STRATEGIC PLAN FOR THE DEPARTMENT OF NEUROBIOLOGY AND BEHAVIOR

Understanding how the cells and circuits of the brain can give rise to consciousness, emotions and the myriad sensations that collectively confer the feeling of being human is both the challenge and the inspiration for the neurobiologist. In many ways the brain is the final frontier of science and medicine. Although the detailed workings of the nervous system remain a mystery, new interdisciplinary tools and approaches encourage optimism that progress will now be very rapid. Excelling in cutting edge basic and translational neuroscience research and helping to prepare and inspire young scientists to meet these challenges is the primary mission of the Department of Neurobiology and Behavior at Stony Brook University.

Neuroscience is both eclectic and multidisciplinary: it integrates ideas and techniques from molecular biology, computer science, anatomy, physiology, psychology, pharmacology, physics, mathematics and statistics. The discoveries of the neuroscientist have direct implications for fields as disparate as clinical medicine, linguistics, anthropology and philosophy. It is vital to the current dynamism and future growth of our University that the Department of Neurobiology and Behavior -the academic heart and head of neuroscience on campus- realize its potential for international eminence.

This strategic plan outlines our vision of the major opportunities and challenges facing the Department of Neurobiology and Behavior in continuing to foster excellence in our educational and research endeavors.

1. Instruction

One of the unique advantages of Stony Brook University is the physical proximity of its undergraduate and medical school campuses. This provides the opportunity to leverage resources and create direct links, both teaching and research, between undergraduate and graduate medical programs and cultivate interactions between basic science and clinical faculty. The strength and success of this configuration is exemplified by the Department of Neurobiology & Behavior (aka NB & B), as it stands at the confluence of all neuroscience-related educational and research activities at Stony Brook University, acting as a vital bridge between East and West campuses.

Our faculty contributes to the instruction of undergraduate, graduate (CAS and CEAS) *and* medical (SOM) students, functioning as a single, seamless unit with both CAS and SOM appointed members actively participating in didactic and scholarly services of both West and East campuses.

In addition to bridging undergraduate and medical education, the Department of Neurobiology and Behavior provides campus-wide and inter-institutional links as the administrative and financial home for the interdepartmental and multi-institutional Program in Neuroscience (PiN). The PiN program includes nearly 50 faculty from the Departments of Biochemistry, NB & B Pharmacology, Physiology, Psychology and Medicine at Stony Brook, as well as faculty at the Brookhaven National and Cold Spring

Harbor laboratories. The PiN director (Dr Joel Levine) *and* the PiN co-ordinator (Ms Diane Godden) serve critical functions for the large and inclusive PhD program. The T&E of these individuals is essential to the continuance of PiN. Indeed, if it were not for the additional dedicated efforts of the PiN graduate program co-ordinator (currently Ms Godden) we would be unable to make progress toward creating a Masters in Neuroscience program as planned (see below).

Current Responsibilities

Undergraduate

- NB & B faculty direct and teach all courses in physiology and in neurobiology in the undergraduate biology curriculum. These include BIO 203 (Mammalian Physiology: approximate enrollment: 1000 students), BIO 317 (~200 students), BIO 328 (~400 students), and the laboratory course for physiology and neurobiology, BIO 335 (~100 students).
- NB &B faculty direct and teach all courses in the Neuroscience track of the biology major including BIO 334 (~200 students) and BIO 339 (~90 students)
- NB &B faculty direct and teach a neuroscience course for non-biology majors: BIO 208 (~200 students)
- NB &B faculty direct and develop a new syllabus each year for summer-sessions of BIO 203 (~250 students / summer session)
- NB &B faculty developed one of the first "hybrid format" versions of a high demand Bio major's course for summer sessions at SBU and for instruction at South Hampton. The creation of a hybrid Bio 203 was done to assure that all students receive identical quality and complete coverage of Bio 203 material.
- NB &B faculty developed and added 3 new summer school session courses this past year. The summer session of BIO 208 is taught by a CAS/NB & B full Professor. Summer sessions of Bio 317 and Bio 334 have been developed in hybrid format and as such are taught by NB& B faculty with advanced post doc assistance.
- Extensive participation by both NB&B faculty and PiN graduate students in other Biology program (non-neuroscience) courses (e.g., BIO 320 (Genetics), ~400 students; Bio 205 Introductory Bio. laboratory course)
- NB &B faculty actively participate in the Undergraduate College's 1st year seminars for incoming freshmen (3-5 per annum run by NB&B faculty, including the Chair)
- NB &B faculty are extensively involved in the training and supervision of high school and college undergraduates in neuroscience research (1-2 per research-active faculty during the school year; as many as 4/ research-active faculty during summer). Both URECA and MARC fellowship students abound in the department and several NB & B supervised high school students have been awardees in the Siemens and Intel Science competitions.

  Excellence in undergraduate education by NB & B faculty has been recognized by multiple awards from both the University and the State of New York.

  Graduate

- The NB & B department founded an interdepartmental and inter institutional graduate Program in Neuroscience (PiN) in 1989. The Department of NB & B provides all staff and financial support for admissions processing and orientation events as well as administrative and stipend support for every PiN student, including those who ultimately carry out their thesis in other departments/institutions.
- N B & B departmental core faculty are responsible for <u>all</u> courses in PiN. Presently, we run nine (9) graduate level courses (BNB 561, 562, 563, 564, 551, 555, 597, 560 & 697) with each course having a typical enrollment of between 8-15 students. These courses are also open to graduate students in all other SBU programs.
- The Program in Neuroscience presently has 35 enrolled students with 11 of these in laboratories of faculty who are outside of the Department of Neurobiology & Behavior
- NB & B organizes and funds a seminar series that brings ~20 internationally renowned neuroscientists to the SBU campus each year. The seminars are grouped into 2 major themes: the fall semester theme changes each year (this year: neural stem cells/adult neurogenesis) and the spring semester seminars focus on Neurobiology of Disease. These seminars are open to the campus community and are regularly attended by faculty and students from Biochemistry, Computer science, Pharmacology, Physics and Psychology as well as by many members of the East campus departments. The department pays all travel, lodging, meals and honoraria for the speakers who routinely meet with several non NB & B faculty and have lunch with all PiN students wishing to attend.
- The Department of Neurobiology in conjunction with the Program in Neuroscience sponsors an annual graduate student retreat and symposium in neuroscience that highlights student presentations and an honored alumnus and to further foster post doctoral and faculty interactions in a full day forum.
- The majority of faculty members are actively involved in the training, teaching and participate (i.e. teach, mentor and serve on qualifying and thesis committees) of multiple students from other SBU departments and programs (e.g. Genetics, Pharmacology, Molecular & Cellular Biology, Biochemistry, Physiology etc) as well as from CSHL and BNL.

Medical

- NB & B faculty (both SOM and CAS affiliates) direct and participate in all didactic (lecture and laboratory) sessions of the Medical Neurosciences I course (required for first-year medical and dental students; enrollment ~175).
- NB & B faculty (both SOM and CAS affiliates) participate in the training of neurology residents, leading ~8 x 2hr lecture and discussion sessions each fall.
- NB & B faculty (2 CAS affiliates) participate in the training of the Ophthalmology Fellows, by giving ~6 lectures/ annum.

  Medical school education is done with attention to excellence as evidenced by NB & B faculty (Kritzer) receiving the Aesculapius Award, which recognizes excellence in teaching.

Future Plans

- Develop an undergraduate major in Neurobiology and Behavior
- Develop new courses for the Neuroscience curriculum. Courses in planning/ submission at this time include 300 level (CAS) courses on Neuromodulatory Circuits and Behaviors, and another on the Biological Basis of Neurological and Psychiatric Disorders. We are exploring the possibility that both of these courses will be developed with the option of "upgrading" to a 500 level listing by participation in additional recitation sections and submission of a research paper (to be open to all Masters and Doctoral candidates at SBU)
- Revamping BIO 335 (Physiology lab) to update its contents to a more modern neuroscience related curriculum
- Establish a master's degree program in Neurobiology and Behavior
- Obtain NIH training grant support for the Graduate Program in Neuroscience
- Improve recruitment and retention of underrepresented minorities in the Graduate Program in Neuroscience
- Integrate the Graduate Program in Neuroscience with clinical departments including having clinicians on advisory boards
- Continue to expand the faculty in the Graduate Program in Neuroscience, as appropriate new faculty arrive at Stony Brook, BNL, and CSHL
- Continue to expand summer course offerings for undergraduate students
- Develop courses for Winter Session
- Continue and expand participation by Department faculty in resident training activities in appropriate clinical departments within the medical school

2. Research

Summary of Funding

Individual faculty in the Department continue to fare extremely well in obtaining external grant funding and in receiving other forms of national and international recognition, despite the increasing competition for such support and accolades. Several NB & B faculty members are asked each year to present plenary sessions / symposia talks at major scientific meetings in the US and abroad. Such invitations are important in cementing SBU's reputation as a center of excellence in neuroscience research.

A snapshot of NB & B faculty grants that are active during the current academic (2009-2010) year is as follows:

Source	total #	$/annum
Federal	22	$5,913,860
(NIH including NINDS, NIMH, NEI, NDCD, NICHD)		
New York State	3	$735,444
(SCIR; Spinal Cord Injury Research)		

Stem Cell	2	~250K
Private (Klingenstein, Merck, NARSAD, MSAssoc., AHA Christofer Reeve Foundation)	7	$547,882
Total	**34**	**~$7.4 M**

Counting only NIH grants, the average grant funding per faculty member for the 17 full-time faculty is approximately $350,000 per year, as of July, 2010. When state and private funding sources are included, the amount per faculty member rises to ~$500,000 per year.

In addition, last month Department Chair Lorna Role was told that she was selected for an NIH Directors Pioneer Award ($500K/annum, x 5 years) which is not included above (award expected start date October 2010). Likewise Dr Alfredo Fontanini has been informed that he is the recipient of the Presidential Early Career Award in Science in Engineering (PECASE). The additional income associated with this award is yet to be announced but in any case the 2011 budget year should yield ~8 M in research dollars earned by the efforts of the 17 full time faculty within the Department of Neurobiology *per se*.

**Please note that we have not included in these totals several K01 awards to non tenure-track faculty within the department and Individual NRSA Predoctoral Fellowships received by graduate students in the Program in Neuroscience during the 2009-2010 academic year. Both the K's and the NRSAs are highly competitive grants ranging from 30K-70K salary per annum.

General Research themes of Departmental Faculty

- Cortical circuits and behaviors: Adams, Evinger, Fontanini, Kritzer, La Camera, Maffei, Role, Wollmuth
- Neurogenesis and regeneration in the developing and adult nervous system: Ge, Halegoua, Levine, Matthews, Mendell, Sirotkin, Shelly
- Synaptic processing: Ge, Maffei, Matthews, Mendell, Role, Wollmuth, Yazulla
- Cell signaling: Halegoua, Kernan, Matthews, McKinnon, Role, Shelly, Wollmuth
- Motor control: Collins, Evinger, Mendell
- Computation and theory: Adams, Fontanini, La Camera, McKinnon
- Sensory processing: Fontanini, Maffei, Matthews, Yazulla

Major Research Clusters in which Neurobiology and Behavior Faculty participate.

The research clusters outlined below form the foundation of on-going and future collaborative program project grants (PPGs). Given the prominence of collaborative efforts and translational research in the NIH agenda these clusters will be emphasized in our future efforts to strengthen research funding.

Glial Cluster: Levine, Ge (N & B), Tsirka, Aguirre, Colagnatto (Pharmacology), William van Nostrand (Medicine)

Neuropsychiatric Disorders Cluster: Kritzer, Maffei, Role, Wollmuth (N & B) and Li (CSHL)
Spinal Cord Regeneration Cluster: Mendell, Levine, Collins (N & B),
Computational Neuroscience Cluster: Maffei, Fontanini, La Camera, Adams, McKinnon (N & B),
Synaptic Structure Cluster: Wollmuth, Matthews (N & B), Mark Bowen (Physiology & Biophysics)

Summary of strengths and recent accomplishments in research

- The Department was awarded one of only 18 P30 awards funded nationwide by NINDS via the ARRA to support new faculty recruitment. This award is for $1M in direct and ~$400K in indirect dollars support, spread over two fiscal years.
- The department received another ~$1.4 M in ARRA support for research in the current FY, with grants to Evinger, Matthews, Role, and Sirotkin.
- The department Chair has been named a 2010 recipient of the NIH Directors Pioneer Award. This highly competitive prize provides $2.5 M in research funds plus up to 60% again in funds to SUNY Stony Brook over 5 years.
- All 5 of the new recruits (3 as of 2009; 2 more signed on 2010) were our first choice candidates. Competition for each of them was fierce; we are very proud to have been so successful in these recruitments.
- All three of the 2009 hired junior NB & B faculty (Fontanini, Ge and Maffei) were awarded R01 funding from the NIH within their first year at Stony Brook, despite an extremely challenging environment for obtaining such grants. Their funding came from three different Institutes (NEI, NINDS, and NIDCD), indicating the breadth of the newly added research programs.
- All three of these junior faculty were also awarded funding from highly competitive private foundation sources (e.g., Klingenstein, Merck, AHA)
- Extensive new shared research facilities with state of the art imaging, behavior, and electrophysiological recording have been established within the Department to serve a variety of neuroscience-related research needs. Both intra departmental and interdepartmental use of these facilities encourage interactions and collaborations.

Recent awards and honors:

- Alfredo Fontanini -- Klingenstein Fellowship Award, PECASE 2010
- Arianna Maffei – Finalist: John Merck Scholarship fund and The McKnight Scholar Award 2009
- Gary Matthews -- Bernard Katz Award 2009
- Lorna Role – NIH Directors Pioneer Award 2010

Summary of issues that need to be addressed

The field of neuroscience was created to bring together scientists from disparate fields, in order to facilitate multi-disciplinary approaches to the analysis of nervous system function. Indeed, the Department of Neurobiology and Behavior was created in this

spirit, and its faculty represents a wide spectrum of specific research expertise. The foremost goal of every member of the department is to strive for continued improvement and true excellence at the national and international level in the areas of neuroscience research and education.

In continuing to meet these goals and challenges in these increasingly difficult times, we identify three areas as being especially important for continues growth and advancement:

(1) Development of additional collaborative and translational program project grants

(2) Supporting and strengthening our ties with research and educational programs on both West and East campus including computational biology, biomedical engineering, physiology, pharmacology, psychology and neurology.

(3) Continuing our trajectory toward international eminence in Neuroscience through sustained involvement in global efforts of societies such as SfN and IBRO and in continued exchange and collaborations as well as service on editorial, grant review and science policy boards worldwide.

Future plans

- By utilizing the theme-based research groups as listed above and expanding to include collaborators from other departments and neighboring institutions (e.g., Brookhaven and CSHL), we expect to submit 5 program-project grants (PPGs) to the NIH and private foundations within the next decade. Examples include an interdepartmental PPG for Glial Biology and Pathobiology, a PPG on spinal cord regeneration, a PPG on neuronal trafficking and another on cortical plasticity.
- The creation of a Center for Computational Neuroscience is a major initiative under the auspices of the Office of the Provost. Although this center will be independent of the NB & B we look forward to the interactions such a center would catalyze with NB &B, as well as physics, mathematics, psychology, computer science etc.
- To facilitate interactions between the Department and the Center, the addition of faculty to strengthen our expertise in computational and systems neurobiological approaches will be a priority for the Department.
- We will continue to strengthen and expand ties with appropriate clinical departments in the medical school, in order to facilitate the development of highly competitive translational research programs that unify the efforts of the departmental and clinical faculty.
- We will establish a new interdepartmental Center for Glial Biology and Pathobiology together with appropriate members of the Departments of Medicine, Neurology and Pharmacology
- We will help to promote the growth of the Neuroscience Initiative established by the School of Medicine and the SBU Hospital (called "The Institute for Advanced Neuroscience")
- Expand non-federal funding from private foundations and donors.

3. Metrics and Benchmarks

We feel strongly that the accomplishments and stature of the Department are not accurately reflected in national rankings, including those complied by or based on data compiled by the National Research Council. The discrepancies arise from two major factors: (1) the statistics are based on periods of time prior to the recent substantial changes in the department profile (2) the statistics are either not normalized for or are based on incorrect estimates of department size. The number of faculty in NB & B *per se* is small – 20 at peak -- and has been as low as 13 in recent years when the surveys were done. Evaluations of faculty:student ratios have incorrectly used the entire PiN program (>50 faculty) as the divisor and have not included our small-group teaching or our contributions to medical education thereby diluting our participation in the educational missions of the University.

In fact, as evidenced by national and international awards, guest professorships, grant reviewing and symposia, the department has achieved high levels of recognition despite its small size. Following the departure of the founding chair of the department (Dr David Cohen, to be Provost at Northwestern) and an external search, Dr. Lorne M. Mendell was appointed Chair of Neurobiology and Behavior in January of 1988. Shortly thereafter the Department began a campaign of intense recruitment and growth (1988-1993) that brought in 7 new faculty, including those with scientific areas of interest in molecular and cellular neurobiology that complemented and extended the research profile of the existing group. Thus, while all faculty members of our group have and continue to be very successful in competing for research grants and in publishing in high quality journals, the snapshot upon which nearly all national rankings are currently based coincides with the time when roughly half of the faculty evaluated were in initial stages of launching independent scientific careers. Likewise, other published (and soon to be published) rankings from the NRC are based on the 2003-2008 interval, which was just before the next growth phase following Dr Mendell's stewardship, that was initiated with the recruitment of L. Role from Columbia University.

The only nationally recognized ranking that we are aware of that is based on contemporary data is the Faculty Scholarly Productivity Index (FSPI). This is essentially a measure of per capita publication, citation, and receipt of new federal grant monies assessed from 2004-2007. This ranking is aimed toward graduate programs, which in the case of neurobiology is multi-departmental and cross-institutional with departmental faculty making up ~30%. This, along with other limitations including failure to account for: (a) journal impact factor, (b) funding from prestigious and highly competitive *private* foundations, and (c) a full range of national and international scientific honors, produces a ranking that does not appropriately or realistically reflect the department.

In any case, we feel strongly that important, positive added value of the department being affiliated with *both* the undergraduate college and the medical school as well as its atypically small size work against us in standard metric systems. An up to date version of the FSPI, modified to address the limitations outlined above and including only departmental faculty, rather than all PiN program faculty would be more apropos.