

## New Brunswick Strategic Planning Proposal

**Proposal Title:** Development of an imaging core facility for supporting collaborative projects within SAS and beyond

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**Primary Strategic Priority/Foundational Element/Integrating Theme Addressed (Select one)**

- Envision Tomorrow's University
- Build Faculty Excellence
- Transform the Student Experience
- Enhance Our Public Prominence
- Strong Core of Sciences and Humanities
- Inclusive, Diverse, and Cohesive Culture
- Effective and Efficient Infrastructure and Staff
- Financial Resources Sufficient to Fund Our Aspirations
- Robust Shared Governance, Academic Freedom, and Effective Communication
- Cultures, Diversity, and Inequality—Local and Global
- Improving the Health and Wellness of Individuals and Populations
- Creating a Sustainable World through Innovation, Engineering, and Technology
- Educating Involved Citizens and Effective Leaders for a Dynamic World
- Creative Expression and the Human Experience
- Measuring Progress and Defining Success

### Proposal Abstract

Visualization of molecular and cellular structure has been the key to major advances in the sciences, and access to ever more powerful microscope technologies has become critical to answering fundamental questions in many fields. In the Department of Cell Biology & Neuroscience and Keck Center, we have been building strength, both intellectual and technical, in imaging technologies that span the range from cryoelectron microscopy to two-photon imaging of neural activity in vivo. To foster collaboration, competitiveness for funding opportunities, and exchange of ideas with other SAS, SEBS, and RBHS departments, we have provided a Confocal Zeiss 510 microscope facility. To augment this capability, we recently applied for, and received, a half-million dollar grant from the state to purchase an IN Cell Analyzer 6000 which offers investigators the ability to conduct highly automated measurements of cell structure and function. As a part of our efforts to encourage collegial interactions, we plan to also offer access to the IN Cell Analyzer as a facility, and are requesting funds to hire personnel to help train investigators to use the equipment and to assist in its operation. Our intent is to charge user fees after a trial period and thus make the facility self-supporting. In addition, we will incorporate this equipment into our Advanced Laboratory courses and undergraduate research programs so as to give SAS students

the unique opportunity to be truly at the cutting edge of scientific discovery and gain an experience available only at a research university such as Rutgers.

## **Full Proposal Description**

### **a) Proposed work**

Starting with the seminal observations of living cells by Anton Van Leeuwenhoek in the late 1600's that ushered in the age of modern microscopy, the analytical power of visualizing cell structure and function has become increasingly evident. Imaging techniques have historically been crucial for resolving debates such as the acceptance of cell theory and the neuron doctrine, and have increased in importance as technical hurdles have been overcome. Today's techniques are capable of clarifying molecular interactions with resolving power undreamed of a decade ago. In the Department of Cell Biology & Neuroscience and the Keck Center, we have been building faculty strength in the most recent cutting-edge methodologies, ranging from super-resolution microscopy to two-photon imaging of in vivo neural activity. Our long term plan is to be on the forefront of imaging technology, both in terms of faculty expertise and providing facilities for use by the Rutgers community. This proposal is directed at one element of our overall program.

As imaging technology has matured, it has become clear that ease-of-use and high throughput are of paramount importance, particularly to those who want to access the technology without necessarily having to become experts. To this end we applied to the New Jersey Equipment Leasing Fund to purchase the IN Cell Analyzer 6000, a high-end, half-million dollar, laser-based confocal imaging microscope that excels at performing demanding high-content assays and screens in a largely automated fashion. We were awarded the funds and recently installed the instrument in the Keck Center. In addition to using this technology as part of CBN faculty research programs, it is our aim to make this instrument available to the larger Rutgers community as a fee-based facility. By incorporating the In Cell Analyzer 6000 into our current workflow, the facility will accelerate efforts and allow users to generate data from discovery all the way to clinical applications. In the future, we hope to further extend our capabilities to high throughput mapping of neuronal circuits in conjunction with super-resolution microscopy. A few users will be trained on the In Cell Analyzer 6000, and one of the trainees will be Dr. Noriko Kane-Goldsmith, who has managed the Neuroscience Imaging Facility for more than a decade. She has trained dozens of users in confocal microscopy and we anticipate that she will train additional users when funds are available to do so.

Listed below are several possible uses that will likely be beneficial to a wide range of investigators at Rutgers but others exist.

- High Content and High Resolution Confocal Imaging
- Validated Analysis Software
- Small Molecule Screening
- RNAi Screening
- Mutant Zebrafish and Worm Screening
- High-Throughput Calcium Imaging
- Cellular Proliferation Assay
- Morphological Assay (i.e. Neurite Growth)
- Cell Viability Assay

In addition to researchers, we intend to make this facility available to undergraduates in our Advanced Laboratory courses. We have noted in our surveys of student views on their Rutgers education that there is (not surprisingly) a correlation between class size and satisfaction with their major. The Advanced Lab courses offered by CBN are limited enrollment courses with extensive faculty-student interactions that provide undergraduates with the opportunity to learn research-grade techniques in a structured classroom environment. Students who take these courses rank their satisfaction with the major very highly (100% of students surveyed rank the major as 4 or 5 on a scale of 5) compared to students who did not take an Advanced Lab course who rate the major somewhat less highly (75% of students rank the major as 4 or 5).

The major motivation to write this grant is to request seed money to incorporate the IN Cell Analyzer 6000 into the larger context of a New Brunswick Neuroscience Imaging Facility so that a wide range of users can apply it to their projects. Keck Center faculty have more than a decade of experience in running the Confocal Zeiss 510 Meta in the Neuroscience Imaging Facility along with other microscopes and a variety of software applications. There are manifold benefits from such a facility, including increased analytical capabilities and promotion of collaboration, but one benefit that deserves special mention is momentum. As we build this facility and its user base, we will provide needed evidence to apply for NIH Shared Instrumentation Grant (SIG) funding to continue progressing with our long-term plan. Our next goal is to obtain funding for one or more of two-photon and super-resolution microscopes to add to the core. Since we have this technology in the labs of our faculty we have the unique capability to collect preliminary results and to exhibit expertise in these areas. Our vision for the future is to continue building and leveraging our existing resources so as to provide an unparalleled resource to the New Brunswick scientific community.

## **b) Alignment with the University Strategic Plan**

This proposal aligns well with the University Strategic Plan, particularly “Effective and Efficient Infrastructure and Staff”. We feel that the IN Cell Analyzer 6000, the support staff and faculty expertise will be of great value to a number of departments such as Biomedical Engineering, Chemistry & Chemical Biology, Genetics, Molecular Biology & Biochemistry, as well as a number of units in RBHS.

## **c) Additional priorities addressed**

- Build Faculty Excellence
- Transform the Student Experience
- Enhance Our Public Prominence
- Strong Core of Sciences and Humanities
- Financial Resources Sufficient to Fund Our Aspirations

As noted above, this proposal also addresses other priorities in the University Strategic Plan. Having a comprehensive imaging facility will be useful when attracting faculty hires and will help build faculty excellence. Incorporating use of the equipment into undergraduate curricula will improve the student experience, translating into better alumni relations. As our program proceeds, and facilities such as in vivo imaging and cryoelectron microscopy are brought online, our prominence in the scientific community will increase, we will build upon core strengths in our existing faculty, and, importantly, we will increase our competitiveness for external funding.

#### **d) Who will be involved?**

We anticipate that the user base for this facility will be large. In addition to interest expressed by faculty within the Division of Life Science, we have also received letters of this support from faculty members of units outside SAS (listed below), thus confirming that building core imaging facilities would lead to enhanced collaboration across institutional boundaries.

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#### **e) Desired outcomes**

The primary desired outcome is to build a world-class suite of cutting edge facilities that will enhance our research programs, lead to new discoveries, and provide new insight into fundamental mechanisms of molecular and cellular function. We anticipate that our findings will lead to an improved understanding the nature of diseases and directly help the development of new therapeutic approaches for the treatment of injury and disease via collaboration with the RBHS. Moreover, the advent of the

NIH BRAIN Initiative makes this a particularly propitious time to make an investment in imaging technologies.

**f) Anticipated resources**

We anticipate that the facility can become self-supporting within a two year period. In the interim period, we request funds to get the facility off to a successful start. As we build a user base, we estimate that we will need 50% of a technician's salary in Years 1 and 2 (\$50K/year, includes fringe) and funds to pay for a service contract in Year 2 (\$50K) for a total request of \$150K over two years. We feel strongly that funding of this proposal would bring significant benefits to the faculty and students alike.

**Proposed Measures to Mark Progress or Determine Success**

Measuring progress and determining the success of this venture will be straightforward. We anticipate that faculty that take advantage of the IN Cell Analyzer 6000 will be able to increase their research productivity, engage in experimental strategies that may have been too costly or technically out of reach, and generally expand the scope of their research programs. We further expect an increase in the number of successful applications for external funding, an increase in the number of hires from top institutions, and an increase in our motivation to continue building an outstanding set of imaging facilities that will be the envy of institutions world-wide.

**Please save your proposal as a Word document and submit it as an email attachment to [NBStratPlanProposals@rutgers.edu](mailto:NBStratPlanProposals@rutgers.edu) by April 15, 2014.**