

UNIVERSITY OF
Miami
FACULTY SENATE
MEMORANDUM

FACULTY SENATE
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To: Donna E. Shalala, President

From: Steven Green
Chair, Faculty Senate *[Signature]*

Date: 14 December 2001

Subject: Faculty Senate Legislation #2001-10(B) – Undergraduate Major in Neuroscience

The Faculty Senate, at its 12 December 2001 meeting, voted to approve the establishment of an undergraduate major in Neuroscience. The proposal is attached for your information.

This legislation is now forwarded to you for your action.

SG/kl

- c: Luis Glaser, Executive Vice President and Provost
- Dan Pals, Interim Dean, College of Arts and Sciences
- David Wilson, Professor of Biology; Director, Undergraduate Neuroscience Program

SG/kl

Enclosure

CAPSULE: Faculty Senate Legislation #2001-010(B) - Undergraduate Major in Neuroscience

PRESIDENT'S RESPONSE

APPROVED:  DATE: 12-18-01
(President's Signature)

OFFICE OR INDIVIDUAL TO IMPLEMENT: Provost

EFFECTIVE DATE OF LEGISLATION: _____
(if other than June 1 next following)

NOT APPROVED AND REFERRED TO: _____

REMARKS (IF NOT APPROVED): _____

Proposal for an Undergraduate Major in Neuroscience

This is a proposal for a reworking of the **existing psychobiology undergraduate major**. That major currently is a joint program between the biology and psychology departments. The reworked major **will be a neuroscience major with two tracks, psychobiology and neurobiology**. While the home of the major will be the College of Arts and Sciences, the teaching faculty and coordinating committee will come not only from faculty in biology and psychology, but also from faculty at the School of Medicine, and possibly from other schools as well. The revised major should help us to attract outstanding students to the University.

Although we have a Ph.D. program in neuroscience, and we have a large and strong group of faculty who do research in neuroscience at the University, we do not have a full undergraduate neuroscience program. Many elite, private universities have an undergraduate neuroscience major, including some (Tulane, Emory, Duke) in direct competition with UM (see *Neuroscience Training Programs in North America*, available on the web at www.andp.org/training/ for a partial listing). Despite the lack of this major at the University of Miami, student interest in the field of neuroscience is indicated by the existence of an undergraduate-run neuroscience club (TUNS, The Undergraduate Neuroscience Society), and the popularity of the existing psychobiology major, which is a joint endeavor by the biology and psychology departments that enrolls approximately 65 students.

With this interest in mind, a couple of years ago, several meetings were held between neuroscientists at the medical school and faculty in biology and psychology. At that time it was decided that the initiation of an undergraduate program in neurosciences would require new fiscal resources, which were not obviously available. More recently, with the announcement of the Innovation and Education Research Initiative, we met again and developed a proposal. That proposal was funded, and so we now are in a position to proceed with the undergraduate major.

The University of Miami is in an unusual position to take advantage of its strength in neuroscience research and graduate training to develop an outstanding undergraduate neuroscience major. A key component of this program would be the integration of neuroscience faculty at the Medical School and Rosenstil School of Marine and Atmospheric Sciences (RSMAS) with those on the Coral Gables campus. Faculty would cross campuses to share their expertise with undergraduates, and students would gain research experience in neuroscience faculty laboratories. Another component of this initiative is the development of several new undergraduate courses, including a comprehensive Neuroscience Laboratory course.

Because we already have an undergraduate major in psychobiology, and a strong graduate and research program in neuroscience, we will not need new library resources related to this revised major. There are some new costs associated with the modification of the major, but funds have already been set aside from the Innovation and Education Research Initiative to cover the start-up and ongoing costs for the first three years of the program.

Introduction

Neuroscience is the study of the nervous system (i.e., brain, spinal cord, and peripheral nerves) and the mechanisms of behavior. This interdisciplinary field draws from several scientific disciplines including medicine, the biological sciences, psychology, physics, chemistry, mathematics, and engineering, and beyond, with the nervous system serving as the common focus. Neuroscience is one of the most rapidly advancing fields of research and training, which is reflected in the fact that the Society for Neuroscience is the largest and fastest growing association of professional scientists in experimental biology. Currently, the University of Miami has a Ph.D. program in neuroscience that is maturing into one of the finest graduate programs at the University. Over 50 faculty members from 13 departments on three campuses participate in graduate and postdoctoral training. They engage in neuroscience research that accounts for more than 20% of the University's federally sponsored research dollars. In

recognition of the importance of neuroscience research, the University recently has opened the Lois Pope LIFE Center, which is the new home of the University's most visible neuroscience endeavor, The Miami Project to Cure Paralysis.

Several areas of neuroscience research constitute particular strengths of the research enterprise at the UM School of Medicine. First, the School of Medicine has a large, interactive, and successful group of scientists in the general area of neuronal injury, neuroprotection, and regeneration. This group includes well-known research centers such as the Miami Project to Cure Paralysis, the Neurotrauma Research Center, and the Cerebrovascular Disease Research Center. In addition, there are a number of well-established scientists, mainly in basic science departments, who work in areas related to neuroprotection, regeneration, and synapse formation; the work of these researchers is a vital link between research focused directly on the clinical problems and our knowledge of the fundamental underlying scientific principles. Another major strength is in neuromuscular research, involving faculty in numerous basic science and clinical departments.

It is important to note that neuroscience research is not limited to the School of Medicine, but is present on the Coral Gables campus and RSMAS as well. In fact, the interdepartmental Neuroscience Graduate Program, one of the most successful graduate programs in life sciences at the University, is the only graduate program to combine faculty from clinical and basic science departments at the medical school (Biochemistry, Cell Biology & Anatomy, Physiology & Biophysics, Psychiatry, Molecular & Cellular Pharmacology, Neurological Surgery, Neurology, Ophthalmology, and Otolaryngology) with faculty at RSMAS and 2 different departments at the Coral Gables campus (Biology and Psychology). The Department of Psychology has a nationally recognized and well-funded program in behavioral medicine, and there are several scientists in the Department of Biology with interests in neurosciences. Thus, there is talent throughout the University, already organized for the Ph.D. program in neuroscience, that can be exploited for the new, two-track major.

THE UNDERGRADUATE NEUROSCIENCE MAJOR

Many universities have undergraduate majors in neuroscience. At UCLA, the program is run by Dr. Mike Levine, and has 300 majors. Although UCLA is a large school and not directly comparable to UM, this number suggests that such a major can be highly popular.

It is very timely to develop an undergraduate program with the goal of attracting highly qualified life science applicants who are aware of the University's eminence in neuroscience. These students will be encouraged to be active participants in the local neuroscience community and will be required to perform neuroscience research. Graduates of this major will be highly qualified candidates for health professional schools or for graduate programs in the biomedical/mental health fields. Because the standards for admission to this program will be among the highest in the University, the quality of students will be excellent. An undergraduate neuroscience major should also be a highly effective recruiting instrument, and it is anticipated that the program will attract about 20 additional excellent students/year. This projection may be an underestimate, as informal discussions with existing students have indicated a significant amount of interest.

The University of Miami is poised to take advantage of its strength in neuroscience research and graduate training to develop an outstanding undergraduate neuroscience major. A key component of this program would be the integration of the Medical School and RSMAS with the College of Arts and Sciences, such that faculty would cross campuses to share their expertise with undergraduates, and students would gain research experience in neuroscience faculty laboratories. A research-based curriculum has been developed, which incorporates an exciting and modern new neuroscience laboratory course, a new major track in neurobiology, and the teaching participation of faculty from the various units of the University. In addition, some

students would perform supervised research projects in neuroscience laboratories across the University.

The new undergraduate neuroscience major is being developed as an expansion of the highly successful psychobiology program, which has flourished as a cooperative effort between the Departments of Psychology and Biology. This program currently has approximately 65 majors, many of whom are among the best undergraduates in the College. We expect to continue the current, high standards for students who are allowed to be in the major—SAT scores of 1270 or above for entrance, and a GPA of 3.3 or higher after 24 credits at the University. In the new neuroscience major, students would have the option to choose between the psychobiology track, which emphasizes behavioral and cognitive neuroscience, and the neurobiology track, which will emphasize cellular and molecular neuroscience. We have developed a series of core courses for these students in the two departments (curriculum outlined in Appendix 1). Those in the new major will have excellent preparation for graduate work, medical school, and/or other health professional careers.

THE STEERING COMMITTEE FOR THE UNDERGRADUATE NEUROSCIENCE MAJOR

The Steering Committee for the Undergraduate Neuroscience Program [not to be confused with the Steering Committee for the (graduate) Neuroscience Program] will provide oversight and guidance for the program. This group will meet each semester to review curriculum, faculty participation, facilities and equipment, student progress, policies and procedures. The Undergraduate Program Director, as a member of the Steering Committee, will work closely with this group. Initial members of the Steering Committee are:

John L. Bixby, Professor of Molecular and Cellular Pharmacology; Chair, Neuroscience Program Steering Committee

Nirupa Chaudhari, Associate Professor of Physiology & Biophysics

W. Dalton Dietrich, Professor of Neurological Surgery and Neurology; Scientific Director of the Miami Project to Cure Paralysis

Robert Keane, Associate Professor of Physiology & Biophysics

William H. Evoy, Professor of Biology

Edward J. Green, Associate Professor of Psychology

Zhongmin Lu, Assistant Professor of Biology

Phillip M. McCabe, Professor and Associate Chair of Psychology

Victoria A. Noriega, Director of Undergraduate Studies, Psychology

David L. Wilson, Professor of Biology; Director, Undergraduate Neuroscience Program

The Chairpersons of Biology and Psychology are *ex officio* members of the Steering Committee.

The Curriculum

The curriculum for the proposed undergraduate neuroscience major is presented in Appendix 1. As mentioned, students would have the option of specializing in either the psychobiology or neurobiology track. Much of the curriculum consists of existing courses, and there is only a

minor reworking of the existing psychobiology major for the new track, but there are several new courses and revised courses, as outlined below, that, in conjunction with existing courses, will allow the neurobiology track to be developed. Proposals for each of the three new courses are in various stages of approval within Arts and Sciences.

A) The New Neuroscience Laboratory

This laboratory will itself foster inter-school collaboration, as it will be developed for both undergraduate seniors and for first-year neuroscience graduate students. A group of UM neuroscientists has been planning a laboratory course for several years, and this proposal offers the chance to bring these ideas to fruition while simultaneously enhancing the undergraduate curriculum.

This proposed laboratory course will expose students directly to many of the current areas of study they encounter in their course work, using state-of-the-art equipment and new exercises developed from the research of the faculty. These labs will include mammalian neuroanatomy using both microscopy of real nervous tissue as well as computer simulations, identification of individual nerve cells by dye injection and/or immunocytochemical staining, recording of sensory evoked potentials from living brains, neurophysiology of nerve cell and synaptic activity, behavioral measures of animal escape responses evoked by discrete mechanosensory stimulation, patch clamp electrophysiology, PCR amplification of neural genes, and agarose gel electrophoresis.

The new laboratory will be developed jointly among faculty from the Neuroscience Program and Departments of Biology and Psychology, to be cross-listed with the same course number in Biology and Psychology. The Psychology department would incorporate appropriate components of the existing PSY 403 course; others would need to be developed.

It is envisioned that a portion of this laboratory (comprising the molecular biology aspects) will be held at the Medical campus, for three reasons. First, most of the current molecular neuroscience research expertise is at the Medical School. Second, first-year neuroscience graduate students would also benefit from the existence of the facility, which would be used for a new graduate course in neuroscience techniques. Third, the undergraduate majors will have an opportunity to view the laboratories of the neuroscience medical school faculty as they visit the school.

B) Two New Neuroscience Lecture Courses

The rest of the Neuroscience track curriculum is being developed from the current Psychobiology curriculum. Some of the required courses in both Biology and in Psychology will be eliminated, some current courses will be updated and revised (see Appendix 1), and two new lecture courses will be substituted as area electives. The new lecture courses are:

Developmental Neuroscience: Several faculty members in the Medical School with research expertise in this area have interest in undergraduate teaching. In addition this may be an area of interest for a new member of the faculty in the Department of Biology who is expected to be hired in the near future. This is a very topical research area and is covered only in summary fashion in the current BIL 368, Cellular and Molecular Neuroscience, and in BIL 355, Developmental Biology. It deals with such problems as normal and abnormal formation of patterned connectivity in brain and spinal cord and capacities of the nervous system for repair following disease or injury. A neuroscience faculty member will coordinate the teaching of this course.

Neuronal Mechanisms of Disease: Undergraduates who are considering medical careers, or careers in biomedical research would benefit from a survey course on current work in specialties such as neurology, psychiatry, neurosurgery, pharmacology and pathology relating to the nervous system. Premedical students will especially be interested in the focus on the

fundamental mechanisms underlying nervous system disease and disorders. The course would be coordinated by a neuroscience faculty member.

C) Research Experience: Some neuroscience majors will have two semesters of research experience in their junior or senior years. This work will take place in one or more of the neuroscience laboratories on the Medical School, Coral Gables, and Marine School campuses. Students will learn techniques (in the new laboratory as well as in the research labs) and will carry out independent research projects. At the end of this research practicum, the student will submit a scientific paper to the faculty that summarizes the project. Some of the students will fulfill this requirement through the use of summer research fellowships.

Special Lectures in Brain and Behavior

To bring together faculty and students in different departments and disciplines, and to bridge the gap between molecular/cellular neuroscience, psychology, biology, and social sciences, there will be a University lecture series, organized and run through the graduate neuroscience program and center at the medical campus, which will sponsor one outstanding lecturer per year in the general area of brain and behavior. These lectures, offered in the evening, will be a way of raising consciousness about neuroscience and its relationship with other disciplines, many of which represent strengths at UM.

INITIAL COSTS AND SELF-SUPPORTING REVENUE STREAM

The initial, start-up costs budget for the undergraduate program are available from the Innovative Education and Research Initiative, and have been approved. These funds will cover the expenses associated with the first three years of the program. Additional short-term funding may come from a Howard Hughes grant, but this additional funding is not necessary to get the program started.

After the three year start-up, it is anticipated that the tuition from new students would offset the recurring expenses of the program. Recurring expenses will be about \$126,000/year. This is a fraction of the tuition that will be provided by the (at least) 20 new students per year expected to be attracted to the University by the program.

SUMMARY OF NEW EXPENSES

Start-up Costs for the Undergraduate Neuroscience Major (\$603,000 total)

- Equipment for Laboratory Course. New equipment for the formal BIL/PSY lab course and for student research projects would include equipment to supplement that which we have obtained from previous educational grants for electrophysiological recording using on-line computers, and items to supplement a behavioral analysis facility provided by a gift from the Dauer family.
- *Neurophysiological recording equipment* (4 complete setups) will be used in the neuroscience laboratory course for exercises on sensory evoked potentials in living brains, recording of nerve action potentials and postsynaptic potentials. It will also be used in student research projects in at least two of the faculty laboratories.
 - *Behavioral analysis equipment* will be used in the neuroscience laboratory course for exercises on fish and insect escape responses. It will also be used for research projects on insect orientation and responses by fish to auditory stimulation. The items

requested will complete an existing facility purchased for undergraduate research in 1998 for approximately \$30,000.

- *Computers for the above.* These are for recording/analyzing data
- *Lab equipment for Molecular Neurobiology* to set up the molecular section of the lab course at the Medical School
- Undergraduate summer fellowships will be used for summer support for selected students to conduct research in various faculty laboratories @ \$2,000/ student/summer.
- Laboratory instructor/laboratory coordinator. Salary and benefits for a person with good technical training in life sciences or neuroscience to coordinate and help teach the laboratory course (probably 2-4 sections of 12 students each per semester), Any teaching assistants assigned to the course will be supervised by this person. The instructor will be trained and supervised by Drs. Evoy, Green and Lu. This individual will also supervise use of the behavioral analysis equipment.
- Psychology 316 equipment and lab instructor. The creation of an undergraduate Neuroscience major will place additional demands upon Psychology 316 (Experimental Psychology), which is a laboratory course required for all Neuroscience majors. Five computers and five computer workstations to be added to the existing undergraduate Psychology laboratory. This additional equipment will accommodate the increased enrollment in this course due to the Neuroscience major. In addition, salary and fringe benefits are requested for a laboratory instructor for this course. Currently, the Psychology Department pays 50% of this individual's salary, new funds will cover the remaining 50% of salary and fringe.
- Teaching salary and fringe for Medical School faculty. Compensation for Medical School faculty to teach the Developmental Neuroscience and the Neuronal Mechanisms of Disease courses (each taught once per year) is available. This will allow for release time for faculty from the medical school to teach in this undergraduate program. Preliminary agreement has been reached with one faculty member, and her chair, to teach the Neuronal Mechanisms of Disease course.
- Undergraduate Neuroscience Program Director. Compensation for a neuroscience faculty member within the College of Arts and Sciences to oversee the undergraduate Neuroscience program. This individual would be responsible for coordinating neuroscience curriculum, organizing program events, supervising TUNS, student recruitment, and coordinating student research.
- Undergraduate Advisor salary supplement. This individual will be responsible for advising all of the undergraduates in the two tracks of the program and will be involved in recruitment and other efforts.
- Administrative and Recruiting Expenses. Mailing, copying, miscellaneous and office expenses.
- Support for a New Assistant Professor of Biology to supplement a start-up package for a cellular/molecular neuroscientist to be hired in the Biology Department.

All of the above expenses are covered for the first three years of the program by \$603,000 from the Innovation and Education Research Initiative.

Library Support

Since there already is an undergraduate major in psychobiology, and adequate library resources are available for that major, it is not anticipated that new resources will be required. In addition, students in the new track in neurobiology will, along with the psychobiology track students, have available the Calder Memorial Library at the medical school, which is well supplied with the latest journals in neurosciences because there are so many faculty researchers at the medical school in this area.

Approvals

Letters that were attached to the original document include:

1. Letters of support from the chairs of biology and psychology indicating approval of the faculty in those departments
2. Letter of support from Dean Pals indicating the approval of the faculty of the College of Arts and Sciences
3. Email from Provost Glaser indicating approval of the budget

APPENDIX 1

Undergraduate Neuroscience Major Curriculum

Common Core

PSY 110 Intro. Psychology (3 cr)
PSY 204 Biobehavioral Statistics (4 cr)
(or BIL 311 Biostatistics)
PSY 316 Exper. Psychology (4 cr)
BIL 150/151 Gen. Biology (5 cr)
BIL 160/161 Evol. And Biodiversity (5cr)
BIL 250 Genetics (3 cr)
BIL 255 Cell and Mol. Biol. (3 cr)
PSY/BIL 403 LAB* (4 cr)

Total 31 credits

Psychobiology Track (3 cr each)

PSY 202 (Intro. Psychobiology)
PSY 300+
BIL 200+ **
BIL 200+ or Research***
BIL 200+ or Neuro Mech Dis*
PSY 402 (Advanced Psychobiol.)

Total 18 credits

Neurobiology Track (3 cr each)

BIL 268 (Neurobiology)
BIL 368 (Cell& Mol Neurosci)
PSY 300+ or BIL 300 **
BIL 200+ or Research***
BIL 3xx (Neuro Mech Dis)*
BIL 3xx (Dev NS)*

Total 18 credits

Grand Total 49 credits
(same as current Psychobiology track)

*New course

**BMB 401 can be used

***Research courses in Psychology or Biology may be used

Required science/math courses outside of biology and psychology:

Chemistry through organic, with lab;

Math through calculus, 111/112 or 131/132;

Physics 101/106 plus 102/108 or comparable 200-level sequence

(note: the 200-level, calculus-based sequence is highly recommended for any students considering Ph.D. level study)

APPENDIX 2
DRAFT
Neuroscience Laboratory BIL/PSY 403 4 cr.
Syllabus

Instructors:

William Evoy, Professor of Biology Cox 03 (284-2853)

Edward Green, Associate Professor of Psychology BMRB 137 (284-4186 x 4)

John Lu, Assistant Professor of Biology Cox 06 (284-6813)

Lab Instructor TBA

Course Description: Research methods and laboratory experiments in contemporary neuroscience from individual cells to behavior. Scientific report writing and computer applications in experimental design and analysis. Lecture/Lab

Prerequisite: PSY 402 or BIL 268 ???

Performance Evaluation: Students will be evaluated on the basis of two exams, a lab practical, several formal written reports, and group project oral reports. Exams will be based upon material covered in lectures, readings and laboratory practica.

Schedule (weekly topics):

A 2-1/2 hour lecture/discussion will be held at the beginning of each week of the course. Background, experimental protocols for the week's work will be presented. There will be student participation in analysis and discussion of the previous week's work. Some labs will be held at the UM School of Medicine. Lab sessions will be 3 hrs/week.

Week	Topic
1	Introduction to course and equipment
2	Neuroanatomy 1: Mammalian Brain and Spinal Cord
3	Neuranatomy 2: "
4	Introduction to Electronic Equipment and Digital Data Recording
5	Sensory Physiology: Cockroach Sensory Fibers
6	Membrane Potentials of Cells: Computer Simulations
7	Resting Potential of Cells- Intracellular Recording of Crayfish Muscle
8	Synaptic Connectivity 1: Anatomy and Recording of Crayfish Nerve-Muscle Preparation
9	Synaptic Connectivity 2: Simultaneous Recording of Nerve and Muscle Potentials
10	Neurotransmitters: Immunocytochemical Identification in Crayfish CNS
11	Neuropsychology: Dichotic Listening
12	Single Ion Channel Recording: Patch Clamp Techniques (or PCR Amplification of Neural Genes and Agarose Gel Electrophoresis)
13	Group Project Reports (or Sensory Evoked Potentials from Living Fish Brains)

Note: the above list of topics is preliminary, as there will probably be modifications. Two of the lab sessions are expected to be developed and taught at the School of Medicine.