Sample RUI Impact Statement

Institutional Background

The University of Wisconsin - Whitewater is a regional comprehensive university whose four colleges offer undergraduate degrees in business, education, the fine arts, and the liberal arts and sciences. The Graduate School offers a limited range of Master's degrees in business, education, and specialized professional areas such as counseling, communicative disorders, and school psychology; there are no doctoral programs. UW-Whitewater is emerging as a national leader in undergraduate research. In its strategic plan, the university identifies developing its educator-scholar community as one of five priorities. Within that priority, engaging undergraduates in original research is identified as a primary means for achieving this goal. The P.I. is a long-standing member of UW-Whitewater's Undergraduate Research Council, which oversees the campus's semi-annual competitive undergraduate research grant program, coordinates and funds student and faculty mentor travel to the annual National Conference for Undergraduate Research (NCUR), and runs the annual campus Undergraduate Research Day. Every year UW-Whitewater sends a large contingent of students to present at NCUR and hosted that conference in 2003. Over the past several years our student NCUR contingent tends to be one of the largest, often rivaling even that of the sponsoring university.

In summer 2007 the university started a competitive summer research internship program under which a small group of faculty members receive summer stipends to conduct research with undergraduates majoring in their specialty areas. The university has also been strengthening intramural support for faculty research during the academic year and offers teaching release and summer stipends for faculty who are developing extramural grant applications.

The College of Letters and Sciences, which contains the P.I.'s home Department of Psychology, supports faculty and undergraduate research by providing up to $1000 annually for faculty travel to research conferences and a smaller travel allowance for undergraduate co-presenters as budgeting allows. The College's dean is creative and supportive in finding financial assistance for research laboratories that are between external funding sources. The Department of Psychology also enthusiastically supports undergraduate research. One's ability to mentor meaningful student involvement in research has been an explicit tenure track hiring criterion for many years.

The department currently has 13 full time tenured or tenure-track faculty positions. Specialties include behavioral neuroscience, clinical and counseling psychology, developmental psychology, cognitive science, and social psychology. All faculty involve students in their research. In our presentations to student clubs each of us emphasizes the centrality of research in psychology and the importance of research experience in gaining admission to graduate programs. We recently instituted two new emphases within the major that are meant to prepare students for graduate training in clinical and experimental psychology, respectively. Both feature a required capstone senior thesis or research project. The department has a 30 station computer laboratory that is used for courses in statistics and research methods and is available for student research projects. The Department also supports faculty who mentor student research by offering a course called Directed Research when scheduling permits. The faculty member assigned this course receives teaching credit for supervising a small group of students involved in his or her research. This helps relieve what can be a prohibitively heavy teaching load.

The P.I.'s laboratory in the Department of Psychology is ideally situated to introduce minority and disabled students to behavioral neuroscience research. UW-Whitewater sponsors a very active McNair Scholarship Program. The McNair program, coordinated by the U.S. Department of Education, is dedicated to preparing minority and first-generation college students from disadvantaged backgrounds for doctoral work. The core of this preparation is research immersion. The P.I. has served as a McNair mentor and has frequent contact with the program's director, as both serve on the Undergraduate Research Council.

Prior to the enactment of the Americans with Disability Act requiring all public institutions to be accessible to disabled people, UW-Whitewater was identified as the UW System campus whose particular mission was to serve students with physical and learning disabilities. Although
other campuses are now catching up in accessibility, UW-Whitewater's tradition of accessibility, its long-established institutional offices such as the Center for Students with Disabilities, and its already-existing accommodations in its physical environment continue to attract a substantial number of disabled students. The rooms in which the P.I.'s laboratory are housed are wheelchair accessible, and there are many opportunities for physically disabled students to participate in the lab's work (e.g., those who are unable to help with rat testing might help with computer programming, literature review, figure preparation, or other tasks suited to their abilities).

The P.I. is also in a strong position to attract women to the sciences. Currently, approximately 70% of the department's majors are women. Although the life sciences tend to attract more women than do the physical sciences, the ratio of women to men in neuroscience is still low. Within psychology, women tend toward the applied and social disciplines, perhaps in part because of the lack of a role model showing that science, particularly behavioral neuroscience, can be "for them". The P.I.'s laboratory has attracted a majority of women (roughly 2/3 of all student workers over the last 10 years). Having the P.I. present and active in research on campus can influence more women to consider graduate training in behavioral and cognitive neuroscience and other areas of experimental psychology.

In addition to mentoring psychology students, the P.I. has strong connections with the Department of Biological Sciences. In any given year about half of the student workers in this laboratory are Biological Science majors who can receive biology independent study credit for their work. The P.I.'s course in behavioral neuroscience was recently cross-listed with Biological Sciences, allowing those majors to take the course for biology credit. This has enhanced the lab's recruitment of these majors, many of whom are pre-med and pre-PhD students seeking research experience. Biological Sciences enthusiastically invites their majors to conduct senior honors thesis projects in the lab for biology credit, and invites this P.I. to be a member of their students' thesis committees. Thus, this lab fosters interdisciplinary links between the psychological and biological sciences and creates a unique opportunity for psychology and biology majors to interact with and learn from each other.

Of course, it must be recognized that even with all of these positive supports in place there are some institutional factors that affect the P.I.'s type and pace of research productivity. Because UW-Whitewater is not a research doctoral institution its faculty have quite limited access to state-of-the-art technologies and research techniques that allow for "cutting edge" research. For example, while our lab and related labs would like to work with new techniques such as channel rhodopsin circuit stimulation or knock-out mouse models, we do not have efficient access to the necessary expertise and resources (financial and otherwise) that would allow us to do so. Research time is also a scarce commodity. A major part of this proposal's budget is for funds to buy out half of the P.I.'s teaching duties for three years. UW-Whitewater faculty have a four course per semester teaching load, the same load that was in place prior to the university's institution of substantial research requirements for tenure and promotion. UW-Whitewater does not have the research support facilities or personnel found in doctoral and research universities. For example, P.I.'s must personally maintain their laboratories and animal colonies. In my own lab, this includes stocking supplies, checking the animal colony every weekend and cleaning the rat cages on holidays when students do not have access to campus buildings, fixing broken equipment, programming computerized testing and data analysis software, and responding to animal health issues. The P.I. must have daily intensive contact with the laboratory's operation and data collection and be ready to respond immediately to any problems or errors that impede research progress. Although our undergraduate researchers are talented they are still undergraduates and therefore need more direct and frequent guidance than do graduate students and postdoctoral fellows. The funds requested here would allow the P.I. to better balance time between classroom teaching obligations and research productivity.

Request's influence on undergraduate research

The funds requested here will allow the P.I. to continue research that has involved more than 25 undergraduate co-workers over the last five years. The students work for course credit, although should this proposal be funded we will apply for funds through NSF's REU program to support summer student salaries. Many of our students are from working class families and personally pay a substantial portion of their ever-rising tuition costs. Therefore many must spend
their summers working to earn the next year’s tuition. Summer salaries will help maintain continuity in both the lab’s work and in the students’ training.

Some students stay in the lab for only one semester while others have remained for several years. Particularly strong students complete thesis projects that require them to supervise (under the P.I.’s guidance) a group of about half a dozen fellow undergraduates in daily lab work. Past thesis projects have been presented at the annual meeting of the Society for Neuroscience and published in journals such as Behavioural Brain Research, with the students sharing authorship. Lab students have gone on to graduate programs in several different areas of psychology and biology, as well as medical and veterinary school. One past thesis student has completed a PhD in behavioral neuroscience and another is currently in a postbaccalaureate training program at the National Institutes of Health, in preparation for PhD work in neuroscience.

An advantage of research in undergraduate institutions is that the students, by necessity, are intimately involved in the research in meaningful ways; they are not just cleaning cages, washing glassware, or cataloging data. Not every student has the time, talent, or inclination to go as far as producing a thesis, presentation, or publication. However, each student has ample opportunity to participate in scientific research as it is performed in reality, not just read about its results in textbooks or walk through canned laboratory assignments whose outcomes are known in advance. They are in on the creation of an experiment from its inception and go through the practical challenges of solving methodological and technological problems that may hinder the experiment’s execution. In fact, it is often the students who come up with the most creative solutions! Universally, students have come away from their experience with both an objective and subjective grasp of the vicissitudes and incremental yet hard-won victories of research as it is actually practiced. We are fond of quoting one student who, after a day of frustration with crashing computers and misbehaving equipment, declared “Now I know why there’s no cure for cancer, the (*expletive*) printer keeps breaking down!” Students also grow appreciably in responsibility, self-confidence, and initiative as they learn to work with peers in keeping a professional research laboratory productive.

The typical student experience begins with training in our computer-automated behavioral testing system. It usually takes only a week or two of practice for all to become proficient; new students are paired with experienced student mentors to speed the training process. Once students are proficient at testing rats and saving and analyzing data without supervision, they are responsible for a regular testing schedule, usually two to four sessions per week depending on how many credits they wish to acquire. Students with good manual skills and a “way” with rats do all of the intracerebral brain injections this work entails. Students are also required to engage in some other aspect of on-going experiments. Some choose to learn how to section and stain brain tissue, others are more interested in computer programming, and still others are more interested in learning the manual skills of electrode, cannula, and injector tip fabrication or constructing electronic devices. These students are usually paired with experienced student mentors or with me, and are given ample time to practice their new skills.

The students are challenged to learn as many skills as they can but are not pushed beyond their limits. Given the nature and risks of the experience we reserve training in rat neurosurgery for students who are prepared to commit to a thesis. These students begin by observing several implant procedures until they are familiar with the important steps. They are then allowed to perform a few of the steps under the P.I.’s supervision (e.g., placing the rat in the stereotaxic frame, taking readings from skull landmarks) and gradually take responsibility for more steps of the procedure until they are proficient and largely independent. Advanced students are also trained in euthanasia, perfusion, and brain harvesting techniques, and typically are able to perform these independently (and to teach others) after just a few experiences.

As scheduling allows, the students attend weekly lab meetings at which we discuss pertinent research papers and new data from our own lab. Experienced students quickly establish a peer culture showing newer students that they are expected to read and think about assigned articles and contribute substantively to these meetings, not to passively wait for someone to explain everything to them. This is a challenging and initially frustrating experience for most undergraduates who are used to “receiving wisdom” rather than personally acquiring knowledge. However, I think this experience is vitally important in this age of online education and large scale lecturing, where studying can become largely a matter of memorizing pre-
processed information. Students have fewer opportunities to acquire knowledge through reading, interpretation, and reflection. I have had students return to visit after a year or two of graduate school and comment on how well these laboratory meetings prepared them for their graduate seminars.

I find training undergraduates to be of benefit to me. Students force me to question preconceptions and stimulate me to try methods beyond those that habit has made comfortable. It is also students that often have the time and "naivete" for the lateral thinking that is so critical to keeping research fresh. Too often established investigators can get stuck in cognitive and methodological ruts; it's good to have fresh minds point out new territory beyond the rut. At the very least, by constantly asking "why?" and "how?" the students keep me on my toes.

The funds requested here will allow us to continue all of these activities. They will also allow us to expand the laboratory beyond its current capabilities, with the hope of attracting a larger and more varied student cadre. Behavioral neuroscience is placed at the nexus of biology and behavior, therefore this laboratory offers research opportunities for both biology and psychology students. Increasingly, theories about behavior, cognition, and emotion derive from consideration of neural, genetic, molecular, and other physiological mechanisms. The psychology student with hands-on experience in exploring these biological mechanisms has considerable advantage in understanding and applying them. Correspondingly, many areas of biology emphasize the functional significance of biological systems and processes; biological sciences students are able to apply their classroom learning of biological principles to a real world problem. Thus, undergraduate research in behavioral neuroscience affords preparation for a broad range of advanced degrees in the life sciences.

To summarize, the P.I. of this proposal has extensive and intensive experience in supervising undergraduate research and in engaging undergraduates in creative, original research in meaningful ways. The funds requested here will help our department and the allied Department of Biological Sciences to continue offering our students these experiences. Given the particular efforts of the University of Wisconsin - Whitewater, the College of Letters and Sciences, and Department of Psychology in fostering undergraduate research, and in attracting and retaining disabled, minority, and female students in the sciences, this proposal also has great potential to attract more members of these groups to careers in the biological sciences.