OUTSIDE IN
New York City...a global population...a densely urban environment...an ideal opportunity to take on cancer from the outside in. Today, the NYU Cancer Institute is building a powerful hub of environmental and population scientists to make the most of this singular urban laboratory. Already known for our work in community outreach and environmental science, we are increasing our focus on understanding cancer disparities in ethnically diverse populations and unlocking the secrets of environmental oncogenesis. Serving and learning from all of New York’s patients, we are advancing cancer research and care.
The tools of the molecular revolution have created unprecedented opportunities to take on cancer from the inside out, exposing its innermost mechanisms to scientists. To make the most of these opportunities, the NYU Cancer Institute is accelerating the pace of our research, focusing on areas such as signaling pathways, cancer stem cells, molecular targeted therapies, immunology and immunotherapy, and developmental genetics. We are building on the strength of our world-class basic science to speed the translation of knowledge from inside the laboratory out to the clinic, and from inside the clinic out to the community, the nation, the world.
TAKING ON CANCER
The NYU Cancer Institute is taking on cancer from the outside in and the inside out. **As a National Cancer Institute (NCI) designated cancer center** in a world-class medical center, in a great university in the heart of a global metropolis, we are uniquely positioned to do so. **The NYU Cancer Institute is a singular point of convergence:** for collaborations between investigators within our walls and elsewhere on New York University’s campuses...for multidisciplinary teams with disease-specific targets...for population scientists to learn from our city and outreach programs to bring cancer care and screening into our community...for laboratory scientists and clinicians to translate the latest research findings to the clinic...and for patients seeking to benefit from the latest advances in cancer care. **We are also at a unique point in time,** with new leadership and a new vision that has already resulted in a 50% increase in National Cancer Institute funding, and groundbreaking scientific discoveries such as the recent identification of a gene that plays a key role in inflammatory breast cancer, and of a molecular agent that may treat devastating leukemia relapse in children; these discoveries may lead the way to new drugs and therapies. **We are institutionalizing the fully integrated model of research and care that we believe best serves our mission.** We are utilizing our rich, global laboratory and endeavoring to deliver equal access to care, building leadership across the whole continuum of research, patient care, and community outreach, and thus **completing the circle whose central focus is taking on cancer.**
A Message from the Director
William L. Carroll, MD

At the NYU Cancer Institute we share a vision to become a global cancer institute not only serving patients in this great city that is our home, but also developing new approaches to cancer prevention and treatments that will benefit patients worldwide. An NCI-designated cancer center since 1975, the NYU Cancer Institute has long been known for excellence in cancer-focused research, patient care, education and community outreach. Now we are building on our unique assets, identifying strategic areas for growth, and sharpening our focus on key programs in order to increase the momentum of our contributions to the understanding and treatment of cancer.

In just five years, the NYU Cancer Institute has made great progress. With a mission that reflects our global outlook and a clearly defined strategic plan, we have seen our research and patient care programs grow in size and reputation; and we have attracted new talent and partners who want to participate in the transformative work of the NYU Cancer Institute:

To discover the origins of human cancer and to use that knowledge to eradicate the personal and societal burden of cancer in our community, the nation, and the world.

We are building on our unique assets, among them:

Our structure, as a “matrix cancer center” without walls operating within the larger NYU Langone Medical Center, enhances collaborations on all NYU campuses across scientific disciplines and provides access to critical new technologies.

Our affiliation with Bellevue Hospital, the oldest public hospital in the country, and with Woodhull Hospital in Brooklyn, afford distinctive opportunities to learn and care for extraordinarily diverse groups of patients with cancer.

Our location in the heart of New York City gives us access to a one-of-a-kind urban laboratory with a unique global patient population.

Our unique relationship with the Nelson Institute of Environmental Medicine drives the pursuit and investigation of environmental carcinogens and preventive measures to eradicate cancer.

Our clinical research focus has encouraged 20% of our patients to participate in therapeutic clinical trials (the national average is 4% participation), providing patients with access to the best available therapies while defining better options to improve outcomes.

We have defined our vision and strategy:

The NYU Cancer Institute will develop new approaches to prevent, diagnose and treat cancers through our focus in basic science with a strong link to transforming that knowledge into clinical applications within five years – the
translational medicine model. To accomplish this, we are bringing our outstanding scientific base to bear on fundamental issues in cancer biology and treatment and pursuing multifaceted initiatives, including:

**Expanding Existing Programs**
The success of the multidisciplinary clinical research and practice model has already been demonstrated by our *Melanoma Research Program* (the Interdisciplinary Melanoma Cooperative Group, IMCG, story on page 29) and the Genitourinary Oncology Program, which has been designated as part of a Center of Excellence (see below). Equally comprehensive and collaborative are the *Breast Cancer Research Program* (see story on page 32) and our *Environmental and Molecular Carcinogenesis Program* (see story on page 17), which has identified cancer-causing agents in the environment and is developing drugs to prevent and diminish cancer growth. Going forward, we will be expanding these programs through further development of our *Hematologic Malignancies, Lung, and GI Research Programs*.

**Developing New Programs**
The NYU Cancer Institute is developing special-emphasis scientific programs focused on specific cancers with emerging technologies in genomics and imaging. For example, the *Thoracic Oncology Program* brings a cutting-edge approach to personalizing treatment of lung cancer by using distinctive “tumor signatures” to select the most effective medicines, and the *Neuro-oncology Program* is a collaborative team of neurosurgeons, medical oncologists and imaging specialists who are converging on one of the most difficult forms of cancer to treat: brain tumors.

Taking advantage of NYU’s strength in molecular carcinogenesis and our large, diverse patient base, we are building a new *Population Sciences Program* through which we will dramatically increase our understanding of cancer formation and its progression in various populations, the interaction between genetic factors and environmental exposures as well as cultural, social and economic factors that prevent access to optimal care. A *Cancer Targets and Novel Therapeutics Program* brings together chemists, biologists and physicians to develop molecular targeted cancer therapy and accelerate the drug discovery and testing process.

**Creating New Centers**
Our cancer research received a significant boost when NYU Langone Medical Center announced the creation of six new Centers of Excellence, two of them cancer-related: the *Center of Excellence for Urologic Disease* with the major component focused on cancer, and the *Center of Excellence for Cancers of the Skin*. The increased funding that accompanies these designations provides opportunities to expand programs and create new initiatives.

To increase patient access to the latest cancer prevention and treatment, and to raise the level of patient-centered care with meaningful outcomes, we are in the process of creating two new centers. Our *Center for Health Care Disparities* was established in 2008 as the
A Message from the Director

CORE Center (story on page 11), which is working to reduce social and cultural barriers to effective cancer care in underserved communities. In the future, a Cancer Prevention and Screening Center will provide patients both at risk and not at risk for cancer with strategies and screening options to prevent cancer and to detect cancer at the earliest, most treatable stages.

We have made great progress in five years:

Richard Hayes, well-known epidemiologist, recruited to lead Population Sciences. NYUCI’s mission-critical Population Sciences Program has new leadership with Richard B. Hayes, DDS, PhD, MPH, as Director of the Division of Epidemiology, Department of Environmental Medicine and Associate Director for Population Sciences at the NYU Cancer Institute. He has made significant contributions to understanding the environmental and genetic causes of prostate and colon cancers, and led research evaluating chemical hazards. (See page 20.)

Owen O’Connor, MD, PhD, drug inventor, leads clinical research enterprise. In his role as Director of the Division of Hematologic Malignancies and Medical Oncology, Dr. O’Connor will oversee our clinical programs and advance our platform for translational science. He has developed novel treatments for a variety of hematologic malignancies. (See page 25.)

Construction is under way for a new stem cell transplant facility. Located in Tisch Hospital, the new unit will serve patients undergoing both allogeneic and autologous stem cell transplantations as part of therapy for hematological cancers.

Our Early Phase Clinical Trials center is supported by Team Continuum. Team Continuum, a non-profit organization that provides non-medical assistance to patients and their families and funding to healthcare facilities and foundations, has pledged $1 million to support Early Phase Clinical Trials. The program helps people with cancer access the newest treatment available at various stages of the disease, when there may be few other therapeutic options available.

Looking Ahead

As we report on the Institute’s progress, we are determined to capitalize on this momentum to increase our impact in transforming the future of cancer care and science.

Our efforts will be enhanced with the appointment of our new Chair of the Board of Directors, Lori W. Fink. Ms. Fink, who helped to establish the Laurence D. and Lori Weider Fink Children’s Ambulatory Care Center through the highly successful Campaign for Children’s Health at NYULMC, is committed to raising resources for and awareness of adult and pediatric cancer. The generosity of individual donors and foundations will play an even more vital role in achieving the ambitious goals we have set at NYU Cancer Institute, as we bring together the many unique assets and initiatives described in these pages to take on cancer, from the outside in and the inside out.
Embracing Diversity, Fighting Disparity

The CORE Center

Today some 40 percent of New Yorkers claim another country as their birthplace. Yet even as the diversity of the population enriches the city, it also brings special healthcare challenges, not the least of which is disparity in the incidence and treatment of cancer. Getting to the heart of these differences and setting one standard of cancer care for all people, regardless of their background, is the goal of the NYU Cancer Institute’s Cancer Outreach, Outcomes, and Research for Equity (CORE) Center.

Breast cancer is more common among white than black women, but more black women die of the disease. Latinas have higher rates of cervical cancer than non-Hispanic women. Asian Americans have the highest incidence of stomach and liver cancers (see inset charts). Among immigrant and minority populations compared with U.S.-born Caucasians, cancer tends to be diagnosed at later, less curable stages. An assortment of reasons underlies these disparities, including poor access to healthcare services, lack of insurance, distrust of the medical system, language barriers, transportation and employment obstacles...the list goes on and on.

“We see a lot of people from immigrant and minority communities diagnosed at advanced stages of disease, and the bottom line is that they’re not being screened,” says CORE Director Francesca Gany, MD, MS, Associate Professor of Medicine and Founder and Director of the Center for Immigrant Health. Her interest in cancer disparities stems back some 25 years, when she began her residency at NYU and witnessed firsthand the health problems of patients coming to Bellevue. “We knew if the information was out there in the community and people knew about and could access the right services, their cancers could be detected earlier. They would have a better chance of a cure.”

The NYU Cancer Institute has had a long-standing commitment to identifying, understanding, and addressing cancer disparities in and around New York City. To reach the goal of providing equal cancer care to all, these efforts were unified into the CORE Center in 2008. The CORE Center addresses disparities in cancer prevention, detection, treatment, and survivorship among immigrant and minority communities. As a model for the study of healthcare disparities in an urban setting, research conducted by the CORE Center holds promise for understanding and remedying gaps in the delivery of cancer care around the world.

The CORE Center partners with other institutions in the community — such as Bellevue Hospital Center, Metropolitan Hospital, and Woodhull Medical and Mental
Health Center — to focus on cancer disparities among African American, Chinese, Haitian, Latino, Arab, African, Caribbean, Russian, Polish, and South Asian individuals.

“The CORE Center conducts community-based education, screening, patient care, research, and training programs to overcome barriers to care and to bring effective cancer interventions to medically underserved communities,” explains Dr. Gany. These efforts require collaboration across disciplines and bring together staff from different departments of the entire New York University community (including the Colleges of Dentistry and Nursing and the main campus at Washington Square).

Ongoing programs include the Cancer Awareness Network for Immigrant and Minority Populations, which has addressed disparities in the utilization of cancer prevention, detection, and treatment services by Haitian, Latino, Caribbean, Korean, and Chinese communities; a dedicated cancer outreach effort for Chinese immigrants living in New York City (established with funding from the Lance Armstrong Foundation); AMBER, a program to help Arab American women access breast cancer education and screening; and the Immigrant Cancer Portal Project, which helps immigrants in New York City access cancer treatment and support services.

A full 40 percent of the population of New York City today was born in another country. Some 83 percent of immigrants speak a language at home other than English, and nearly a quarter of the city’s foreign-born population (some 1.5 million people) have limited English proficiency. Consider these statistics:

- 48.9 percent from Latin America
- 23.7 percent from Asia
- 22.7 percent from Europe
- 3 percent from Africa

Dr. Gany notes that the NYUCI is getting more calls from members of immigrant and minority communities because of the best publicity possible: word of mouth. The CORE Center now has a number of research projects under way to determine why people don’t keep their appointments or complete therapy, and to develop more effective ways of communicating with patients so they can make informed decisions about their care.

“Ideally we want to see all patients coming in with earlier stage disease, see them able to access social support services and complete the recommended regimen of treatment,” says Claudia Ayash, Administrative Director of Community Outreach and Education and the CORE Center. “Our goal is to have one standard of care for cancer for everyone in New York City.”
A Picture of Cancer Disparities*

These graphs illustrate the differences in cancer incidence and mortality among the diverse populations, as found in New York City.

**CERVICAL CANCER**
Latinas have higher rates of cervical cancer than non-Hispanic women.

**BREAST CANCER**
Breast cancer is more common among white than black women, but more black women die of the disease.

**PROSTATE CANCER**
African American men are diagnosed with prostate cancer 60 percent more often than white men, and more than twice as many die from the disease.

**LIVER CANCERS & STOMACH CANCERS**
The incidence of stomach and liver cancers is highest in Asian Americans.

* Data drawn from Cancer Facts & Figures 2009, a publication of the American Cancer Society.
“Have faith in your ability to act with wisdom.” — Egyptian proverb

If Maha Abdelrazek had not trusted her instinct to seek a second opinion, her future might be quite different than it is today. And had she not received assistance from special programs offered through the NYU Cancer Institute, her journey would not have been as smooth.

Diagnosed with breast cancer, the former banker had breast cancer surgery in December 2008 in her native Cairo, Egypt. But the pathological analysis performed on her tumor tissue was incorrect. It took a visit to the NYU Cancer Institute for Ms. Abdelrazek, 52, to learn that her tumor expressed high levels of HER2, no hormone receptors and also presence of microinvasive components. This indicated that she was a candidate for trastuzumab (Herceptin®) — a drug that targets HER2 and that offers her the greatest chance of a cure. Ms. Abdelrazek began chemotherapy at the NYU Cancer Institute in February 2009, guided by veteran medical oncologist Franco Muggia, MD, the Anne Murnick Cogan and David H. Cogan Professor of Oncology.

NYUCI programs helped clear the way for her to receive care. A physician in the Arab community referred Ms. Abdelrazek to Arwa Aziz, a patient navigator from the NYUCI’s Arab American Breast Cancer Education and Referral (AMBER) program, funded by Komen Greater NYC, which coordinates culturally appropriate breast cancer education and screening for Arab women. Ms. Aziz referred her to Julia Ramirez, program manager for the Immigrant Portal Project—an NYU program funded by New York Community Trust, which facilitates access to cancer treatment and support services. Ms. Ramirez helped Ms. Abdelrazek, an uninsured immigrant, obtain financial assistance from the CancerCare organization.

Ms. Abdelrazek secured housing at the American Cancer Society’s Hope Lodge in midtown Manhattan, just blocks from NYU, for the duration of her treatment. This is not the first time she has lived in the United States: she originally came to the U.S. in 1979, raised her three children here, and later returned to Egypt. When Ms. Abdelrazek completes treatment in February 2010, she will return again to Egypt...with a piece of NYU in her heart. “I’m so thankful I came to NYU,” she says. “Everyone has been so kind and understanding. It’s been a great experience.”

Ms. Aziz and Ms. Ramirez are shown in the adjacent photograph.
Air pollutants in Beijing. Arsenic in the drinking water in Bangladesh. Exposure to chromium in industrial settings. Scientists at the Nelson Institute of Environmental Medicine — at work in the woodland setting of Sterling Forest, New York, some 45 miles northwest of NYU Medical Center’s midtown campus — are seeking to understand how these dangers can trigger cancer development and how to improve the health of people around the world.

The Perfect Environment
The Nelson Institute of Environmental Medicine

Investigators of the NYU Cancer Institute’s Environmental and Molecular Carcinogenesis Program at the Nelson Institute are identifying environmental agents that can cause cancer and studying the cell signaling mechanisms they disrupt to get to that point. Researchers are highlighting harmful genes that are “turned on” to cause cancer, as well as the deactivation of helpful genes that normally prevent uncontrolled cell growth. Others are assessing how compounds found in commonplace foods, such as garlic and blueberries, may work inside cells to reduce cancer risk.

Three dozen investigators call the Nelson Institute home for their research. Their work builds on more than four decades of achievements to pinpoint environmental carcinogens, to delineate how they provoke cells to become cancerous, and to seek ways to prevent these events from ever occurring.

The High Cost of Nickel
Max Costa, PhD, the Fred Wild Professor and Chair of Environmental Medicine, Professor of Pharmacology and Director of the Nelson Institute of Environmental Medicine, and his colleagues discovered a novel mechanism through which nickel — a particulate component of air pollution — causes cancer, which may also explain how other carcinogens do their work. They showed that nickel inactivates a tumor suppressor gene, which normally puts the breaks on rampant cell growth but when inactivated can lead to cancer. They have also discovered that nickel disrupts iron levels in cells, altering certain enzymes via the disruption of cell signaling pathways. The result: cancer cells are given the ability to live with little or no oxygen, enabling them to grow and multiply unabated.

Dr. Costa now uses an approach called Chipseq to facilitate his work. This technology allows investigators to map the locations of different proteins on the cell’s DNA “hard drive” in response to exposure to nickel and other carcinogens. “This technology provides fundamental information about cancer development,”
he explains. “Elucidating the roots of cancer induced by these chemicals may help us identify targets for new therapies or even preventive approaches.”

Exploring a Cell’s Own Checkpoints

Normal cells go about their everyday lives relying on a well-orchestrated series of steps called the cell cycle, during which time they grow, divide, and multiply. Nature has put important checkpoints in place to ensure that this delicate cycle does not go awry. But sometimes certain checkpoints are turned off or missing, leading to the unrestrained cell growth that characterizes cancer.

“One hallmark of cancer is uncontrolled cell division,” explains Wei Dai, PhD, Professor of Environmental Medicine and Pharmacology and head of the Growth Control Program at the NYU Cancer Institute. “If you can control cell division, you can control cancer progression.” Toward that goal, Dr. Dai and his team study checkpoints in mitosis — the phase of the cell cycle when a cell doubles its genetic material in the nucleus and divides into two new cells.

Dr. Dai uses fluorescent markers to visualize this process. In the past several years, he has used genetically altered mice (in which the functions of certain genes are “knocked out”) to study the functions of genes involved in maintaining the integrity of DNA during cell division. For example, he has shown that environmental carcinogens such as arsenic, chromium, and ultraviolet radiation impair the ability of surveillance genes — such as ones called BubR1 and Polo-like kinase 3 — during the “S” and/or “M” phases of the cell cycle, when the cell duplicates its DNA or undergoes nuclear division.

Chuanshu Huang, MD, PhD, Professor of Environmental Medicine and Pharmacology, is studying the mechanisms through which arsenic — a metal known to interfere with the function of cell cycle checkpoints — causes squamous cell and basal cell carcinomas, the two most common forms of skin cancer. In most developed nations, arsenic is commonly found in only small amounts in soil. But in other parts of the world, especially resource-limited countries, arsenic contamination is a major public health problem. As an example, high concentrations are found in the drinking water in Bangladesh.

Dr. Huang has demonstrated through cell culture and animal studies that arsenic exposure is able to induce skin cancer through the activation of a signaling pathway called PI3K/Akt, further leading to expression of a protein called Cyclin D1. He and his colleagues have also shown that induction of the COX-2 protein is also partially responsible for arsenic-related skin cancer in mouse skin cells. Dr. Huang’s research could potentially lead to new ways to use Cyclin D1 and/or COX-2 as targets for reducing the risk of arsenic-related skin cancers.
The Nelson Institute of Environmental Medicine opened its doors in 1963, just a year after Rachel Carson published *Silent Spring* — a book that documented the adverse effects of pesticides on the environment. NYU already had some 15 years of experience with environmental research under its belt, having founded the Department of Environmental Medicine in 1947. Yet scientists were aware that external variables like ambient air pollution can skew the results of a well-intentioned experiment.

They knew they needed a “pure” facility, one far from the polluted air of New York City, in which to perform experiments in animals using novel inhalation chambers. The Nelson Institute — some 100,000 square feet of laboratories and offices — was one of the first and largest designated by the U.S. National Institute for Environmental Health Sciences.

Over the years, investigators here have published numerous “firsts” about the environment and health: pioneering studies of the roles of inhaled aerosols and particulates in lung cancer development; showing that ambient ozone reduces lung function in individuals exposed during normal outdoor active recreation; discovering how benzo(a)pyrene, a potent chemical in cigarette smoke, binds to mutations in the p53 gene in smokers who develop lung cancer; and demonstrating how inhaled metals such as nickel and chromium induce lung cancer by altering cell signaling mechanisms. Most recently, NYU scientists were among the first to respond to the World Trade Center disaster in 2001, collecting dust samples just one day after the collapse of the Twin Towers.

Taming Carcinogens

Research conducted at the Nelson Institute is also providing clues about possible ways to reduce cancer risk. For example, Dr. Dai and his team are developing a mouse model that is susceptible to cancer to study the potential chemopreventive effects of chloroquine (the drug most often used to treat malaria) and a compound found in garlic. Dr. Huang is also working with Ohio State scientists to determine if compounds in blueberries may reduce the cancer-causing effects of carcinogens like UV radiation and from cigarette smoking.

Krystyna Frenkel, PhD, Professor of Environmental Medicine and Pathology, and her colleagues are evaluating CAPE, a honeybee product extracted from beehives. They recently showed that CAPE (caffeic acid phenethyl ester) inhibits the growth of breast cancer cells in laboratory studies and suppresses the renewal of breast cancer stem cells. Their findings suggest that low doses of CAPE, alone or in combination with paclitaxel (a drug commonly used to treat breast cancer) may be useful in patients with a form of breast cancer called triple-negative disease (for which few effective therapies are available).

The idyllic setting of the Nelson Institute may be thousands of miles from the polluted air of the world’s busiest cities and the tainted water of developing nations. Yet with its proximity to the global metropolis of New York City, it is the perfect environment to raise awareness about environmental dangers and advance the health of all of the Earth’s inhabitants.
Thirty-five years ago, Richard Hayes, a practicing dentist who had earned a DDS degree from Columbia University College of Dental Medicine, did not envision that he would one day become a leading authority on the epidemiology of cancer. His later studies of chromium chemical workers proved to be an “occupational exposure” that forever changed the direction of his career.

In 1973, after two years of dental practice, Dr. Hayes enrolled at Johns Hopkins University to pursue a master’s degree in public health (MPH), with the goal of teaching preventive dentistry. “But by getting involved in research on the health risks of occupational exposures, I learned I could expand our knowledge of environmental carcinogens and have a broader impact on health everywhere,” explains Dr. Hayes, who came to NYU Langone Medical Center in February 2009 as Director of the Division of Epidemiology in the Department of Environmental Medicine and Associate Director for Population Sciences at the NYUCI. He did earn his MPH, and also went on to complete a PhD in epidemiology.

His studies of chromium workers in a factory in downtown Baltimore confirmed that they had a twofold-increased risk of lung cancer, information that has led to greater protection from occupational exposures in the years since. Dr. Hayes took his expertise to the National Cancer Institute, where he was on staff for 23 years before coming to NYU Langone Medical Center.

He has led research evaluating the cancer hazards of benzene, formaldehyde, and other chemicals — an area of investigation that dovetails with NYU’s strong tradition in environmental medicine. He has also made significant contributions to the understanding of the environmental, behavioral, and genetic causes of prostate and colon cancers.

Through “genome-wide association studies,” Dr. Hayes led a team that identified twelve gene regions associated with prostate cancer. His interest in genetic determinants of disease risk evolved from his earlier occupational studies, in which it was noticed that some workers were more susceptible to the adverse health effects of occupational exposures than others, a result of genetic variations.

Dr. Hayes is working with the senior leadership of NYU Langone Medical Center to strengthen research on genetic and environmental causes of cancer that may lead to novel cancer prevention strategies. “I was drawn to the NYUCI because of the support of the leadership here, the strength of the environmental medicine group, and the epidemiology program,” Dr. Hayes concludes. “This is the more global approach needed to address environmental carcinogenesis.”
The molecular biology revolution has transformed the discovery of new drugs designed to treat cancer. Today, drug discovery is far more “target-driven,” as advances in technology provide insights into the most fundamental mechanisms controlling cell growth and development. “The drug discovery process has accelerated as we fill in all the pieces on how molecular pathways work and how they speak to each other,” says Mark R. Philips, MD. “We now have precise molecular targets, in many cases in atomic detail.”

In his laboratory, Dr. Philips, Professor of Medicine, Cell Biology, and Pharmacology and Associate Director for Basic Research at the NYU Cancer Institute, is exploring a family of enzymes called GTPases — ubiquitous elements of many signaling pathways, including those regulating cell growth and differentiation. He and his colleagues are scrutinizing what he calls the “quintessential GTPase,” the ras protein — specifically where it communicates with other proteins inside the cell. His team identified one of three key enzymes that help ras get to cellular membranes to do its work — enzymes that could potentially serve as therapeutic targets, since mutated ras is implicated in some 30 percent of cancers. Clinical trials are currently evaluating drugs that inhibit the enzymes that modify ras.

Basic science research such as the work of Dr. Philips’ laboratory forms the foundation of translational research. “Real advances come through a very thorough understanding of basic biology,” says Dr. Philips. “You can’t shortcut that process.”

Michele Pagano, MD, Deputy Director for Basic Science, Howard Hughes Medical Institute Investigator, the May Ellen and Gerald Jay Ritter Professor of Oncology, and Professor of Pathology, found himself drawn back to the laboratory bench when his research was not going in the direction he was hoping for. After founding a Cambridge, Massachusetts–based company in the early 1990s evaluating drugs designed to target enzymes regulating cell growth and division, he was frustrated by the slow pace of progress.

“It made me realize that cancer is far more complicated than we imagined,” he says. “So we went back to the laboratory, to learn more about basic cell biology.” He established a laboratory at NYU in 1996, where he and his research team are gleaning insights into how a family of enzymes called ubiquitin ligases control cell growth, division, and survival. “The problem of cancer is a multidimensional jigsaw puzzle, and we might be able to contribute just a few pieces a year. We are looking for the critical pieces of the puzzle that will
Drug Discovery continued

facilitate the jump to the next dimension,” Dr. Pagano says. “Only more research will help us find it.”

Dafna Bar-Sagi, PhD, Professor and Chair, Department of Biochemistry, agrees. “The amount of knowledge and information we are dealing with today is enormous,” she says. “We now know that curing cancer is not as simple as turning off one pathway.” Like Dr. Philips, she is exploring the role of ras. In her laboratory, Dr. Bar-Sagi has found that the mutated ras gene alone is not sufficient for pancreatic cancer to occur. When pancreatic cells are “stressed” by factors such as inflammation or the accumulation of scar tissue, normal cells die. But those containing mutated ras survive and continue to grow and divide abnormally, leading to cancer.

Dr. Bar-Sagi and her team have found that inflammation creates cells that are more susceptible to ras mutations. “This supports our belief that stressors of the pancreas — such as smoking, alcohol, and certain dietary factors — can promote the adverse effects of mutated ras,” Dr. Bar-Sagi says. “Basic scientific inquiry such as this is critical in order for us to make progress against cancer, particularly aggressive types such as pancreatic cancer.”

“The public has been sold that there is one magic bullet to cure cancer, but it’s just not that simple,” adds Robert Schneider, PhD, the Albert B. Sabin Professor of Microbiology and Molecular Pathogenesis, Departments of Microbiology and Radiation Oncology, who is leading the NYUCI’s Translational Research Program. He is also co-investigator of the Center of Excellence for Locally Advanced Breast Cancer (LABC), and is studying how gene regulation is involved in cancer development. (For more in LABC research at NYU, see page 32.)

Dr. Schneider has made significant progress in identifying molecular factors that predict which breast cancers are more likely to respond to chemotherapy and which are likely to metastasize. He and his colleagues were the first to report that a gene called eIF4G1 orchestrates how inflammatory breast cancer cells form unique structures called “tumor emboli.” These small clusters of highly mobile tumor cells can quickly metastasize to other areas of the body.

“The good news is that we’re beginning to understand inflammatory breast cancer (IBC) at a molecular and genetic level,” says Dr. Schneider. “We believe this gene is a target for new drug discovery, and we also believe it is possible to silence the gene without hurting normal cells. Our next step will be to look at the genetic changes underlying IBC to reveal more molecular targets.”

“It’s only been in the last 30 years that we’ve been able to achieve a molecular understanding of hundreds of diseases which were mysterious before,” Dr. Philips points out. “We have all these pieces in place to take advantage of what’s transpired in this accelerating field to develop better treatments. There’s never been a better time to move science forward.”
An experimental drug gets surprising results in patients with Peripheral T-Cell Lymphoma (PTCL)

A new drug called Pralatrexate has recently shown promising results in a hard-to-treat population of patients with Peripheral T-Cell Lymphoma (PTCL), even in heavily pretreated patients who have not responded to conventional chemotherapy. In an international Phase II trial — PROPEL (Pralatrexate in patients with relapsed refractory peripheral T-cell lymphoma) — 109 patients were treated with Pralatrexate. Over half of these patients had received more than the three previous chemotherapy regimens, and 25% had not responded to any combination chemotherapy. In the PROPEL trial, there was an overall response rate of 27%, irrespective of the amount of prior therapy.

“This was surprising because one common feature of drug-resistant tumors is their ability to acquire resistance to many drugs. That cross-resistance means that a patient who receives chemotherapies A and B will become resistant to C and D, even though they never received therapy C and D,” explained Owen A. O’Connor, MD, PhD, the principal investigator of PROPEL and an authority on the biology and treatment of lymphoma. Dr. O’Connor was recently appointed Deputy Director of Clinical Research and Cancer Treatment in the NYU Cancer Institute and Director of the Division of Hematologic Malignancies and Medical Oncology in the NYU Langone Medical Center Department of Medicine. “Pralatrexate produced the same efficacy no matter what or how much previous chemotherapy a patient received. In fact, some patients achieved a complete remission, making them candidates for a potentially curative peripheral blood stem cell transplant.”

In addition to being the Principal Investigator of the study, Dr. O’Connor was a co-inventor of Pralatrexate, a novel antifolate that is specifically designed to be internalized selectively in tumor cells through a specific transporter protein on the surface of tumor cells called RFC (reduced folate carrier). This biological feature allows the anti-tumor drug to be concentrated only in malignant and not normal cells. Pralatrexate inhibits enzymes required by the tumor cell necessary to make new DNA.

Pralatrexate has orphan drug designation for T-cell non-Hodgkin’s lymphoma, and is currently being reviewed by the FDA. It is not the first drug Dr. O’Connor has taken from the laboratory, through pharmacological studies, preclinical and clinical trials, and ultimately to FDA approval. Indeed, Dr. O’Connor is leading a laboratory program focused on the discovery of drugs for the treatment of non-Hodgkin’s lymphoma and Hodgkin’s disease. His studies on the novel proteasome inhibitor bortezomib and the histone deacetylase inhibitor vorinostat (SAHA) have led to the FDA approval of these drugs for the treatment of mantle cell lymphoma and cutaneous T-cell lymphoma, respectively.

Dr. O’Connor was drawn to the opportunity to build a translational research program at the NYUIC. “There is great basic scientific research along with a strong clinical research effort at this institution,” he says. He intends to fortify the Institute’s bone marrow transplant program and also lead initiatives to identify and evaluate new strategies to treat cancer at the molecular level.
Sometime in the next year or so, Tommy Waters will take the Medical College Admission Test — a grueling six-hour examination required of students applying to medical school. For many test-takers, the exam will be one of the biggest challenges of their lives. But for Tommy, his biggest challenge is already behind him.

That is because Tommy, now 21, has spent the last six years battling acute lymphoblastic leukemia (ALL), the most common form of childhood cancer.

It is a journey that began in December 2002, when Tommy was 15. Laboratory tests conducted as part of a routine physical exam revealed an elevated white blood cell count. He received the diagnosis that Christmas.

“At first I didn’t realize leukemia was cancer, but when I learned it was, I remember crying that night,” recalls Tommy, whose family lives in Queens. The news was delivered by his doctor at the NYU Cancer Institute, Aaron R. Rausen, MD, Professor of Pediatrics (Oncology), who told him treatment must begin right away.

Tommy’s calendar for the next three and a half years was studded with medical visits to NYU’s Stephen D. Hassenfeld Children’s Center for Cancer and Blood Disorders to receive multiple regimens of chemotherapy aimed at ridding his body of the cancerous blood cells. Along the way he graduated from high school and started college at St. Bonaventure University near Buffalo, New York, where he still took chemotherapy (primarily in pill form). By March 2006 he completed treatment, but his remission was short-lived: by May the cancer had returned.

This time his doctors knew they had to take a different approach. Bone marrow transplantation was not an option because a family-related matched donor for Tommy could not be found. So he entered a clinical trial led by Elizabeth Raetz, MD, Associate Professor of Pediatrics (Oncology), which assessed a new drug called epratuzumab in combination with conventional chemotherapy. He endured several rounds of chemotherapy through December 2007, completed maintenance chemotherapy in January 2009, and has been in remission ever since.

Now a biology major back at St. Bonaventure, Tommy’s experience has changed his life’s direction, and he is now studying to become a pediatric hematologist/oncologist. “The nurses and staff at Hassenfeld made me feel like part of their family,” he asserts. “I’d like to be able to do that for other people.”
INSIDE OUT
Melanoma strikes more than 62,000 people and claims more than 8,000 lives annually. Many melanomas escape detection until they have spread to other parts of the body. Such metastatic disease presents the greatest challenge to clinicians, who are teaming up with basic scientists to ask: Why do some melanomas spread more than others? Which tumors are likely to recur? Why does this disease evade the effects of anticancer drugs? To accelerate the search for answers, NYU in 2002 established the Interdisciplinary Melanoma Cooperative Group (IMCG). It has rapidly come to embody the power of the translational model.

“Clinical research based on translational findings from laboratory studies holds the only key to taking on the challenges posed by metastatic melanoma,” says Iman Osman, MD, who leads the Interdisciplinary Melanoma Cooperative Group (IMCG). Dr. Osman was drawn to NYU in 2000 because of its long history of caring for patients with skin cancer—dating back to its founding in 1882 as the New York Skin and Cancer Hospital, the first hospital in America devoted to the research and treatment of cancer and skin disorders—and because of the opportunity to develop and drive a multidisciplinary program that unites laboratory scientists with physicians.

Two years later, the IMCG was inaugurated, bringing together a cadre of 23 dedicated researchers (including dermatologists, surgeons, biostatisticians, basic scientists, and medical oncologists) who share the goal of clarifying the mechanisms through which this serious skin cancer develops and metastasizes, and developing more effective treatments. Since then, the IMCG has enrolled more than a thousand patients, collecting their blood, tissue specimens and clinical data—creating a database that is an unparalleled resource for the study of how to improve melanoma treatment.

IMCG members rely on the tissue and blood samples and clinical data to develop and evaluate new avenues of basic science and clinical investigation that may yield clues about the disease’s development and the most promising ways to treat it. “This is a very integrated program, bringing together basic scientists and clinicians to attack melanoma from its earliest stages of development to advanced disease,” adds Seth Orlow, MD, PhD, Chairman of the Ronald O. Perelman Department of Dermatology, the Samuel Weinberg Professor of Pediatric Dermatology, and Professor of Cell Biology and Pediatrics, who is leading the new NYU Center of Excellence for Cancers of the Skin. “As the program matures, new collaborations will form because we start to recognize more synergies with one another.”
One of the mysteries behind melanoma is how it develops. Eva Hernando, PhD, Assistant Professor of Pathology, is studying melanoma development in laboratory systems and in mice to determine if the disease develops from an adult pigment cell or from a more primitive “stem cell.” “We’ve found that melanoma cells often behave like stem cells. They have an ability to differentiate into different cell types and can migrate like stem cells, and they are often resistant to therapy,” she explains. “This may explain the aggressive behavior of many melanomas and provide a different understanding of the biology of these tumors. So the question is, can we use this information to devise new ways to attack it?”

She and her team have been studying microRNAs — tiny pieces of RNA that don’t have the ability to encode proteins, like regular RNA, but are involved in gene expression and the normal maintenance of tissues — and examining how they might contribute to the ability of melanoma to metastasize. They are investigating the use of a molecule to deactivate a microRNA, called microRNA182, and seeing if this molecule can be used to make melanomas more sensitive to the cancer-killing effects of chemotherapy.

These scientists are also seeking to identify a “microRNA signature” that could be used to predict the propensity for a melanoma to metastasize — information that would be helpful for determining how aggressively a patient needs to be treated. “A microRNA signature might help us predict which patients are likely to have melanoma that spreads to the brain or lungs and which may not,” Dr. Hernando says.

“Many of these clinical studies stem from ideas generated by basic science researchers, who share them with clinicians via the IMCG. Our patients know that we have an active clinical research program and that we have numerous options for individualized therapy,” explains Anna Pavlick, DO, Associate Professor of Medicine and Dermatology, and Director of the Melanoma Clinical Program.
From the Lab to the Clinic

The rational method of devising new drugs for cancer — find a pathway that leads to cancer development, identify a target for a new drug, create a drug to interfere with that pathway, and evaluate it in patients — doesn’t seem to be working effectively for melanoma. So investigators are turning the tables. “We need more shots on goal,” explains Dr. Orlow. “So instead of saying let’s target a pathway involved in melanoma, we’re saying let’s find a drug that works against melanoma and then see how it works.”

Case in point: Using an approach called “drug repositioning,” he and his colleagues are exploring the effects of mebendazole, a drug that has been used for half a century to treat pinworm. “We know a lot about the way mebendazole works, which in the laboratory kills melanoma cells the same way it attacks the pinworm parasite,” Dr. Orlow explains. “This can teach us things about the biology of melanoma that we didn’t know before.” Specifically, mebendazole inflicts damage to the structural scaffolding that melanoma cells need to survive, grow, and multiply, causing them to self-destruct. It is now under study in mice.

Another drug used to treat parasites, pyrimethamine, is being evaluated to sensitize melanoma cells to the drug temozolomide, which is currently used to treat metastatic melanoma — especially cancer that has spread to the brain. Dr. Orlow notes, “We have a growing pipeline of these approved drugs which we’re planning to move into the clinic, particularly in patients with metastases and those at risk of recurrence.”

Marc Jacobs
Protects the Skin You’re In

A simple little T-shirt is changing the future for people with melanoma at the NYU Cancer Institute.

Marc Jacobs’ styles have graced fashion show runways around the world. Today his “Protect the Skin You’re In” campaign is raising awareness about melanoma and has generated more than $1 million for the Interdisciplinary Melanoma Cooperative Group (IMCG) at the NYU Cancer Institute. The T-shirts feature celebrities—model Heidi Klum, Naomi Campbell, and former Spice Girl Victoria Beckham, among others—tastefully baring it all in the name of melanoma research. Proceeds from the T-shirt sales benefit the IMCG.

Mr. Jacobs and his business partner, Robert Duffy, President of Marc Jacobs International LLC and a melanoma survivor treated by NYUCI surgeon Richard Shapiro, MD, launched the campaign in 2006. “The funds generated through this campaign have enabled us to substantially expand our research capabilities,” Dr. Shapiro explains.

T-shirts are available only in Marc Jacobs stores nationwide. For more information, go to www.marcjacobs.com.
A Partnership of Daring and Hope
Silvia Formenti, MD

It is a type of breast tumor measuring five or more centimeters in diameter, in some cases large enough to penetrate the skin. Yet it afflicts a fifth of all women with breast cancer in this country, many of whom are Latina or Eastern European immigrants from medically underserved communities. “People wonder why these women wait so long to seek care—but when you ask them about their greatest challenges, cancer is never number one,” said Dr. Silvia Formenti, who has made the fight against “locally advanced breast cancer” (LABC) her own number-one challenge.

“They don’t go to the doctor because they are too busy working to provide for their own families and sending money to their native countries,” explains Silvia Formenti, MD, the Sandra and Edward H. Meyer Professor of Radiation Oncology, Chairman of Radiation Oncology, Associate Director for Clinical Research, and co-leader of the NYU Cancer Institute’s Breast Cancer Research Program.

Driven to help these women, Dr. Formenti came to the NYUCI in 2000 to build a translational research team with Sandra Demaria, MD, Assistant Professor of Pathology, and Robert J. Schneider, PhD, the Albert B. Sabin Professor of Microbiology and Molecular Pathogenesis.

Bringing their unique scientific perspectives to the exceptionally diverse patient population of Bellevue Hospital, the NYUCI team has gained new insights on the progression of breast cancer by studying whether LABC that responds to specific drug therapy is biologically different from cancer that does not respond. Their expertise earned the NYUCI a Center of Excellence designation for LABC from the Department of Defense Breast Cancer Research Program.

They have also made substantial contributions to clinical care. Today the team combines chemotherapy and radiation therapy together (not sequentially) for many women with LABC. They are identifying the types of genetic mutations in each patient with LABC to select the optimal form of chemoradiation to give before surgery.

In another major development, NYUCI breast cancer investigators pioneered a shorter, high-intensity regimen of radiation therapy delivered to the breast while a woman is lying face down — an approach that requires only 15 visits over three weeks (versus the usual 25 visits over five weeks) and spares heart and lung tissue from the damaging effects of radiation.

Perhaps most promising is a new direction that has emerged from Dr. Formenti’s collaboration with Dr. Demaria: in an early clinical trial, patients treated with a combination of radiation and a substance that activates some immune cells had an anti-tumor response beyond the area specifically treated with radiation — showing that radiation therapy may have the power to enhance the immune system response against metastatic cancer.

“Cancer is such a fascinating, complicated and insidious disease,” Dr. Formenti concludes. “Figuring out how to manage cancer requires a partnership between daring and hope.”
Highlights

Developed new cancer vaccine approaches that are capable of eliciting more anti-tumor immunity in patients with melanoma
- Nina Bhardwaj, MD, PhD

Defined the mechanisms of how chromatin undergoes remodeling to regulate gene expression
- Brian Dynlacht, PhD

Identified the association of the gene KLK3 (encoding the prostate-specific antigen, PSA) with risk of prostate cancer
- Jiyoung Ahn, DPhil, PhD; Richard Hayes, DDS, PhD, MPH

Identified genetic alterations that lead to deregulation of the androgen receptor on resistant prostate cancer cells, which could potentially be reversed by drugs that target enzymes associated with prostate cancer
- Anna Ferrari, MD

Established that environmental carcinogens, such as arsenic, chromium, and ultraviolet radiation, impair the ability of surveillance genes when the cell duplicates its DNA or undergoes nuclear division
- Wei Dai, PhD

Discovered a gene signature in childhood leukemia that predicts outcome and identified genetic alterations in leukemia cells that lead to relapse
- William L. Carroll, MD

Revealed that radiation therapy triggers the release of a protein called CXCL16 that attracts effector T cells to the irradiated tumor
- Silvia Formenti, MD; Sandra Demaria, MD; Sylvia Adams, MD
Established that the miR-182 gene is frequently amplified in melanoma and is associated with metastasis
- Eva Hernando, PhD

Determined that maintenance therapy with the monoclonal antibody rituximab following chemotherapy outcome improves progression-free survival in patients with stage III-IV indolent lymphoma
- Howard S. Hochster, MD

Delineated the mechanism through which T-cell acute lymphoblastic leukemia (T-ALL) infiltrates the central nervous system and suggested a new potential drug target for this disease
- Ioannis Iafantis, PhD

Identified a novel mechanism whereby cells use the ABC transporter protein to send a cell attractant signal that functions in cell migration
- Ruth Lehmann, PhD

Established that the XIAP protein modulates the RhoGDI pathway leading to cancer cell metastasis. Demonstrated that induction of the COX-2 protein is also partially responsible for arsenic-related skin cancer in mouse skin cells
- Chuanshu Huang, MD, PhD

Established that a small RNA gene, miR-182, is frequently amplified in melanoma and is associated with metastasis
- Eva Hernando, PhD

Revealed the impact of anti-angiogenic therapy in brain tumors
- Ashwatha Narayana MD, MB; John Golfinos, MD; Michael Gruber, MD

Revealed that the STAT3 protein plays a fundamental role in converting normal cells to cancerous cells
- David E. Levy, PhD
Highlights

Piloted a novel triple induction chemotherapy platform with the monoclonal antibody epratuzumab nationwide for children with relapsed leukemia
- Elizabeth Raetz, MD

Discovered that mebendazole, an orally available antiparasitic drug, can selectively target human melanoma cells in the laboratory and in a mouse model by interfering with a pro-survival molecule, BCL-2
- Seth Orlow, MD, PhD

Dissected the mechanism whereby cells choose between important DNA repair pathways to maintain genomic integrity
- David Roth, MD, PhD

Discovered that a single microRNA, HAS-MIR-29c*, is a master controller of malignant mesothelioma growth
- Harvey I. Pass, MD

Elucidated the biochemical and molecular details of a novel pathway controlling the breakdown of the Bim protein that allows cancer cells to evade therapy
- Michele Pagano, MD

Learned that a genetic variation in the MDM2 gene leads to a nearly four-fold increase of melanoma in women under the age of 50 and showed that inactivation of another gene called ARF occurs commonly in melanomas
- David Polsky, MD, PhD
Identified a novel transcriptional pathway that selectively governs survival or death specifically in breast cancer
- Herbert Samuels, MD

Identified a genetic mutation in local freshwater Tomcod fish that confers resistance to the hazardous effects of PCB carcinogens
- Isaac I. Wirgin, MPhil, PhD

Delineated the role of an enzyme called V(D)J recombinase in the proper pairing of certain genes that may provide insight into the inappropriate gene pairings (translocations) that occur in hematologic tumors
- Jane A. Skok, PhD

Determined a key gene, eIF4GI, that is overexpressed in the majority of cases of inflammatory breast cancer (IBC), which provides a new target for the development of therapeutics for advanced forms of breast cancer
- Robert Schneider, PhD

Identified a novel transcriptional pathway that selectively governs survival or death specifically in breast cancer
- Herbert Samuels, MD

Established genetic alterations in the Ha-ras oncogene that activate pathways leading to bladder cancer; inhibiting these signaling pathways could provide a novel means of treating low-grade, superficial papillary bladder tumors
- Xue-Ru Wu, MD

Revealed that people with blood group O may have a lower risk of pancreatic cancer than those with groups A or B
- Anne Zeleniuch-Jacquotte, MD; Alan Arslan, MD

Identified a genetic mutation in local freshwater Tomcod fish that confers resistance to the hazardous effects of PCB carcinogens
- Isaac I. Wirgin, MPhil, PhD

Delineated the role of an enzyme called V(D)J recombinase in the proper pairing of certain genes that may provide insight into the inappropriate gene pairings (translocations) that occur in hematologic tumors
- Jane A. Skok, PhD
The Cancer Institute sets the scientific, clinical, and educational agenda for oncology across the NYU Langone Medical Center. Resources and institutional support are allocated to various departments and institutes to fund cancer-focused basic and clinical research initiatives, faculty recruitment, programs in various disease areas, the Division of Medical Oncology, and new technologies.
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* Member, Board of Trustees, NYU Langone Medical Center

Lori Fink is Named NYU CI Board Chair

Lori Fink, a longtime supporter of NYU Langone Medical Center (NYULMC) and a member of the NYULMC Board of Trustees, was recently named Chair of the Cancer Institute Board of Directors. Previously she served as Chairperson of the Campaign for Children's Health and Co-chair of KiDS of NYU. She is also on the Board of Directors of Prep for Prep, a leadership development program for inner-city minority youth. Ms. Fink received a Bachelor of Arts degree from UCLA and a Master of Science degree from the Bank Street College of Education.

Along with her husband, Larry, who is co-chair of the NYULMC Board of Trustees, Mr. and Ms. Fink chaired the 2008 NYU Cancer Institute Gala, and have established both the Laurence D. and Lori Weider Fink Children's Ambulatory Care Center and the Laurence D. and Lori Weider Fink Pediatric Intensive Care Unit at Tisch Hospital.

As Chair, Ms. Fink's goals are to advance the mission of the NYU Cancer Institute, raise awareness of the Institute's rapid expansion, and lead our efforts to raise the necessary resources to expand our scientific and technological capabilities.
NYU Cancer Institute
Facts & Figures

165,000 patients visit each year

151,170 sq. ft. of dedicated space, a 400% increase since 2002

$88 million in research funding inclusive of $21 million from the National Cancer Institute

201 investigators working on cancer initiatives

150+ oncology clinical trials available

20% patient participation in clinical trials, compared to 4% national average

5,000 community members, patients and healthcare professionals benefit from our Community Outreach and Education Programs

8 main campuses/locations comprise the NYU Cancer Institute, along with significant collaborations throughout the greater University, including the NYU Downtown campus, the School of Nursing and the School of Dentistry

- The Joan and Joel Smilow Research Center
- Tisch Hospital
- NYU Clinical Cancer Center
- The Stephen D. Hassenfeld Children’s Center for Cancer and Blood Disorders
- Bellevue Hospital Center
- Nelson Institute of Environmental Medicine
- Woodhull Medical and Mental Health Center
- Manhattan Veterans Affairs Medical Center

Important Phone Numbers

New Patient Physician Referral Line 212-731-5000

Clinical Trials Information 212-263-6485

Mammography and/or Related Procedures 212-731-5002

Lucille Roberts Wellness Boutique managed by Underneath It All 212-731-5198

Lynne Cohen Breast Cancer Preventive Care Program 212-731-5452

Lynne Cohen Cancer Screening and Prevention Project for High Risk Women Bellevue Hospital Center 212-263-3198

Stephen D. Hassenfeld Children’s Center for Cancer and Blood Disorders 212-263-8400

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