

Translating Research and Transforming Medicine

THE STONY BROOK UNIVERSITY SCHOOL OF MEDICINE
STRATEGIC PLAN 2011-2015

RESEARCH
EDUCATION
CLINICAL CARE
COMMUNITY

 STONY BROOK
UNIVERSITY
MEDICAL CENTER

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Vision, Mission, Goals, and Expected Outcomes

OUR VISION

The School of Medicine at Stony Brook University (SBU) will rise to become a national leader in academic medicine. We will epitomize all that is possible from the marriage of the science and the art of medicine. We will define innovation in physician education and graduate outstanding medical students, resident and post-doctoral fellow physicians and advanced degree biomedical researchers. Our graduates and faculty will serve as exemplars of scientific excellence, innovators of medical education and humanistic patient care, adept at developing and applying new knowledge and procedures to solve the challenging problems in the ever-changing field of medicine. We aspire to become both one of the nation's top-ranked public institutions for scientific research and the first choice of patients on Long Island and beyond for healthcare—for themselves, their families, their friends and their community. Toward these ends, we submit that the development of innovative and integrative programs centered on basic, translational and clinical research will serve as the catalyst and organizing foundation of our strategic plan for the future.

“Our mission is to educate physicians and investigators in the biomedical and clinical sciences so that they are well-prepared to advance the frontiers of research, education, clinical practice and advocacy.”

OUR MISSION

The primary goals of the School of Medicine at SBU are to 1) advance the medical sciences by translating cutting-edge biomedical science into diagnostic, therapeutic and prognostic advances, 2) develop a diverse cadre of caring and skilled physicians and biomedical scientists who are outstanding candidates for graduate and specialty training programs, 3) deliver compassionate clinical care in an efficient, state-of-the-art, safe and cost-conscious fashion, and 4) reach out to multiple communities to enrich both our citizens and ourselves. We should train our graduates and faculty to value and apply the scientific method and evidence-based medicine to the solution of clinical problems. They will integrate clinical, biomedical and behavioral knowledge in order to promote the health and well-being of patients and our communities. They will value lifelong learning and be able to locate, critically evaluate and integrate new scientific and clinical findings that advance the science of medicine. Our healthcare practitioners will develop a deep appreciation for the healing dynamic of the physician-patient relationship, in which compassionate care is manifested by attentive listening, empathy, respect and commitment. They will provide highly competent, safe and patient-centered care while demonstrating the highest level of professionalism and sensitivity to the diverse personal and cultural contexts in which medical care is delivered. We should instill in each School of Medicine graduate and faculty member the willingness to accept the professional responsibility to model and teach compassionate and diligent care in such a way as to inspire these virtues in others, regardless of circumstances. Simply put, our mission is to educate physicians and investigators in the biomedical and clinical sciences so that they are well-prepared to advance the frontiers of research, education, clinical practice and advocacy.

OUR GOALS

The goals of our research program are to:

- Advance medical knowledge by fostering active programs in basic, clinical and translational research.
- Advance the research of trainees and their mentors through communication and interaction with investigators throughout the University, the SUNY system, and the national and international communities.

The goals of our educational programs are to:

Achieve excellence in educating trainees for careers in clinical practice, medical education and biomedical research by:

- Providing broad-based medical knowledge and clinical skills.
- Developing professional behavior.
- Encouraging mastery of core competencies.
- Preparing students for continued intellectual growth as members of an evolving medical culture devoted to compassionate care, patient safety and the scientific method.

The goals of our clinical programs are to:

- Deliver state-of-the-art, compassionate, safe, patient-centered and cost-conscious clinical care to our patients.
- Develop an Accountable Care Organization that establishes and implements best practices across our inpatient, faculty outpatient and captive physician networks.
- Create a clinical information infrastructure that allows for hardwiring quality-care initiatives and for mining of de-identified patient data warehouses to establish testable hypotheses of clinical causality.

The goals of our community outreach efforts are to:

- Make every effort to recruit and retain persons of color to School of Medicine faculty, staff and trainees at all levels.
- Engage community healthcare systems in clinical research efforts that understand the barriers to high-quality access and implement pilot projects to eliminate these barriers.
- Advance patient welfare by ensuring access to health and educational opportunities by service, advocacy and public policy.

OUR EXPECTED OUTCOMES

Success in our research program will be demonstrated by:

- Becoming a Top 50 NIH grant receiving Institution (currently #95) by recruiting and developing our own innovative basic science and physician-scientist faculty members who are successful in obtaining individual and multi-investigator grants.
- Achieving designation as a National Cancer Institute Comprehensive Cancer Center (NCI-CCC) by growing both basic science funding and clinical trial enrollment.
- Attaining a Clinical and Translational Science Award (CTSA) by developing a robust biomedical informatics faculty and a clinical investigation infrastructure.
- Creating a Biomedical Imaging Center, which supports multiple grants, develops educational seminars and generates intellectual property.
- Acquiring at least five additional multi-investigator grants (program project, specialized center of excellence, center grants) over the next five years.

- Translating our involvement in global medicine programs into meaningful changes in understanding emerging infections, other international health problems and the challenges to delivery of effective healthcare in under-resourced communities.

Success in our educational program will be demonstrated by:

- All our medical learners, undergraduate (UGME), resident and fellow (GME), and continuing (CME) practitioners exhibiting exceptional clinical performance.
- MD and MD/PhD basic and clinical investigators entering academic careers.
- PhD biomedical scientists beginning careers in basic and applied research in their field of training.
- A major increase in UGME and GME enrollment of qualified students from medically underrepresented groups.
- Wide student and resident physician participation in curricular development and implementation.
- Appropriate involvement by non-physician healthcare providers teaching the concepts and practice of teamwork in healthcare.
- Expansion and enhanced use of our state-of-the-art clinical skills centers.

Success in our clinical program will be demonstrated by:

- Growing our clinical faculty by 20 percent.
- Increasing cancer patient volumes to facilitate clinical research.
- Growth of 25 percent over the next five years in the patient volumes and complexity of our six focus clinical programs.
- Achieving an Accountable Care Organization including at least 40 “affiliated” cardiologists,

80 “affiliated” primary care physicians, and 80 physicians of other specialties through Stony Brook Community Medical, PC; establishing and demonstrating best clinical practices in at least 10 focus diseases; meaningful use of the electronic medical record that is spread across all clinical sites; and meaningful integration with at least one community hospital within the next five years.

“The goals of our educational programs are to achieve excellence in educating trainees for careers in clinical practice, medical education and biomedical research.”

Success in service to the community will be manifested by:

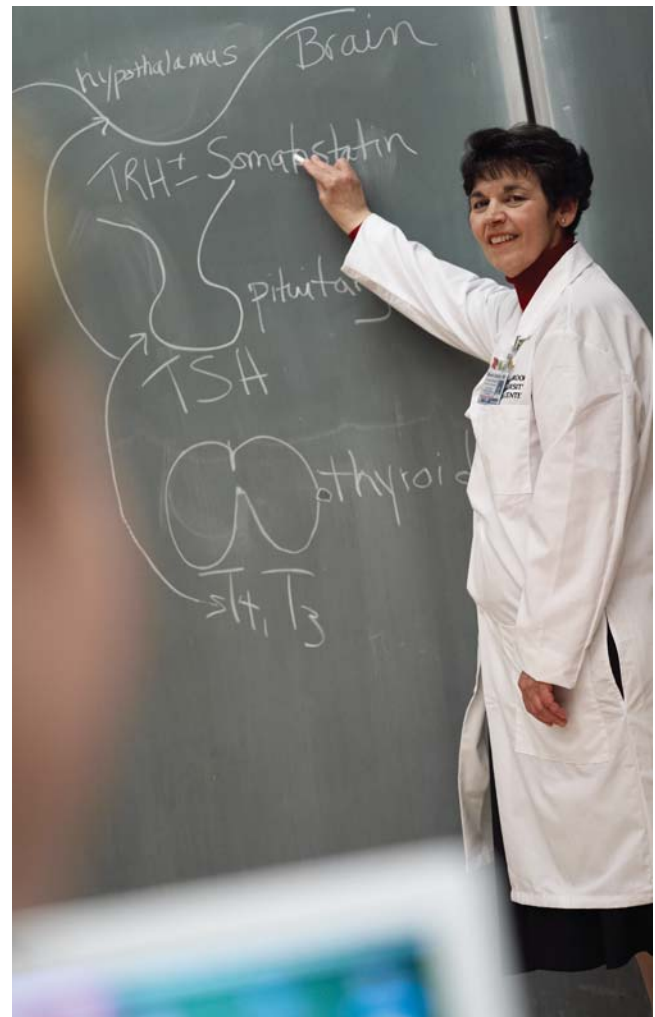
- The application of contemporary medical knowledge to the care of patients, as demonstrated by phase IV community-based studies.
- Participation in an Accountable Care Organization that provides efficient services of the highest possible quality in a patient-centered fashion.
- Better public visibility and accessibility for/to all of our missions, including public lectures and continuing medical education.
- Development of a workforce, staff, students, resident and faculty members that reflect the diversity of New York and the U.S. ■

What It Takes to Get From Here to There

This Strategic Plan represents a bold vision of the elements necessary to turn the SBU School of Medicine into a world-class institution, an organization that transforms all whom it touches: researchers, educators, learners, patients and members of many communities. But to obtain bold results, we must be equally bold in funding the vision. The Research Strategic Plan calls for 30 new basic or translational science faculty recruits, who would require approximately 60,000 assignable square feet (asf) of wet lab space and \$24 million of start-up funding. We must also attend to our existing scientific facilities, which are aging, less than gracefully. We estimate that at least 90,000 asf of space in the HSC tower can be renovated to state-of-the-art facilities for approximately \$12 million. The Plan also calls for the recruitment of 50 new clinical research faculty members and associated staff, who would require approximately 50,000 asf of dry lab/office space that supports 1) the design and management of innovative clinical testing of new treatments and 2) working with our local and regional partners in spreading these new medical insights to our communities. Realizing this vision by creating outstanding basic, translational and clinical research programs also requires a significant investment in infrastructure support, at least \$5 million to modernize our scientific core facilities, \$17 million to obtain state-of-the-art imaging instruments and roughly \$10 million to support a new Department of Biomedical Informatics, designed to create an information superhighway and the tools that allow mining data sets as complex as 250 cancer genomes and all the available clinical data in a de-identified warehouse of 250,000 patient medical records. We envision these expanded research programs being housed in a new, state-of-the-art *Medical and Research Translation (MART)* center. This new

building would be strategically placed on campus, so as to bring scientists, translationalists and clinicians in selected research *Themes* into close physical juxtaposition, fostering communication between all of the vital components of successful medical translations.

The Educational Strategic Plan calls for, among several other initiatives, the training of 64 more undergraduate medical students (increasing our class size from 124 to 140), who would also demand nearly 40,000 sq. ft.



The Educational Strategic Plan calls for Stony Brook University Medical Center to train 64 more undergraduate medical students, who would need nearly 40,000 square feet of classroom and laboratory space.

(575 gsf/medical student) of classroom and laboratory space. Of note, this is likely an underestimate of space needs, as medical education is turning to simulation laboratories for clinical training, which are not included in the old models that calculate the physical space needs for educating healthcare professionals. It is envisioned that such space be provided in the MART building, to further translate our new biomedical research initiatives into an enriched educational environment in the School of Medicine.

The Clinical Strategic Plan calls for expansion of our inpatient and outpatient facilities to accommodate our increasing patient numbers, because we feel that cutting-edge care should be offered to as many people as possible. Specifically, we need to expand the hospital capacity by at least 20 percent over the next 10 years, costing at minimum \$250 million. We anticipate continuing to grow our outpatient clinical capacity to an equivalent degree, simultaneously bringing our focus clinical programs into a more patient-friendly, faculty-efficient setting on campus, which will also enable our expanding clinical research and providing procedural backup currently available only in the hospital. This effort will require the construction of three medical office buildings, the first of which would be a 96,000 gsf, two-story building costing approximately \$60 million.

Finally, our renewed efforts to engage our communities will take a broad based and (literally) global perspective. We envision bringing our clinical research efforts into our local community on Long Island, because it provides a more diverse population of patients for study, because our local citizens should have access to cutting-edge medicine, and because conclusions derived from highly selected clinical trials conducted in University-based practices must be verified in the less “rarefied

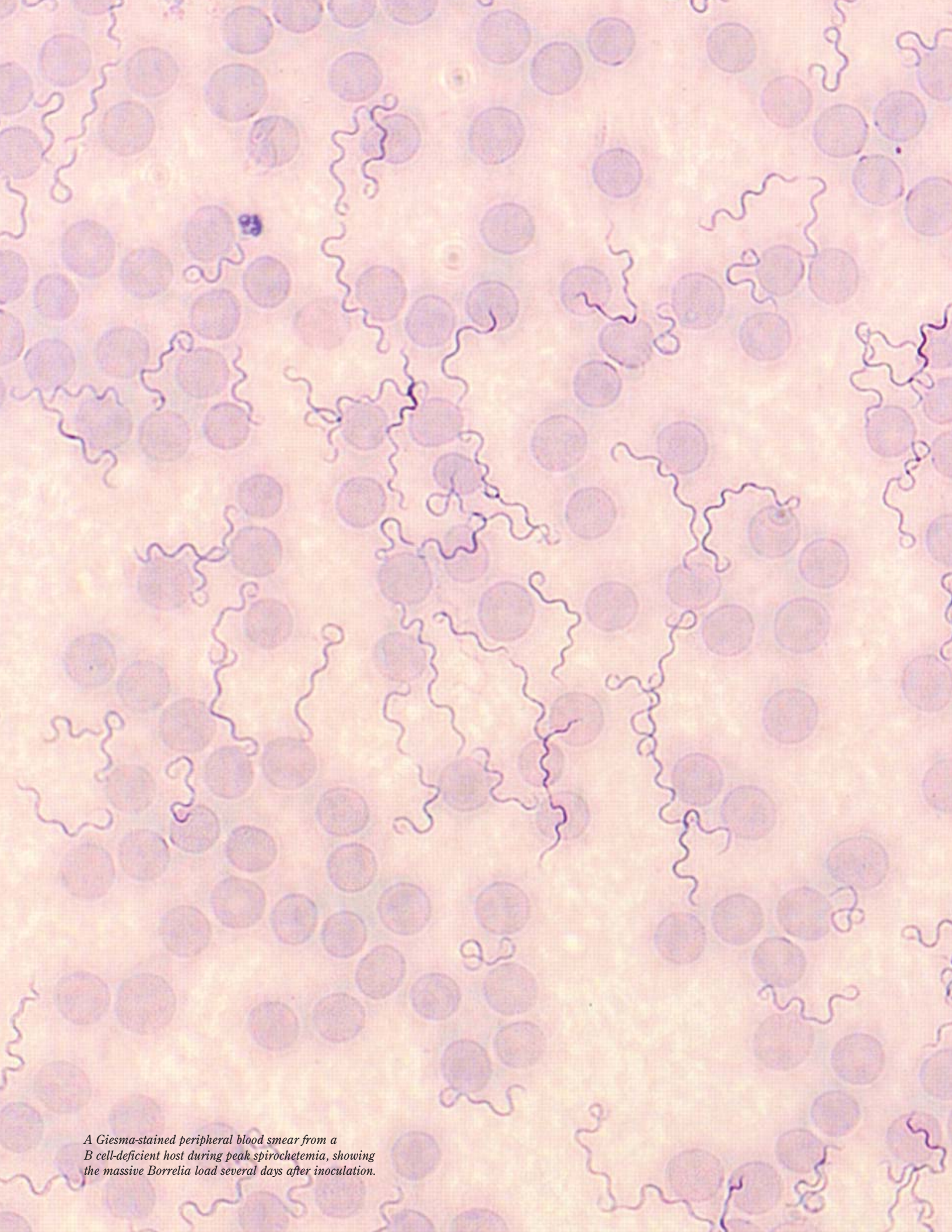
climate” of office-based practices and community clinics in order to be applicable to the broadest possible range of patients. And we envision spreading Stony Brook Medicine to global sites in sub-Saharan Africa and South America, because we can help train the next generation of global healthcare providers, and there are certain aspects of cultural influences and emerging pathogens on the health of humans that our learners can only acquire in those settings.

Individually, and especially all together, these are hefty needs. But we would argue that the consequences of not doing these things are far greater—we would miss the opportunity to contribute to translating basic scientific discoveries into new diagnoses and treatments; we would miss the opportunity to apply the outstanding skills of the SBU engineers, chemists and mathematicians to medicine, turning it into a quantitative science; we would miss the opportunity to develop new and more effective ways to train the next generation of physicians to deal with the avalanche of new information available to them; and because medicine is ever changing, we would miss the opportunity to deliver the very best care to our patients. Simply put, we refuse to be complacent, falling backwards to mediocrity, when faced with the opportunity to achieve excellence. ■



A handwritten signature in black ink that reads "Kenneth Kaushansky". The signature is written in a cursive, flowing style.

Kenneth Kaushansky, MD
Senior Vice President, Health Sciences
Dean, School of Medicine
Stony Brook University



A Giesma-stained peripheral blood smear from a B cell-deficient host during peak spirochetemia, showing the massive Borrelia load several days after inoculation.

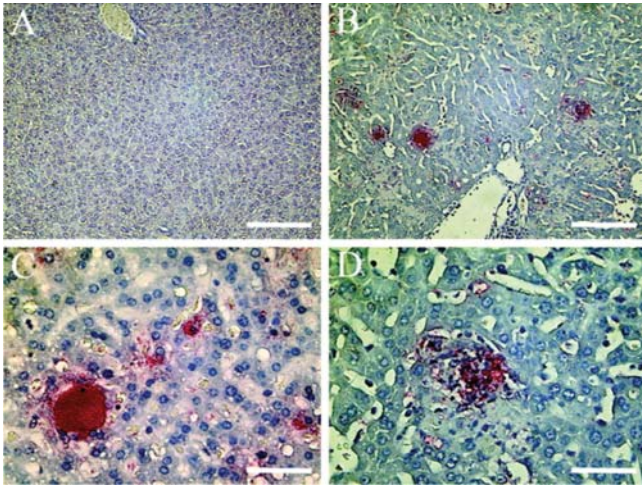
Several “major” and “minor” research “themes” are proposed for strategic development in the School of Medicine. Innovation in medical education, clinical care and community engagement will be integrated around these research themes. The current status of each theme within the School is reviewed, and strengths and weaknesses are duly noted. Justifications and potential synergies are presented for each theme, and connections to SUNY REACH (Research Excellence in Academic Health, a nascent research consortium of the five SUNY academic health centers) are emphasized.

INFECTIOUS DISEASES AND IMMUNOLOGY

OVERVIEW

This *Theme* has the goal of enhancing our understanding of Infectious Diseases and Immunology and translating this knowledge into improved health-care by adding faculty in underrepresented areas of microbiology and the host immune response, allowing us to build upon our existing creative programs in Medicine, Pediatrics and Pathology. Integration of the infectious disease enterprise with new faculty who excel in immunology and related fields will create an extraordinary center of excellence in which traditional and novel areas of research could be explored. It is envisioned that all faculty represented in this *Theme* will be housed together in suitable new laboratory space. This approach will build upon the Department of Molecular Genetics and Microbiology and the Center for Infectious Diseases, and solid research ties

to the Departments of Pediatrics and Medicine, particularly in infectious and gastrointestinal disorders. The latter is an emerging area of Stony Brook expertise, an area rich in immunological dysfunction and host-intestinal flora interactions, and provides an additional area for building fruitful investigation (see Theme VI). An important goal of this *Theme* is to develop additional links to clinical departments in order to enhance collaborations in translational population-based studies and expand research into our sites of global medicine. For this to occur, a world-class research-oriented Chief of Infectious Diseases within the Department of Medicine needs to be identified by our new Chair of Medicine. Research in this *Theme* can expand from its current level through several avenues. By linking infection research with immunology, synergistic new areas of



Detection of bacteria in livers inoculated with sublethal doses of *Francisella tularensis* bacteria (red): (A) normal liver, (B) low-power view of hepatic parenchyma showing multiple sites of bacterial infection, (C) hepatocytes infected with *F. tularensis*, and (D) bacteria concentrated within the granuloma.

investigation into microbial pathogenesis will be developed. Research on pathogenesis will be the link to translational research in the clinical departments, the foundation for studies on drug resistance and discovery, and the impetus to expand our research onto the global stage.

RECOMMENDATIONS

1. Recruitment of additional faculty members.

In the next five years we propose to recruit an incremental total of six new faculty members, including both assistant and associate professors, and replacement faculty as needed. Three faculty members will be sought who focus on infectious diseases, and three with expertise in immunology. All six positions should be open to scientists or physician scientists. The background of successful candidates would determine their appropriate departmental homes. It is anticipated that our Assistant Professors would avail themselves of the training provided by the Stony Brook Institute of Clinical and Translational Sciences (see section Enhancing Critical Infrastructure I, below).

2. For infectious disease, faculty members with several critical research skills are desirable.

A physician-scientist bacteriologist with research interests in antibiotic resistance or host-biome interactions would be an optimal recruitment for this position. A mycobacteriologist is needed to add to the existing strength in tuberculosis research, presently represented by Dr. Tonge in the Department of Chemistry. A parasitologist is needed to fill a void in both research and teaching. The parasitologist will also be critically important for our global health program. It is anticipated that one of these newly recruited faculty members could be skilled in clinical research. In anticipation of the arrival of our new Chair of Medicine, one or more of these recruits should be a strong candidate for Chief of the Division of Infectious Diseases. And because of anticipated retirements in the next few years, a replacement RNA virologist is needed to maintain a critical mass and visibility.

3. For our immunological focus, it is envisioned to have two faculty members in the area of host-responses to infection and one general immunologist who could also integrate with the Cancer Center or other departments of the SOM.

The addition of these three immunologists will result in the formation of the critical mass required for interactions with other medical specialties. This focus is particularly well-suited to translational research within the SOM, as immunological dysfunction underlies many illnesses that span most, if not all, specialties of medicine.

4. Dedicated space is required for the new faculty members, co-localized with their collaborators.

To ensure that the *Infectious Diseases* and *Immunology* theme reaches its potential, the new faculty, along with their colleagues, should be housed in new laboratories that foster the types of research and integration that will result in a world-class center of excellence. ■

CARDIOVASCULAR HEALTH AND DISEASE

OVERVIEW

Cardiovascular medicine within the SOM at SBU represents a broad-based group of basic scientists, clinicians and physician scientists from various departments (Biochemistry, Biomedical Engineering, Medicine, Neurobiology, Pharmacology, Physiology and Biophysics and Surgery) pursuing studies related to vascular biology and disease. The best-organized topics of the basic research program are in the areas of electrophysiology (EP) and stem cell biology, the latter currently being pursued within the Institute for Molecular Cardiology, housed in the Department of Physiology and Biophysics. The electrophysiology program also provides subspecialty fellowship training, and the stem cell program is a recent recipient of an Empire State Stem Cell Board development funding award. The research program is enhanced by a strong clinical program organized within the Stony Brook University Heart Center, comprised of a well-staffed Cardiology Division, a strong Cardiothoracic Surgery Program, and a prominent Vascular Surgery presence. The Heart Center provides state-of-the-art diagnostic and therapeutic modalities related to non-invasive imaging, electrophysiology, congestive heart failure

“The Heart Center provides state-of-the-art diagnostic and therapeutic modalities related to non-invasive imaging, electrophysiology, congestive heart failure (CHF) and stroke.”

(CHF) and stroke. Funding related to cardiovascular research is moderate, with expenditures totaling ~\$10.2, \$10.8, \$8.3 and \$13.7 million over FY 07-10, derived from a multitude of sponsors, including NIH, AHA, the State of New York, industry, and various University subcontracts. There are currently no training grants or career development awards. Moreover, what is clearly missing is integration of the research and clinical missions. Expanded opportunities for thematic growth exist with the School of Engineering (Mechanical, Electrical, and Material Sciences), the Institute for Molecular Cardiology, the Center for Wireless Information Technology (CEWIT), a developing program in vascular devices (Neurosurgery), and Cardiac Imaging for Health Services Outcomes. Strong clinical programs at the Northport Veterans Affairs Medical Center (NVAMC) and Winthrop University Hospital (WUH) expand access to patients and several databases.

RECOMMENDATIONS

1. Recruit a world-class physician scientist leader for Cardiovascular Research within the School, potentially leveraging this with recruitment of a permanent Chief of Cardiology within the Department of Medicine. There is a need to recruit a strong leader who is an active physician scientist and will be able to integrate and lead cardiovascular research at SBU, developing its vision and plan.
2. Recruit additional, synergistic faculty. Cardiovascular research would be strengthened with the addition of three physician scientists and/or PhDs with interests in clinical outcomes research, molecular cardiology, obesity and metabolic disorders, devices, or vascular biology, as each is a major contributor to cardiovascular disorders. These new faculty members would



The Stony Brook University Heart Center provides state-of-the-art diagnostic and therapeutic modalities.

complement those proposed for Minor Research Theme II, a Center for Translational Metabolic Disorders (see next page).

3. Identify renovated space for faculty recruits.

The research space for the individuals involved in cardiovascular research should be housed in a thematically contiguous space.

4. Work toward and submit a cardiovascular research related training grant. A formalized training grant in cardiovascular research supporting pre-doctoral and/or post-doctoral students should be submitted once a critical mass of mentors, programs and laboratories is developed. Like most training grants, the SBU cardiovascular research training grant should be multi-disciplinary involving several basic

science departments and at a minimum the Departments of Medicine, Surgery, Biomedical Engineering, Radiology and Pathology.

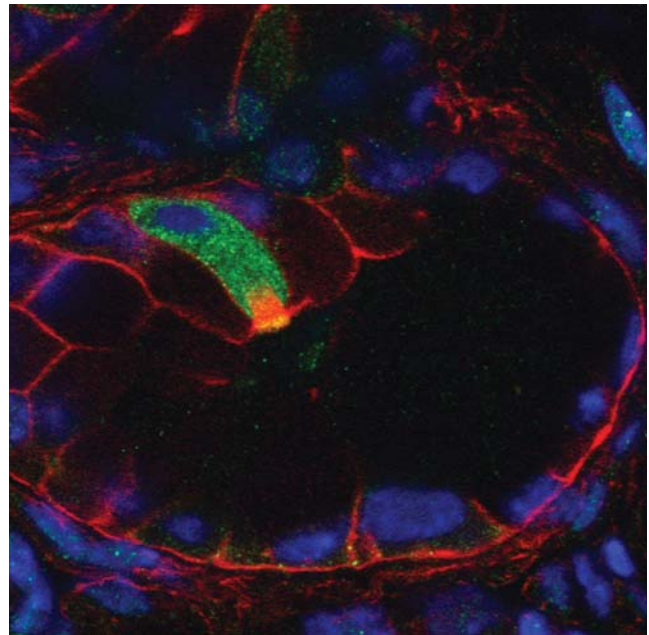
5. Initiate a cardiovascular research seed grant program. Provide two annual seed grants (\$40,000 per year for two years) to promote collaborative research related to the cardiovascular system.

6. Launch a monthly meeting and annual Symposium related to cardiovascular research. This would strengthen collaboration and bring visibility to the research being conducted here. Include members of the SBU SOM, west campus colleagues, and SUNY REACH faculty. ■

CANCER RESEARCH AND CLINICAL CARE

OVERVIEW

Despite considerable advances in tumor biology and cancer therapeutics in recent decades, cancer remains the second-leading cause of mortality in the US, and unlike the decrease being seen for cardiovascular mortality (the current #1 killer in the U.S.), cancer deaths are increasing with the aging of the population. While the SBU Cancer Center serves as a major site for cancer treatment and the SOM is a major cancer research institution on Long Island, there remains a substantial opportunity and responsibility to become a leader in the conceptual and clinical development of new treatments for cancer. Current SBU cancer-related research grants are broad-based, involving more than 50 investigators from many departments and Centers, and exceed \$20 million at present. Of this amount, \$10 million is National Cancer Institute sponsored; while this latter figure surpasses the minimum required for attaining status of an NCI-designated Comprehensive Cancer Center (NCI-CCC), it is not comparable to other institutions currently so designated, making enhancing our NCI funding a major priority in order to attain comprehensive center status. While the efforts of individual investigators have been very successful, there are only a few areas (for example, genome integrity) that have successfully competed for larger, thematically linked program project grants. Another area of relative weakness is the lack of protected time and resources for clinicians to establish programs in cancer clinical investigation, resulting in insufficient coordination of basic, translational and clinical cancer research. Finally, the leadership of the Cancer Center has been in flux for many years, and its focus has been entirely driven by our clinical mission, with minimal investment in basic and translational research programs. To enhance cancer research, the first step should be to hire a new Director of the Cancer Center



LFABP isoform (green) in a pancreatic tumor (phalloidin outline of the tumor in red)

and provide him/her with significant resources to set up integrated basic and clinical cancer research programs, with the ability to partner with a variety of SOM and other departments to recruit investigators of targeted talents, and to enhance our core facilities, in particular a fully annotated pathology tissue bank and longitudinal clinical databases. The first goal for the new Director will be to choose areas of cancer biology and clinical care on which to focus. At present, strengths are recognized in breast cancer, gastrointestinal malignancies and hematological neoplasms, although the final decisions will require additional consideration. Once identified, our focused efforts should be supported by expanding core and research facilities, such as genomics, proteomics and small molecule screening facilities. Educational and networking opportunities should be enhanced to improve the quality, visibility and philanthropic potential of the Center.



The Stony Brook University School of Medicine is a major cancer research institution on Long Island, with a substantial opportunity to become a leader in the development of new treatments for cancer.

The relationship of the Stony Brook University Cancer Center to a pre-existing, basic-science-focused Cancer Center at Cold Spring Harbor Laboratory (CSHL) provides a unique opportunity for important new synergies; optimizing these relationships should be a primary goal of the new Director and SOM/University leadership.

RECOMMENDATIONS

1. Hire a new director for the Cancer Center.

The new Director should ideally be a physician-scientist or scientist with a strong appreciation for translational medicine with an outstanding record in research. A main focus of the Cancer Center director should be to bring together basic, translational and clinical cancer research efforts at SBU, identify two or three major topics for focused investment, and oversee the recruitment of new faculty to launch this effort. Potential basic science topics with pre-existing strengths include genome integrity/cell death pathways, signal transduction, the stem cell origin of cancer, cancer prevention and cancer drug

development. The translational foci should also take into consideration our clinical strengths in breast, gastrointestinal and hematological malignancies.

2. The Director should be given significant resources to partner with departments and the Vice Dean for Research to recruit the very best clinicians, translational and basic cancer scientists. While various structures could be considered, a matrix-style organizational structure is favored—one that requires departmental and cancer center appointments and that returns faculty resources (i.e., partial indirect cost distributions and partial salary offsets) to both the Cancer Center and the relevant Departments for operational and new recruitment costs.
3. Hire at least 5-10 clinician-scientists to ensure the growth of clinical cancer research and provide them with adequate protected time to establish research programs. Adequate research space in proximity to other cancer researchers, competitive start-up packages with joint appointments in basic science departments, and protected time for

academic effort would be key elements of the recruitments. At least half of these recruits should be at the Assistant Professor level, although others should be thought leaders in their fields. The backgrounds of successful candidates would determine their appropriate departmental homes. It is anticipated that Assistant Professors would avail themselves of the training provided by the Stony Brook Institute of Clinical and Translational Sciences (SBICTS; see section Enhancing Critical Infrastructure I, below).

4. Hire 5-10 prominent translational MD, PhD or MD/PhD researchers with a strong interest in translational research. Adequate research space in proximity to other cancer researchers, and competitive start-up packages would be key elements of the recruitments. At least half of these recruits should also be at the Assistant or Associate Professor level, although individuals who have already begun to impact their chosen fields should also be considered.
5. Provide incentives for current clinicians at the Cancer Center to become involved in research. Provide seed grants to encourage clinicians to develop research programs and to participate more actively in investigator-initiated and Pharma-sponsored clinical trials, while holding clinicians accountable for success in exchange for long-term support. Again, an adequate mentoring environment must be available for new faculty members, through SBICTS, to enhance the likelihood of success.
6. Expand the capabilities of the tissue bank to provide for the collection of optimally preserved snap-frozen tissues and circulating mononuclear cells from all cancer patients undergoing cancer treatment, from selected patients with benign disease processes, and from normal control populations. Provide personnel support to obtain patient informed consent to perform frozen section histologic validation; to prepare DNA, RNA, and protein processing; to store and manage the biorepository; and to provide for clinical annotation of specimens, including annual updating of the clinical database.
7. Work with the Department of Applied Mathematics and Statistics, and once launched, the newly formed Department of Biomedical Informatics, to facilitate cancer-related clinical trials and cancer-related outcomes data.
8. Improve service/research capabilities of core facilities. Upgrade DNA microarrays, proteomics, sequencing, Department of Laboratory Animal Research (DLAR) facilities at the SOM and small molecule screening facilities at the ICB&DD to boost discovery of cancer-related biomarkers and drug candidates. Increase the current capacity of the Pathology Translational Research Laboratory to support immunohistochemical studies, laser capture microdissection, and tissue microarray construction. Develop capability in the Laboratory to provide for quantitative image analysis of immunohistochemically stained sections, including whole slide digitization and image archiving.
9. Promote interactions between basic and clinical cancer researchers. Launch retreat and seminar series that are attended by both basic and clinical researchers.
10. Formalize the long-term vision for attaining NCI-designated Comprehensive Cancer Center (NCI-CCC) status. Although Stony Brook surpasses the minimum for extramural cancer-related research, the Director should be charged with formulating distinct milestones and timelines for completing the myriad requirements needed for NCI-CCC designation.
11. Foster the relationship with CSHL to produce collaborative research and clinical projects, potentially producing a two-campus NCI-CCC application.
12. Foster relationships with other SUNY Academic Medical Centers (AMCs) through SUNY REACH to obtain funding for cancer center building, faculty positions and informatics infrastructure. ■

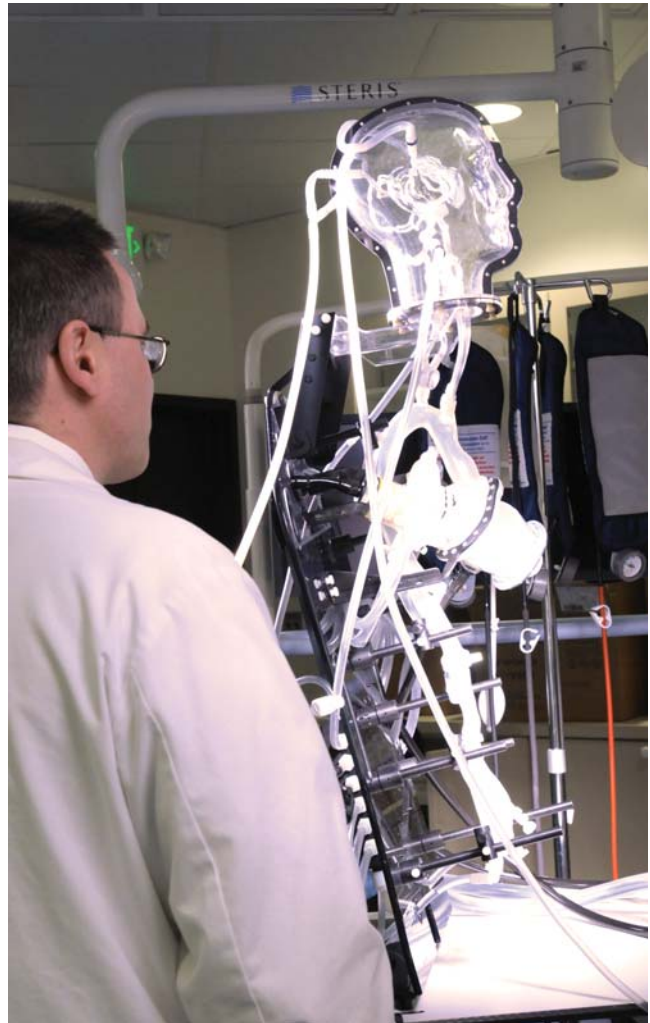
NEUROSCIENCES

OVERVIEW

The clinical departments that encompass Stony Brook University neurosciences include Neurology, Neurosurgery, Psychiatry, Ophthalmology and portions of several other departments, e.g., pain service in Anesthesiology), and provide excellent clinical service with pockets of distinction. Basic neurosciences at SBU are spread through many departments, with the greatest concentration in Neurobiology and Behavior, in which many faculty members are well funded and have a very strong national presence. Current research expenditures by neuroscientists in SBU departments (\$20 million annually) are robust; neurosciences also provide a key collaborative link to Cold Spring Harbor Laboratory (CSHL) and Brookhaven National Laboratory (BNL). To bring these elements together and build on our pre-existing strengths, the SOM strategic plan includes developing translational research in the clinical departments. This will be achieved by providing the infrastructure necessary to foster patient-oriented clinical research, by recruiting new translational research faculty members into neurology and/or other clinical departments, and by cultivating collaborations between the basic and clinical science faculty members.

RECOMMENDATIONS

1. **Recruit a nationally recognized, scientifically oriented Chair of Neurology.** This crucial recruitment should identify a physician-scientist who will embrace the currently strong research programs in basic science departments at SBU and who has the vision to expand the research enterprise into the clinical domain. This individual will be provided resources to recruit strong translational scientists who can also collaborate with the basic scientists and provide a critical bridge to other clinical departments.



Stony Brook's Cerebrovascular Center includes a one-of-a-kind neuroendovascular simulator that recreates vasculature in the brain, including scenarios of damaged vessels from acute stroke, brain aneurysms and other cerebrovascular anomalies.

2. **Formation of dedicated clinical-translational research teams focusing on strategically selected themes.** The new Chair of Neurology, in conjunction with members of the "Institute for Advanced Neurosciences," should identify two or three focus areas and then recruit at least four additional physician-scientists to build these groups into world-class programs. The initial

themes should be chosen based on current strengths in the clinical neurosciences and the basic science departments. Such choices should be made by the faculty leadership in close consultation with the Dean, the Dean for Research and other members of the Health Sciences leadership. Areas of excellence that already exist within the SOM are in cerebrovascular disease, multiple sclerosis and other neurological injury and repair processes. Areas not chosen for initial development should continue with the expectation that, as neurosciences become stronger, it will be possible to develop additional centers of excellence.

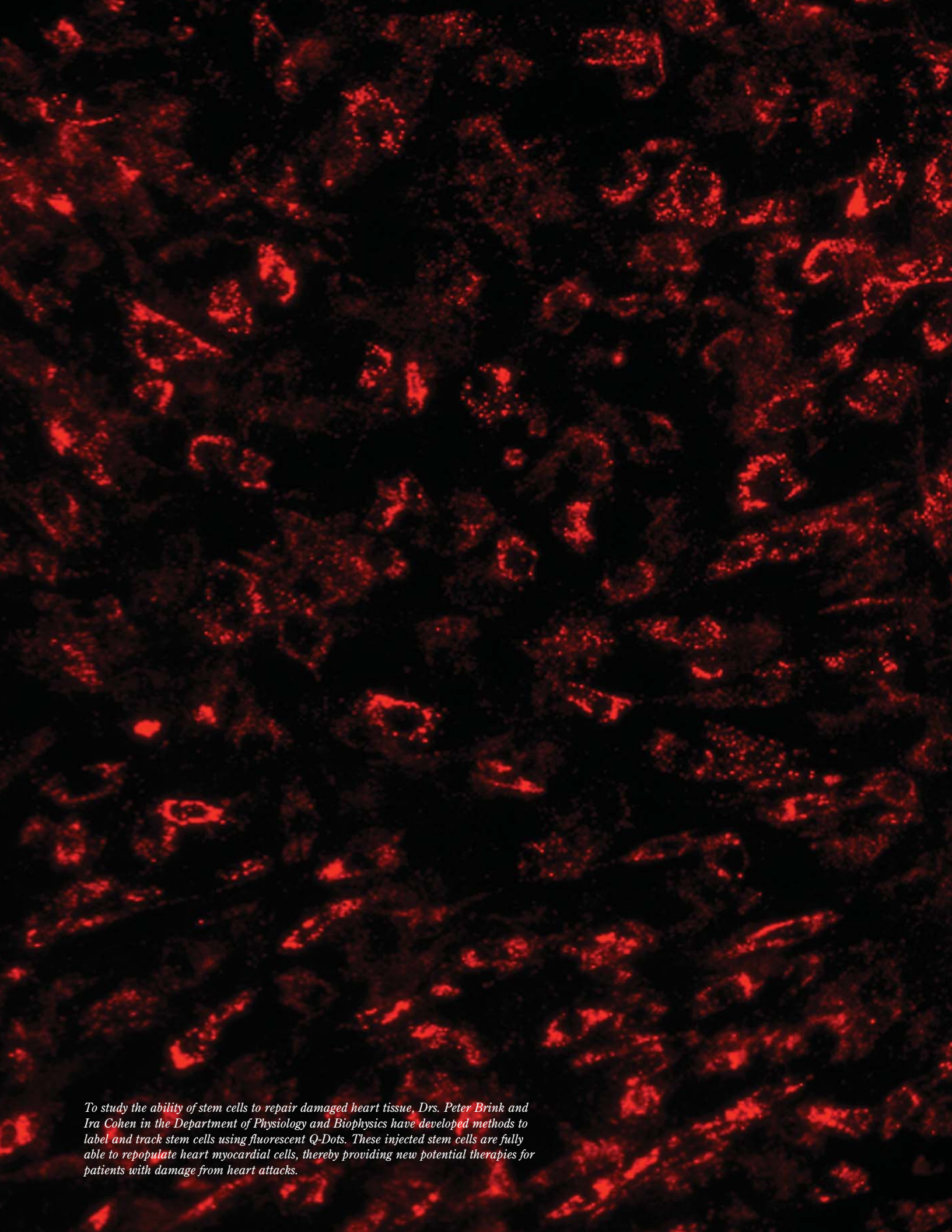
3. **Development of integrated facilities that will provide an environment to link the basic and clinical neurosciences.** Core research facilities need to be enhanced, especially a more extensive imaging infrastructure than is currently available. This need dovetails nicely with New Tools to Enhance the Research Strategy II/Biomedical Imaging. This section of the strategic plan (see below) includes many modalities essential to the neurosciences, such as functional MRI and PET/CT. To foster patient-oriented clinical research from current and future faculty members, the New Tools to Enhance the Research Strategy I/Clinical Translational Science Center section of the strategic plan will provide a robust clinical trial design group, biostatistics and database mining facilities. Such facilities are needed both to recruit top translational researchers and to make the faculty more competitive for external funding.
4. **Development of scholarly venues that will provide an environment to link the basic and clinical neurosciences.** Venues that could be helpful in fostering the appropriate collaborations include a monthly or bimonthly meeting featuring a well-known speaker carrying out translational research, the formation of a University-wide *Neurobiology of Disease* course (perhaps integrated with or complementing the current module on Neuropharmacology of Disease

HBH655/BNB655), and an annual Meeting of the Minds (launched September 2010).

5. **Finalization of the Computational Neuroscience initiative.** The recent recruitment of a new leader (Dr. Ken Dill from UCSF) for Computational Biology (the Laufer Center) makes computational neurobiology an even more strategically appropriate area to develop. This program could serve as a bridge to the excellent physical and mathematical sciences available at SBU and BNL. ■



Affectionately known as “Headley,” the neuroendovascular simulator is supported by the only robotically powered multi-axis angiography imaging technology in the region dedicated solely to research, and some of the region’s most sophisticated imaging technology.



To study the ability of stem cells to repair damaged heart tissue, Drs. Peter Brink and Ira Cohen in the Department of Physiology and Biophysics have developed methods to label and track stem cells using fluorescent Q-Dots. These injected stem cells are fully able to repopulate heart myocardial cells, thereby providing new potential therapies for patients with damage from heart attacks.

While compelling arguments are easily made to justify building upon four major research themes, two additional areas of research excellence at Stony Brook University School of Medicine might provide unprecedented opportunities: stem cell biology and metabolic/obesity syndromes. The availability of New York State Stem Cell Board training and core facilities grants is currently uncertain, but should the promised funds materialize, we will have available a state-of-the-art facility. Likewise, a target of opportunity exists in translational metabolic disorders, and we are currently in the process of recruiting leaders in Medicine and in Surgery whose research interests lie in this endeavor.

STEM CELL BIOLOGY AND REGENERATIVE MEDICINE

OVERVIEW

SBU has well-documented interests in stem cell research, exemplified by successful competition in many of the developmental initiatives put forth by the Empire State Stem Cell Board, the funding and regulatory body overseeing distribution of the 10-year, \$550 million commitment to stem cell research within New York State. To date, the SBU School of Medicine has been approved to receive nearly \$10.9 million in support of stem cell research, highlighted by the recent \$5.6 million Facilities Award that will provide Core and programmatic support relevant to stem cell biology and therapeutics. Stem cell research funded through NYSTEM includes eight SBU investigators; research efforts are clearly multidisciplinary and the recently submitted pre- and post-doctoral training grant includes 40 investigators from 14 departments and four major academic units throughout the

University (SOM, CEAS, CAS, and SDM). Submission of this training grant builds on previous success for the Summer Undergraduate Stem Cell Fellowship Award, which is slated for programmatic initiation in the Spring/Summer of 2011. Thus, this nascent program has already developed educational programs at multiple levels (undergraduate, graduate, post-doctoral), a growing number of funded investigators, a multidisciplinary faculty base, and a sizeable infrastructure grant that collectively serve as the foundations for continued programmatic expansion. Of note, a therapeutic program related to cardiac dysrhythmias is also being developed that provides opportunities for novel treatment strategies and high-profile philanthropic development. The program will have continued opportunities for expansion with development of ongoing NYSTEM-related proposals related to commercialization and consortia development.



Stony Brook Doctoral Awardee Varsha Sitaraman (PhD in Genetics, 2010) works on a collaborative research project with Wadie Bahou, M.D., Department of Medicine, and Patrick Hearing, PhD, Department of Microbiology and Molecular Genetics, to develop new cures for hemophilia using stem cells.

RECOMMENDATIONS

- 1. Complete the renovation of the Stony Brook Stem Cell Center.** Supported by the \$5.6 million Facilities Award (initially projected start date 11/1/2010), the Center will leverage ~\$1.1 million in new equipment and Core facilities that will serve as a resource for stem cell research throughout the University.
- 2. Appoint a Director to lead the Stony Brook Stem Cell Center.** The Stony Brook Stem Cell Facilities Award provides the initial outlay of dollars for infrastructure development, although a long-term business plan must be developed to make this self-sufficient. Appointment of a Director will facilitate growth of the Center, smooth operation of the core facilities, and coordination of philanthropic efforts. One option for consideration is creation of a formal Center structure, possibly with authority for salary and IDC capture, service billing, etc., helping to ensure the long-term viability of the Center.
- 3. Launch the Summer Undergraduate Fellowship Program.** Funded by a grant to SBU, this program will offer formalized training and experience in stem cell research to 10 undergraduate students annually interested in pursuing research/training related to stem cell biology.
- 4. Obtain funding for a stem cell-related training grant.** A formalized training grant in stem cell research supporting five pre-doctoral and two post-doctoral students annually has been submitted to NYSTEM, with an anticipated start date of July 2011.
- 5. Initiate a stem cell/regenerative medicine seed program.** Provide two annual \$30,000 seed grants to promote collaborative research related to stem cell/regenerative medicine.
- 6. Launch a quarterly lecture and annual Symposium related to stem cell/regenerative medicine research.** ■

CENTER FOR TRANSLATIONAL METABOLIC DISEASES

OVERVIEW

Metabolic conditions, in particular obesity and diabetes, are reaching epidemic proportions in New York State, the U.S. and across the world, and are closely linked to major medical morbidity and mortality from cardiovascular disease, especially when found to accompany hypertension and hyperlipidemia. Many translational research questions and clinical issues that initiate with diabetes and obesity have inherent overlap and connections to neuroscience, cancer, and infectious disease, providing for synergy with these areas as well. Moreover, stem cell therapy for diabetes is currently a very important research topic that is driving some of the most exciting translational medicine in this field. The NIH currently supports a wide variety of diabetes and obesity-related research and, recognizing the increased prevalence of obesity and its public health implications, has developed a 2010 strategic plan to accelerate progress in understanding and treating diabetes and obesity by funding both translational and public health research.

Accordingly, a research theme based on a Diabetes & Endocrine Research Center (DERC; modeled after the NIDDK national template) and a complementary Center for Translational Metabolic Diseases is proposed in partnership with Winthrop University Hospital (WUH) and perhaps other Long Island institutions. This multi-Center concept leverages (1) the existing Diabetes & Metabolic Diseases Research Center at SBU with (2) WUH resources designed to construct a Diabetes, Obesity and Cardiometabolic Research Center and (3) pre-existing New York State resources currently being used to develop the Calverton Agriculture and Consumer Science Center. The overall goal should be to establish an NIH-funded DERC in the SOM to expand ongoing basic and

translational metabolic research at Stony Brook. Twice in the past 15 years we have submitted a DERC application; both times the application was scored “outstanding” (priority score < 150), but failed to “knock out” one of existing 12 centers. In both cases, the failure to convert was due to lack of retention of key diabetes-focused researchers. This multidisciplinary center should be modeled on the DERC/DTRC examples, which have been extremely successful, rather than “reinventing the wheel.” A DERC within the SOM would become a regional magnet for diabetes/obesity research and translational medicine. The incidence of type 2 diabetes is increasing exponentially, and such a Center would be the portal for the SBU vascular surgery, heart surgery, endocrinology, and nutritional clinical services.

This multidisciplinary center approach would be highly visible, given its focus on childhood and adult diseases involving metabolic disorders. Across the University there are currently 11 grants from NIDDK in the area of diabetes and related disorders. Stony Brook has one of the largest and well-recognized T32 training programs for postdoctoral/postgraduate training in diabetes and metabolic disorders (rated outstanding in each of four competitive renewals). In addition, SBU faculty members involved in thematically related areas include 16 in diabetes, 13 in obesity and seven in cardiovascular disease. Clinical faculty in the Departments of Internal Medicine, Family Medicine and Pediatrics—and with development of a bariatric program, the Department of Surgery—treat a large number of patients with obesity, diabetes, and their co-morbidities, thereby providing broad-based opportunities for basic, translational, comparative effectiveness, and public health-related research.

RECOMMENDATIONS

1. Recruit a Chair of Medicine who supports the development of a diabetes and/or obesity center and portal for all medical services that are derivative of type 2 diabetes and obesity.
2. Establish an NIH-funded DERC at Stony Brook as a regional hub for a broader effort in translational metabolic studies, organized around excellence in translational research and in collaboration with WUH and other regional Institutes that focus on diabetes management. At SBU, creation of a DERC would not require any additional new space for research, but rather investment in clinical investigators with focus in diabetes/obesity research. By design, a DERC within the SOM would include a core in community outreach that models the priorities of the NIDDK and provides pilot/feasibility funds to encourage new research. WUH is planning to build a new research building within four years that would devote ~30,000 square feet of research space with a particular emphasis on diabetes research, and a new diabetes clinical center. A SOM DERC would work in synergy with WUH to maximize patient enrollment in clinical trials and clinical studies based in clinical/translational research.
3. Recruit a new clinical Center Director whose charge (among others) is to formalize research collaboration between both Medical Centers and across Family Medicine, Medicine, Pediatrics, Surgery and Obstetrics.
4. Recruit 2-3 clinical investigators in the area of diabetes/obesity who have natural affinities for basic research collaborations and a proven track record in scholarly research. Start-up packages for such talented, highly competitive individuals must be suitable for recruitment efforts.
5. Recruit 2-3 basic translational scientists to SBU with emphasis on themes that link effectively to other new initiatives within the SOM strategic plan. Possible topics for collaborative studies include the immunological components of diabetes, mouse models of diabetes, vascular biology, pancreatic

cancer and beta-cell regeneration, neurobiology of eating disorders, stem cell/regenerative medicine, cardiovascular themes, therapeutic development, and bioimaging of the pancreas.

6. Invigorate the Long Island Obesity Prevention and Early Intervention Program in Suffolk and Nassau counties, leveraging current initiatives at SBU and WUH. The initial focus will be on maternal and childhood obesity.
7. Develop a Metabolic Kitchen in conjunction with the Calverton Agriculture and Consumer Science Center (CACSS) whose focus is to design nutritional interventions for translational research, as well as to design, validate, produce and deliver diets for feeding studies that control for calorie, macronutrient and/or micronutrient content. The CACSS (scheduled for completion in the Fall of 2011) is an 8,500-square-foot Center that will be equipped to house nutritional product development based on Long Island agricultural output, along with a teaching kitchen. Such a Center can house a small research staff, and its availability can be used to develop new nutritional strategies to target obesity and diabetes.
8. Recruit a Clinical Researcher in Nutrition and Prevention to facilitate design of research protocols and menus, prepare and package food, and conduct dietary intake analyses through the CACSS. ■



Translational to the Roots: Families gardening at the Gateway Community Garden (2010) partially funded by the SB Family Medicine Community Roots Project under the auspices of a NYSDOH grant. Studying the effects of community gardening and consumption vegetables grown will be a unique aspect of our work.



The Stony Brook Institute for Clinical and Translational Sciences will provide an integrated infrastructure for transforming the process of translational investigation, leading to development of expert care models and partnerships with affiliates and the community that will lead to improved health.

For the School of Medicine and its faculty to achieve and maintain a competitive edge in biomedical research with translational potential, a number of infrastructure tools will be required. The following recommendations are based on national trends for: (i) expanded availability, accessibility, and utilization of electronic databases for mining and analyzing health-related information and outcomes, (ii) progressive focus on pharmacogenomic approaches for tailored therapeutics and personalized medicine, (iii) interest in early detection and prevention of human diseases, (iv) expanded emphasis on translating basic discoveries into clinically relevant diagnostics and therapeutics, and (v) invigorated scrutiny on assessing the economic impact of new devices and therapeutics for developing cost-effective strategies for optimizing population health. Many of the infrastructure needs delineated below are also highly relevant to the educational, clinical, and community components of the strategic planning process.

INSTITUTE FOR CLINICAL TRANSLATIONAL SCIENCES

OVERVIEW

Building on Stony Brook's previously funded General Clinical Research Center (GCRC), the creation of the Stony Brook Institute for Clinical and Translational Sciences (SBICTS) that partners with our research (BNL and CSHL) and clinical (WUH, VAMC) affiliates should be a primary vision for promotion of research and education. The overarching goal of this Institute is to provide an integrated infrastructure that will conform to the NIH vision for transforming the process of translational investigation. An extensive infrastructure of translational research resources, clinical facilities, and biomedical informatics should be assembled to facilitate clinical and translational research. This strategy will lead to the development of expert care models and partnerships with affiliates and the

community that will lead to improved health and support the multidisciplinary teams pursuing bench-to-bedside technologies to advance patient and population-based health initiatives.

The Stony Brook Institute for Clinical and Translational Sciences is designed to:

- Establish a home that will support the transformation of clinical and translational research and education. This center will provide the nursing, data management, study coordinators, and biomedical informatics support necessary for facilitation of investigator-initiated research and data analysis.
- Coordinate a comprehensive informatics infrastructure to facilitate bench-to-bedside-to-community practice and health policy research among affiliated institutions.

- Develop education and training programs that rigorously prepare learners at different levels and from multiple disciplines to conduct interdisciplinary research leading to novel treatments, drugs, diagnostics and medical devices.
- Provide a single point-of-entry site for study design and biostatistical analyses.

The SBICTS synergizes with:

- The NIH vision for development of regional centers that promote translational research
- SUNY REACH for development of an integrated program promoting the health of New Yorkers
- The recent opening of the \$40 million Center for Biomolecular Diagnostics and Therapeutics
- Center for Public Health and Health Policy Research
- Health-care related programs in CEWIT

The SBICTS provides for expanded opportunities in:

- Health research economics
- Comparative effectiveness research
- Investigator-initiated research, technology transfer, and new product development

RECOMMENDATIONS

Full details of the plans for SBICTS can be found in the CTSA application submitted in October 2010, and so will not be reviewed here, except to include the stated goals from that application:

1. Create an academic home that will support the transformation of clinical and translational research and education.
2. Coordinate a comprehensive informatics infrastructure to facilitate bench to bedside to community practice and health policy research; ensure data security and privacy; synergize and support research collaborations between informatics faculty and clinical and translational researchers and share new approaches with the

national CTSA consortium. The Translational Research Informatics Core (TRIC) will integrate disparate but well-developed informatics expertise, researchers and services to provide enhanced informatics service and research resources; create a central access point for research teams (i.e., The Translational Research Information Portal (TRIP)); establish an infrastructure for interoperability and sharing, both locally and nationally; ensure data security and privacy; and synergize and support research collaborations between SBICTS informatics faculty and clinical and translational researchers to support existing research and foster new innovative research by incorporating informatics capabilities such as visualization, natural language processing and advanced imaging analysis.

3. Transform the culture of clinical and translational research education into a system that rigorously trains students to conduct interdisciplinary, translational, and collaborative research. The Clinical and Translational Research Training Program (CTRTP) will be the academic home for CTR education and training. New components of the education and training initiative include:
 - A new T32 program to support trainees in the professional schools who will enter a joint professional degree/MSCR program
 - A new K12 program that will support young faculty who will earn advanced degrees in CTR and carry out mentored research as part of a structured program designed to lead to research independence
 - Establishment of the Clinical Training for Translational Scientists (CTTS) program to connect PhD students with clinical mentors, and provide them with relevant clinical didactic preparation and experiences
 - Implementation of a novel program to train mentors

- Training programs for research coordinators and nurses
 - Further investment in existing early pipeline programs for high school students and undergraduates to expose learners at early stages in their educational paths to CTR
4. Encourage, prepare and incentivize researchers to develop interdisciplinary research collaborations leading to new treatments, drugs, diagnostics and medical devices and provide the resources for their success. SBICTS will supply basic and clinical investigators with the support and expertise they need to seamlessly translate basic science into clinical inquiry by establishing new key functions as briefly described below.
- Novel Methods and Pilot Project Program. To encourage new investigators to apply novel methods in CTR that cross departmental and disciplinary boundaries, a pilot projects program will be offered annually and funded entirely with institutional funds.
 - Study Design, Biostatistics, and Clinical Research Ethics: Research Design Incubator (RDI). The RDI will provide a centralized infrastructure for study design, epidemiology, biostatistics and research ethics support.
 - Regulatory Knowledge and Support. To assist investigators in meeting regulatory obligations, we will create the Translational Research Office of Support Services (TROSS), which will provide researcher-focused support to assist investigators in complying with internal and external regulatory requirements, preparing budgets, and ensuring completion of compliance training for investigators and trainees. A Research Subject Advocate (RSA) function responsible for advocating for human subjects protection will be created, building upon the existing RSA program in the GCRC.
 - Participant and Clinical Interaction Resource (PCIR). The scope of the GCRC activities will be expanded from a traditional in-patient discrete hospital unit to include satellite facilities in the emergency department, intensive care units, ambulatory practices and in the community setting. Unique resources, including a clinic on wheels, supported by WUH, and the mobile dental clinic of the SBU School of Dentistry will bring research studies to the community.
 - The Translational Technologies Core (TTC) will support clinical and translational research by making cutting-edge technologies more widely available and educating faculty and students about potential utilization of these cores in their research.
5. Transform existing programs and create new ones to engage the community and address disparities at all levels. Coordination, expansion and focusing of currently available outreach programs and strengthening ties with critical community leaders and agencies will be accomplished through the formation of the Community Engagement Research Core (CERC). Community partnerships will be fostered through interactive websites for the public, community focus groups, traveling workshops to provide information about being a research participant, and outreach programs. A Community Advisory Board (CAB) will be established to seek input from the community, provide advice to CERC leadership and assist in the development and expansion of community affiliations. In addition, SBICTS will aggressively recruit minorities, women and the disabled to its training programs and faculty through a diverse range of outreach campaigns. ■

STATE-OF-THE-ART CORE FACILITIES

OVERVIEW

The availability of specialized, competitively priced core facilities is necessary to apply cutting-edge technologies to biomedical research questions. Although the University currently boasts several outstanding animal and core facilities (e.g., Proteomics), other core facilities (e.g., Genomics and Biostatistics/Bioinformatics) remain generally inadequate to provide support for investigator-initiated research. We note for example, the lack of NextGen sequencing capabilities and concomitant Bioinformatics Support for data analysis. Similarly, sophisticated microscopic imaging is needed for cell biology and biochemistry advances and for enhancing our understanding of human pathophysiology of disease.

Expanded Core Facilities are designed to:

- Provide sophisticated, competitively priced technological services in genomics, proteomics, microscopy and cell sorting to support cutting-edge biomedical research.
- Provide scientific expertise to assist investigators in experimental design and data interpretation (the Research Design Incubator).
- Provide state-of-the-art cellular and subcellular imaging technologies.

RECOMMENDATIONS

1. **Flow cytometry core – obtain the Bectin Dickenson LSRII analytical flow cytometer.** Once in place, the LSRII will be the only dedicated analytical instrument on Long Island with UV and green laser high throughput capacity. The flow cytometry facility at SBU serves as the centralized resource for complex cellular immunophenotyping, although most of the equipment is more than 10 years old and has no capacity to analyze more than four fluorescent parameters; more advanced instrumentation is required by researchers in the basic and clinical science departments to maintain our NIH/NSF competitiveness.
2. **Create a centralized Microscopy Imaging Center.** To remain competitive, the School should obtain two distinct, but complementary platforms for cellular imaging:
 - Spinning Disc confocal microscope with Live Cell Imaging Software – A major challenge of live cell imaging is keeping cells alive and functioning as naturally as possible for the duration of the experiment. Fluorescence illumination, especially in the UV range, is harmful to cells and causes photobleaching and phototoxicity. The use of high-power lasers as the excitation source adds to this challenge. Advanced incubation chambers allow cells to be cultured on microscope stages with minimum disruption. Before the development of live cell imaging, researchers have relied on snapshots of fixed cells. It is now possible to turn these snapshots into moving pictures of dynamic processes that are more true to life, at least cultured life.
 - Super-resolution microscope – The field of cell biology has been constrained for the past century by the fact that the optical resolution of both conventional wide-field and confocal light microscopy is limited to approximately half the wavelength of light. This diffraction limit made it impossible to resolve structures separated by less than about 200 to 250 nm in the focal plane, with an even poorer axial resolution. Recent advances have featured the development of new optical methods that break the diffraction barrier, permitting up to a 10-fold increase in resolution. These new methods, variants of photoactivated light microscopy (PALM, STORM), structured illumination microscopy (SIM) and stimulated emission and depletion (STED), are collectively referred to as super-resolution microscopy (see section New Tools to Enhance the Research Strategy II/Program in Biomedical Imaging on page 30). These breakthrough methods enable

researchers to view molecules bearing fluorescent tags with a resolution approaching that of electron microscopy, which of course is not amenable to use of fluorescent tags. These methods will enable cell biologists to view structures with unprecedented resolution and flexibility to complement other approaches such as two-hybrid analysis of protein-protein interactions, cryo-electron microscopy and X-ray crystallography. Commercial microscopes that take advantage of these methods are just becoming available and would provide unique imaging capacity for a wide array of basic and translational biomedical research applications.

3. Advance the Proteomics Core Facility: Proteomics experiments have evolved from analysis of spots on a gel to comparison of expressed proteins in different sample subsets. Applications of this technology are highly relevant not only for biomarker development, but for whole cellular analysis focusing on functional endpoints such as cellular metabolism (i.e., metabolomics). To provide optimal capabilities in comparative proteomics, the Proteomics Core facility seeks to obtain two new mass spectrometers with enhanced speed and sensitivity, thereby allowing the user to optimally extract mass spectroscopic data from precious tissue/cellular samples. Instruments that will considerably enhance our capabilities in biomedical proteomics include:

- Thermo Orbitrap-Velos – This instrument will dramatically enhance the spectroscopic capabilities by providing enhanced sensitivity and mass accuracy for global proteome characterization and for identification of post-translational modifications (i.e., phosphorylation, ubiquitination, etc.); the enhanced sensitivity and accuracy are major advantages in clinical situations where tissue availability is limiting.
- Thermo TSQ Vantage – The current TSQ Access is used for small molecule analysis and pharmacokinetic analysis for the Translational Experimental Therapeutics Laboratory. An

updated version will provide more precise peptide-based protein quantification required for high-throughput protein analysis and biomarker-based discovery projects. In addition to these major instrumentation needs, supporting equipment will be required including high pressure liquid chromatographic pumps for high-throughput peptide separation, mass spectrometry-related software to support the high-throughput functions, and an upgraded computer cluster for data analysis and storage. Finally, the Core seeks to obtain the Advion TriVersa NanoMate, a chip-based electrospray ionization technology that simplifies the analysis of small volume samples, inclusive of a fraction collector to allow fractionation of chromatographic gradients for careful reanalysis and peptide identification.

4. Further develop a sufficient Genomics Core Facility. Next generation sequencing technologies provide robust opportunities for gene discovery and the study of human genomic variability linked to human disease and/or treatment responses. Specific applications include whole transcriptomic sequencing, metagenomics, structural variance analysis, and deep resequencing, as well-developed examples. Although the University is in the process of obtaining the Ion Torrent platform for large-scale sequencing, a fundamental gap exists in having support personnel available for computational biological analyses, and for software licenses that are required for optimal extraction and manipulation of complex genomic data sets, or in concert with the proposed Department of Biomedical Informatics, for developing our own tools. In fact, it is envisioned that while we will continue to require genomic level sequencing capacity for clinical analyses, once genomic level sequencing is affordable and is used to make clinical diagnoses, one can make a compelling argument that the key to genomic research of the future will be to have intellectual resources invested in Biomedical Informatics, rather than in the machines that provide sequence, as the latter is becoming immediately available online. ■

DRUG DISCOVERY AND ANALYSIS

OVERVIEW

Although pharmaceutical companies are best staffed and equipped to manage late stages of drug development, the initial stages (target identification, initial compound isolation and characterization) are progressively being completed by academicians, with subsequent University/biotechnology partnerships. Target identification, chemical compound development, and initial ADME/T (absorption, distribution, metabolism, excretion, and toxicology studies) are frequently expected as initial feasibility steps (or in parallel) in the drug discovery pipeline prior to University-biotechnology/pharmaceutical licensing and partnering agreements. SBU is well positioned to further expand on this theme through the Institute for Chemical Biology/Drug Discovery (ICB/DD), coupled with a strong track record of commercialization that is spearheaded by the Office of Technology Licensing and Industry Relations. The ICB/DD currently has well-established programs in cancer and anti-tuberculosis drug development, and the SOM has recently developed a Translational Experimental Therapeutics Laboratory headed by Dr. Peter Tonge, designed to assist with initial ADME/PK studies. As we believe expansion of the ICB/DD should be a critical campus-wide strategic goal, tactical details are better left for campus-wide planning, presumably coordinated through the Office of Vice President for Research. However, a short discussion is warranted in the SOM strategic plan, as there is a strong track record of interaction between SOM faculty members and the Institute.

RECOMMENDATIONS

1. Expanded ICB/DD facilities should be designed to:

- Provide a single infrastructure for high-throughput technologies related to target validation, compound screening, chemical synthesis, and compound optimization.
- Provide support for selected *in vivo* ADME/T studies of lead compounds.
- Provide initial partnering opportunities with biotechnology/pharmaceutical partners.

2. The expanded ICB/DD Core Facilities synergize with:

- The Laufer Center for Computational Biology
- The Stony Brook Center for Biotechnology
- The newly funded animal BSL3 and bioimaging initiatives in conjunction with Brookhaven National Laboratory (BNL)
- Development of a NCI-designated Comprehensive Cancer Center
- Center for Infectious Diseases
- Center for Structural Biology and the National Synchrotron Light Source II at BNL. ■

ROBUST INFORMATION TECHNOLOGY PLATFORM

OVERVIEW

A well-integrated biomedical information technology (IT) platform will be needed to accelerate the pace of translation of scientific discovery to prevent and treat disease. The ability to access and integrate disconnected information systems into a seamless, unified technological platform that can be used to mine and analyze data relevant to human health represents an overarching need in translational research. In virtually every scientific *Theme* envisioned in this Strategic Plan, enhanced information systems and biostatistical analysis will be necessary to fully realize the enunciated goals. The integrated tools outlined in this *Information Technology Platform* will allow for data sharing, synergies and optimized information analyses. The integrated IT infrastructure may be used to leverage pre-existing computational resources within the New York Center for Computational Sciences (NYCCS), along with the Center of Excellence for Wireless and Information Technology (CEWIT), the Department of Computer Sciences, the Louis and Beatrice Laufer Center for Computational

“The ability to access and integrate disconnected information systems into a seamless, unified technological platform that can be used to mine and analyze data relevant to human health represents an overarching need in translational research.”

Biology and Genome Sciences, the e-health network of Long Island (RHIO) and the CSHL Bioinformatics group.

RECOMMENDATIONS

1. The IT platform will be designed to:

- Store and federate data from specialized laboratories and core resources across the University and our partner institutions
- Access online analysis tools developed by SBU faculty members.
- Create and manage a Data and Resource Sharing Registry, a searchable source of information about data and other research resources specifically relevant to human health and treatment outcomes
- Provide informatics and data management consultation
- Ensure data security

2. The IT platform will synergize with:

- SUNY REACH focus on integration of the Academic Health Centers
- Development of a SUNY-wide Office of Clinical Trials for robust patient recruitment and assessment of new therapeutics and devices, along with comparative effectiveness analyses

3. The IT platform provides for expanded opportunities in:

- Translating genomic knowledge into clinical studies
- Imaging informatics
- Comparative effectiveness research
- Clinical quality assessment and improvement

It is envisioned that a new Department of Biomedical Informatics (DBMI) be created with two major



In translational research, integrated information systems can provide a seamless, unified technological platform to access and mine data related to human health.

purposes; first, the DBMI will be tasked with developing the tools necessary to decipher causative and epiphenomenal components of large genomic and proteomic studies of the origins of disease and its response to various therapies. Second, the new Department will be the driver of: 1) extracting useful information from a myriad of clinical sources, patient history and physical examinations, chemistry, hematology and other laboratory evaluations, all the major imaging techniques and pathological specimens, and 2) sharing insights of clinical practice so generated with clinicians in real time to impact the quality of clinical care delivery. It is envisioned that most or all faculty recruited to DBMI will be secondarily appointed in other departments, to facilitate ongoing collaborations.

The new DBMI will be modeled after a Division of BMI that was created by the Dean when serving as

Chair of the Department of Medicine at UC San Diego (see <http://dbmi.ucsd.edu/confluence/display/BMI/Division+of+BioMedical+Informatics>). Now in its second year of existence, the Division includes 12 faculty members (six primary and six secondary appointees), six post-doctoral fellows, six students and eight staff members. The members of the Division have backgrounds in medicine, biology, nursing, computer science, mathematics, statistics, engineering, and business. Their research missions include 1) bioinformatics, 2) clinical informatics, 3) global health informatics and 4) infrastructure, privacy technology and health information exchange. Faculty participate in the National Center for Biomedical Computing and the National Network for Comparative Effectiveness Research. ■

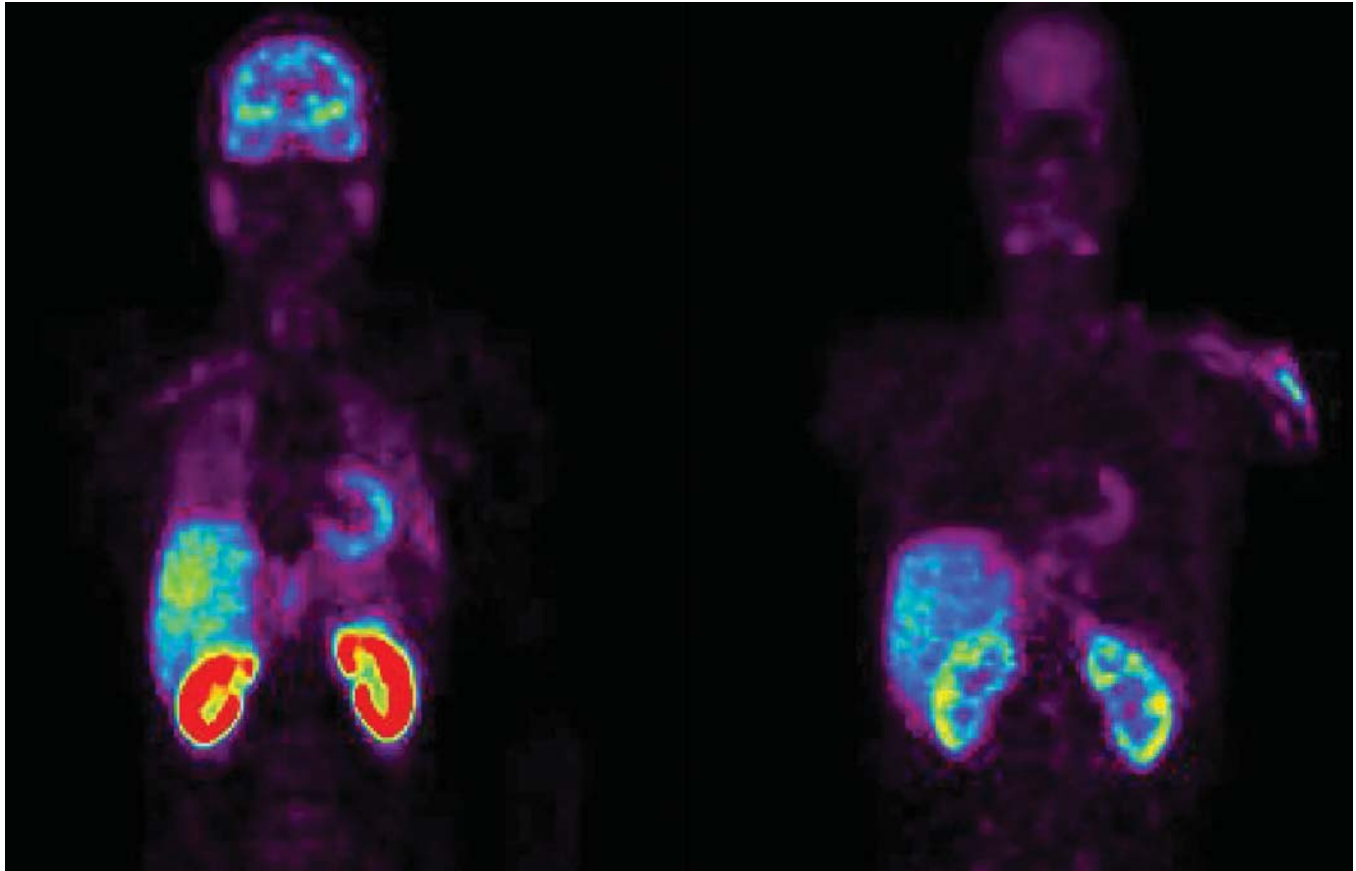
PROGRAM IN BIOMEDICAL IMAGING

OVERVIEW

The scale of resolution by which modern clinical imaging technologies can probe the anatomical, physiological, metabolic and toxicological origins of health and disease is approaching that of the pathologist's microscope. The resolution of computerized tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET) are providing structural and functional information previously available only with invasive radiographic techniques or, in some cases, determinable only by biopsy, sectioning and microscopic examination. Our ability to harness this enhanced imaging resolution to address critical clinical questions is increasing at an impressive rate. For example, based on the Stony Brook University Hospital 320-slice cardiac CT scan, we can now send home with impunity more than 75% of emergency department patients with chest pain as having a non-cardiac origin of their symptoms, all of whom previously spent at least one night in the hospital. And PET imaging can now distinguish between an actively growing tumor

“The scale of resolution by which modern clinical imaging technologies can probe the anatomical, physiological, metabolic and toxicological origins of health and disease is approaching that of the pathologist's microscope.”

and a benign, post-radiation or chemotherapy induced fibrotic scar in patients treated for lymphoma and other malignancies. More recently, biomedical imaging has moved to the cellular level; *in vivo* cellular bioluminescence can be detected in intact (anesthetized) animals, and labeling cells with quantum dots or other substances allows their tracking throughout organs (see figure in Minor Research Theme I). Molecular structural imaging modalities have been available for decades, including x-ray crystallography, nuclear magnetic resonance (NMR), atomic force microscopy (AFM) and cryoelectron microscopy, but image resolution continues to improve substantially and has even moved into functional imaging. For example, how normal and pathological molecules assemble into subcellular structures and how molecular machines operate can now be imaged. Moreover, even the static structure tools are taking a vast step forward. The construction of the National Synchrotron Light Source (NSLS)II at Brookhaven National Laboratory (BNL), due to open in less than three years, will advance X-ray crystallographic images to another level. The term “convergence” was used recently by the Nobel Laureate Dr. Philip Sharp and several MIT colleagues to describe “the merging of distinct technologies, processing disciplines, or devices into a unified whole that creates a host of new pathways and opportunities.” It is clear that newer approaches to biomedical imaging will require convergent thinking. Given our University's strengths in physics, chemistry, engineering, biomedical sciences and clinical medicine, and our strong relationship with BNL and its innovative approaches to imaging tools and reagents, and CSHL, a recognized world leader in defining biologic processes and pathologic pathways, the School of Medicine is well positioned to make a singular impact on this field, and through current and future tools, an impact on all of our strategic goals.



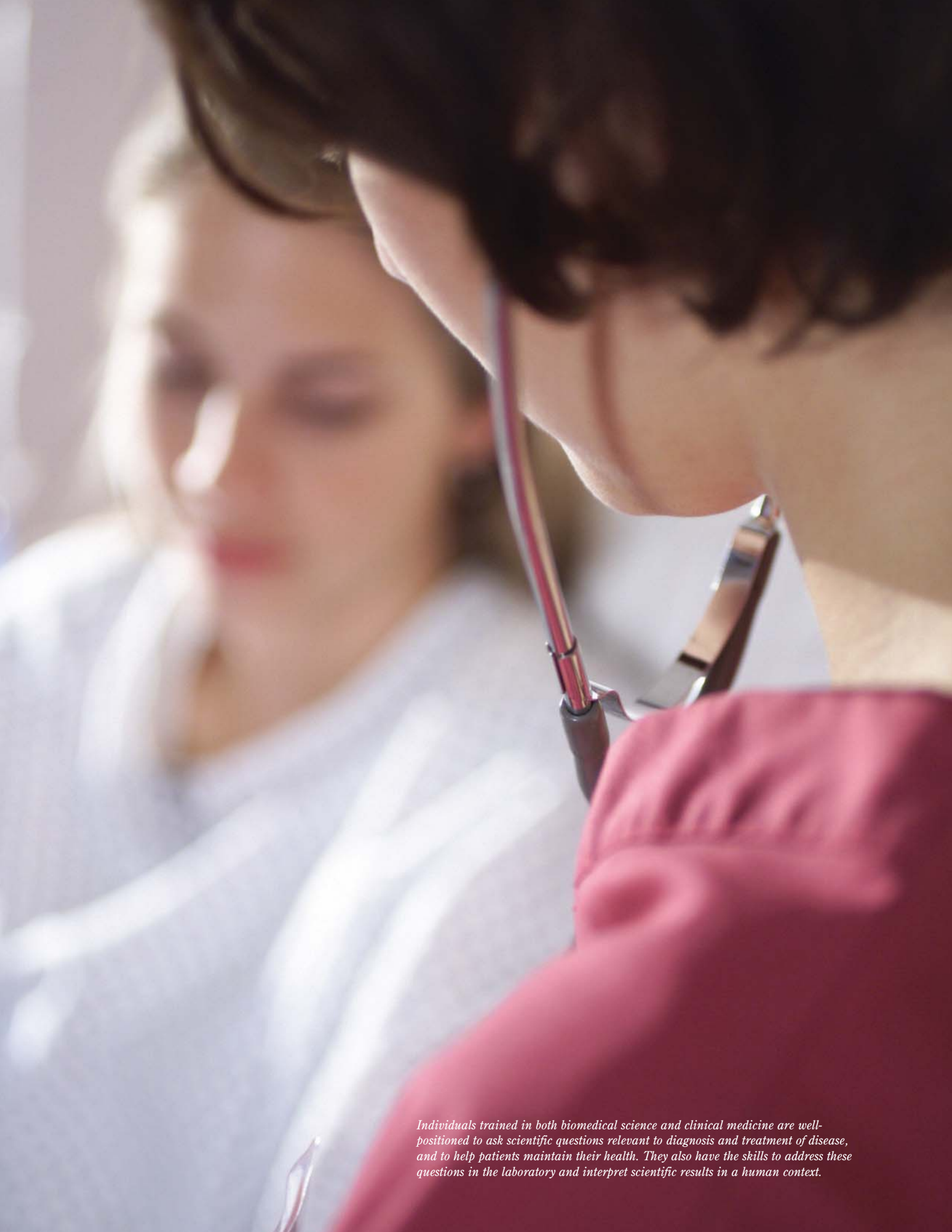
In a study of low monoamine oxidase B in peripheral organs in smokers performed by Brookhaven National Laboratory and Stony Brook University, whole-body images of carbon-11 distribution are shown in a non-smoker, left, and a smoker, right. Red is the highest radiotracer concentration on the color scale, and images are scaled so that they can be compared directly.

RECOMMENDATIONS

1. Recruit a Director of Biomedical Imaging, a basic or translational scientist with broad imaging experience, collegiality and innovative approaches to multiple imaging modalities.
2. Recruit three additional bioimaging faculty members, devoted to innovative, “convergent” approaches to imaging.
3. Provide a state-of-the-art animal imaging facility by transferring the 9.4T MRI from BNL to the SBU campus and then to the Translational Medicine building, along with developing animal PET imaging, to match up with other animal-level imaging modalities, and build upon existing optical and fluorescence imaging tools to define the next generation of imaging modalities.
4. Help develop novel PET imaging reagents for functional studies in animals and man, by installing a medicinal cyclotron and radiochemistry laboratory in addition to a dedicated clinical research PET and MRI scanner in close proximity to the hospital/cancer center.
5. Develop state-of-the-art tissue, cellular and subcellular imaging technologies as part of the BNL-SBU Bioimaging Institute (see diagram on next page).
6. Develop a new research home for the Program in Biomedical Imaging in the Translational Medicine Building, adjacent to the new Radiology suite. ■



The Bioimaging Institute would provide a central resource for a new and unique pathway to collaborative, interdisciplinary research, technology development and education programs that integrates Stony Brook University (SBU), Brookhaven National Laboratory (BNL) and Cold Spring Harbor Laboratory (CSHL). It would build on existing world-class imaging and instrumentation strengths in the biological, physical and engineering sciences, and foster collaboration between numerous basic science, engineering and clinical departments, integrating more than 300 faculty and facilitating access to an unmatched array of imaging resources. A broad array of imaging technologies exists at SBU/BNL/CSHL, from human/animal PET/MRI to X-ray microscopy and NMR. The Bioimaging Institute would bring many of these resources under one roof and bring together people who are working at the edge in developing/applying/integrating these imaging technologies to a range of biological length scales and biomedical challenges.



Individuals trained in both biomedical science and clinical medicine are well-positioned to ask scientific questions relevant to diagnosis and treatment of disease, and to help patients maintain their health. They also have the skills to address these questions in the laboratory and interpret scientific results in a human context.

A primary mission of the School of Medicine is to educate the next generation of physicians, physician-scientists, and biomedical researchers who will provide better healthcare than is currently possible. As such, the School will initiate several innovative programs to better train this new generation. With so wide an expertise as our School, we plan to provide the ideal training environment for bilingual biomedical scientists, enhance our training of clinical investigators, encourage scholarship in teaching teachers of medicine and encourage careers in primary care medicine.

BILINGUAL BIOMEDICAL INVESTIGATORS

OVERVIEW

Individuals who are trained in both biomedical science and clinical medicine (“bilingual” biomedical scientists) are well positioned to (1) ask scientific questions that are most relevant to improve the diagnosis, treatment or prognostication of humans with disease and to maintain health, (2) have the skills to address these questions in the laboratory and then (3) to interpret the scientific results in a human context. Such bedside-to-bench-to-bedside translation has typically been conducted by graduates of medical scientist training (MD/PhD) programs, or “late bloomers,” individuals who received full clinical training and then pursue their scientific training. SBU SOM has a long-standing MD/PhD program, which was recently successfully renewed with an increased number of funded positions.

“Late bloomers” are derived from a pool of scientifically oriented post-doctoral clinical subspecialty fellows, who have obtained what Nobel laureate Joe Goldstein has termed “technical courage,” sufficient experience and training in the experimental method to acquire vital troubleshooting skills and knowledge of the full range of experimental approaches. Both MSTP and late bloomers have contributed in a major way to advances in biomedicine. In fact, nearly half of the more than 100 Nobel prizes in Medicine or Physiology have been awarded to such individuals. This Strategic Plan calls for investing in both of these tracks; by far the biggest current SOM shortage is in faculty members with whom MSTP students and nascent “late bloomers” can train and be mentored. Throughout the four major and two minor scientific *Themes* and the five infrastructure

programs illustrated above, it is proposed that the SOM recruit and/or develop faculty members with the following orientations: infection/immunology, cardiovascular disorders, cancer, neuroscience, metabolism and bioimaging, and five section chiefs focused on translational medicine. Moreover, there is a third pathway emerging to develop the bilingual biomedical scientist. In contrast to the MSTPs and “late bloomers,” far less attention has been paid to a third pathway, providing clinical training to a PhD student. By immersing PhD students in a clinical world, one can jump-start the career of a basic biomedical scientist interested in the origins and treatment of human disease, promoting their asking more relevant, patient-oriented questions, establishing clinical collaborators and enhancing better communication with their colleagues. While serving as Chair of the Department of Medicine at UC San Diego, the Dean of SBU SOM was the co-Principal Investigator of a Howard Hughes Medical Institute

“Late bloomers have sufficient experience and training to acquire vital troubleshooting skills and knowledge of the full range of experimental approaches.”

training program termed Med-into-Grad, currently in its fifth year, which provides basic clinical skills and reasoning, a seminar series providing examples of bench-to-bedside translations, and a three- to six-month clinical immersion experience, with a scientifically oriented physician mentor or mentors chosen to match the students’ thesis work. During the clinical component of the program, neurosciences graduate students were paired with a neurosurgeon and a neurologist, and participated in various neurology clinics (Multiple Sclerosis, Headache, Stroke) and neurosurgical procedures, while cancer biology students were paired with medical oncologists and participated in a similar, albeit topic-specific range of activities. The experience of the participants of the program at UC San Diego was simply outstanding (see <http://molpath.ucsd.edu/hhmi.html> and scroll towards bottom of site). It is now proposed to develop a similar program in the SOM.

RECOMMENDATIONS

Two faculty members will be recruited to serve as scientific and clinical directors of the program, either from existing or incoming faculty in the SOM, and approximately 10 scientifically oriented clinical faculty representing diverse medical fields will be recruited as mentors for student clinical experiences and to deliver bedside-to-bench-to-bedside seminars. Approximately \$200,000 per year will be needed to offset student tuition and stipends during the period of clinical experience (10 per year for six months each). ■

ACADEMY OF CLINICAL AND EDUCATIONAL SCHOLARS (ACES)

OVERVIEW

Medical schools face many educational challenges, including (1) effective teaching of residents and fellows under continually changing and progressively more restrictive regulatory agency rules, (2) optimizing undergraduate prerequisite preparation for medical school, (3) evaluating strategies for advancing educational scholarship and igniting interest in clinically-based research across our campus, (4) setting promotion expectations for scholarship for clinician-educator track faculty, (5) making the pre-clinical curriculum clinically relevant, and (6) setting expectations for community faculty, amongst many others. At SBU SOM there exist numerous clinician-educators who have both firsthand knowledge of the challenges of modern medical education and the scholarly approach and ability to provide the solutions to these and other challenges. Creation of an Academy of Clinical and Educational Scholars (ACES) will provide the platform for addressing these issues and implementing the changes necessary to fulfill proposed solutions. Much like the Institute of Medicine, a group of leaders in

American Medicine periodically charged by the President or the Congress to investigate pressing public health problems and recommend solutions, ACES will be charged with working with individuals and programs in all corners of the School to enunciate, analyze the origins, and solve our challenges in medical education and clinical scholarship. ACES will also foster clinical and educational scholarship by providing funds for continuous career development for clinician-educators, recognizing and rewarding those who display dedication to and excellence in education, and providing mentors (master teachers) and programs that develop and reinforce scholarship and teaching skills in order to create a community of dedicated educators.

RECOMMENDATIONS

1. Create the admission criteria and establish and generate the mission and vision statements for ACES.
2. Explore potential external funding sources (grants and philanthropy) and institute a governance and reporting structure for the Academy. ■

ENHANCING THE PRIMARY CARE PRACTITIONER OUTPUT

OVERVIEW

The AAMC has estimated that the United States will require 21,000 new primary care physicians by 2015. A number of interventions are planned to address this need, including new laws that provide Department of Health and Human Services funds for primary care training programs. And yet a number of factors, including the increasing average level of debt of recent medical graduates, the relatively low compensation provided to primary care providers, the relatively long work hours in modern medical practice and the fragmentation of outpatient general medicine from the better compensated specialty of hospital medicine all militate against recent graduates choosing one of the four primary care career pathways: general internal medicine, general pediatrics, combined medicine-pediatrics and family medicine. Moreover, with the rapid aging of the population (70 million baby boomers will turn 65 in the next 20 years), our strategic planning must include training initiatives for students and residents to be able to care for the elderly. Several pilot programs will be implemented

“Moreover, with the rapid aging of the population (70 million baby boomers will turn 65 in the next 20 years), our strategic planning must include training initiatives for students and residents to be able to care for the elderly.”

within the SOM to test whether this recent trend can be altered: invigoration of the combined Medicine-Pediatrics residency, providing internal medicine residents with more access to general medicine master teachers, providing scholarship funds to encourage choice of a primary care specialty and establishment of a longitudinal curriculum to encourage a career in Family Medicine. If our pilot efforts prove encouraging, we will implement the successful plans across the School.

RECOMMENDATIONS

1. **Enhance the SBU Medicine-Pediatrics Residency Training Program.** Approximately 80 percent of graduating combined Medicine-Pediatrics residents remain as primary care providers of both children and adults, and 20 percent specialize, compared to only ~60 percent of internal medicine residents. This has been the experience of the Dean of the SOM; of 36 combined Medicine-Pediatrics residents trained while he served as Chair of Medicine of a highly rated academic combined Medicine-Pediatrics program, only one resident sub-specialized. SBU has an established ACGME-approved combined Medicine-Pediatrics residency program, but we currently do not have sufficient combined Med-Peds trained faculty leaders and do not attract sufficient numbers of applicants to be highly competitive. As such, we will pilot enhancing the program by recruiting four new, well-trained, academic combined Medicine-Pediatrics faculty members, two of whom have experience serving as residency directors, and develop a fourth-year elective in outpatient Medicine-Pediatrics practice.

2. Develop enhanced opportunities for Internal Medicine and Pediatrics residents to work with primary care oriented master teachers. It is clear that residents make career choices based on their residency mentors. Currently, the fastest growing medical career path is in hospital medicine, physicians derived almost entirely from general internal medicine residencies. Thus, this potential source of primary care physicians is being rapidly depleted. One of the potential reasons for this career diversion is that nearly every internal medicine resident spends 2/3 of his or her training on inpatient medicine services, staffed almost entirely by hospitalists. Moreover, most of a resident's outpatient time is spent in subspecialty clinics. For most, only 10 percent of a resident's time is spent in a general internal medicine outpatient clinic. Moreover, some of the very best outpatient medicine attendings are clinically quite busy, usually because of the demands of clinical productivity necessitated by poor salary scales. It is proposed that by providing enhanced teaching time to a cadre of master teachers of primary care medicine, and moderately increasing resident outpatient general medicine experiences, an increased fraction of internal medicine residents will choose primary care as a career pathway.

3. Provide scholarship funds to fourth-year students headed to a career in primary care medicine. The LCME "suggests" that at least 10 percent of an institution's total tuition be forgiven in scholarships, but do not specify for what purpose. Currently, SBU SOM falls short of this benchmark, and the Dean has pledged to quadruple the scholarship pool for five years, longer if philanthropic funds can replenish the current fund balance. A large amount of the new scholarship funds

will be devoted to need-based support, but it is recommended that fourth-year tuition be forgiven for top students who pledge to pursue a primary care career (internal medicine without specialty, pediatrics without specialty, combined medicine-pediatrics or family medicine) at SBU.

4. Development of a Longitudinal Family Medicine Curriculum. The proposal includes the development of a longitudinal clerkship experience in Family Medicine. Specifically, each student would be assigned to a disadvantaged family or families with significant medical needs. The student would work directly with a preceptor and manage all aspects of the families' healthcare over the course of his or her four years of medical training.

5. Expand the Medical School Class. All other things being equal, expansion of the SBU medical school class should increase the number of primary care physicians we produce. The LCME has given permission for SBU to expand the medical school class size, from the current 124 to 140. However, at present, three issues block our plans to increase class size: sufficient large and small classroom space, sufficient faculty for small group sessions and adequate numbers of third- and fourth-year clerkship opportunities. Each of these can be addressed through remodeling of space on the second floor of the Health Sciences Center building, expanding our faculty through the proposed strategic plan recruitments, and partnering with surrounding hospitals to develop high-quality clinical clerkships. ■

CREATING A HOME TO TRAIN CLINICAL INVESTIGATORS

OVERVIEW

The goal of this *Theme* is to transform the culture of clinical and translational research education into a system that rigorously trains students to conduct interdisciplinary, translational and collaborative research. Building on the extensive education programs and mentored research opportunities within the SOM, an academic home for clinical and translational (CTR) education and training will be developed to integrate existing programs and provide a coordinated platform for CTR education and mentoring initiatives. A continuum of advanced academic learning opportunities and innovative, interdisciplinary, mentored training opportunities that will remain stimulating throughout a clinical and translational researcher's professional career will be developed.

RECOMMENDATIONS

1. Establish a new NIH T32 program to support trainees in the professional schools who will enter a joint professional degree program, Masters in Clinical Research.
2. Establish a new NIH K12 program. Along with institutional support for an additional two positions per year, the K12 will support young faculty who are earning advanced degrees in CTR and who carry out mentored research designed to lead to research independence.
3. Develop a program to provide dual mentorship by basic and clinical scientists for all trainees. The critical components of the program will be the mentors; trainees will have the opportunity to pursue a bench-to-bedside (T1) translational pathway, working with faculty in the graduate programs in biochemistry, pharmacology, biomedical engineering, and genetics along with appropriate clinical faculty, or focus on community-based participatory (T2) research, through collaboration with faculty trained in healthcare outcomes research.
4. Implement a program to train mentors. As noted in (3), mentors are key to the success of this *Theme*. As such, it will be vital to develop programs that mentor the mentors. ■



Stony Brook University Heart Center is responding to the growing need for diagnosis and treatment of patients with cardiovascular disease in our aging population.

Stony Brook University Medical Center has developed a number of programs in which a compelling patient care mission or expertise in research has driven the development of an excellent clinical program. Six of these programs are the focus of the clinical strategic plan.

Our goal is to become a high reliability organization (HRO), a medical institution that aims to provide error-free operations, so that every patient receives optimal care at all times. We also strive to lead an Accountable Care Organization (ACO), in which we collaborate with physicians to institute and monitor best clinical practices. Finally, a major focus is determining our clinical positioning in the healthcare “market.” A major determinant of our success will be efforts to develop a corporation to permit private groups of physicians to partner with Stony Brook to improve healthcare quality.

CARDIOVASCULAR SERVICES

OVERVIEW

Cardiovascular disease diagnosis and treatment is a major need in our aging population, and it appears that the epidemic of obesity will continue to expand that need despite considerable progress in reducing other conditions that predispose to cardiovascular diseases. Expertise in clinical care and research in cardiovascular disease has been strong and broad based within the School of Medicine. The Stony Brook University Heart Center was initially organized around cardiology and cardiothoracic surgery, but more recently has incorporated vascular surgery and cardiac imaging. The importance of cardiovascular services to

Stony Brook University Hospital (SBUH) is clear, as renovating the Heart Center was included in the first phase of the Major Modernization Plan. The Heart Center now boasts state-of-the-art cardiac catheterization and electrophysiology laboratories, operating suites and equipment to support these efforts. Cardiac surgery is a major program at SBUH, yielding both intellectual and financial contributions to the School and Hospital. For years, SBUH has been the only site of cardiac surgery in Suffolk County. Nevertheless, we capture only 30 percent of all patients in the County who require cardiac surgery, most of the remainder being cared for in Nassau County or Manhattan.

Moreover, we now face two significant threats to the cardiovascular clinical enterprise with (1) the recent approval for two nearby hospitals to begin cardiac surgery programs and (2) the competition for private cardiology groups in Suffolk County to become part of our competitors' clinical networks. There have already been several cardiology groups who previously referred cases to us who have now virtually stopped because of this change in affiliation.

RECOMMENDATIONS

1. Following the arrival of a new Chair of Medicine, begin recruitment of a permanent Cardiology Division Chief. The new Chief will improve interactions with the Division of Cardiothoracic Surgery, co-lead the Center, coordinate clinical, educational and scientific cardiology efforts within the School, and cultivate relationships with practicing cardiologists in the community.
2. Continue to develop and grow state-of-the-art acute cardiac imaging (ACI). Led by Dr. Michael Poon, the ACI program has become a premier program within the cardiovascular community in Suffolk County, with many outside physicians beginning to refer patients to SBUH for advanced imaging studies. It also serves as a tremendous opportunity for clinical scholarship, both in developing new image analysis protocols and assessing its effects on clinical outcomes.
3. Expand several marquis clinical programs. SBUH is the Suffolk County leader in advanced electrophysiology, adult extracorporeal membrane oxygenation and the use of hybrid operating rooms. We propose to expand these programs to provide additional service to our community and to develop the clinical volumes necessary to develop robust clinical research programs.
4. Grow newly established cutting-edge programs. SBUH has begun to insert the Heartmate II ventricular assist device (VAD) in patients with severe heart failure, both as bridging and destination therapy. It is proposed to grow this program, by capturing more patients who leave Suffolk County for Manhattan, and to achieve The Joint Commission (TJC)-disease specific certification for VAD.
5. Develop new clinical programs. Recruit advanced surgeons and interventional cardiologists who have the clinical skills for new programs, particularly in percutaneous valve insertion.
6. Reestablish the pediatric heart surgery and interventional cardiology programs once approved by the NYSDOH.
7. Expand inpatient capacity by expanding the Heart Center footprint in the hospital expansion, secure incremental acute inpatient beds and expand the cardiac hospitalist/NP service.
8. Assist in the development of the clinical integration of physicians in Stony Brook Community Medical, PC. Begin with a focus on the care of heart failure patients.
9. Co-locate all Heart Center ambulatory services, cardiology, cardiac and vascular surgery in a new medical office building. ■

INSTITUTE FOR ADVANCED NEUROSCIENCES

OVERVIEW

The SBU School of Medicine is well positioned to assume a leading role in clinical care and research in the neurosciences. Faculty and staff expertise exists in clinical Neurology, Neurosurgery, Neuroradiology, Neurointerventional Surgery, Skull Base Surgery, Orthopaedics, Pediatrics and Ophthalmology. Stony Brook University Hospital is already an established Stroke Center, which has recently received Gold Plus recognition by the American Stroke Association. The hospital has invested heavily in state-of-the-art neuroimaging and neurointerventional angiography suites for the Cerebrovascular Center, led by Drs. Henry Woo and David Fiorella, in order to become the foremost cerebrovascular service in the region. Favorable publicity and community support have resulted from early success in this area, so there is ample opportunity to grow into a true multidisciplinary center of excellence. Collaboration with Brookhaven National Laboratory could advance non-invasive neuro-imaging on both a clinical and an experimental level. It is envisioned that the newly constituted Institute for Advanced Neurosciences will fully integrate hospital services, research and educational missions to serve as virtual neurosciences centers created around disease-based models. Each center will work collaboratively to provide efficient, effective and high-quality care alongside basic and translational researchers.

RECOMMENDATIONS

1. Further develop the cross-disciplinary Institute for Advanced Neurosciences. Promote collaborations between clinical researchers and basic scientists. Improve communications and planning among faculty in the established centers within the Institute.

“The Stony Brook University School of Medicine is well positioned to assume a leading role in clinical care and research in the neurosciences.”

2. Recruit a nationally recognized permanent Chair of Neurology. The School needs an individual who can build on current strengths in our clinical and research programs and collaborate with other departments. The Chair of Neurology could be a candidate to run the Institute for Advanced Neurosciences.
3. Develop a strong neurological intensive care unit. Integrate clinical care, teaching and research missions along with adjacent medical, cardiac, surgical, burn and pediatric intensive care units.
4. Build clinical volumes in neurosurgery, neurological disorders (multiple sclerosis, headache, stroke, movement disorders) and neuro-oncology. With our prominent position in cerebrovascular disease, acute amyotrophic lateral sclerosis (ALS), autism, multiple sclerosis and other disorders, critical marketing can be used to grow clinical volumes.
5. Support the development of a postgraduate training program in neurosurgery. All world-class neurological institutes train their next generation of faculty. This will require that new faculty be recruited with strong research programs and track records of successful mentoring.
6. Co-localize neurology and neurosurgery ambulatory practices in the new medical office building. ■

CANCER SERVICES

OVERVIEW

The Stony Brook University Cancer Center delivers multidisciplinary adult and pediatric disease-specific care for a large number of conditions, including cancers of the breast, lung, colorectal region, brain, soft tissues, skin, gynecologic tract, thyroid, head and neck region, leukemia and lymphoma, upper aerodigestive region and genitourinary tract as well as pediatric cancers. For a number of cancers, innovative therapies have been introduced, and in many cases SBUH serves as the only site on Long Island to offer such services. These include Cryoablation and Radiofrequency Ablation, the da Vinci® S HDTM Robotic Surgical System, a 3D Conformal Radiation Therapy, Image-Guided Body Radiation Therapy and Stereotactic Body Radiation Therapy with the ExacTrac® X-Ray System, and Respiratory Gating System for radiation delivery. For hematological malignancies, we offer a Blood and Marrow Stem Cell Transplantation Program, and for skin cancers a Mohs Micrographic Surgery option. As an academic medical center, we offer a wide range of cancer clinical trials and research programs. However, we strive to achieve NCI designated comprehensive cancer center (NCI-CCC) status, necessitating expanding our clinical trials range and enrollment numbers, and our support for research through NCI-sponsored basic cancer biology grants. Currently, a national search is underway to identify a new Director of the SBU Cancer Center, focusing on an active physician-scientist or basic biomedical scientist. Finally, our proximity to Cold Spring Harbor Laboratory and Brookhaven National Laboratory is viewed as an opportunity to create important new scientific collaborations in cancer and cancer imaging, and to create a pipeline for novel, first-in-man therapeutic trials.

RECOMMENDATIONS

- 1. Recruit a Cancer Center Director.** The new Director should be a physician-scientist with a record of success in research or a basic cancer researcher who has a great appreciation for the importance of clinical translation and excellence. The successful candidate must be devoted to establishing a multidisciplinary center of excellence for cancer care and research. Resources must be made available to allow for recruitment and expansion of the research and clinical facilities.
- 2. Expand the clinical trials office into a robust support organization that enhances patient accrual and initiating clinical trial protocols.** The stem cell transplant program, led by Dr. Michael Schuster, can act as a catalyst of a broader cancer clinical trials support infrastructure, and incorporation into the CTS infrastructure (see Enhancing Critical Infrastructure I/Institute for Clinical Translational Sciences, above) could allow development of important efficiencies and best practices.
- 3. Develop expanded clinical facilities that fully incorporate radiation oncology along with additional clinical and research capabilities.** Our current clinical volumes are insufficient to support adequate clinical trials for success as a NCI-CCC. Increased clinical space and outreach to our community partners is required.
- 4. Expand the inpatient stem cell transplant (SCT) program along with needed clinical space and support space, allowing the hematological malignancy program to grow.**
- 5. Support targeted recruitments to rebuild the Gastrointestinal Cancer program.**



The planned Medical and Research Translation (MART) building will include a new Cancer Center and will bring together scientists, “translationalists” and clinicians to foster communication amongst all components necessary to bring clinical problems into the laboratory for intense study, and basic science innovation to the clinic. It will also provide additional space for medical education, biomedical informatics and innovative clinical and research imaging in the School of Medicine.

6. Recruit physician-scientists who can collaborate with scientists on campus and those at Cold Spring Harbor and Brookhaven National Laboratories.
7. Integrate the Cancer Center with the Northport VAMC to expand the volume of patients and to leverage resources for clinical and research physician scientist recruitment, space and research support.
8. Develop a neuro-oncology disease management team. Because of our strength in neurosciences, a robust neuro-oncology program will dovetail with our clinical and research cerebrovascular and degenerative neurological disorder programs.
9. Expand palliative care to the outpatient clinic setting, to support patients and their families, and to enhance our inpatient service to be able to see a broader array of patients. Establish a comprehensive training program in Compassionate Care that achieves both local and national recognition.
10. Enhance our relationships with community hematology/oncology groups. One mechanism is through development of Stony Brook Community Medical, PC; the other is to create a “community board” of interested oncologists who could serve as a steering group for joint SBU/community oncology trials.
11. Co-locate all inpatient oncological beds on the 17th, 18th and 19th floors.
12. Achieve the clinical milestones (patient volume and clinical trial enrollment) necessary to submit a planning grant for NCI-CCC designation within five years. ■

WOMEN'S AND CHILDREN'S SERVICES

OVERVIEW

With opening of the hospital in 1980, Obstetrics, Gynecology and Reproductive Services and Pediatrics were brought on site within the School of Medicine. There has been tremendous growth in faculty and clinical services since that time, and SBUH now serves as the Regional Perinatal Center. More recently, an assessment by the National Association of Children's Hospitals and Related Institutions supported the development of a Children's Hospital in Suffolk County, based on demographic need and the presence of a critical mass of pediatric faculty and expertise in providing specialized care. There is considerable support to continue to develop Women's and Children's Services within the community and within Stony Brook University.

RECOMMENDATIONS

1. Develop Stony Brook Long Island Children's Hospital. We will continue to work with Advancement, the Stony Brook Children's Hospital Task Force and the Stony Brook Council to obtain the necessary financing for the building of a 120-bed expansion to SBUH to house the new Children's Hospital.
2. Build a new inpatient facility that is child and family friendly, single bedded and provides appropriate accommodations for adolescents, play and family space, and patient centered care based on the most advanced information systems.
3. Assure collaboration across pediatric specialties to enable the success of Stony Brook Children's. An organizational structure that facilitates joint

program building in children's services across SOM Departments, branding and reputation enhancement is needed to be successful with this initiative.

4. Build new, unique pediatric clinical programs that serve regional needs and will support the growth of research programs (e.g., muscular dystrophy, adolescent programs, pediatric cardiac surgery and interventional programs).
5. Establish Extracorporeal Membrane Oxygenation (ECMO) in support of Neonatal and Pediatric Critical Care and Pediatric Cardiac Care.
6. Expand the primary care base and affiliations with community hospitals to grow referrals to tertiary care service.
7. Engage community pediatricians and subspecialists in the success of SB Children's.
8. Build a pediatric clinical trials network.
9. Expand high-risk perinatal services to capture additional patients throughout the region.
10. Expand women's and children's cancer services in coordination with the Cancer Center.
11. Create new programs in pediatric neurology, including a muscular dystrophy certification and movement disorders program.
12. Have a full-service pediatric ED that is open 24/7 and provides care for all pediatric patients, including trauma and critical care.
13. Establish a comprehensive pediatric ambulatory subspecialty clinic that includes both cognitive and surgical specialties in the new medical office building. ■

EMERGENCY/TRAUMA SERVICES

OVERVIEW

The Emergency Department is the source of approximately 60 percent of the admissions to SBUH and is the region's only Level 1 Trauma Center. The Department of Emergency Medicine also runs the Emergency Department at Peconic Bay Medical Center, further supporting our outreach for education and potential clinical referrals.

RECOMMENDATIONS

1. Continue to support the expansion of regional emergency services to other hospitals.
2. Expand the health services research program within Emergency Medicine.
3. Finalize construction of ED facilities to include a new Comprehensive Psychiatric Emergency Program and fully staff (24/7) the Pediatric ED.
4. Study the implementation of advanced imaging in the ED, to allow enhanced accessibility and make resuscitation imaging possible.
5. Participate in CEWIT collaborations in IT and wireless monitoring.
6. Expand global emergency medicine training opportunities in Incheon and Cheju Island, South Korea. ■



Stony Brook University Medical Center provides Suffolk County's only Level 1 Trauma Center.

PROGRAM IN GASTROINTESTINAL EXCELLENCE

OVERVIEW

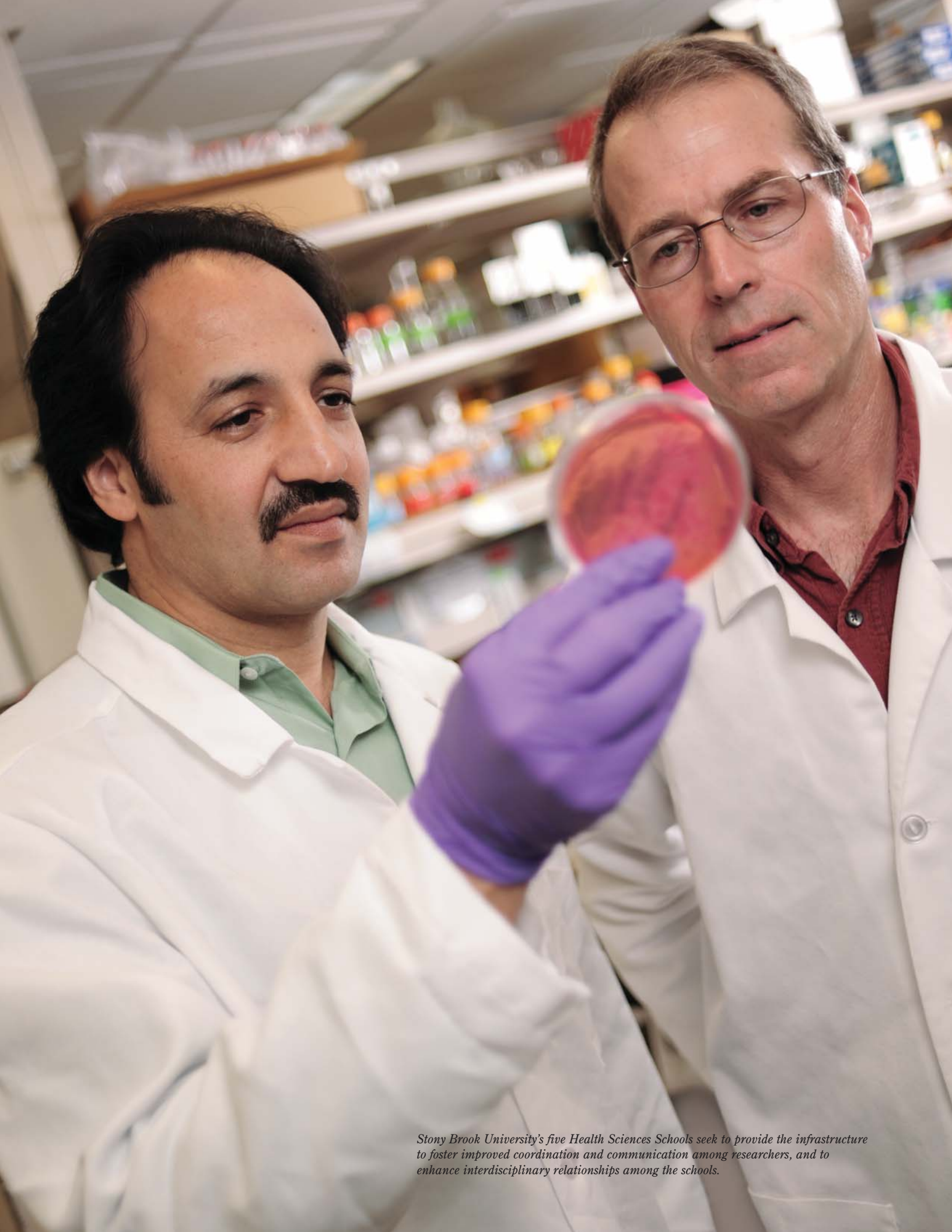
This year *US News and World Report* ranked the gastrointestinal services at Stony Brook University Medical Center (SBUMC) among the Top 50 programs in the country. With a growing clinical and research enterprise, the School has an opportunity to establish itself as the regional market leader in GI services.

Our vision is to create the SBU Program in GI Excellence to address GI disorders that are prevalent, challenging, instructional, and often require interdisciplinary approaches, can form the basis of an innovative clinical research effort and creates a paradigm of response to societal needs. The Institute will consist of GI Centers that will each be a functional unit that efficiently addresses a group of related diseases, includes two to three nationally recognized GI experts as physician leaders, and brings together the relevant SBUMC medical talent.

The GI Program will focus on seven topics and will be established over the next three to five years. We anticipate developing excellence in (1) GI cancer screening, (2) inflammatory bowel diseases (IBD; Crohn's disease and ulcerative colitis), (3) advanced endoscopy and pancreaticobiliary diseases including pancreatic transplant, (4) GI motility and esophageal disorders, (5) liver diseases, possibly including transplantation, (6) women's GI health, and (7) nutrition, weight control and bariatric/metabolic disorders. Each center, under the umbrella of the Program, will provide state-of-the-art medical care, be profitable, conduct cutting-edge clinical and basic research, be a center of medical education, interact with the community and attract extramural funding. Through its clinical and scholarly activities, the Program will differentiate SBUMC from its regional competition, enhance the Hospital's operational performance, and elevate SBU's reputation as a world-class healthcare organization.

RECOMMENDATIONS

1. Continue to recruit physician leaders necessary to fully realize each of the seven centers within the Program. We project recruiting four physicians (assuming no replacements of the current faculty will be necessary): one for GI cancer screening, one for advanced endoscopy and pancreaticobiliary diseases including pancreatic transplant, one for GI motility and esophageal disorders and one for nutrition, weight control and bariatric/metabolic disorders (in conjunction with one surgeon with expertise in this area, to be hired by the Department of Surgery).
2. Expand the endoscopy facilities to accommodate approximately 50 percent growth over five years.
 - Expand outpatient capacity to accommodate approximately 50 percent growth over five years.
 - Grow our Pediatric GI service. Many GI disorders on which we will focus often begin in childhood, and with construction of the new Children's hospital, a balanced adult and pediatric service will enhance transition of clinical care in adolescence. The most prevalent disorders in this "transitional" population include eating disorders, irritable bowel syndrome and IBD. We will employ a novel, comprehensive approach that will incorporate expertise from pediatric GI, adult GI, nutrition and surgery. These patients will be treated by the Children/Adult Transition GI Service, which will address their needs in toto, instead of referring them from one subspecialist to another. ■



Stony Brook University's five Health Sciences Schools seek to provide the infrastructure to foster improved coordination and communication among researchers, and to enhance interdisciplinary relationships among the schools.

The Stony Brook University community lives within many local, regional and national communities. As such, the broad goals of the SBU School of Medicine are to provide state-of-the-art innovative care to Suffolk County, while serving as a resource to a regional healthcare network and to the traditionally underserved. We will foster community awareness and involvement throughout the mission of teaching, research and service, by defining and responding to specific needs of our external communities. It is our expectation that the SBU School of Medicine will become a national leader in fostering and teaching the congruence of the science and the art of medicine, graduate students who serve as exemplars of scientific excellence *and* humanistic care in the practice of medicine, individuals who are adept at developing and applying new knowledge and procedures to solve unique or novel problems in the ever-changing field of medicine.

BUILDING A COMMUNITY-ORIENTED RESEARCH INFRASTRUCTURE

OVERVIEW

Our goal is to create an infrastructure that fosters coordination and communication among researchers engaging in community-based research and enhances interdisciplinary relationships between and among the five SBU Health Sciences Schools. At present, research projects have been investigator-driven rather than community-driven, resulting in a perception of disconnection between the University and the community within and among community groups. Moreover, an infrastructure that fosters coordination and communication among researchers engaging in

community-based research is lacking. To accomplish this, we will assess the needs of the internal and external community to guide research activities and program planning, establish bidirectional communication between the community and the researchers, inform internal and external community members about the benefits of community-based participatory research and how it can empower communities to take control of their health and drive social change, and based on this discovery process, create a viable and sustainable community-based research infrastructure.

RECOMMENDATIONS

1. Enhance the existing research infrastructure to include community-based participatory research. Provide new resources to the clinical trials office to encourage community recruitment of physicians, and their patients, in healthcare research.
2. Educate and train community members and voluntary clinical faculty on community-based participatory research, community engagement, cultural competency, cultural sensitivity, and health literacy. To enhance opportunities for collaboration, build public trust by nurturing our researchers' relationships with the community through seminars and office visits. Monitor, track, and evaluate community-based research activities by creating a database that is community healthcare provider accessible.
3. As healthcare outcomes studies are generally regarded as “community friendly,” enhance efforts to develop a comprehensive healthcare outcomes research agenda and set priorities. Recruit an outcomes research leader and two additional faculty members focused on both School of Medicine and community patients. Partner with the office of Health Outcomes Research at Winthrop University Hospital to increase these opportunities.
4. Assist investigators with recruitment from the community and provide resources and networking opportunities between researchers and community members.
5. Monitor, track, and evaluate community-based research activities. ■



To help the Stony Brook University School of Medicine achieve a more diverse faculty and student body, student pipeline programs should be enhanced.

ACHIEVING EXPANDED SCHOOL OF MEDICINE FACULTY DIVERSITY

OVERVIEW

At present, the SOM is not very representative of the community in which we live, with 7 percent, 10 percent and 11 percent of faculty, housestaff/fellows and medical students reported as Underrepresented Minorities in Medicine (UMM), compared to 33 percent of the population in New York State that is Black or Latino (US Census 2010). Much evidence exists that various communities prefer to be “doctored” by people from their own community. If we are to increase our pipeline of faculty, house staff and student diversity, high school and college underrepresented minority students need role models that look like them, understand their culture and can relate to their backgrounds. An institutional commitment to diversity demonstrates that it is possible to become a doctor. Likewise, a diverse SOM faculty demonstrates to our medical students and residents that it is possible to be a successful academic physician of color. To help the School achieve a more diverse student body and faculty, it is proposed that we assess our current diversity pipeline programs, enhance those programs (or others) that are successful, target broadly, aiming at high school, college and graduate students, and develop recruitment and retention programs designed to diversify faculty, staff and students at all levels. To accomplish these goals it will be necessary to invest in an Office of Multi-Cultural Affairs.

RECOMMENDATIONS

1. Make efforts and successes in diversifying the workforce a critical part of the evaluation of department chairs. The dean’s office will provide faculty and resident demographic data to department chairs annually.
2. Departments will evaluate the steps taken to diversify their workforce. The Dean’s office will develop and provide best practices, and the departments will analyze their practices and construct and report their action plan to the Dean’s office.
3. Identify, examine, and address the problems and issues that are barriers to recruiting and retaining members from underrepresented groups within departments/divisions. In order for this effort to be successful, an expansion of outreach activities will be necessary, facilitated by a distinct Office of Faculty Diversity.
4. Reward chairs and departmental units that are making substantial progress in enhancing the diversity of the work environment by providing additional recruitment resources.
5. Build pipeline programs that will enhance the entry of underrepresented minorities into medicine and monitor their success.
6. Emphasize overcoming adversity in the medical school admissions standards. ■

TRAINING AND EVALUATION IN CULTURAL COMPETENCY IN UGME/GME

OVERVIEW

We will develop an infrastructure to support continuous teaching and learning in cultural competency and health literacy utilizing, but not limited to, the AAMC Tool for Assessing Cultural Competence Training (TACCT; <https://www.aamc.org/initiatives/54262/tacct/>). We hope to utilize existing curricular structure formats (e.g., MCS, Foundations) to accomplish this goal. Our training will:

- Be positive, meaningful and reflect real-life experiences.
- Involve cooperative rather than competitive experiences and thus promote skills associated with teamwork and community involvement and citizenship.
- Address complex problems in complex settings rather than simplified problems in isolation.
- Offer opportunities to engage in problem-solving by requiring participants to gain knowledge of the

specific context of their service-learning activity and community challenges, rather than drawing only upon generalized or abstract knowledge, such as might come from a textbook.

As a consequence of this immediacy of experience, service-learning is more likely to be personally meaningful to participants and to generate emotional consequences, to challenge values as well as ideas, and hence to support social, emotional and cognitive learning and development.

RECOMMENDATION

Develop curriculum to teach cultural competency for both students and residents, as part of the graduation requirements. There are many possible sources of such curriculum; we can enhance the curriculum already present in the SOM and residency programs and borrow from the other SUNY Schools of Medicine, or other Schools of Medicine or Graduate Studies. ■



The School of Medicine will develop an infrastructure to support continuous teaching and learning in cultural competency and health literacy.



The Stony Brook University School of Medicine global medicine program provides healthcare and education to clinics and hospitals in sub-Saharan Africa, South America and several other sites, while providing important insights and experiences for our own learners.

GLOBAL MEDICINE

OVERVIEW

The practice of medicine in SBUH and clinics relies heavily upon technology for diagnosis and treatment. Although the repertoire of illness and societal impacts upon health are quite broad on Long Island, they pale in comparison to those found in the developing world. Moreover, through education and direct patient care, our learners can provide a vital service to the underserved abroad. Finally, global health teaches us all about emerging infectious diseases, about the face of illness in the absence of quality care (e.g., AIDS in the developing world appears as it did in the U.S. prior to the availability of highly active anti-retroviral therapy), about how to use basic skills of careful history taking and physical examination to make accurate diagnoses, about how a drug or a device that works well in New York City might not work so well in a village in remote Kenya, and about compassionate care. Over the past many years the School of Medicine has placed medical students in a diverse range of global health environments, but our current program is diffuse, frequently conducted at sites never before visited by our faculty or students, and has been limited in scope, being almost entirely focused on undergraduate medical students. It is proposed to expand the global medicine program to residents, fellows and faculty, focusing on sites where the School of Medicine has already developed strong relationships with the local health-care establishment and/or governmental officials. Through continuity of clinical care at a manageable number of carefully selected sites, it is anticipated that

strong, bi-directional relationships will be built with global communities, enriching both partners. Because of already established relationships in sub-Saharan Africa, in Kenya and Mozambique, and in Latin America, in Peru and Nicaragua, it is proposed to grow these sites and allow medical students, residents, fellows and faculty the opportunity to participate in (both receiving and delivering) education, clinical research and service.

RECOMMENDATIONS

1. Establish two bi-directional global medicine collaborations in sub-Saharan Africa, likely with the Methodist University of Kenya School of Medicine, in Meru, Kenya, and University Eduardo Mondlane School of Medicine, in Maputo, Mozambique.
2. Establish two bi-directional global medicine collaborations in Latin America, likely with the Autonomous University of Nicaragua, in Leon, Nicaragua, and either the US Naval Research Station in Lima, Peru, or the Oswaldo Cruz Foundation in Brazil.
3. Establish sustainable funding mechanisms to allow at least 40 month-long global medicine experiences abroad per year.
4. Establish mechanisms to allow global partnering Institutions to send trainees to SBU SOM for additional training experiences. ■

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**Stony Brook University
School of Medicine Strategic Plan**
Produced by the Office of
Communications.

**Assistant Vice President for
Communications:** Yvette St. Jacques

**Senior Director, Public Affairs and
Marketing:** Clinton Weaver, MBA

Copy Editor: Clinton Weaver, MBA

Art Director: Karen Leibowitz

Designers: Agapito Design Studio; Allison
Schwartz

Photography: Sam Levitan, Media
Services, Juliana Thomas and
courtesy of Stony Brook University School
of Medicine

Rendering page 45: Prepared by the
architecture and urban design firm of
Cooper, Robertson & Partners.

Stony Brook University/SUNY is an affirmative
action, equal opportunity educator and employer.
This publication can be made available in an
alternate format on request. ©2011
11010690H



Stony Brook, NY 11794-9445

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