GRADUATE EDUCATION

ACCELERATING SCIENCE

ADVANCING MEDICINE

VOL. III

Mount Sinai

MSSM

MOUNT SINAI SCHOOL OF MEDICINE

Message from the Dean

Greatness does not just happen. Its potential must be recognized early, inspired to grow, and mentored to truly succeed. Nor does greatness happen in isolation. It develops in the context of a group of individuals who are equally motivated, intelligent, ethical, and dedicated. That group, in turn, is led by someone who is visionary, passionate, creative, and ever willing to listen.

Creating great groups that will drive epoch-making science is the overarching goal of Mount Sinai's Graduate School of Biological Sciences. Today, biomedical science has the potential to transform the way medicine is practiced. Increased knowledge of the molecular pathways underlying disease will ultimately lead to personalized—rather than population-based—approaches to diagnosing, treating, and preventing human diseases.

To prepare our students to take advantage of the opportunities before us, we developed eight basic science Multidisciplinary Training Areas (MTAs) in disciplines that will greatly influence the future of medicine. Each area, aligned with one or more of our research institutes and our research-oriented departments, is designed to develop an outstanding cadre of scientists. To further strengthen bench-to-bedside connections, we have expanded our clinical research degree programs—all of which rest on a particularly strong basic science foundation.

Such training ensures that Mount Sinai graduates will continue to be known worldwide for their scientific expertise and clinical skills. Our graduates' renown as professional leaders is secured through the strong mentoring relationships they develop during their time here. I like to refer to this as Mount Sinai Magic because the relationships that start here continue to thrive over lifelong careers in science and medicine.

As an institution, we owe the success of our graduate programs to John H. Morrison, PhD, Dean of the Graduate School of Biological Sciences, and his team. Together, they provide our students, post-docs, and faculty with the support and opportunities they need to achieve greatness.

DENNIS S. CHARNEY, MD
Anne and Joel Ehrenkranz Dean of Mount Sinai School of Medicine and Executive Vice President for Academic Affairs of The Mount Sinai Medical Center

Message from the Dean for Graduate Education

As Dean of the Graduate School of Biological Sciences, I am proud to present Mount Sinai School of Medicine's vision on basic and translational research.

Since my appointment in October 2006, I have focused on reinforcing the importance of basic science and basic science education toward the establishment of a truly powerful translational continuum. Over the past 50 years, our knowledge of basic biology has greatly expanded, giving biomedical scientists unprecedented opportunities to develop true clinical innovations. Doing so will require a transformation in our thinking that brings basic scientists into the mainstream of clinical relevance; Mount Sinai is uniquely positioned to foster that change.

We are one of the few free-standing medical schools in the country that has developed independent graduate programs leading to the PhD or MD/PhD degrees, as well as several MS programs. Our medical school, graduate school, and hospital coexist on one main campus that provides an extraordinary environment for basic science education in a translational context. Historically, many of the most exciting areas of basic science matured at medical schools, and the PhD programs grew with these disciplines.

In a series of strategic planning meetings, my colleagues and I set out to create a specific set of doctoral programs designed to take advantage of the robust basic and patient-based research taking place every day in Mount Sinai's 16 translational research institutes. One great advantage at Mount Sinai is a minimal level of bureaucratic hurdles that are inherent to large universities. This allows us to be nimble in responding to new developments in science and education, giving us the flexibility to modify existing PhD training areas and launch new training areas as needed.

As described below, each of our training areas in the PhD program is now directly aligned with at least one Institute, confirming that recruitment of outstanding faculty is the institution's highest priority and assuring that all of our graduate students pursue cutting-edge scientific themes. According to Academic Analytics, LLC, our graduate school faculty is rated in the top 10 percent of our 65 biomedical sciences peer institutions.

Centered around health and disease as well as core technologies, our institutes lie at the heart of Mount Sinai's $2.25 billion Strategic

Plan. Originating in 2005, the Plan also established the goal of building a new 450,000-square-foot facility: the Center for Science and Medicine. Currently under construction and scheduled to open in 2012, it will house six full floors of laboratory space and will increase our research capacity by 30 percent. To maximize interactions among clinical and basic investigators, each basic science floor will also contain workspace and offices for clinical investigators.

Mount Sinai is also making major investments in its state-of-the-art Shared Research Facilities (SRF), a consortium of high-end computational and imaging capabilities that enable powerful insights and analyses to take place across the biomedical sciences. Available to all faculty and graduate students, SRF's expert staff provides research services, and conducts trainings on these cutting-edge tools.

Taking advantage of these and many other opportunities, our graduates have become research scientists and faculty at many of the most outstanding medical and graduate schools in the United States, and they have joined distinguished research institutions, such as The Scripps Research Institute, The Cold Spring Harbor Laboratory, the National Institutes of Health, and Fox Chase. Our alumni are similarly well represented in research laboratories of major pharmaceutical and other industrial firms, while others have gravitated towards science writing, patent law, business aspects of science, and public policy areas.

Mount Sinai is a magnet for visionary scientists, truly compassionate mentors, and the most promising students in the biomedical sciences. It is my honor to work among them.

JOHN H. MORRISON, PHD
Dean of Basic Sciences and the Graduate School of Biological Sciences, the W.T.C. Johnson Professor of Geriatrics and Adult Development (Neurobiology of Aging), and Professor of Neuroscience

Top: Dr. Charney discussing new data during his weekly laboratory meeting.
Bottom: Dr. Morrison and his team in his laboratory reviewing experimental protocols to visualize neurons.

Karen Zier, PhD, Associate Dean for Medical Student Research, reviewing experimental results with students.

The Magic of Mentoring

Students in the Graduate School of Biological Sciences are at the heart of Mount Sinai's investigative activities. Partnering with world-class basic science and clinical researchers—Mount Sinai is ranked third in National Institutes of Health (NIH) funding per investigator—they pursue the most significant part of their doctoral training in a mentor-student relationship that leads to the PhD dissertation.

The Perfect Partnership

"We put great emphasis on the quality of mentoring our students receive," says John H. Morrison, Dean of Basic Sciences and the Graduate School of Biological Sciences. "The PhD and post-doctoral experiences are unique among educational programs in that the student is tied so closely to an individual mentor. The PhD thesis advisor is perhaps the single most important figure in the development of a young scientist, so we do everything we can to assure that the advisor/student relationship is strong, supportive, and productive."

Basic science training is defined by eight Multidisciplinary Training Areas (MTAs), a format that is the vanguard of modern science research education. Each MTA, as described in these pages, was carefully designed to take advantage of Mount Sinai's robust research-institute structure. This was done to ensure that the Graduate School and its student body would grow in concert with the expansion of the research faculty.

That growth reflects a commitment to offering PhD education that represents Mount Sinai's long-term strengths in the biomedical sciences and puts our students at the forefront of maturing and emerging disciplines. To that end, we converted three MTAs that we viewed as too broad into five highly focused areas that we know will have great impact on biomedical research. These are Structural-Chemical Biology and Molecular Design, Developmental and Stem Cell Biology, Pharmacology and Systems Biology, Cancer Biology, and Immunology.

With special seminars, journal clubs, and laboratory rotations, our graduate programs feature many opportunities for collaboration, both within and across disciplines. This diversity of experiences underscores Mount Sinai's commitment to nurturing PhD students who are rigorously trained in the discipline of their choice and who are prepared to cross conventional boundaries to establish great interdisciplinary teams that can address the large-scale biomedical challenges that will dominate the next several decades. In addition, while it is critically important for our PhD students to master a discipline, we train them to be open-minded with respect to the evolution of disciplines, so that they will be prepared to lead their field into new terrain.

Our MTAs culminate in a PhD in Biomedical Sciences with specialization in a chosen area, or a PhD in Neuroscience. In addition, Mount Sinai offers a range of patient- and population-oriented degree programs—at the certificate and master's level, through the PhD—in clinical research and public health. These programs, also discussed in this publication, will be increasingly important as we grow our translational research programs to fulfill the goals set forth in our Strategic Plan.

With about 90 students—nearly 20 percent of the graduate student body—pursuing both an MD and a PhD, Mount Sinai School of Medicine has made the training of physician-scientists a very high priority. "I believe this demonstrates Mount Sinai's overwhelming commitment to translational medicine," says Yasmin L. Hurd, PhD, Director of the MD/PhD program, supported in part through the NIH Medical Scientist Training Program (MSTP).

Indeed, since the hospital's founding, Mount Sinai doctors have turned to science to better understand the conditions they encounter in their patients. As a result of this tradition, more diseases have been named for Mount Sinai physicians—Crohn's disease, Tay-Sachs disease, and Churg-Strauss disease among them—than for physicians from any other medical center in the world.

That momentum continues today among our students, whose work has had outstanding success in securing NIH funding. Both our PhD and MD/PhD candidates have been very successful in obtaining highly competitive individual National Research Service Awards from the NIH. In addition, many of our PhD and MD/PhD students have authored articles for top journals, including *Science, Neuron, Cell, Nature,* and the *Proceedings of the National Academy of Sciences.*

"As students, we all come from very different backgrounds," explains Tom Hays, an MD/PhD candidate in Microbiology who recently served as president of Mount Sinai's Student Council. "Our common bond is

Top: Dr. Hurd and her team setting up an experiment to analyze gene expression patterns in the brain. Bottom: Stuart Aaronson, MD, Chair of the Department of Oncological Sciences, and a member of his team preparing for a tissue culture experiment.

a passion for doing bench research and seeing its impact in the clinical arena. Even though we are a comparatively large group of MD/PhD candidates, Mount Sinai has more than enough inspiring mentors to choose from."

The MD/PhD track is carefully designed to integrate clinical and scientific experiences throughout the eight- to ten-year time frame. Training alongside MD students in the first two years, MD/PhD candidates participate in the Longitudinal Clinical Experience (LCE), a program that pairs two students with a physician-mentor who guides them in the care of chronically ill patients. Students start seeing their own small group of patients in the early weeks of medical school and continue the close provider-patient relationships into the beginning of their third year.

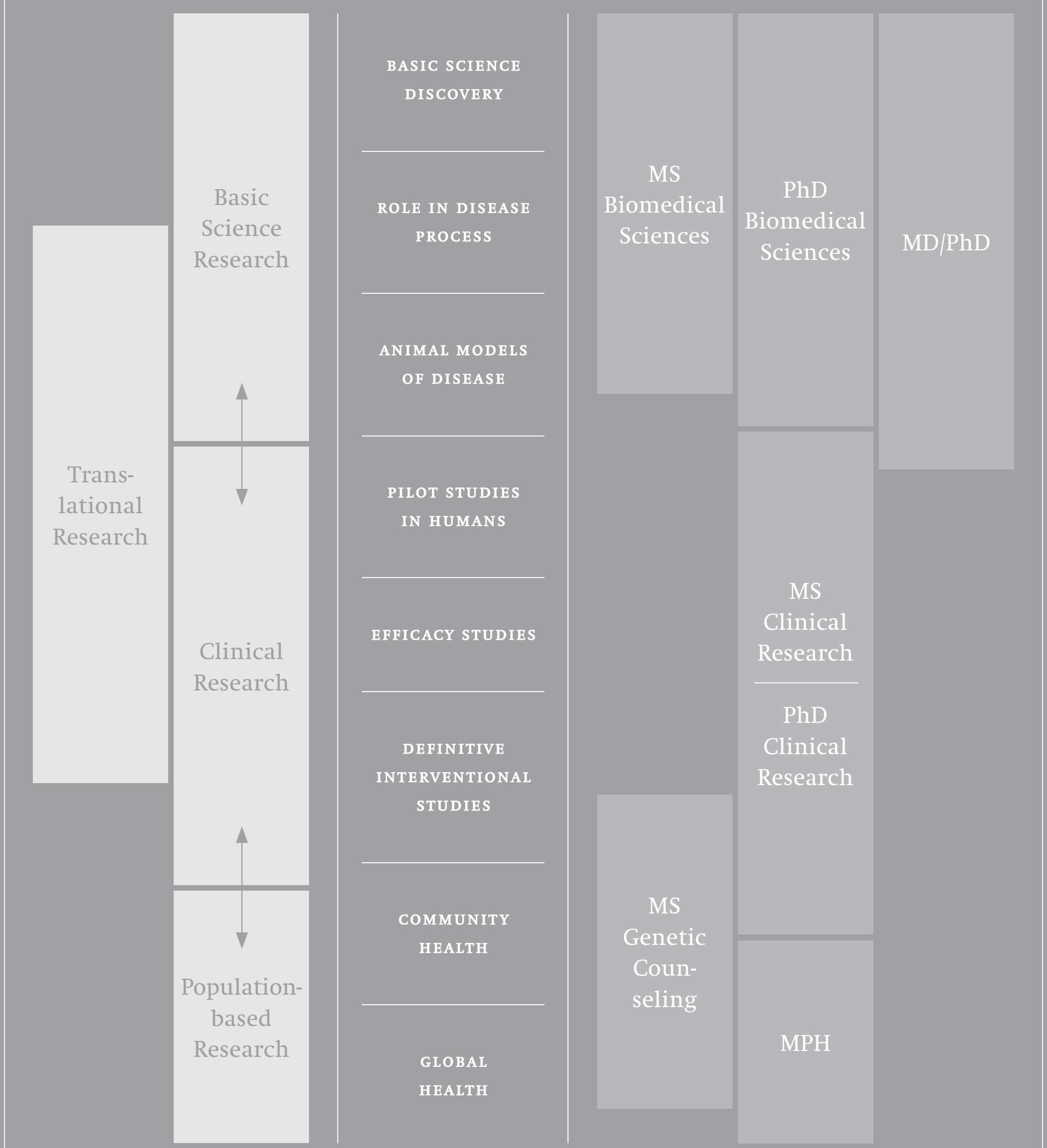
Students may also take a medical clerkship elective during the first phase of their PhD training and following that, they participate in a six-week summer course in clinical research that is designed to help them formulate and get feedback on their translational research proposal. "This much exposure to the clinical side is unique—and it gets students thinking about the bedside implications of what they're doing at the bench," explains Dr. Hurd.

Mount Sinai's MS in Biomedical Sciences is also structured to maximize translational training over a two-year period. During the first year, master's and PhD candidates take the same core courses. Master's candidates often enroll in clinical courses at the School of Medicine while pursuing their research in a laboratory.

"What sets this program apart is that it's a very high-level master's degree that includes a research thesis and PhD-level courses," says Miki Rifkin, PhD, Director of the MS in Biomedical Sciences and Associate Dean of the Graduate School of Biological Sciences.

Ross Cagan, PhD, Associate Dean of the Graduate School of Biological Sciences and Professor of Developmental and Regenerative Biology, adds, "From there the future holds many possibilities: medical or graduate school, work in pharma or biotech, patent law, consulting, science writing, or any number of careers in health care."

GRADUATE SCHOOL OF BIOLOGICAL SCIENCES EDUCATION THROUGHOUT THE TRANSLATIONAL CONTINUUM



EACH DEGREE-GRANTING PROGRAM IN THE GRADUATE SCHOOL FOCUSES ON A PORTION OF THE TRANSLATIONAL CONTINUUM, AND AS A WHOLE, THE SCHOOL COVERS THE FULL CONTINUUM REQUIRED FOR SUCCESSFUL TRANSLATION OF BASIC SCIENCE.

Powerful Partnerships

Few people are in a better position than Peter Palese, PhD, Chair of the Department of Microbiology, to say that the spirit of mentorship at Mount Sinai is now very strong. After nearly 40 years as a faculty scientist, he has witnessed—and contributed to—the growth of this atmosphere, as Mount Sinai expanded the number of labs and disciplines it offered and received a greater number of NIH-designated program project grants.

"By definition, program project grants have people from many different areas working together on a particular topic," he explains. "There is now a general trend for institutions to seek this type of funding over individual investigator grants. Here, we have recognized their value for some time and are fortunate to have so many."

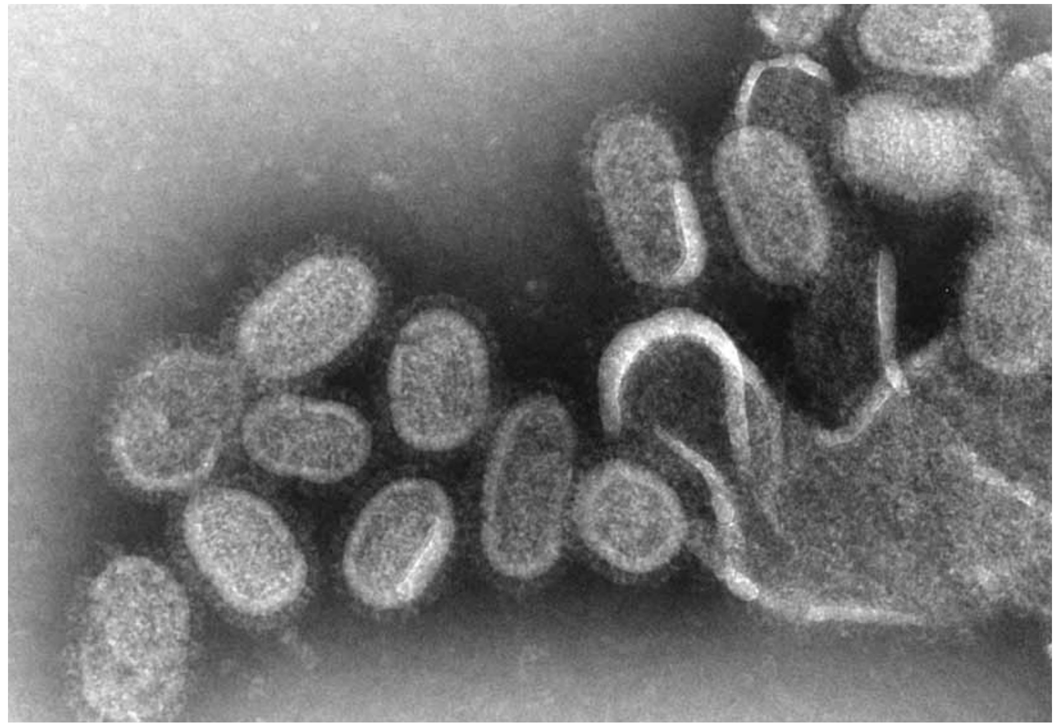
Mount Sinai's Center for Research on Influenza Pathogenesis (CRIP), which is one of five Centers of Excellence for Influenza Research and Surveillance (CEIRS) in the United States, is one such example. Under the direction of Adolfo García-Sastre, PhD, whose post-doctoral work Dr. Palese mentored at Mount Sinai, CEIRS, which is supported by the National Institute of Allergy and Infectious Diseases, brings together investigators from pathogenesis, immunology, epidemiology, and clinical research to work toward developing new control measures for emerging flu viruses.

Dr. García-Sastre, who is Co-Director of the Global Health and Emerging Pathogens Institute and CRIP Principal Investigator, recalls that as a post-doctoral fellow, Dr. Palese fostered a virology community that was—and remains—tight knit and interactive. "As a mentor, he always helped us keep the broader picture in mind, even as we went deeper into our own research."

Having now mentored several students and post-docs himself, Dr. García-Sastre says he strives to create the same atmosphere in his lab. "You have to guide them into asking the right questions for the larger context and be genuinely excited about their work yourself." He adds, "This is easy; it is most rewarding when a student comes to tell you an exciting result."

Today, Drs. Palese and García-Sastre collaborate on several projects, including the development of novel vaccines and broad-spectrum antivirals. They also both say that mentoring a variety of students and post-docs is critical to advancing their own work and ideas. "With fresh ideas and new approaches to problems, students have absolutely shaped my work," Dr. Palese explains. "Credit always belongs to the group, as we are very interdependent."

"Credit always belongs to the group, as we are very interdependent."



Top: Drs. Palese and García-Sastre in their renowned microbiology laboratory.
Bottom: An electron micrograph of the reconstructed 1918 influenza virus. Courtesy of the Centers for Disease Control and Prevention.

A scientist setting up Drosophila *genetic crosses in the Cagan Laboratory.*

Illuminating the Invisible

"A revolution is occurring in biology as new technologies and computational analyses are increasing our ability to determine the role of genes in development, evolution, physiology, and disease," explains Kenneth L. Davis, President and Chief Executive Officer of The Mount Sinai Medical Center.

Computational Biology

With funding from the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) initiative and other sources, the Computational Biology program is training a new generation of scientists in the fundamentals and applications of computational methods to biological problems, including the elucidation of macromolecular structure and function (proteins, DNAs, RNAs), genomic analysis and bioinformatics, and the understanding of the structure and function of physiological systems (cells, organs, neuronal networks).

By developing a software called GATE (Grid Analysis of Time-Series Expression), for example, a team of computational biologists at Mount Sinai opened the door to understanding how regulatory mechanisms interact to determine the fate of embryonic stem cells—and that is just the beginning.

GATE turns data on genetic regulation processes into colorful animated movies, thereby illuminating many molecular species, regulatory layers, and temporal regulatory changes. "We can now witness and track the complexity of the multilayered regulatory mechanisms responsible for changes in gene and protein expression that determine cell fate," says Avi Ma'ayan, PhD, Assistant Professor of Pharmacology and Systems Therapeutics, whose laboratory developed the program. "This greatly extends hypothesis generation for systems biology approaches." The team's work appeared in the journals *Nature* and *Bioinformatics*.

In this and other ways, Mount Sinai scientists are discovering how to target the very molecules that cause disease. Investigations rely on advanced molecular imaging techniques used in Mount Sinai's laboratories, including X-ray crystallography, nuclear magnetic resonance (NMR) spectroscopy, and computational modeling and simulation.

Through Mount Sinai's robust Shared Resource Facilities (SRF), students and researchers also have access to a powerful cluster of 800 computing units with high-speed connectivity to allow for efficient parallel computing.

While not an MTA itself, the Computational Biology path can be combined with any other scientific discipline, such as Neuroscience and Stem Cell Biology, or students can pursue a purely computational track, says Roman Osman, PhD, Director for this area and Professor of Structural and Chemical Biology and of Pharmacology and Systems Therapeutics.

Genetics and Genomic Sciences (GGS)

Mount Sinai is recognized as an international leader in the study of the genetic underpinnings of human disease. The Genetics and Genomic Sciences MTA emphasizes coursework and research experience in the molecular pathology of genetic diseases, gene discovery and characterization, translational genetics, informatics and genome analysis, gene regulation, and genome organization and evolution. The program covers all types of organisms and genetic mechanisms, but focuses in particular on human genetic diseases using model organisms.

The GGS faculty is expert in the application of molecular, biochemical, immunologic, cytogenetic, and somatic cell approaches for the study of genetic diseases. Students are given unique opportunities to integrate basic genomics research with clinical and translational genetics.

Using the cutting-edge analytical tools that are available at Mount Sinai, our scientists have identified the exact locations of a number of disease-promoting or susceptibility genes, including those responsible for Noonan syndrome, a relatively common genetic syndrome associated with congenital heart disease. With this knowledge, experts in stem cell biology and molecular cardiology have teamed up to take novel approaches toward understanding a Noonan-related disorder called LEOPARD syndrome, particularly aspects related to heart cell abnormalities.

"This project represents the success of the multidisciplinary, collaborative environment that Mount Sinai fosters," says Bruce Gelb, MD, Director of the Child Health and Development Institute, and the Arthur J. and Nellie Z. Cohen Professor of Pediatrics, in reference to an article recently published in *Nature*. "Individually, neither Dr. Lemischka nor I would have undertaken this project. Working together, our research teams are poised to make great progress." Ihor Lemischka, PhD, is Director of The Black Family Stem Cell Institute and the Lillian and Henry M. Stratton Professor of Gene and Cell Medicine. As Co-Directors of the GGS graduate program, Peter E. Warburton, PhD, Associate Professor of Genetics and Genomic Sciences, and Martin J. Walsh, PhD, Associate Professor of Pediatrics and of Structural and Chemical Biology, stress the importance of this scientific contribution, "as an example of scientific achievement for all our graduate students to strive for."

The Genetics and Genomic Sciences MTA is aligned with our Charles R. Bronfman Institute for Personalized Medicine and our Genomics Institute. The Genomics Institute, along with our Department of Genetics and Genomic Sciences, is led by Robert J. Desnick, MD, PhD.

In this area, priority research is also directed toward understanding how newly identified genes and their encoded proteins are regulated in different organs and at different times of the life cycle. Current investigations are exploring how genes and proteins work to mediate complex biological processes: from heart function to metabolism to higher brain activity, both in homeostasis and disease. Genomics will continue to be a major PhD focus area as the Genomics Institute matures over the next few years.

Each of our MTAs is carefully designed to align with one or more of our science institutes. See page 47 for a list of all 16 institutes.

Multidisciplinary Training Area (MTA)	Science Institutes
Cancer Biology	The Tisch Cancer Institute Translational and Molecular Imaging Institute
Development and Stem Cell Biology	The Black Family Stem Cell Institute
Genetics and Genomic Sciences	Genomics Institute The Charles R. Bronfman Institute for Personalized Medicine
Immunology	Immunology Institute The Charles R. Bronfman Institute for Personalized Medicine Child Health and Development Institute
Microbiology	Global Health and Emerging Pathogens Institute Disease Prevention and Public Health Institute
Neuroscience	The Friedman Brain Institute Translational and Molecular Imaging Institute
Pharmacology and Systems Biology	Experimental Therapeutics Institute Cardiovascular Institute The Friedman Brain Institute The Tisch Cancer Institute Metabolism Institute
Structural-Chemical Biology and Molecular Design	Experimental Therapeutics Institute Translational and Molecular Imaging Institute

Structural-Chemical Biology and Molecular Design (SMD)

Scientists in the Structural-Chemical Biology and Molecular Design program are developing novel small molecules that are designed to control biological functions of macromolecules in cellular processes. New nanoparticles are also being developed for targeted drug delivery in the treatment of many different diseases. Working with their thesis advisors and extended teams, students are developing mathematical models of complex processes, such as cell division, and mapping the molecular and cellular mechanisms underlying the regulation of gene transcription and translation.

"Such advancements will lead to the development of novel nanoparticles for targeted drug delivery in the treatment of atherosclerosis, diabetes, cancer, and more," says Dr. Osman.

This MTA, which builds upon work that is going on throughout our Experimental Therapeutics Institute, was recently restructured to integrate molecular mechanism-based approaches to studying human biology and disease, as well as research on molecular imaging. Students learn to use the concepts and techniques of structural and chemical biology to investigate fundamental intermolecular interactions and mechanisms of biological processes. A major goal of the program is to foster the design of small molecules targeting biologically important or clinically relevant processes.

Through lab rotations and projects with researchers, Mount Sinai students also work with a range of advanced biophysics and chemical instruments for high-throughput screening and have access to chemical libraries of 120,000 compounds, says Ming-Ming Zhou, PhD, Co-Director of the Experimental Therapeutics Institute, the Dr. Harold and Golden Lamport Professor and Chair of the Department of Structural and Chemical Biology, and Professor of Oncological Sciences and of Pharmacology and Systems Therapeutics.

"We now have a far greater understanding of how enzymes and transcriptional/translational regulators interact with nucleic acids to affect cellular development and disease outcome," says Aneel K. Aggarwal, PhD, Professor of Structural and Chemical Biology and of Oncological Sciences.

Claudia Calcagno, MD, PhD, a recent graduate, used both experimental methods and computational techniques to study kinetic models of contrast-agent uptake in atherosclerotic plaques by using dynamic contrast-enhanced magnetic resonance imaging. Her PhD thesis focused on quantifying, with imaging methods, plaque inflammation, which is a known marker of high-risk atherosclerotic lesions, and its changes upon therapeutic intervention in both an animal model and in patients. Dr. Calcagno, a member of the Translational and Molecular Imaging Institute (TMII), is continuing her research with her advisor, Zahi A. Fayad, PhD, TMII Director, Professor of Radiology and of Medicine (Cardiology).

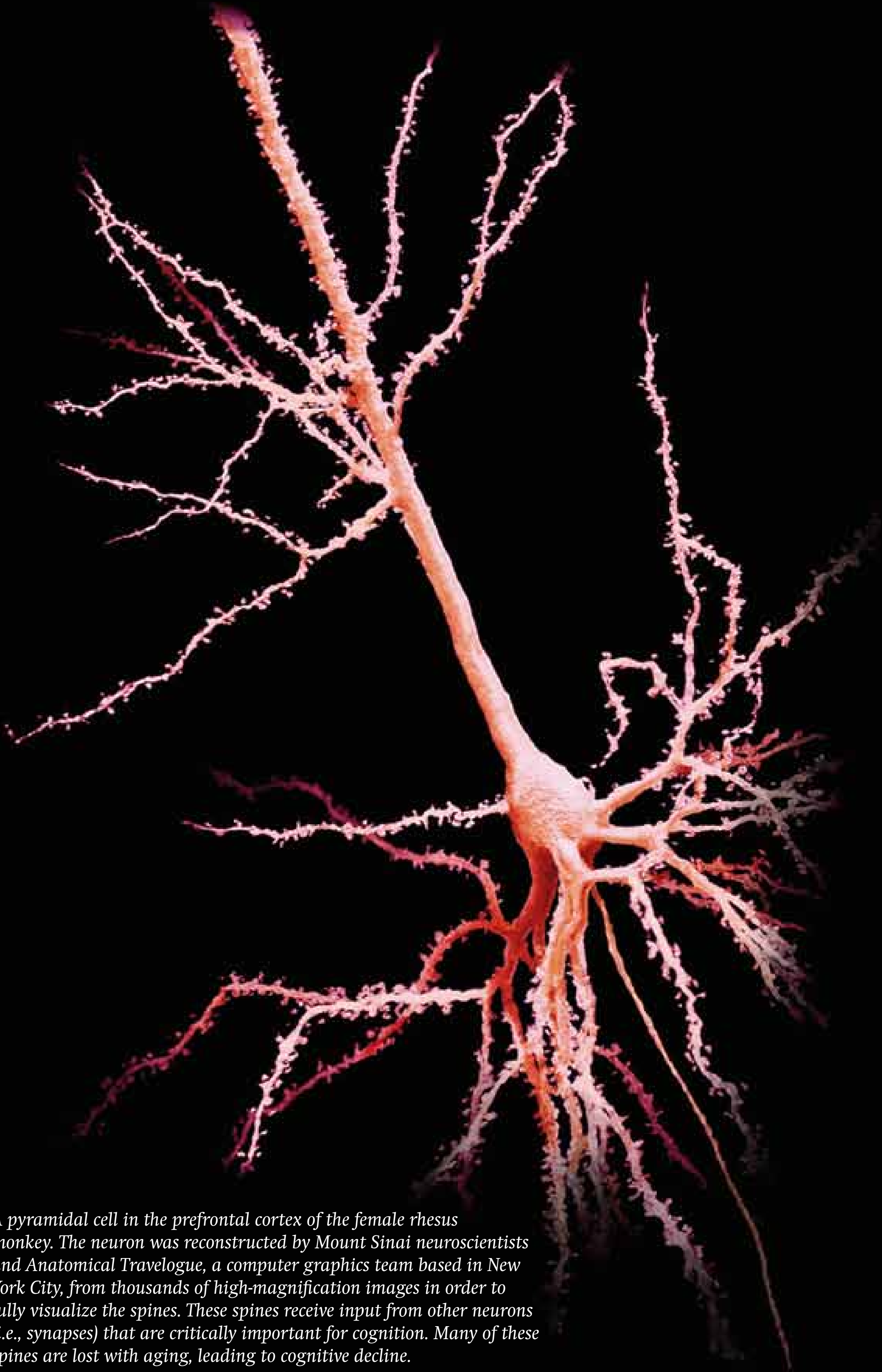
Her work, as is the case with many other TMII projects, is highly interdisciplinary and innovative. It utilizes both basic and clinical research, combined with experimental methods and computational analysis, to develop and validate imaging markers of disease. This may ultimately provide valuable benefits to patient care in future clinical practice.

MS in Genetic Counseling

"As our knowledge of human genetics and genomics greatly expands, the need for sophisticated genetic counseling likewise grows," explains Randi Zinberg, MS, CGC, Director of the Master of Science in Genetic Counseling Program and Assistant Professor of Genetics and Genomic Sciences and of Obstetrics, Gynecology, and Reproductive Science. "We can predict risk for an increasing number of conditions, and with such knowledge, counselors can educate and provide support to the people who need it."

Working as part of a health care team, genetic counselors analyze risks of disease occurrence or recurrence, discuss genetic testing options with patients, and help patients and their families understand and adjust to a diagnosis of a genetic disorder or birth defect. "Our focus is always on the patient and his or her family, but we are in a cutting-edge science environment so our students are particularly sophisticated in bridging science and the communities they serve," Ms. Zinberg explains.

Courses cover human embryology, molecules and cells, biostatistics, bioethics, interviewing and counseling, genetic counseling, human and medical genetics, and behavioral medicine. Students receive clinical training in the Department of Genetics and Genomic Sciences, The Mount Sinai Medical Center, and its affiliates to prepare them to provide genetic counseling throughout the life cycle, from reproductive and pediatric health, to common diseases of adulthood.



A pyramidal cell in the prefrontal cortex of the female rhesus monkey. The neuron was reconstructed by Mount Sinai neuroscientists and Anatomical Travelogue, a computer graphics team based in New York City, from thousands of high-magnification images in order to fully visualize the spines. These spines receive input from other neurons (i.e., synapses) that are critically important for cognition. Many of these spines are lost with aging, leading to cognitive decline.

Addicted to Science

"The brain is the last frontier of modern medicine," says Eric J. Nestler, MD, PhD, Director of The Friedman Brain Institute, Nash Family Professor, and Chair of the Department of Neuroscience. "It is by far the most complex organ in our bodies by orders of magnitude, which is why progress has lagged behind that of other medical specialties."

Neuroscience (NEU)

"Now, however, for the first time, we have the cellular and molecular tools that will enable transformational advances in our understanding of the brain and spinal cord under normal and diseased conditions," he explains. "We are thus poised over the next decade for truly revolutionary advances in neurology and psychiatry."

Within Mount Sinai's Departments of Neuroscience, Neurology, and Psychiatry—all of which are in or near the top 10 recipients of NIH funding—neuroscientists in The Friedman Brain Institute (FBI) are defining the mechanisms underlying brain and nervous system diseases such as Alzheimer's disease (AD), schizophrenia, and autism spectrum disorders with the goal of translating those findings into preventive or restorative interventions.

In the classroom and in over 50 neuroscience labs, students in the Neuroscience MTA, which is tightly linked to the FBI, study individual neurons and the molecules they synthesize, circuits connecting groups of neurons and regions of the nervous system, and the function of the nervous system in the organism as a whole. They also work closely with scientists who use diverse model systems for their research, from invertebrates such as the sea snail *Aplysia*, the fruit fly *Drosophila*, and the worm *C. elegans* to complex vertebrates including genetically engineered mouse models, non-human primates, and humans.

"The environment is collegial and interactive, to the point where we are frequently co-mentoring students across labs," says Patrick R. Hof, MD, the Irving and Dorothy Regenstreif Professor of Neuroscience and Vice Chair for Translational Research in the Department of Neuroscience. "It is a formula that works remarkably well."

Afia Akram, PhD, a recent graduate, is one such example. Working in Dr. Hof's lab at Mount Sinai, she launched an investigation into assumed changes in cholesterol metabolism in the brains of people with Alzheimer's disease. From there, she worked with Vahram Haroutunian, PhD, Professor of Psychiatry, at the James J. Peters VA Medical Center in the Bronx, using a combination of high throughput microarray, quantitative PCR, and immunochemical techniques on a large collection of tissue samples that she obtained from the Brain Bank at the VA's Alzheimer's Disease Research Center.

This work is significant because it elucidates that cholesterol homeostasis is unsettled in AD, and it provides unique insight into the contribution of abnormalities in cellular cholesterol trafficking to the pathogenesis and progression of AD under physiologically relevant conditions. These findings have potentially important implications for early therapeutic intervention. Her work was recently published in *Brain Research*.

Developmental and Stem Cell Biology (DSCB)

Working alongside researchers in The Black Family Stem Cell Institute, students in the Developmental and Stem Cell Biology MTA address a fundamental question: How do complex organisms develop from zygotes? From there, the questions are limitless: What events govern the organization, structure, and function of cells, tissues, and organisms? What influences the development, regeneration, and patterning of organs? And what disruptions within complex processes result in disease?

For example, unraveling the exact sequence by which a neuron becomes a neuron from its stem-cell state will be key to understanding how to predict or treat neurological disorders, explains Dr. Lemischka, Director of The Black Family Stem Cell Institute. "There is great potential to improve quality of life from diseases that occur at every point on the developmental spectrum," he says.

In a popular class called "The Development Rave," scientists-in-training visit a different lab each week to participate in the full scope of developmental research at Mount Sinai. Working in small groups, they score worm phenotypes, perform robotics-based screening, dissect flies and worms, discuss mammalian brains, and explore philosophy of science. "They do what that lab does," Dr. Cagan explains. "And ultimately, that helps them choose a lab—and their own path in this sophisticated area."

Top: Dr. Lemischka using his office window to design an experiment.
Bottom: Susumu Hirabayashi, PhD, a post-doctoral fellow, and Dr. Cagan examining novel anti-cancer agents.

Developmental biologists use approaches from genomics, cell biology, and stem-cell biology, along with sophisticated tools that could yield astonishing results, Dr. Cagan says. "With stem cells, for example, many underlying processes are being worked out so we can get on with the task of adapting them to very specific goals, such as making new beta cells or repairing hearts."

Pharmacology and Systems Biology (PSB)

Working alongside renowned scientists, students in the Pharmacology and Systems Biology MTA study biological processes in cells, tissues, and organisms in order to unravel the mechanisms by which these complex physiological processes function and how they can be targeted for therapeutic purposes.

"The future of medicine lies in our ability to develop small-molecule drugs, gene- and cell-based treatments, and therapeutic vaccines that target specific disease mechanisms," explains Ravi Iyengar, PhD, Chair of the Department of Pharmacology and Experimental Therapeutics and Director of the Experimental Therapeutics Institute (ETI). This MTA aligns with ETI and other institutes, such as the Cardiovascular, Cancer and Brain Institutes. It also draws support from the Systems Biology Center-New York, one of the ten national centers funded by the NIH. Many of Mount Sinai's students in this area are supported by a pharmacology training grant from the National Institute of General Medical Sciences.

Using math as a common language for analyzing physical and biological processes, the course "Systems Biology: Biomedical Modeling" teaches students techniques for developing models that delineate biological networks and then analyze and predict behaviors at multiple scales that can later be experimentally tested.

"Biological interactions often produce interesting and unexpected properties in cells and tissues and give us ideas for designing new therapies," says Eric A. Sobie, PhD, Co-Director of this MTA and Assistant Professor of Pharmacology and Systems Therapeutics. This course, along with others in the program, enables students to develop integrated experimental and computational expertise to drive discovery of new personalized medicines and understand drug action for many diseases, including cancer, psychiatric disorders and addiction, kidney diseases, and cardiovascular diseases.

For example, Seth Berger, an MD/PhD student who has defended his thesis and has started his third year of medical school, is using bioinformatics and network analyses to understand the common basis of genetic and drug-induced cardiac arrhythmias. Working in Dr. Iyengar's lab, Dr. Berger has built networks based on interactions between proteins, generating novel predictions about genomic variations that can potentially cause arrhythmias and developing insights into drugs that can treat arrhythmias. The study, recently published in *Science Signaling*, provides a basis for explaining the rare drug-induced arrhythmias observed in the FDA Adverse Events Reporting System. It also exemplifies the new field of systems pharmacology, which integrates numerous experimental and computational approaches for development of personalized therapies for complex diseases.

One landmark application in this area is being led by Roger J. Hajjar, MD, Research Director of the Wiener Family Cardiovascular Research Laboratories and the Arthur and Janet Ross Professor of Cardiology, Medicine, and Gene and Cell Medicine, and Jill Kalman, MD, Associate Professor of Medicine (Cardiology) and Director of the Cardiomyopathy Program. Using gene therapy, the team has developed an approach to treatment of advanced heart failure that has already progressed to clinical trials.

"Mount Sinai is committed to bringing groundbreaking therapies from bench to bedside and to training tomorrow's scientists to carry on this tradition," says Dr. Hajjar. Since heart failure is a condition that affects about 5.8 million people in the United States, with an additional 670,000 new cases diagnosed each year, such treatment can improve the lives of millions of affected patients.

The ability to make such landmark discoveries—and to potentially affect so many lives—lies in a profound understanding of how the different parts of a biological system interact, explains Dr. Sobie.

Creating Legacies

"As special as I feel my relationship with Paul [Greengard, PhD] is, I know that many other people feel the same way," says Eric J. Nestler, MD, PhD, Director of The Friedman Brain Institute, Nash Family Professor, and Chair of the Department of Neuroscience. "That, to me, is one key to being a great mentor—making everyone you work with feel valued."

Dr. Nestler describes three distinct, and equally rewarding, eras in his relationship with Dr. Greengard, the Vincent Astor Professor and Director of the Laboratory of Molecular and Cellular Neuroscience at Rockefeller University. Dr. Greengard is also a 2000 Nobel laureate in Physiology or Medicine.

The first era began in the mid-1970s when Dr. Greengard agreed to give the undergraduate Nestler a position in his laboratory at Yale University, a renowned research group that was leading groundbreaking investigations into the molecular and cellular functions of neurons. "In my 15 years at Yale, I had maybe five undergraduates work with me," Dr. Greengard recalls. "Eric was very intelligent and exceptionally well-organized, and he was always willing to interact closely."

> "That, to me, is one key to being a great mentor—making everyone you work with feel valued."

With decades of experience to draw on, Dr. Greengard notes that it is the more talented students who solicit the advice of professors and mentors. "You might think it would be otherwise, but I guess the less talented students are trying to hide their shortcomings," he says.

The second Greengard-Nestler era stretched over a decade, into the 1990s, years that Dr. Nestler describes as "struggling"—to secure funding, start a lab, and lead research "without an army of resources."

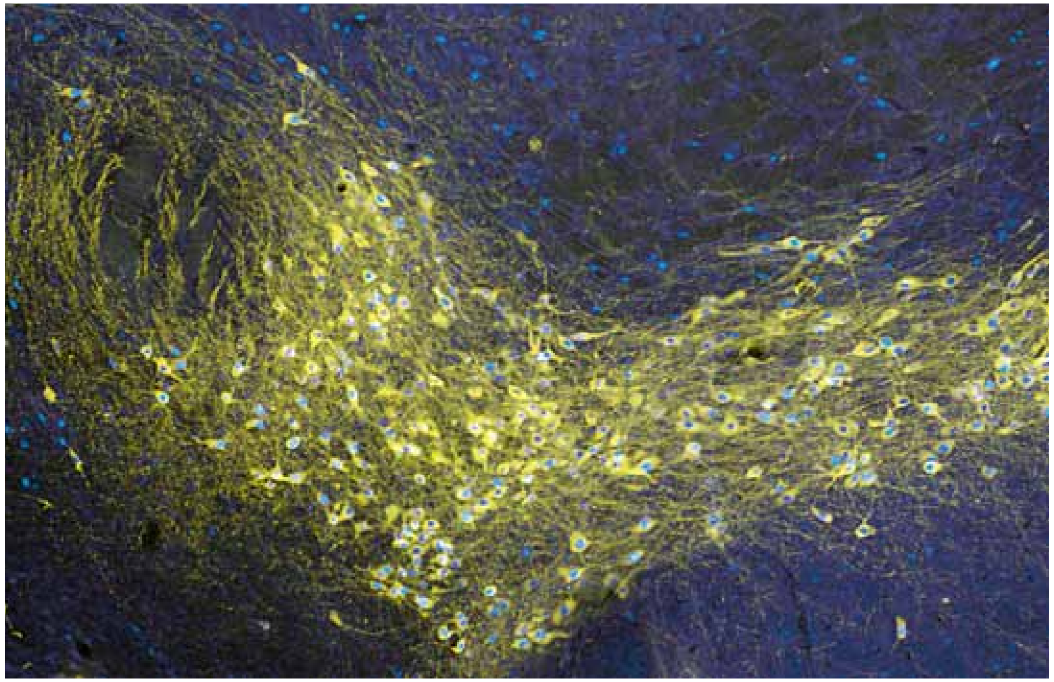
"By this time, Paul and I were at different institutions, but we got together several times a year for these amazing dinners," Dr. Nestler recalls. "We would brainstorm about science, or I would bellyache about whatever was going on in my professional or personal life, and I always left feeling replenished and reinvigorated—with renewed confidence and determination."

The third phase began in the late 1990s and continues today, a period during which Drs. Greengard and Nestler have collaborated on numerous projects such as studying molecular mechanisms of action of antipsychotic medications and drugs of abuse.

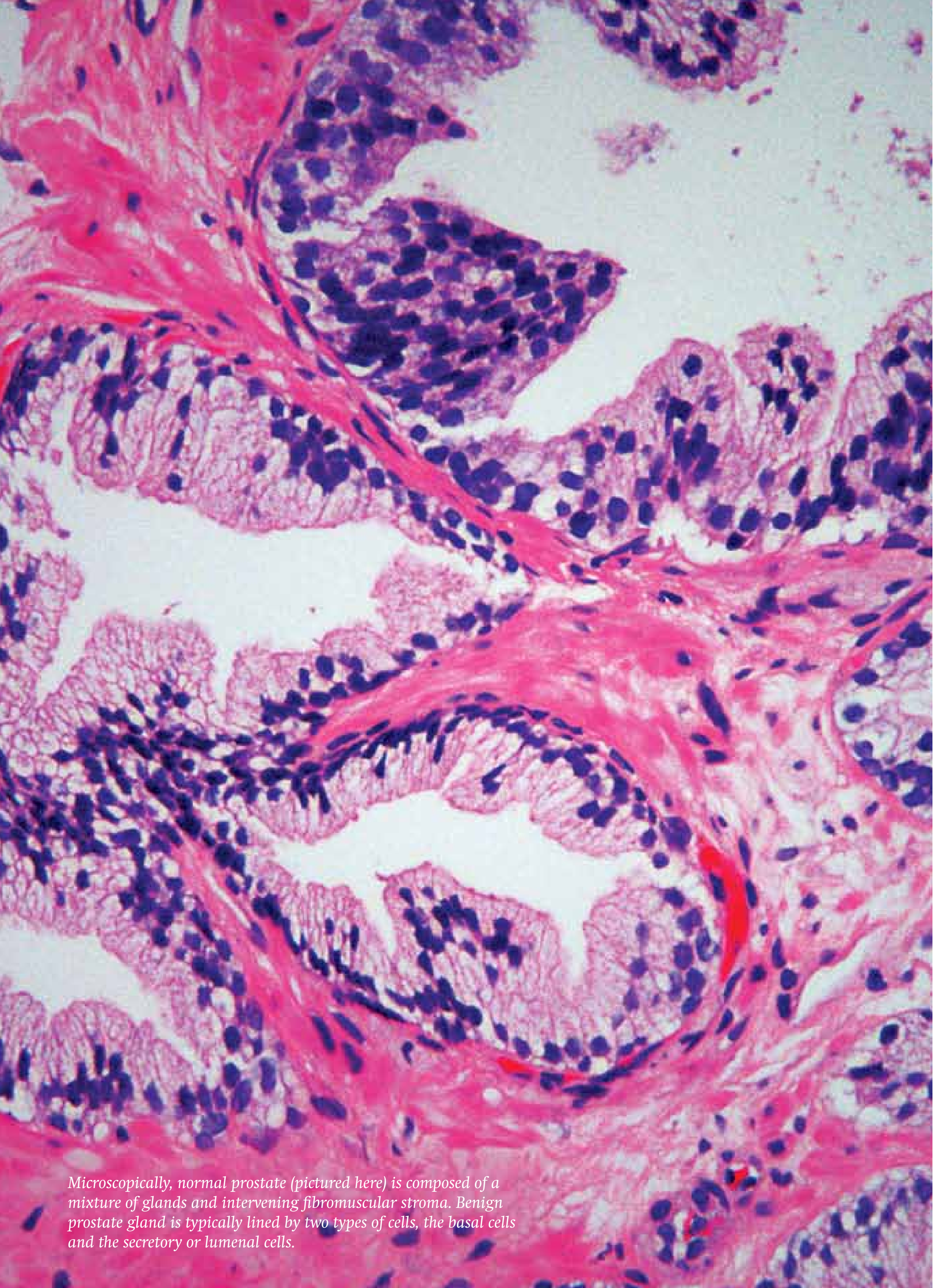
Dr. Greengard has also greatly influenced Dr. Nestler's mentorship style. "Through him I learned the value of being generous, flexible, and available and how to motivate people to work hard by helping them realize the importance of their work."

Dr. Greengard echoes this sentiment. "You can't affect the way people think. They've either got critical faculties or they don't. As a mentor what you do is direct them, based on your years of empirical experience and insights." Drs. Greengard and Nestler both agree that it is most gratifying to see the people you have worked with become successful scientists who, in turn, help others do the same.

With close collaboration among labs and a proximity to robust clinical investigations, Dr. Nestler says the Mount Sinai environment nurtures strong mentorships particularly well. As a tribute to this, in 2009 Dr. Nestler, together with Dr. Charney, Dean of Mount Sinai School of Medicine, received the Julius Axelrod Mentorship Award from the American College of Neuropsychopharmacology for their dedication to helping young scientists become leaders in their field.



Top: Pam Kennedy, PhD, a post-doctoral fellow, and Dr. Nestler reviewing computer images of neurons as visualized through the confocal microscope.
Bottom: Social defeat stress in mice activates the transcription factor, CREB, in a midbrain region rich in the neurotransmitter dopamine. CREB, acting in this region, mediates many of the deleterious effects of stress on the animal. The yellow stained cells are rich in dopamine; the blue stained cell nuclei mark CREB activation. Photo by Vincent Vialou, PhD, a post-doctoral fellow in the Nestler Laboratory.



Microscopically, normal prostate (pictured here) is composed of a mixture of glands and intervening fibromuscular stroma. Benign prostate gland is typically lined by two types of cells, the basal cells and the secretory or lumenal cells.

Recalculating Cancer

This year, nearly 600,000 people in the United States—more than 1,500 each day—will die from cancer, and 1.5 million new cases will be diagnosed. Cancer is often described by very large numbers like these, but such figures obscure a fundamental shift in thinking that has taken place in cancer research, and that is: There is no one denominator for cancer. Cancer is hundreds of different diseases and each must be evaluated—and treated—on its own.

Cancer Biology (CAB)

The goal of the Cancer Biology MTA is to develop a cadre of highly selected and committed scientists, skilled in molecular and cellular biology, who will pursue long-term careers in cancer research. Students work closely with faculty from throughout Mount Sinai, ensuring that this research is both comprehensive in scope and related to practical issues faced by physicians in preventing and treating cancer.

Themes include cancer gene signaling pathways, development and differentiation, invasion and metastasis, and disease foci, including breast and prostate cancer, leukemia, and melanoma. The program also trains investigators in approaches aimed at the translation of research advances to the clinic. This involves advanced course work in both basic and clinical cancer biology. All students participate in conferences that utilize the superb clinical resources at Mount Sinai to further train them on the clinical aspects of cancer.

Among the more than 40 laboratories within the MTA, the Co-Directors, James J. Manfredi, PhD, Professor of Oncological Sciences and of Developmental and Regenerative Biology, and Matthew J. O'Connell, PhD, Associate Professor of Oncological Sciences, are leading groups with CAB trainees who are investigating the initiating events that cause cancer, as well as developing new approaches to therapy that specifically target defects in the cancer cell that may provide an Achilles heel to the disease.

The Cancer Biology MTA is supported by a $3.9 million training grant from the National Cancer Institute (NCI) that is in its twelfth year of continuous funding. The grant provides support for both PhD and MD/PhD candidates and post-doctoral trainees. Recently, the training program has been expanded to include opportunities for clinical fellows to be trained in basic science laboratories with the goal of fostering further academic development of outstanding clinically trained physicians in the field of cancer research. "Our trainees are making fundamental discoveries in cancer, and some of our early graduates have gone on to renowned academic institutions," says Stuart Aaronson, MD, Jane B. and Jack R. Aron Professor and Chair of the Department of Oncological Sciences, who serves as the Program Director for the NCI-funded training grant.

The recent establishment of The Tisch Cancer Institute will provide additional opportunities to strengthen cancer biology training at Mount Sinai. "It is our mission to unravel the complexity of these diseases we call 'cancer,' with the goal of developing more targeted, effective treatments and, ultimately, prevention strategies," says Steven J. Burakoff, MD, Director of The Tisch Cancer Institute and Professor of Medicine (Hematology and Medical Oncology) and of Oncological Sciences. "This requires the thinking and insight of investigators from many different and sometimes unexpected disciplines."

It is anticipated that Mount Sinai's contribution to landmark cancer diagnostics and therapeutics will increase sharply after 2012 when the new Center for Science and Medicine opens. Providing more than four new floors of clinical, research, and imaging space for cancer, the building will nearly double the size of our cancer research facilities.

Immunology (IMM)

The Immunology MTA trains students in the basic principles of the immune system and helps them to acquire advanced technical skills to address complex scientific questions. The MTA includes courses and research opportunities in areas such as immune cell trafficking, immune responses to infection, immune regulation, antigen presentation and recognition, tumor immunity, mucosal immunity, signal transduction, transplant immunology, and diseases and disorders of the immune system. Many of the laboratories where students work have close collaboration with clinical investigators at The Mount Sinai Hospital.

Among many basic science programs with direct clinical implications, Miriam Merad, MD, PhD, Associate Professor of Gene and Cell Medicine and of Medicine (Hematology and Medical Oncology), is leading a team that has explored the role of dendritic cells in microbial immunity, an area that has opened up the possibility of vaccines for the treatment of high-risk hematological malignancies including leukemia and aggressive lymphoma and myeloma.

"The immune response and consequent inflammation are at the root of many diseases. If we have a better understanding of these processes, we will have the ability to treat diseases as diverse as cancer, atherosclerosis, multiple sclerosis, and diabetes," says Sergio Lira, MD, PhD, Co-Director of the Immunology Institute and Professor of Medicine (Clinical Immunology).

For students in the Immunology MTA, there are many research opportunities within the Immunology Institute. Researchers here have already developed a vaccine for peanut allergy, conducted pioneering research on intravenous immunoglobulin therapy for the treatment of primary immune deficiency disorders, and identified novel targets for treating inflammatory bowel disease.

In the case of the latter, Keren Rabinowitz, a PhD candidate working in the lab of Lloyd Mayer, MD, brought the bench back to bedside by working on the development of a new cell-based therapy for Crohn's disease—an inflammatory bowel condition that was identified by a Mount Sinai physician in 1932.

"Work like this demonstrates how Mount Sinai was translational long before 'translational' was a buzzword," says Dr. Mayer, Co-Director of the Immunology Institute, the Dr. David and Dorothy Merksamer Professor of Medicine (Clinical Immunology), Chief of the Divisions of Clinical Immunology and Gastroenterology, and Professor of Microbiology. "Given the marriage between basic scientists and clinicians, we will continue to make major inroads in our ability to treat human disease."

Microbiology (MIC)

The Microbiology MTA offers research training in areas such as antivirals, vaccine development, molecular virology, immunology, signal transduction, autoimmune disease, bacterial genetics, gene therapy, oncogenesis, and nucleic acid technology. It prepares students to pursue biomedically important questions in the broad areas of microbiology, virology, host-pathogen interactions, cancer biology, and immunology.

Faculty in the Department of Microbiology are revealing the mechanisms of immune response to pathogens, investigating oncogenes to discover how they make cells cancerous, and studying RNA- and DNA-

INVESTIGATING INFLUENZA

THE BURDEN OF SEASONAL INFLUENZA

250,000 TO 500,000 DEATHS GLOBALLY/YEAR

36,999 DEATHS AND >200,000 HOSPITALIZATIONS/YEAR IN THE U.S.

$37.5 BILLION IN ECONOMIC COSTS/YEAR IN THE U.S. RELATED TO INFLUENZA AND PNEUMONIA

EVER-PRESENT THREAT OF PANDEMIC INFLUENZA

Sources: World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), American Lung Association

THE BURDEN OF H1N1 TO DATE

LATE APRIL 2009
FIRST CONFIRMED CASES REPORTED TO WHO

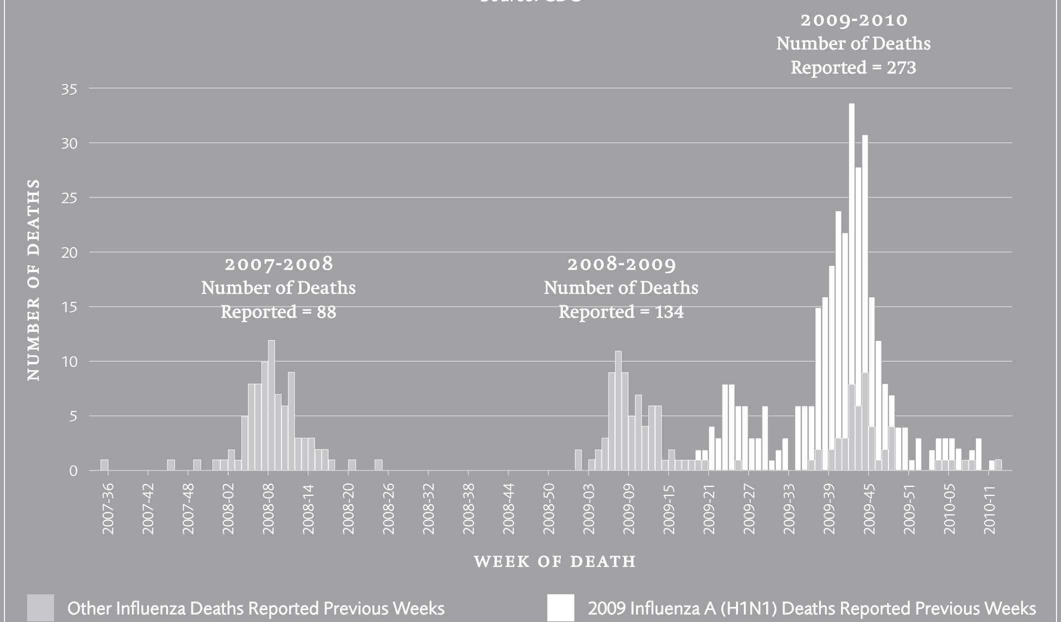
11 JUNE 2009
GLOBAL SPREAD PROMPTED WHO TO DECLARE PANDEMIC

MARCH 2010
80 MILLION CASES
UP TO 362,000 HOSPITALIZATIONS
14,460 DEATHS IN THE U.S.

Source: CDC estimates

THREE-YEAR TRAJECTORY OF PEDIATRIC INFLUENZA DEATHS

Source: CDC



containing viruses with a special emphasis on influenza, hepatitis C, herpes, HIV, and hemorrhagic fever viruses. They are also working to develop vaccines and antiviral drugs against these viruses.

One $8.9 million NIH study in particular could greatly expand the portfolio of vaccine adjuvants across the biomedical sciences. Under the leadership of Megan L. Shaw, PhD, Assistant Professor of Microbiology; Adolfo García-Sastre, PhD, Director of the Global Health and Emerging Pathogens Institute; and Peter Palese, PhD, Chair of the Department of Microbiology, researchers are identifying the molecules that induce production of interferon—a collection of proteins released by cells to fight off invading viruses, bacteria, or tumor cells—and applying that knowledge to the development of novel vaccines.

"To develop a compound that acts as an antiviral and adjuvant would be a significant advantage," says Dr. Palese, who is also a member of the National Academy of Science. Together with Dr. García-Sastre and colleagues, Dr. Palese reconstructed the devastating 1918 influenza virus, confirmed its virulence, and showed that it was sensitive to currently available antiviral agents such as Tamiflu. Their work was named Paper of the Year in 2005 by *The Lancet*, and their reverse-genetics technique paved the way for influenza vaccine development.

Understanding how—and why—one condition may differ among many individuals is another research priority within the Microbiology MTA, a training area that is aligned with our Global Health and Emerging Pathogens Institute. "Not every pathogen causes the same disease in every host," says Dr. García-Sastre, who is also Principal Investigator for the Center for Research on Influenza Pathogenesis. "Influenza, for example, affects people differently—severely, or not at all. It depends on previous exposures and on a combination of genes."

"To complicate things further, some genes may help to fight particular pathogens but facilitate more serious disease through other pathogens," García-Sastre explains.

Master Mentor

"At a point, mentoring becomes exponential," says Steven J. Burakoff, MD, Director of The Tisch Cancer Institute. Over the past three decades, Dr. Burakoff has guided many promising students and researchers into careers as well-established scientists throughout the world. "It is most rewarding to see them go on to grow the field in new and exciting areas."

In 1995, Dr. Burakoff became the first faculty member—out of 247 nominees—to receive the A. Clifford Barger Excellence in Mentoring Award at Harvard Medical School. "In my view, mentoring is a moral imperative," Dr. Burakoff explains. "You cannot bring people into your lab if you don't have the time to spend with them."

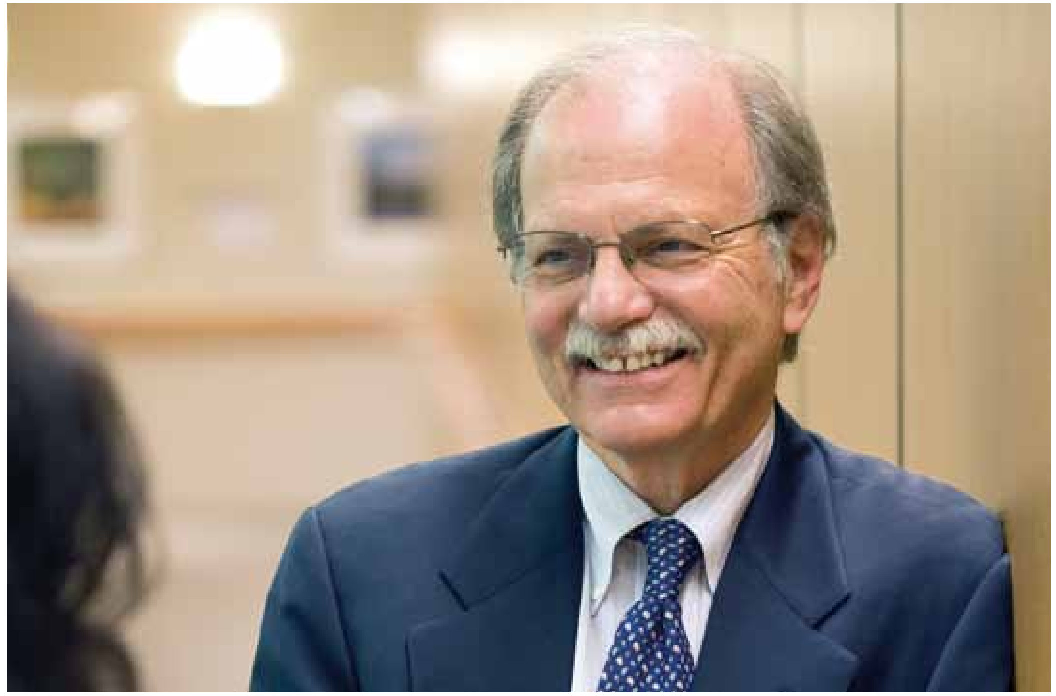
"The goal is to bring them as far as they can go in all areas so they can truly thrive."

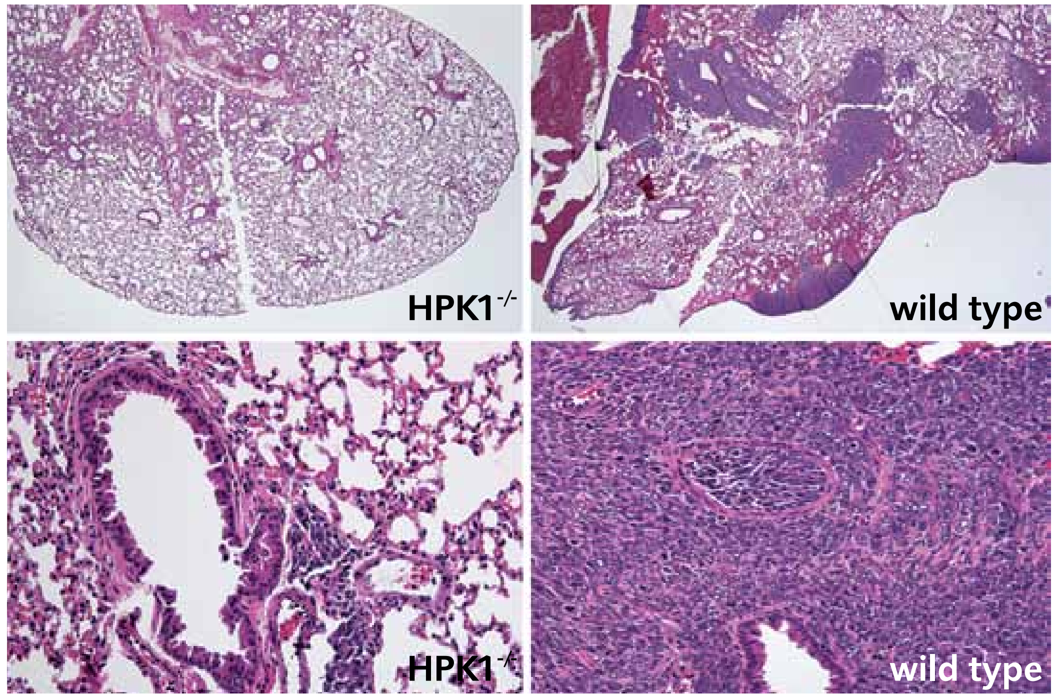
While he is legendary for giving of his time and expertise, Dr. Burakoff admits that there is a "selfish aspect" to mentoring. "The better I am as a mentor, the better the lab does," he explains. "Then we attract the best people, do great work, and the whole thing becomes a self-fulfilling prophecy."

As a mentor to graduate students, post-doctoral candidates—and now to newly recruited faculty—as he develops and directs The Tisch Cancer Institute toward becoming a NCI-designated facility, Dr. Burakoff says he looks for one key quality in everyone he works with: fire in the belly.

"If someone has passion—a 'fire in the belly' that you can feel and see—you can help him or her become the best scientist or clinical investigator he or she can be," he says. "Not everyone can do everything perfectly right off. Some people are great at designing experiments, others are excellent at building collaborations. The goal is to bring them as far as they can go in all areas so they can truly thrive."

Having had a number of renowned mentors himself—among them David G. Nathan, MD, President Emeritus of the Dana Farber Cancer Institute and recipient of the 1990 National Medal of Science, and Baruj Benacerraf, MD, who received the Nobel Prize in Physiology or Medicine in 1980—Dr. Burakoff says, "It feels important to be involved in the success of others."





Top: Dr. Burakoff talking with a student whom he is mentoring.
Bottom set: Genetically engineered mice missing the protein "HPK1" (HPK1-/-) are more capable of rejecting lung tumors than their normal counterparts (wild type). Lewis Lung Carcinoma cells were injected into HPK1-/- (left panels) or wild type (right panels) mice. Tumor infiltrations are shown at 20X magnification (top panels) and at 60X (bottom panels).

With a commitment to global and community health, Mount Sinai's Greenmarket brings fresh fruits and vegetables to its East Harlem neighborhood. East Harlem, which has disproportionately high rates of obesity and diabetes, has fewer places to buy produce than more affluent areas nearby.

Committed to Cures

Biomedical science matters most when it is translated into cures. Our PhD and MD/PhD programs are strategically designed with this goal in mind, and an array of highly specialized patient- and population-based training programs furthers our commitment to cures. These programs give physicians and medical teams the tools they need to assess not just the health of individual patients, but also of caseloads and communities. This, in turn, informs the work of scientists in their quest to develop improved diagnostics and treatments.

Clinical Research

In support of its long-standing commitment to collaborative, clinical research, in 2009 Mount Sinai was awarded a $34.6 million Clinical and Translational Science Award (CTSA) grant for five years. Now 64 institutions strong, the national CTSA consortium is dedicated to translating scientific discoveries into medical practice.

"Until quite recently, the paucity of physician-scientists who were rigorously trained in clinical research was not appreciated," notes Hugh Sampson, MD, Dean for Translational Biomedical Sciences, Director of the Jaffe Food Allergy Institute, and the Kurt Hirschhorn Professor of Pediatrics. The NIH recognized this lack of well-trained clinical investigators—as well as the gap between basic scientific discoveries and the implementation of truly innovative treatments—and started funding programs through CTSAs to establish the necessary infrastructure for translational research and to help address the nation's need for clinical investigators.

"As a medical school embedded in a hospital, Mount Sinai is uniquely positioned to expand its role in training future clinical investigators and translating basic discoveries into future therapies," he says.

With focus areas as diverse as the student interests that generate them, Mount Sinai offers a range of degree programs that are specially designed to train future leaders in patient-oriented research. In 1999, Mount Sinai received an NIH-funded K30 Clinical Research Curriculum Award that served as the foundation for the institution's Clinical

Research Education Program. The program now offers both MS and PhD degrees, as well as a one-year certificate in clinical research.

"Each of these programs is for students who want to pursue a scientific approach to answering specific questions concerning the health and/or well being of unique groups of patients or in the general population," says Lisa M. Satlin, MD, Chair of Pediatrics, Director of CePORTED (Center for Patient-Oriented Research, Training, Education, and Development), and Professor of Pediatrics and of Medicine (Nephrology).

Jeffrey M. Saland, MD, MSCR, Assistant Professor of Pediatrics (Nephrology), enrolled in the MS in Clinical Research (MSCR) while completing a Fellowship in Pediatric Nephrology. He received a K23 NIH grant (Mentored Patient-Oriented Research Career Development) to cover his training and research as he investigated why children and young adults with kidney disease have abnormal levels of cholesterol, triglycerides, or both, in their blood.

"One of my goals was to do clinical research, and I knew the training in biostatistics and study design would be useful," he says. "The historical lessons I learned from the program were also very important. Through exposure to examples of flawed or unethical study design, you learn how excluding certain populations or using the wrong statistical model can affect the validity of your research."

"These training opportunities are intended to encourage the development of critical thinking necessary to conduct innovative hypothesis-driven clinical/translational research. We hope to position trainees from a broad range of scientific and health care backgrounds to become well-versed in a range of scientific vocabularies so as to become effective members and leaders in the enterprise of team science," says Janice L. Gabrilove, MD, the James F. Holland Professor of Medicine and Oncologic Sciences and Director of the Clinical Research Education Program.

The PORTAL Program—for Patient-Oriented Research, Training, and Leadership—is a highly selective five-year MD/MSCR open only to students applying for medical school entry. "PORTAL is for the most promising medical students who are interested in becoming leaders in clinical research," explains Karen Zier, PhD, Associate Dean for Medical Student Research, Professor of Medicine (Clinical Immunology), of Medical Education, of Oncological Sciences, of Microbiology, and of Gene and Cell Medicine.

Building on the master's coursework, the PhD in Clinical Research offers outstanding health-science professionals more advanced studies in biostatistics, research methodology, clinical epidemiology, and drug development.

Population Programs: Public Health and the Global Impact

Learning to bring best practices in preventive care to whole communities is the goal of the Master of Public Health (MPH) program. Over two years, students are prepared to promote health, prevent disease, and protect the environment with the understanding that, as health professionals, they will work in partnership with a wider community.

Connecting Science and Medicine

Bridging bench to bedside, and bedside to community is the goal of the CePORTED Annual Retreat. "We try to connect the dots between the basic science and the epidemiology of disease," Dr. Satlin explains. "The retreat aims to engage all facets of Mount Sinai's academic community, from graduate and postgraduate trainees, to faculty in all clinical and basic science disciplines."

"Each retreat focuses on a selected theme that spans the translational research spectrum, with the aim of generating information exchange between the bench, bedside, and population," she says. Launched in 2009, the first retreat focused on obesity and diabetes and was co-sponsored by the Metabolism Institute. It included a plenary session that began with presentations summarizing our state-of-the-art understanding of the molecular and cellular basis of diabetes, and then moved on to explore environmental and community-related factors that contribute to obesity that can, in turn, lead to diabetes.

This year's conference, co-sponsored by the Center for Nursing Research and Education, focused on viruses and disease. The program included presentations on the past and future of influenza, microbidicides in HIV, and the molecular epidemiology of, and evidence-based approaches to, patients with hepatitis C.

They learn how to assess the health status of populations, design appropriate interventions, evaluate the success of interventions, and critically evaluate published research. Medical students have the option of completing the dual MD/MPH degree program over a four- to five-year period.

Specialty tracks within the MPH program allow students to focus on specific areas of public health such as Environmental and Occupational Health, Outcomes Research, General Public Health, Global Health, and Health Promotion and Disease Prevention.

Mount Sinai's MPH students have created an obesity education program for the East Harlem community, developed a research database for the Mount Sinai Cord Blood and Placental Tissue Repository, and worked to improve the health of villagers in India through child health and nutrition programs. Students participate in a practicum experience that requires 150 hours or more of work in a public health setting, such as the New York City Department of Health and Mental Hygiene, or with organizations overseas such as the International Rescue Committee in Kenya.

"Recent disasters like 9/11 and Hurricane Katrina and the persistent threat of bioterrorism revealed the lack of public health infrastructure," says Emily Senay, MD, MPH, Director of the MPH program from 2006-2010 and Assistant Professor of Preventive Medicine. "Our nation's leaders are supporting the rebuilding of that infrastructure, and Mount Sinai is at the forefront of this effort," says Dr. Senay, a graduate of Mount Sinai's MPH program. While the MPH is an independent degree, currently half of the students enrolled are either working physicians or medical students.

Nils Hennig, MD, the current Director of the MPH program and leader of the Global Health track, explains, "Working with experts across fields, students learn how to assess population health status, design appropriate interventions, and evaluate program success—in both industrially developed and remote environments."

Whether our graduates work domestically or abroad, they will encounter a diversity of patients whose lives and health will be influenced by any number of global factors, explains Philip J. Landrigan, MD, MSc, Dean for Global Health and Chair of the Department of Preventive Medicine. "It is our goal to give our students the insight and training they will need to best help individual patients and whole communities."

It was Dr. Landrigan's research that prompted the federal government to require companies to remove lead from paint and gasoline in the 1970s and 1980s, a move that has been credited with reducing lead poisoning in children by 90 percent in the past 25 years and producing an annual economic benefit of $200 billion to the United States. Many other nations adopted similar policies, greatly reducing the incidence of childhood lead poisoning worldwide.

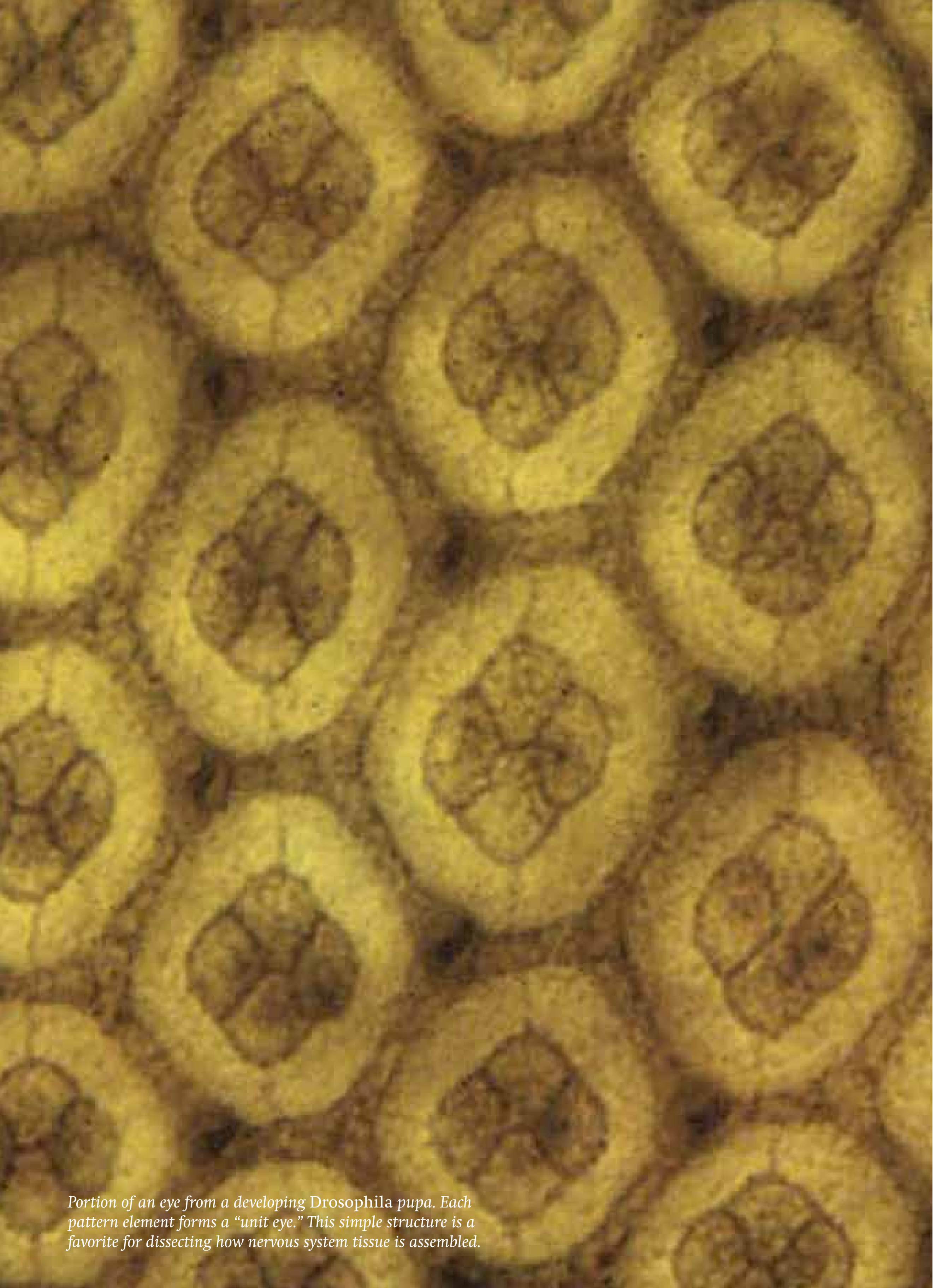
In a 2005 profile in *The Lancet* titled "Philip Landrigan: Children's Health Crusader," Dr. Landrigan said that he is now focused on cultivating the next generation of environmental pediatricians, explaining, "It's a medical tradition that goes back to Hippocrates, which says to train your successors."

Indeed, that time-honored philosophy drives all of Mount Sinai's graduate school training—whether in basic science or clinical research—as we fulfill our stated mission to "prepare our students for leadership roles in one of the scientific challenges that will dominate the 21st century: the translation of scientific discovery into clinical innovation and improvements in health care."

Investing in the Health of Our Children

MPH students at Mount Sinai can also contribute to the National Children's Study (NCS), the largest study of children's health and the environment ever conducted in the United States. The study will follow 100,000 children from conception to age twenty-one to identify genetic influences and environmental exposures that cause disease in children and across the lifespan.

"Of all the groups in American society, young children are at the highest risk of exposure to toxic chemicals in the environment," explains Dr. Landrigan, who had a central role in launching NCS through Congress and is now Principal Investigator for NCS in New York and northern New Jersey. "The ultimate goal is to come up with a blueprint for protecting health and preventing disease in American children that can contribute also to the global effort to combat disease," he says.



Portion of an eye from a developing Drosophila *pupa. Each pattern element forms a "unit eye." This simple structure is a favorite for dissecting how nervous system tissue is assembled.*

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