Course Expectations and Goals

Undergraduate research is a critical component of a solid undergraduate life science major and in our major it is a central event in your academic experience. The goal of Undergraduate Research is to give students an opportunity to work closely with experienced researchers who will help the student identify and conduct an original research project.

Because this experience is important to our students’ success in achieving career goals, the Neuroscience major requires completion of a minimum of 3 credits of research experience or completion of a select research methods course (BIOL 262 – Neurobiology Techniques or CSD 262 – Measurement of Communication Processes) as part of the NEUR curriculum. The research requirement can be met by 3 credit hours of NSCI 197 or 198. Typically, a student will work a minimum of 3 hours of lab work per credit hour per week (9 hours per week on the research for 3 credits). Many students devote even more time. This pays off as you become more involved in your research project. In the end, you understand your project much better, you can discuss it with much more depth and confidence in job or school interviews, and your Faculty Research Sponsor (the person directing the research project) will be able to write a much stronger letter of recommendation for you.

NSCI 197-198 can be taken for 1-6 credits. You will need to prepare a Research Proposal under the guidance of a Faculty Research Sponsor (note – students taking 6 credits of NSCI 197/198 are also required to give a short Research Talk – see below).

If you intend to take just 1 credit, you only need to write a 1-page proposal which summarizes the problem, the hypothesis being tested, and a brief description of the methods used to test the hypothesis.

If you intend to take a total of 2 or more credits, the research proposal must center on a conceptual problem in neuroscience, or in the area of expertise of the Faculty Research Sponsor (e.g., Biology, Chemistry, Communication Sciences, Psychological Science). The proposal will include (1) the statement of a problem, (2) presentation of a hypothesis, (3) organization of observations to test that hypothesis, (4) collection of data, and (5) analysis and potential interpretation of those data.

This proposal will be reviewed and approved by the Faculty Research Sponsor (the Sponsor will sign the title page of the proposal). The student will then submit a paper copy of the Research Proposal with the signed title page to the Neuroscience Undergraduate Program Director at least 2 days before the end of the Drop Period (which is two weeks after the first day of the semester).

After the proposal is approved, the Neuroscience Undergraduate Program Director will prepare a course over-ride, and the student can register. A student cannot register before the Proposal is approved.

It is the responsibility of the student to read, understand, and follow the requirements listed on this document. Any questions should be addressed to the Neuroscience Undergraduate Program Director.
Students are urged to consult with the Neuroscience Undergraduate Program Director before beginning the preparation of the Research Proposal.

Final Paper

Students will prepare a paper in standard journal format under the supervision of the research sponsor. The length of the paper should reflect the time devoted to the project (either one or two semesters), and should be in the format of a journal (the journal should be indicated on the cover sheet). The paper must match the format of a specific journal.

Research Talk (for students taking a total of 6 credits of NSCI 197 and 198)

Neuroscience majors who plan to use six credits of Undergraduate Research as part of their required advanced courses MUST present a short seminar at a venue approved by the Neuroscience Undergraduate Program Director. Typically this will be in the Biology or Psychological Science Departments, but could be in the department of the Faculty Research Sponsor if approved by the Neuroscience Undergraduate Program Director. It is up to the student to work with their Research Sponsor to identify an appropriate venue and to notify the Neuroscience Undergraduate Program Director of the title, date, and time of the presentation.

Evaluation

The Neuroscience Undergraduate Program Director will award the final grade based on the evaluation of the Faculty Research Sponsor, the final paper, and the mini-seminar presentation (if one is given). The Neuroscience Undergraduate Program Director may also consult other faculty members of the Neuroscience Undergraduate Program. The grade will be based on the evaluation of the amount of work put into the project by the student and the creative thinking displayed by the student.

Deadlines

DEADLINES ARE FIRM

The Research Proposal is due no later than two days before the end of the Drop Period (which is two weeks after the first day of the semester). This will allow the proposal to be reviewed by the Neuroscience Undergraduate Program Director and perhaps other faculty members in the Neuroscience Program. To prevent disappointments, it is a VERY good idea to discuss the proposal with a faculty member of the Neuroscience Program well in advance of the deadline.

A new proposal is generally not required for NSCI 198 if the project is a continuation of a Fall semester (NSCI 197) project.

The final paper (in the format of a journal article) must be approved by the Faculty Research Sponsor and then submitted to the Neuroscience Undergraduate Program Director by the LAST DAY OF CLASSES.

For projects which continue for two semesters, a final paper is not generally required at the end of the first semester. For example, if the project begins in the Fall semester and the project
continues in the Spring semester (i.e., the student registers for NSCI 197 and NSCI 198), then a final paper is due at the end of the Spring semester.

The suggested final grade must be submitted by the Faculty Research Sponsor to the Neuroscience Undergraduate Program Director by the last day of classes. Students are responsible for reminding their Sponsors of the approaching deadline. The grade can be submitted by paper message, e-mail, or phone to Dr. Hammack (shammack@uvm.edu; 656-1041).

If a student is doing two semesters of research (Fall and Spring), the Fall grade is recorded as an SP (Satisfactory Progress), and the grade for both semesters is given in the Spring. Students should inform the Neuroscience Undergraduate Program Director if they plan on a second semester of research (for the SP grade in the first semester).

Remember that dozens of students will be working in research courses every semester, so it is important that a suggested grade from the Faculty Research Sponsor and the final paper be submitted by the last day of classes. Late grades and papers will delay reporting the final grade to the Registrar's office and may cause problems for graduating seniors.

Therefore, mark the date on your calendar. The suggested grade from you sponsor and the final paper must be submitted by the LAST DAY OF CLASSES.

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RESEARCH PROPOSAL INSTRUCTIONS

The proposal begins with the cover page with ALL information requested. Note that ALL the information must be provided. Please write clearly!! The proposal should be a professional document, neatly typed, spell-checked, and composed in the style typical of a journal in biology.

1. **Length**. The proposal should be 2-3 pages, single spaced, with an extra page for references.
2. **Style**. The proposal should be in the standard prose of science, prepared in professional format, and include at least 10 references.
3. **Organization**
   a. **Introduction**. Place the project in a general context of the discipline. Begin with a very general statement, then focus in on the specific topic to be explored. What are the implications of your study? Demonstrate that this is a scientific study, asking original questions about an important problem in the life sciences. The QUESTION, HYPOTHESIS, and PREDICTED OUTCOME should be stated in language understandable to a general reader familiar with the life sciences. A reader should know, after reading the Introduction, WHAT you will be doing and WHY you are doing it.
   
   b. **Methods**. Present the details of the protocol to be followed. Where will you do the work? What equipment and supplies will you be using? What methods are required, and which will you need to learn? What are the analyses to be completed? Note that any use of vertebrate animals or human subjects must be approved by the appropriate institutional review panel (the student's research sponsor will have information on this subject).
c. **Results.** Present here some ideas of the type of results that you expect from your project. Suppose your results conflict with the hypothesis under scrutiny -- how would you interpret such results?

**Examples (poor and acceptable) of the opening of an Introduction to a Research Proposal**

**Poor** -- Goober fish are very pretty; the males have lots of bright colors on their fins. Very little is known about nervous system of goober fish, so I will do a study on them. I will determine if the peripheral nervous system determines the bright colors of goober fish and if the colors attract predators. It seems to me that bright colors should attract predators. I don't know if anyone has done such a study before, but I will learn from the project.

**Acceptable** -- The males of many species of animals display extravagant morphological features (such as bright colors), whereas the females are relatively dull in their appearance (Smith, 1998). Darwin (1880) noted that such extravagant features may reduce the lifespan of the males, perhaps by attracting the attention of predators. He argued that the cost of the extravagant trait to fitness will be more than balanced by "sexual selection" in which females prefer to mate with the showy males. However, little evidence exists to test the idea that predators actually attack the showy males more often (review in Jones, 1991). Goober fish (about 40 species are known [Williams, 1989]) are a strongly sexually dimorphic species. Males are strongly left hemisphere dominant whereas females are strongly right hemisphere dominant (Schall, 1991). I wish to test the hypothesis that this dominance has a direct effect on choice behavior in a visual discrimination paradigm. The optic tectum in the brainstem is thought to inhibit this dominance. I intend to examine the relationship between the tectum and the visual cortex using a visual discrimination task when the visual cortex in one hemisphere is temporarily cooled. To study the sexual dimorphic aspects of this relationship, I will study the effects of cortical cooling in both male and female goober fish.