1] Ph.D., 1988, University of Washington, Seattle: Regulation of meiotic recombination in yeast.

Jesty, Jolyon,[8] D.Phil., 1972, University of Oxford, England: Mechanisms of thrombogenesis.

Johnson, Roger A.,[6] Ph.D., 1968, University of Southern California, Los Angeles: Regulation of cell function by pro-nucleotide inhibitors of transmembrane signaling mechanisms.

Katz, Eugene,[2,14] Ph.D., 1969, University of Cambridge, England: Genetics/development in cellular slime molds.

Konopka, James,[2] Ph.D., 1985 University of California, Los Angeles: Regulation of G protein coupled receptor signal transduction; morphogenesis in pathogenic yeast.

Levine, Joel M.,[3] Ph.D., 1980, Washington University: Cell-surface molecules of the developing nervous system.

London, Erwin,[1] Ph.D., 1979, Cornell University: Membrane protein structure/translocation/folding; structure and function of sphingolipid/cholesterol rafts in membranes.

Malbon, Craig C.,[4] Ph.D., 1976, Case Western Reserve University: Signal transduction and gene regulation in differentiation and development; roles of G-proteins.

Marcu, Kenneth B.,[1] Ph.D., 1975, Stony Brook University: NF-kappaB kinase signaling in stress, immunity, and cancer; mechanisms of action of AID in adaptive immune responses.

McLaughlin, Stuart,[6] Ph.D., 1968, University of British Columbia, Canada: Calcium/phospholipid second messenger system.

Miller, Todd W.,[6] Ph.D., 1989, Rockefeller University: The regulation and substrate specificity of ttyrosine kinases.

Moll, Ute M.,[5] M.D., 1985, Ulm, Germany: Function/regulation of the p53 gene family in apoptosis and cancer; Function/regulation in normal cells and tumor-associated inactivation.

Reich, Nancy L.,[2] Ph.D., 1983, Stony Brook University: Signal transduction and gene expression in response to cytokines and virus.

Reinitz, John,[16] Ph.D., 1987, Yale University: Systems biology of development and transcription.

Scarlata, Suzanne,[6] Ph.D., 1984, University of Illinois: Structure/function studies of G proteins and effectors.

Schechter, Nisson,[1] Ph.D., 1971, Western Michigan University: Homeobox and filament proteins in neuronal differentiation, growth, and regeneration.

Shroyer, Kenneth,[5] Ph.D. 1983, M.D. 1987, University of Colorado: Cancer biomarkers as diagnostic adjuncts in cervical pathology and cytopathology; cervical cancer and HPV.

Simon, Sanford R.,[1,5] Ph.D., 1967, Rockefeller University: Proteinases and their inhibitors in invasiveness inflammation and tumor metastasis; inhibition of bacterial metalloproteinases.

Smith, Steven O.,[1] Ph.D., 1985, University of California, Berkeley: Structure and function of membrane proteins.

Staros, James V.,[1] Ph.D., 1974, Yale University: Molecular mechanisms of transmembrane signaling.

Steigbigel, Roy T.,[8] M.D., 1966, University of Rochester: Immune dysfunction induced by HIV infection.

Taichman, Lorne B.,[10] M.D./Ph.D., 1971, University of Wisconsin: Cutaneous gene therapy.

Tonge, Peter J.,[9] Ph.D., 1986, University of Birmingham, England: Tuberculosis drug discovery; spectroscopic insights into enzyme mechanisms; GFP fluorescent and chromophore formation.

Tseng, Linda,[11] Ph.D., 1968, University of North Dakota: Reproductive molecular endocrinology.

Van Nostrand, William E.,[8] Ph.D. 1985, University of California, Irvine: Molecular pathogenic mechanisms in cerebrovascular pathology of Alzheimer's disease and related disorders.

Associate Professors

Berrios, Miguel,[4] Ph.D., 1983, Rockefeller University: Cell structure and function; the cell biology of DNA damage and repair.

Fleit, Howard B.,[5] Ph.D., 1980, New York University: Leukocyte Fc receptors; macrophage differentiation.

Ghazizadeh, Soosan,[10] Ph.D., 1994, Stony Brook University; Epithelial stem cell biology; skin bioengineering and gene therapy.

Holdener, Bernadette,[1] Ph.D., 1990, University of Illinois: Biochemical and genetic characterization of the role of chaperone, MESD, in folding the LRP receptors during mouse embryonic development.

Karzai, Wali,[1] Ph.D. 1995, Johns Hopkins University: RNA-protein interaction and translational control of gene expression.

Kernan, Maurice,[3] Ph.D., 1990, University of Wisconsin: Genetics of touch and hearing in Drosophila; ciliogenesis and ciliary signaling.

Kew, Richard B.,[5] Ph.D., 1986, Stony Brook University: Role of complement activation peoptide C5a and mast cells in acute an chronic inflammation.

Leatherwood, Janet,[2] Ph.D., 1993, Johns Hopkins University: Cell-cycle control and DNA replication; fission yeast molecular biology.

Lin, Richard,[6] M.D., 1988, University of California, San Francisco: Phosphoinositide 3-kinase signaling and cell growth.

Lyman, Harvard,[1] Ph.D., 1960, Brandeis University: Photocontrol of chloroplast development.

Mackow, Erich R.,[8] Ph.D., 1984, Temple University: Research on hantavirus and rotavirus directed signaling responses and pathogenesis; viral regulation of cellualr response.

McKinnon, David,[3] Ph.D., 1987, John Curtin School of Medical Research, Australia: Molecular physiology of sympathetic neurons and cardiac muscle.

Moriya, Masaaki,[4] Ph.D. 1981, Nagoya University, Japan: Cellular responses to DNA damage.

Neiman, Aaron,[1] Ph.D., 1994, University of California, San Francisco: Vesicle trafficking and intracellular signaling in yeast.

Prives, Joav,[4] Ph.D., 1968, McGill University, Canada: Cytoskeletal membrane interactions in muscle cell.

Quitschke, Wolfgang,[7] Ph.D.,1983, Stony Brook University: Gene regulation of proteins associated with neurodegenerative diseases.

Rebecchi, Mario J.,[8] Ph.D., 1984, New York University: Phospholipases and signal transduction.

Schärer, Orlando D.,[4,9] Ph.D., 1996, Harvard University: Chemical biology of DNA damage and repair.

Simmerling, Carlos,[9] Ph.D. 1994, University of Illinois, Chicago: Development of tools for efficient and simulation of chemical systems and using them to study the structure and dynamics of molecules involved in biological processes.

Spector, Ilan,[6] Ph.D., 1967, University of Paris, France: Neuronal differentiation and microfilaments.

Spitzer, Eric D.,[5] M.D./Ph.D., 1985, Johns Hopkins University: Molecular biology of Cryptococcus neoformans.

Thanassi, David G., Ph.D., 1995, University of California at Berkeley: Virulence factors of pathogenic bacteria.

Thomsen, Gerald H.,[1] Ph.D., 1988, Rockefeller University: Emproyic development mechanisms and their evolution.

Tsirka, Styliani-Anna,[4] Ph.D., 1989, University of Thessaloniki, Greece: Neuronal-microglial interactions in the physiology and pathology of the central nervous system.

Wang, Hsien-yu,[6] Ph.D., 1989, Stony Brook University: Wnt/Frizzled and G-protein signal transduction in development.

White, Thomas,[6] Ph.D., 1994, Harvard University: Molecular biology and physiology of gap junction channels.

Wollmuth, Lonnie,[3] Ph.D., 1992 University of Washington, Molecular mechanisms regulating excitatory synaptic transmission in the brain.

Zieve, Gary,[5] Ph.D., 1977, Massachusetts Institute of Technology: Assembly/transport of snRNP particles.

Assistant Professors

Boon, Elizabeth M.,[9] Ph.D., 2003, California Institute of Technology: Nitric oxide signaling in bacteria.

Carrico, Isaac,[9] Ph.D., 2003, California Institute of Technology: Site-specific protein labeling; glycoproteins.

Cohen, J. Craig,[8] Ph.D., 1976, University of Mississippi: Organogenesis.

Colognato, Holly,[4] Ph.D., 2000, Rutgers University: Extracellular matrix in the brain; roles during development and during neurodegeneration.

Sirotkin, Howard,[3] Ph.D., 1996, Albert Einstein College of Medicine: Vertebrate neural development and patterning.

Zong, Wei-Xing,[2] Ph.D., 1999. Univeristy of Medicine and Dentistry of New Jersey: Molecular regulation of apoptotic and necrotic cell death.

Adjunct Faculty

Dunn, John, *Microbiologist,*[13] Ph.D., 1970, Rutgers University: Structure/function of bacteriophage T7 RNA polymerase.

Hannon, Gregory, *Professor,*[15] Ph.D., 1992, Case Western Reserve University: Genetics of growth in mammalian cells and dsRNA-induced gene silencing.

Joshua-Tor, Leemor, *Professor,*[15] Ph.D., 1991, The Weizmann Institute of Science Structural Biology: X-ray crystallography; molecular reconginition; nucleic acid regulation; RNAi.

Krainer, Adriane, *Professor,*[15] Ph.D., 1986, Harvard University: mRNA splicing; gene expression; RNA-protein interaction.

Lazebnik, Yuri, *Professor,*[15] Ph.D., 1986, St. Petersburg State University, Russia: Molecular mechanisms of apoptosis.

Lowe, Scott, *Professor,*[15] Ph.D., Massachusetts Institute of Technology: Modulation of apoptosis; chemosensitivity; senescence by cancer genes.

Martienssen, Robert, *Professor,*[15] Ph.D., Cambridge University, Plant genetics; transposons; development; gene regulation; DNA methylation.

Mills, Alea, A., *Associate Professor,*[15] Ph.D., 1997, University of California, Cancer; development; aging; senescence; epigenetics.

Mittal, Vivek, *Assistant Professor,*[15] Ph.D., 1994, Jawaharlal Nehru University: Id transcription factors; tumor-mediated neovascularization; transcription profiling; RNA interference; dendritic cells.

Muthuswamy, Senthil, K., *Assistant Professor,*[15] Ph.D., 1995, McMaster University: Understanding cancer initiation using three-dimensional epithelial structures.

Setlow, Richard, *Professor,*[1,13] Ph.D., 1947, Yale University: DNA damage and repair; carcinogenesis and mutagenesis in fish, light-induced malignant melanoma.

Spector, David L., *Professor,*[15] Ph.D., 1980, Rutgers University: Spatial organization of gene expression.

Stenlund, Arne, *Associate Professor,*[15] Ph.D., 1984, Uppsala University, Sweden: DNA replication of papillomaviruses.

Stillman, Bruce, *Professor,*[15] Ph.D., 1979, Australian National University: DNA replication and chromatin assembly in human and yeast cells.

Studier, F. William, *Professor,*[1,13] Ph.D., 1963, California Institute of Technology: Molecular genetics of phage T7: recombinant protein productions.

Tonks, Nicholas, *Professor,*[15] Ph.D., 1985, University of Dundee, Scotland: Characterization of protein tyrosine phosphatases.

Van Aelst, Linda, Ph.D., *Associate Professor,*[15] 1991, University of Leuven, Belgium: Role of ras in mammalian cell transformation.

Wigler, Michael, *Professor,*[15] Ph.D., 1978, Columbia University: Genomics and cancer.

Number of teaching, graduate, and research assistantships, Fall 2008: 101

1) Department of Biochemistry and Cell Biology

2) Department of Molecular Genetics and Microbiology

3) Department of Neurobiology and Behavior

4) Department of Pharmacological Sciences

5) Department of Pathology

6) Department of Physiology and Biophysics

7) Department of Psychiatry

8) Department of Medicine

9) Department of Chemistry

10) Department of Oral Biology and Pathology

11) Department of Obstetrics and Gynecology

12) Department of Anatomical Sciences

13) Brookhaven National Laboratory

14) Recipient of the State University Chancellor's Award for Excellence in Teaching, 1975

15) Cold Spring Harbor Laboratory

16) Department of Applied Math and Statistics

Requirements for the Ph.D. Degree

A. Course Requirements

Biochemistry and Molecular Biology Specialization

1. Molecular Genetics (MCB 503)

2. Graduate Biochemistry (MCB 520)

3. Membrane Biochemistry (MCB 517)

4. Cell Biology (MCB 656)

5. Physical Biochemistry (MCB 512)

6. One approved elective graduate course

7. Students in their first year rotate in four laboratories with the goal of selecting an environment for their thesis research

8. Participation in Journal Club (MCB 531/532); Student Seminars (MCB 603/604); Visiting Scientists Seminars (MCB 601/602)

9. Enrollment in the first year in Ethics (GRD 500)

10. Enrollment in the third semester in Computational Methods in Biochemistry and Structural Biology (BSB 515)

Cell and Developmental Biology Specialization

1. Molecular Genetics (MCB 503)

2. Graduate Biochemistry (MCB 520)

3. Membrane Biochemistry (MCB 517)

4. Cell Biology (MCB 656)

5. Developmental Biology (MCB 657)

6. One approved elective graduate course

7. Students in their first year rotate in four laboratories with the goal of selecting an environment for their thesis research

8. Participation in Journal Club (MCB 531/532); Student Seminars (MCB 603/604); Visiting Scientists Seminars (MCB 601/602)

9. Enrollment in the first year in Ethics (GRD 500)

10. Enrollment in the third semester in Computational Methods in Biochemistry and Structural Biology (BSB 515)

Immunology and Pathology Specialization

1. Molecular Genetics (MCB 503)

2. Graduate Biochemistry (MCB 520)

3. Membrane Biochemistry (MCB 517)

4. Cell Biology (MCB 656)

5. General Pathology (HBP 531)

6. Immunology (HBP 533)

7. Students in their first year rotate in four laboratories with the goal of selecting an environment for their thesis research.

8. Participation in Journal Club (HBP 590); Student Seminars (MCB 603/604); Visiting Scientists Seminars (MCB 601/602)

9. Enrollment in the first year in Ethics (GRD 500)

10. Enrollment in the third semester in Computational Methods in Biochemistry and Structural Biology (BSB 515)

Students must achieve a B or better in all required courses and must maintain a B average in elective courses.

B. Qualifying Examination

At the beginning of the fourth semester, the student must pass a written qualifying examination.

C. Research Proposal

Following successful completion of the qualifying examination, the student writes a research proposal based on the probable area of the student's Ph.D. dissertation. The proposal is defended orally to a faculty examination committee that does not include the student's research advisor. The proposal examination normally takes place by the end of the fifth semester. After passing the proposal examination, the faculty committee and Ph.D. research advisor usually become the student's Ph.D. thesis committee and meet with the student at least once a year to follow his or her thesis progress.

D. Teaching Experience

All students are required to gain experience in teaching by assisting in laboratory sections, leading discussion sections, or helping to formulate and grade examination papers. The teaching experience may be in either undergraduate or graduate courses, and extends over a period of two semesters.

E. Advancement to Candidacy

When the above requirements have been satisfactorily completed, a recommendation for advancement to candidacy for the Ph.D. will be forwarded to the Graduate School.

F. Ph.D. Dissertation

During the second year, the student initiates a dissertation research project in the laboratory of a particular member of the program faculty. After the student has passed the proposition examination, a research committee is appointed to guide the dissertation research, and when the research nears completion, a dissertation examining committee is approved by the dean of the Graduate School.

G. Dissertation Defense

The dissertation defense, which completes the requirements for the Ph.D., consists of a public seminar presentation of the dissertation work followed by an oral examination before the dissertation examining committee.

H. Residence Requirement

The University requires at least two consecutive semesters of full-time graduate study. The demands of the course of study necessitate a longer period of residence.

Courses

MCB 500 Directed Readings in Molecular and Cellular Biology
Directed readings in topics of current interest, under supervision of a faculty sponsor.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall and spring, 1-3 credits, ABCF grading
May be repeated for credit

MCB 503 Molecular Genetics
Introduces the classical work and current developments in lower and higher genetic systems. Covers gene structure and regulation in prokaryotic and eukaryotic organisms, mutational analysis and mapping, transposable elements, and biological DNA transfer mechanisms. Bacteriophage as well as lower and higher eukaryotic systems are used to illustrate aspects of molecular genetic structure and function. This course is offered as both MCB 503 and HBM 503.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall, 3 credits, ABCF grading

MCB 509 Experimental Molecular and Cellular Biology
An introduction to modern biochemical research techniques. The student spends a half-term in the laboratory of each of four different members of the staff selected in consultation

with the course director. In each laboratory the student participates in some aspect of the ongoing research pursued by the faculty member.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall, 1-4 credits, ABCF grading

MCB 510 Experimental Molecular and Cellular Biology
An introduction to modern biochemical research techniques. The student spends a half-term in the laboratory of each of four different members of the staff selected in consultation with the course director. In each laboratory the student participates in some aspect of the ongoing research pursued by the faculty member.
Prerequisite: Matriculation in graduate program or permission of instructor
Spring, 1-4 credits, ABCF grading

MCB 512 Physical Biochemistry
Theoretical principles and experimental methods used in the study of proteins and nucleic acids, e.g., spectroscopy, magnetic resonance, and diffraction.
Prerequisites: MCB 520 or undergraduate physical chemistry course, plus matriculation in gradaute program or permission of instructor
Fall, 2 credits, ABCF grading

MCB 517 Membrane Biochemistry
Examines the molecular architecture of membranes; the structure, organization, functions, and assembly of lipids and proteins in biological membranes. This course is also offered as BSB 517.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall, 1 credit, ABCF grading
May be repeated for credit

MCB 520 Graduate Biochemistry I
Several topics in modern biochemistry are treated at an advanced level. Topics covered will include protein structure, enzyme kinetics and mechanisms, and enzyme regulation.
Prerequisite: Undergraduate biochemistry course, matriculation in graduate program, or permission of instructor
Fall, 3 credits, ABCF grading

MCB 529 Organelle Development
This course is concerned primarily with the development of the mitochondrion and the chloroplast. Subjects will include the biogenesis of these organelles and their relation to the interaction with the nucleus. Emphasis will be on genetic and biochemical analysis.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall, alternate years, 3 credits, ABCF grading

MCB 531 Graduate Seminar in Molecular and Cellular Biology
Seminars are given by graduate students on current literature in the fields of biochemistry, molecular biology, cell biology, or developmental biology.
Prerequisite: Matriculation in graduate program or permission of instructor
1 credit, ABCF grading

MCB 532 Graduate Seminar in Molecular and Cellular Biology
Seminars are given by graduate students on current literature in the fields of biochemistry, molecular biology, cell biology, or developmental biology.
Prerequisite: Matriculation in graduate program or permission of instructor
Spring, 1 credit, ABCF grading

MCB 599 Dissertation Research
Original investigation under the supervision of a member of the staff.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall and spring, 1-12 credits, S/U grading
May be repeated for credit

MCB 601 Colloquium in Molecular and Cellular Biology
A weekly series of talks and discussions by visiting scientists covering current research and thinking in various aspects of molecular and cellular biology. Required for all MCB graduate students. Attendance is mandatory. Visitors welcome.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall, 1 credit, S/U grading

MCB 602 Colloquium in Molecular and Cellular Biology
A weekly series of talks and discussions by visiting scientists covering current research and thinking in various aspects of molecular and cellular biology. Required for all MCB graduate students. Attendance is mandatory. Visitors welcome.
Prerequisite: Matriculation in graduate program or permission of instructor
Spring, 1 credit, S/U grading

MCB 603 Student Seminar in Molecular and Cellular Biology
Seminars given by graduate students on the progress of their own thesis research. Required of all students every term in which they are registered in Graduate Studies in Molecular Biology and Biochemistry. Attendance is mandatory. Visitors welcome.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall and spring, 1 credit, S/U grading
May be repeated once for credit

MCB 604 Student Seminar in Molecular and Cellular Biology
Seminars given by graduate students on the progress of their own thesis research. Required of all students every term in which they are registered in Graduate Studies in Molecular Biology and Biochemistry. Attendance is mandatory. Visitors welcome.
Prerequisite: Matriculation in graduate program or permission of instructor
Fall and spring, 1 credit, S/U grading
May be repeated once for credit

MCB 656 Cell Biology
Introduction to the structural and functional organization of cells and tissues and to the way structure relates to function. Particular emphasis is placed on nuclear and chromosomal structure, signal transduction, protein translocation, the cytoskeleton, and the extracellular matrix. The interaction of cellular structures and components and their regulation is stressed as is the organization and interaction of cells in tissues. The course is comparative and includes examples of cells and tissues from vertebrates, invertebrates, plants, and prokaryotic systems.
Prerequisite: Matriculation in graduate program or permission of instructor
Summer, 4 credits, ABCF grading

MCB 657 Principles of Development
This course deals with developing systems at all levels from the morphological to the molecular. Illustrative material from both animal and plant kingdoms is used. Special attention is given to gametogenesis, genetic control of early development, transcriptional and translational control of protein synthesis, the role of cell division and cell movements, and cell-to-cell interactions in defining developing systems.
Prerequisite: MCB 656, matriculation in graduate program, or permission of instructor
Fall, 3 credits, ABCF grading

MCB 699 Dissertation Research On Campus
Prerequisites: Must be advanced to candidacy (G5); major portion of research must take place on SB campus, at Cold Spring Harbor, or at Brookhaven National Lab; matriculation in graduate program or permission of instructor
Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit

MCB 700 Dissertation Research Off Campus—Domestic
Prerequisites: Must be advanced to candidacy (G5); major portion of research will take place off campus, but in the U.S. and/or U.S. provinces (Brookhaven National Lab and Cold Spring Harbor Lab are considered on campus); all international students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor; matriculation in graduate program or permission of instructor
Fall, spring, and summer, 1-9 credits, S/U grading
May be repeated for credit

MCB 701 Dissertation Research Off Campus—International
Prerequisites: Must be advanced to candidacy (G5); major portion of research will take place outside the U.S. and/or U.S. provinces; domestic students have the option of the health plan and may also enroll in MEDEX; international students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed; international students who are not in their home country are charged for the mandatory health insurance (if they are to be covered by another insurance plan, they must file a waiver by the

second week of classes; the charge will only be removed if the other plan is deemed comparable); all international students must receive clearance from an International Advisor; matriculation in graduate program or permission of instructor
Fall, spring, and summer, 1-9 credits, S/U grading

MCB 800 Summer Research
Prerequisite: Matriculation in graduate program or permission of instructor
S/U grading
0 credit, S/U grading
May be repeated

BSB 515 Computational Methods in Biochemistry and Structural Biology
Computational methods used in sequence searching and analysis, bioinformatics, graphical analysis of proteins, and nucleic acids.
Prerequisite: This class is restricted to first-year BSB, HBM, and HBH Ph.D. students and second-year MCB Ph.D. students; exception requires approval from the course instructor
Fall, 1 credit, S/U grading

HBP 531 General Pathology
Introduces the nature and causes of disease, death, reaction to injury, and repair. Analyzes associated structural changes in cells and tissues, with reference to their functional correlates.
Prerequisites: Histology, gross anatomy, physiology, and biochemistry, prior or concurrent microbiology, or permission of instructor
Spring, 3 credits, ABCF grading

HBP 533 Immunology
Principles of immunology for graduate students in the biological sciences, including definition of antigens and antibodies, specificity of the immune response, immunoglobulin structure, the genetics of immunoglobulin synthesis, cellular cooperation in the immune response, hypersensitivity, tolerance immunogenetics. Open to advanced undergraduates.
Prerequisites: Advanced courses in biology and biochemistry and permission of instructor
Fall, 3 credits, ABCF grading

HBP 554 Advanced Immunology
Selected topics in immunology are discussed using original research literature as the central focus. Students present and discuss the literature in a seminar format.
Prerequisite: HBP 531 or 533 and permission of instructor
Spring, 2 credits, ABCF grading

HBP 561 Electron Microscopy for Experimental Pathologists
Uses electron microscope (EM), alone and in conjunction with other methodologies in studies of biological dysfunction. Special techniques include histochemistry, enzyme histochemistry, immunohistochemistry, diffraction, stereo-EM, and scanning EM. Design of protocols, preparation, and interpretation of data.
Prerequisite: Permission of instructor
Fall and spring, 2-6 credits, ABCF grading

HBP 580 Teaching Honors
Selected students whose performance in the basic required courses for the graduate program is in the top 10 percent conduct tutorials for first-year graduate students in the program and other students taking graduate courses for credit. The tutors are supervised and graded by program faculty of the graduate program. Successful completion of this course will make the students eligible to receive an "Honors in Teaching" on their transcript.
Prerequisite: Permission of instructor
Fall and Spring, 1 credit, ABCF grading

HBP 590 Seminars in Immunology
A series of monthly seminars focusing on research in progress by the participants, current journal articles in the field of immunobiology, and prepared reviews of specified areas in the general field.
Prerequisite: MCB graduate student
Fall and spring, 1 credit, S/U grading
Repeatable for credit