

2015 Strategic Plan

Interdisciplinary Graduate Program in Neuroscience and Behavior

The Neuroscience and Behavior Program (NSB) is one of four interdisciplinary graduate programs in the College of Natural Sciences. It was first developed in 1986 to unite the neuroscientists from different departments at the University and to create a cohesive collaborative research and graduate training program. Currently, the program includes 32 faculty from seven departments on campus along with four faculty from the 5-college consortium. Since 1990, when the first doctoral degrees were awarded, a total of 93 students have earned their Ph.D. in this program. In 1997, a fast track Master's program was added specifically to enable a small number of promising UMass undergraduate students already engaged in research to obtain a Master's degree within 18-24 months following their baccalaureate degree. Currently, 30 students have graduated from the fast track Master's program.

The NSB program is unique among neuroscience programs nationwide in its strong emphasis on behavior and cognition as two important outcome measures of neuroscientific investigation. Consistent with the new federal emphasis on translational research, nearly every neurological and mental health disorder is associated with some form of behavioral and/or cognitive dysfunction. Thus, a significant number of faculty within the program are either poised to take advantage of funding from the National Institutes of Health (e.g., new, pre-tenure faculty working on Parkinson's disease) or are currently involved in NIH funded translational research (ranging from animal models of mental health disorders and the effects of endocrine disrupters to human memory systems and sleep).

Neuroscience is a very broad field, ranging from studies in animal models at the cellular level to animal and human studies of behavior and cognition. As such, the NSB program has strong ties to the Molecular and Cellular Biology (MCB) Graduate Program as well as to the Organismic and Evolutionary Biology (OEB) Graduate Program. Betsy Dumont, in collaboration with the four Program Leaders, is currently creating an umbrella structure for these programs which should assist in the strengthening of research collaborations and graduate training at the interfaces. Of particular interest are new technology short course modules that would be offered by various programs and available to students in all the programs.

The NSB program is well known internationally in several areas. Primary among these is Neuroendocrinology (involving 12 faculty, 9 federally funded), an area of significant strength, which was built over several decades. The faculty within this area are also actively involved in the Center for Neuroendocrine Studies which hosts a biweekly seminar series "Hormones for Breakfast" and an annual Neuroendocrine Symposium with internationally recognized speakers and attendees. A new translational direction for the neuroendocrine faculty is a stress working group, assisted by the Center for Research on Families, which has drawn faculty from many different departments including Nursing, Public Health, and Anthropology. A major goal of this working group is the development of a training grant in stress studies ranging from animal studies to clinical and epidemiological, as well as building stronger ties to colleagues on campus with technology that can be applied to stress monitoring. The group also routinely provides substantial input to the federal grant proposals of individual members, and activity that has met

with success in funding for its members. Some of the faculty in this area are involved in the IALS Models to Medicine Center.

A second significant area of research strength, cognitive/developmental neuroscience, was developed within the last decade and includes 19 faculty (9 federally funded and 5 pre-tenure faculty within their first two years). Faculty research in this area ranges from neural plasticity at the cellular level to computational modeling of memory systems and studies of memory and sleep in both normal and clinical populations. Some of the faculty within this group are active in the IALS Center for Personalized Health Monitoring.

In the next several years, major changes at the University, as well as changes in the field of Neuroscience itself, make it imperative to think strategically about program visibility and training. In October 2014, the National Academy of Sciences convened a panel of leading neuroscientists to discuss "Defining the Expertise Needed for the 21st Century Neuroscience Workforce." The NIH also convened a BRAIN working group which produced a report for the NIH Director entitled "Brain 2025: A Scientific Vision." Although several emergent themes were identified from both documents, the UMass NSB program, in partnership with other units on campus, is poised to develop several of these areas. The first is in neuroscience data management and bioinformatics. Many of the current technologies used by neuroscientists on campus generate massive amounts of data (as two examples; electrophysiological recordings and functional magnetic resonance imaging). Additionally, new requirements for grant recipients by the National Institutes of Health mandate data sharing across a wide number of domains and access to these data domains. In the future, scientists will have ready access to preexisting data across facilities and investigators for their own research. But such a vision will not happen automatically, and specific kinds of training will be required to insure data integrity, consistency, and utility. The University is launching a Center for Data Science and already has a green High Performance Computing Facility in Holyoke MA. Thus, significant expertise is becoming available on campus to help the NSB Graduate Program develop necessary training in this area.

A second area the NAS panel identified was the brain/computer interface, and in combination with the NIH Report. At present, much of this work occurs in neural control of prosthetic limbs. But the panel considered very wide ranging ideas in this area. We have new, young faculty who are interested in broad applications of a possible interface but future discussions of our neuroscience faculty will be needed to flesh these ideas out and determine how we might make a significant contribution to the field. Certainly, this area would involve neuroscientists, kinesiologists, computer scientists, and bioengineers and the new IALS Institute for Computational Biology, Biostatistics and Bioinformatics.

The Brain 2025 Scientific Vision Report highlighted a primary area of research, the analysis of circuits of interacting neurons, as "being particularly rich in opportunity with the potential for revolutionary advances." We have some strength in this general area (Bergan, Downes, Li, Moorman, Remage-Healey, Vazey), however this growth is recent, with five of the six being pre-tenure. We plan to continue growing in this area.

The first two ideas are for future development. Our immediate objectives are to maintain our very strong programs in neuroendocrinology and cognitive/developmental neuroscience and to grow the area of neuronal circuitry, given the high potential for new findings that will significantly advance the field. We also need to provide facilities necessary for the expansion of research programs using new technologies. Although not new, we laud the University's efforts to obtain a

research magnetic resonance scanner for the campus. It will have a significant impact on the cognitive/developmental neuroscience area. We look forward to the renovations of the new animal vivarium which will assist our animal model researchers in having the highest quality animal facilities for their research.

There are three significant challenges to the Interdisciplinary Graduate Programs, two of which we need help with and the third we have made significant strides with. The first is concerned with faculty hires. Departments hire faculty; graduate programs do not. Thus, it is hard to plan for the growth of new areas and training. What is needed is greater collaboration across departments and programs. That won't always happen so we urge the University to set aside one or two faculty positions each year from the available pool for a competitive process of possible hires for the interdisciplinary programs. Departments would gain positions by partnering with these graduate programs.

The second issue is the graduate student stipend which is not competitive, and this in turn affects student quality and outcome data (e.g., time to completion etc.). Additionally, this problem is also combined with what is widely perceived as an unfair University tax on federal grant holders (Curriculum fee). It should be noted that faculty who teach graduate courses and mentor graduate students never see any of this money even though they deliver the curriculum. We urge that the University consider giving a small percentage of this money back to the graduate programs to be used only for stipend increases. This may result in greater success in getting the very top applicants to enroll in our program.

A third issue raised in the Graduate Program Review was the level of grant activity compared to peer institutions. Some of the differential was due to the high proportion of young pre-tenure faculty in the program. However, a number of these very promising young faculty have now obtained federal grants as Assistant Professors (Downes, Lacreuse, Li, Remage-Healey, Richardson, Scott, and Spencer) and four of those faculty are now Associate Professors. Additionally, nearly all the neuroscience faculty at our peer institutions have access to scanners. Imaging research is very expensive and greatly increases the monetary size of federal grants. With a magnetic resonance scanner on the way, we fully anticipate that our current upward trajectory on grant dollars will increase substantially.

In summary, the NSB program is doing relatively well considering available resources and the lack of a medical school on campus. We have a vibrant group of young faculty who will move us forward and help define the neuroscience graduate program of the future.