Behavioral Neuroscience Research Course Manual

Compulsive-like (left) and non-compulsive like (right) OCD mice

BIOL 394W (3 credits)
University of Alaska Fairbanks
Fall 2016
Abel Bult-Ito
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Part I: Syllabus

1. Detailed Description of Behavioral Neuroscience Research

Welcome to Behavioral Neuroscience Research, a fully online special topics course! During this semester you will participate in biomedical research on mice, including data collection, data analysis, and interpretation of results. You will learn about obsessive-compulsive disorder (OCD) and other conditions in humans and how basic animal research has the potential to contribute to improving the human condition. You will be collecting data on three different behaviors using over 90 videos of individual mice per behavior, and an additional behavior with about 23 videos. You will write a research paper describing your results and do a thorough review of the peer-reviewed literature to put these results into the appropriate scientific context.

The goals of this course are:
To offer a comprehensive undergraduate biomedical research experience to online students from Alaska, the US, and around the world that is an equivalent experience to students who work in the physical research laboratory, to expose students to the scientific research method with hands-on research activities, and to have students develop scientific writing skills.

The learning objectives of this course are:
1. Complete IACUC training.
2. Discuss how research on animals must be scientifically justified, humane and ethical, and provide new knowledge.
3. Perform biomedical behavioral neuroscience research entirely online.
4. Collect behavioral data from mouse videos from compulsive-like, non-compulsive-like, and randomly bred mouse strains.
5. Analyze data for each behavior collected by students.
6. Interpret and discuss results in the context of other published research.
7. Describe the key characteristics of obsessive-compulsive disorder (OCD), anxiety, and depression in humans.
8. Compare and contrast compulsive-like, anxiety-like, and depression-like behaviors in mice to equivalent conditions in humans.
9. Formulate original research hypotheses.
10. Describe and discuss as to how basic research, as performed in this course, contributes to the animal model of OCD and how it may have the potential to contribute to improving the human condition.
11. Write a scientific research paper.
12. Complete writing intensive (W) requirements.

The OCD Mouse model you will be using:
The compulsive-like mouse model was developed from mouse strains artificially selected for high levels of nest-building behavior (compulsive-like big nest-builders; BIG1 and BIG3), low levels of nest-building behavior (non-compulsive-like small nest-builders; SMALL1 and SMALL3), and randomly-bred control mice (CONT1 and
CONT3), with intermediate nest-building levels (Bult and Lynch, 2000). These mice show face and predictive validity for a compulsive-like phenotype, using behavioral assessments and pharmacological treatments (Greene-Schloesser et al., 2011).

References:

We will use a variety of approaches to accomplish the goals and learning outcomes, which are all available on the course online portal through BIOL 043 MORE Behavioral Neuroscience Research (CRN 75330) or BIOL 194 Behavioral Neuroscience Research (CRN 77825). You need to register for one of these classes.

1. **Content modules (about 9 hours).** We will discuss the format of the course, what you get out of the course, what is expected of you, and the ethics of using mice in research. In addition, we will discuss the background on the four mouse behaviors you will be researching and how these behaviors relate to obsessive-compulsive disorder (OCD), anxiety, and depression in humans.

2. **Laboratory training, data analysis, and data interpretation modules, Institution Animal Care and Use Committee (IACUC) training, and discussion boards (about 10 hours).** In these modules, you will receive detailed information on how the behavioral data of the OCD mice was obtained and how you are to collect your own data set using these behavioral videos, and how to analyze and interpret the data. In addition, you will learn about the ethical use of mice in research and how to handle the animals. You will also be asked to contribute to discussion boards related to the course content.

   **You are required to successfully complete IACUC training during the first two weeks of the course.** You will be withdrawn from the course if you have not completed this training by the end of the third week, i.e., by 11:59pm on Friday 9 September 2016 Alaska standard time.

3. **Collection of behavioral neuroscience research data (about 75 hours).** For each behavior, 11-16 mice from each of six mouse lines will be individually videotaped. You will collect your own dataset using all the available videos (over 90). For each of three behaviors, you will spend about 20-25 hours to collect and analyze the data and 5-6 hours for one additional behavior. Please be advised that you may be collecting several behavioral components for each behavior. This course is individualized to meet your needs and the research experiences you want to have. You get to choose the three behaviors from a set of 6 behaviors/experiments,
including marble burying behavior, open field, forced swim test, elevated plus maze, and elevated zero maze of the six mouse lines, and elevated plus maze following treatment of the compulsive-like mice (BIG mice) with different doses of fluvoxamine, a drug used to treat OCD symptoms in humans. Please realize that collecting data in this format is very intensive, at a very high scientific level, and one of the most challenging laboratory exercises you have ever done. Take frequent short breaks so you can stay focused.

4. Provide course feedback (about 1 hour). You will be asked to choose a novel behavioral neuroscience experiment in collaboration with the other students in the course. You will be asked to choose what type of experimental manipulation to conduct and what behavior(s) of the OCD mice to test. This may include treatment with a drug and/or selection of which OCD mouse lines to use. The instructor will perform this experiment and videotape the procedures and the mice, so you can collect and analyze the data of this novel experiment. You will also be asked to provide a student opinion of instruction of the course, so we can improve it for future offerings.

5. Write a scientific research paper describing your results and doing a thorough peer-reviewed literature review to put your research results in the appropriate scientific context (about 45 hours). This paper will follow the format of a peer-reviewed neuroscience journal of your choice.

This manual will act as your guide for this course. In it is a description of the course requirements, module topics, and reading assignments, as well as general information to help you get the most out of this course. You should refer to it regularly throughout the semester.

Your minimal responsibilities for this course are defined in the Course Requirements section below. Be aware, however, that your successful completion of the course activities depends on how well you integrate all of the different kinds of information you receive from content modules, trainings, reading assignments, and data collection, analysis, and interpretation activities. Therefore, do not think of those assignments as separate entities but rather as parts of a jigsaw puzzle; together the complete concepts emerge.

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Office hours: Tuesday noon – 1pm
Thursday noon – 1pm
Or by appointment

Course Meeting Times and Locations
Content modules, laboratory trainings, and data sets will be available online. Generally, these will be made available on Monday 9am Alaska standard time and activities need to be completed by Friday 5pm (17:00) Alaska standard time.

Course Section
BIOL F394; UX1; CRN 78281; Prerequisite: UAF junior or senior undergraduate standing, or permission by instructor.

Course Blackboard Site and Canvas Network
http://classes.uaf.edu

Disabilities Services
The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will closely work with the Office of Disabilities Services (208 Whitaker Building, 474-5655 or TTY at 474-1827; email: uaf-disabilityservices@alaska.edu) to provide reasonable accommodation to students with disabilities.

To ensure that everyone has equal opportunities to succeed in this course, please let me know if I need to accommodate any disabilities that you may have with assistance of Disability Services. Any information you provide will be held strictly confidential.

Support Services
Computer labs on the UAF main campus are available in 303 Irving I (please contact Biology and Wildlife Office to get access), MBS complex room 110, 319 Bunnell Building, and Rasmuson Library 404. You may be eligible for services from the Student Support Services, 514 Gruening Building, Phone: 474-6844, E-mail: trio.sss@alaska.edu, http://www.uaf.edu/sss/.

The Writing Center
The Writing Center is located in 801 Gruening and is a resource center providing a full range of dictionaries, handbooks, thesauruses, and it is an art gallery displaying work by students from the UAF Art Department. The Writing Center also features a Computer Laboratory. There is no charge for printing. For fall semester hours please contact the Writing Center at (907) 474-5314 or uaf-writing-center@alaska.edu.

Accessibility and Privacy
Details on the accessibility and privacy statements for technologies used in this course can be found at:
2. Course Requirements
To do well in this course you must watch and participate in all course activities. Your grade will be based on the following criteria:

1. Content Modules 4%
2. Laboratory Training 4%
3. Data Analysis 4%
4. Data Interpretations (W: writing intensive) 5%
5. Collect Data 25%
6. Participate on Discussion Boards (W) 5%
7. Choosing Novel Experiment 1%
8. Complete Course Evaluation 2%
9. Scientific Research Paper (W) 50%

Total: 100%

Watch Content Modules
Whether you watch the content modules will be monitored by the Canvas Network course management system and evaluated with short online quizzes. You cannot move forward to the next module without watching the video in its entirety and completing the quizzes for each content module correctly.

Watch Laboratory Training Modules
Whether you watch the laboratory and training modules will be monitored by the Canvas Network course management system and evaluated with short online quizzes. You cannot move forward to the next module without watching the video in its entirety and completing the quizzes for each laboratory training session module correctly.

Watch Data Analysis Modules
Whether you watch the data analysis modules will be monitored by the Canvas Network course management system and evaluated with short online quizzes. You cannot move forward to the next module without watching the video in its entirety and completing the quizzes for each data analysis session module correctly.

Watch Data Interpretation Modules (writing intensive)
Whether you watch the data interpretation modules will be monitored by the Canvas Network course management system and evaluated with short online quizzes. You cannot move forward to the next module without watching the video in its entirety and completing the quizzes for each data interpretation session module correctly.

Collect Data
Because this is a laboratory course, data collection comprises 25% of your final grade. Whether you watch the mouse videos will be monitored by the Canvas network course
management system. You cannot move forward to the next module without watching each of the assigned mouse videos and uploading the data in the appropriate spreadsheet.

For three of the four behaviors, you will collect data of all animals from the six mouse strains. For some behaviors, you will collect data on several different components. To get credit for data collection for each behavior, all your data points need to be within an acceptable range, which will be defined for each behavior.

**Participate on Discussion Boards (writing intensive)**
Your active participation in this course is expected. For each module, we will have at least one discussion board to which you are expected to contribute constructively. To receive credit for this activity, you should have contributed constructively to all of the discussion boards.

**Choosing a Novel Experiment**
The instructor will design two novel experiments from which the students taking the course will choose one. Each experiment will have received IACUC approval before the start of the semester. Whether you contribute to choosing the novel experiment on the OCD mice will be monitored by the Canvas Network course management system. To receive credit, you will have to complete the online survey(s) related to this activity.

**Complete the Course Evaluation for BIOL 043**
Receiving your feedback on the course is very important for improving the course for future offerings. Your feedback will be anonymous and only provided to the instructor after the grades have been posted. Please be advised that completion of the evaluation is mandatory, as you will not receive a grade if you do not complete it within one week of the end of the course.

**Writing Intensive (W) Activities (60% of final grade)**
Because this is a writing intensive (W) class, 60% of your final grade will be determined by the following writing intensive activities:

**Write a Scientific Research Paper (50% of final grade)**
Although in the BIOL 043 class the reading is not mandatory, you are required to read most of these papers and include them in your scientific research paper where appropriate. You are also expected to do additional literature searches to bring your paper to the highest scientific level possible. The paper should include a 200-word abstract and introduction, material and methods, results, and discussion sections, to a minimum length of 15 pages double spaced with 1 inch borders, and font size of 11 or 12, using Arial or Times fonts. The references cited section is in addition to this page minimum and should contain at least 30 peer-reviewed articles.

- The first draft of your paper is due on 4 November 2016 (15% of final grade). You will receive detailed feedback about content and organization. These are the most important components of your grade (75%), although I will also pay attention to tone, word choice, sentence structure, grammar, punctuation, and spelling (25%). I will
also meet with you in person to discuss your first draft and how to improve it.

- The second draft of your paper is due 18 November 2016 (15% of final grade). You will receive detailed feedback as described for the first draft and you are encouraged to meet with me to discuss my feedback.
- Your final paper is due 9 December 2016 (20%) and will be graded as described for the first draft.

The scientific research paper should have the following components:

- **Title page**, including author and affiliation information.
- **Abstract.**
  - No more than 250 words.
  - Usually it includes 2-3 sentences of background, 2-3 sentences of methods, 3-4 sentences of results, and 2-3 sentences of discussion/conclusion/interpretation.
- **Introduction.**
  - The background information, including OCD and comorbidities.
  - Describe the Bult-Ito mouse model.
  - Briefly describe what you studied in this paper and what hypotheses you want to test, questions you want to answer, or objectives you want to accomplish.
- **Methods.**
  - Describe the animals used and IACUC approvals obtained.
  - Describe how the behaviors were measured.
  - Describe what experimental manipulations were done if applicable.
  - Describe the statistical analysis.
- **Results.**
  - Describe the results in writing and include appropriate statistical results.
  - Illustrate the results with figures and/or tables.
  - Use a similar format as used in the methods section.
- **Discussion.**
  - Compare your findings with already published work.
  - Describe how your findings relate to and contribute to the understanding of the OCD model.
  - Describe how your results compare to other animal models and the OCD condition in humans.
  - Describe how you interpret your results in the context of what is known in the research field.
  - Include a concluding paragraph at the end in which you summarize the discussion and present one or two key interpretations.
- **Acknowledgments**, in which you thank those who have contributed to the work and list those who have funded the research.
- **References.**
  - Include full citations of all peer-reviewed articles you have cited in the text of the paper.
  - Do not include articles you did not cite in the text of the paper.

**Data Interpretation (5% of final grade)**

For each of four data interpretation modules (1.25% each), you will submit your
interpretation of the results in writing after each data analysis module. You will be graded on content and organization (75%) and other writing characteristics (25%), and I will provide you with detailed feedback. This will help you write the discussion section of your scientific research paper.

**Discussion Board Contributions (5% of final grade)**
Each of your Discussion Board contributions will be reviewed on content and organization (75%) and other writing characteristics (25%). You will receive detailed comments from me to improve your discussion board contributions.

**Additional Writing Intensive Activities (0% of final grade)**
You are encouraged to provide me with written sections of the scientific research paper before the first due date of 14 November. I will provide you with general feedback regarding content and organization.

**Additional Activities**
For your own literature research good sources for peer-reviewed literature include PubMed Central (http://www.ncbi.nlm.nih.gov/pmc/) and Web of Science/Knowledge (http://apps.webofknowledge.com).

**Grading**
The class will be graded on a straight percentage basis:

- 97.0-100% is an A+
- 93.0-96.9% is an A
- 90.0-92.9 is an A-
- 87.0-89.9 is a B+
- 83.0-86.9 is a B
- 80.0-82.9% is a B-
- 77.0-79.9 is a C+
- 73.0-76.9 is a C
- 70.0-72.9% is a C-
- 60.0-69.9% is a D
- < 60% is an F

I will not grade on a curve. Be aware that the grading scale above will be used without exception. Therefore, for example 89.9% will result in a final grade of B+ and 59.9% will result in a final grade of F. The 0.1% difference may seem like a small difference, but since it is based on 9+ separate grades, it truly reflects a level of performance that does not warrant a higher grade. Being on the right side of the cut-off is your responsibility!
## Part II: General Course Information

### 3. Outline of Content Modules, Laboratory Trainings, and Data Collections

(Subject to Change)

<table>
<thead>
<tr>
<th>Week of the semester</th>
<th>Content Modules/Laboratory Trainings: Topics</th>
<th>Data Collections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Module 0: Format of the course; student expectations</td>
<td>Module 1: IACUC Training</td>
</tr>
<tr>
<td>2</td>
<td>Module 2: The ethics of using mice in research</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Module 3: Scientific background on OCD in humans and compulsive-like behavior in mice; nest-building data presentation</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Module 4: Laboratory training session 1: Marble burying test (compulsive-like behavior) and Data collection 1</td>
<td>Marble burying test</td>
</tr>
<tr>
<td>5</td>
<td>Module 5: Data analysis session 1: Marble burying behavior</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Module 6: Scientific background on anxiety behaviors in humans and mice</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Module 7: Laboratory training session 2: Open field test (anxiety) and Data collection 2</td>
<td>Open field test</td>
</tr>
<tr>
<td>8</td>
<td>Module 8: Data analysis session 2: Open field behavior</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Module 9: Scientific background on depression behaviors in humans and mice</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Module 10: Students choose one behavioral experiment from 3-4 possible experiments designed by the instructor Module 11: Laboratory training 3: Tail suspension test (depression) and Data collection 3</td>
<td>Tail Suspension test. Provide feedback for the choice of a novel new experiment</td>
</tr>
<tr>
<td>11</td>
<td>Module 12: Data analysis session 3: Tail suspension test. Scientific background on the students’ chosen topic</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Module 13: Scientific background on the behavioral test chosen by the students Module 14: Laboratory training session and Data collection 4 for behavioral test chosen by the students</td>
<td>Behavior chosen by the students</td>
</tr>
<tr>
<td>13</td>
<td>Thanksgiving Break</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Module 15: Data analysis session 4: Behavioral test chosen by the students</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>Module 16: * Interpretation of data session 1: Compulsive-like behaviors in the OCD mice * Interpretation of data session 2: Anxiety-like and depression-like behaviors in OCD mice * Interpretation of data session 3: How does it all fit together</td>
<td>Provide course feedback to improve future courses on behavioral neuroscience</td>
</tr>
</tbody>
</table>
4. How to Get the Most Out of the Course

1. On average, you need to spend 9-10 hours per week on this course to be successful. Some weeks, you may only spend 3-5 hours on course activities, while other weeks this may be 20-25 hours, especially for data collection.

2. Do the assigned readings before watching the content modules. This will help you understand the module content material and see how a topic is going to be developed. Watching the content module prepared will also give you the necessary background to enjoy and absorb the content.

3. Establish a schedule of activities that includes some time set-aside for review. For example, as we discuss the results of the open field test, review the data analysis and interpretation of the marble-burying test, so you can put the new information into the proper context.

4. Don't be embarrassed or afraid to admit that you are having difficulty. We should all work together to see that everyone learns. Please contact me because I want this course to be a successful learning experience for everyone. I have office hours because I want to help you succeed; use me!

5. Ask questions. This is the best way you have for clearing up confusing points and misunderstandings and to go beyond what we talked about in content and laboratory modules. Learning to ask questions is the first skill that a scientist has to develop in order to find meaningful answers.

6. Have fun! Nothing works better than enjoying what you are doing. Please let me know at any time what I can do to improve the course.

5. Students' Rights and Responsibilities

The university subscribes to principles of due process and fair hearings as specified in the "Joint Statement on Rights and Freedoms of Students." This document can be found in the Division of Student Services. You are encouraged to read it carefully.

Most students adjust easily to the privileges and responsibilities of university citizenship. The university attempts to provide counsel for those who find the adjustment more difficult. UAF may terminate enrollment or take other necessary and appropriate action in cases where a student is unable or unwilling to assume the social responsibilities of citizenship in the university community.

STUDENT CODE OF CONDUCT

UAF students are subject to the Student Code of Conduct. In accordance with board of regents' policy 09.02.01, UAF will maintain an academic environment in which freedom to teach, conduct research, learn and administer the university is protected. Students
will benefit from this environment by accepting responsibility for their role in the academic community. The principles of the student code are designed to encourage communication, foster academic integrity and defend freedoms of inquiry, discussion and expression across the university community.

UAF requires students to conduct themselves honestly and responsibly, and to respect the rights of others. Conduct that unreasonably interferes with the learning environment or violates the rights of others is prohibited. Students and student organizations are responsible for ensuring that they and their guests comply with the code while on property owned or controlled by the university or at activities authorized by the university.

The university may initiate disciplinary action and impose disciplinary sanctions against any student or student organization found responsible for committing, attempting to commit or intentionally assisting in the commission of any of the following prohibited forms of conduct:

a. Cheating, plagiarism or other forms of academic dishonesty
b. Forgery, falsification, alteration or misuse of documents, funds or property
c. Damage or destruction of property
d. Theft of property or services
e. Harassment
f. Endangerment, assault or infliction of physical harm
g. Disruptive or obstructive actions
h. Misuse of firearms, explosives, weapons, dangerous devices or dangerous chemicals
i. Failure to comply with university directives
j. Misuse of alcohol or other intoxicants or drugs
k. Violation of published university policies, regulations, rules or procedures
l. Any other actions that result in unreasonable interference with the learning environment or the rights of others.

This list is not intended to define prohibited conduct in exhaustive terms, but rather offers examples as guidelines for acceptable and unacceptable behavior.

Honesty is a primary responsibility of you and every other UAF student. The following are common guidelines regarding academic integrity:

1. Students will not collaborate on any quizzes, in-class exams, or take-home exams that contribute to their grade in a course, unless the course instructor grants permission. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.
2. Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses, and other reports.
3. No work submitted for one course may be submitted for credit in another course
without the explicit approval of both instructors.

Alleged violations of the Code of Conduct will be reviewed in accordance with procedures specified in regents' policy, university regulations and UAF rules and procedures. For additional information and details about the Student Code of Conduct, contact the dean of students or visit www.alaska.edu/bor/.

STUDENT BEHAVIORAL STANDARDS
Education at the university is conceived as training for citizenship as well as for personal self-improvement and development. Generally, UAF behavioral regulations are designed to help you work efficiently in courses and live responsibly in the campus environment. They are not designed to ignore your individuality but rather to encourage you to exercise self-discipline and accept your social responsibility. These regulations, in most instances, were developed jointly by staff and students. Contact the dean of students for more information.

NETIQUETTE
We are mutually interdependent in the success of our learning endeavor. I expect that we will all model the highest standards of respect and consideration for one another and for our learning process.

Please make sure that:

- Your contributions are regular and sufficiently engaging.
- Your contributions are insightful with deliberate contemplation evident.
- You contribute meaningfully to the discussion, and your comments demonstrate original thought and stimulate continued dialog.
- Your feedback is constructive and collegial.
- Your comments are widely distributed across the cohort.
- Your communications exhibit professionalism and respect.

Netiquette addresses civility and professionalism in online communications. Adhering to some basic guidelines further ensures the success of our communications and collective learning experience.

- Do not use offensive language.
- Do not dominate discussions.
- Use simple English.
- Use correct spelling and grammar.
- Share tips with other students.
- Keep an “open-mind” and be willing to express even your minority opinion.
- Think before you push the “Send” button.
- Do not hesitate to ask for feedback.
- When in doubt, always check with others for clarification.
6. Conditions You Agree To When Taking This Course

1. You agree that you will not make any course materials, including but not limited to content modules, data, data videos, etc., available to anyone else. Doing so will violate copyright law and will be prosecuted.
2. You agree that you do not object to the use of the OCD mice in the experiments performed in this course.
3. You agree to waive any ownership rights to any of the data collected or findings in this course.
4. You agree to waive any rights to authorship related to any data or findings obtained during this course.
5. You agree that any findings related to the delivery of this course maybe be published. Neither your name nor any other personal data will be released in such publications.
6. You will be required to successfully complete online institutional animal care and use committee (IACUC) training before you are given access to the behavioral data videos. You will be withdrawn from the course if you have not completed this training by the end of the third week, i.e., by 11:59pm on Friday 9 September 2016 Alaska standard time.