BIBB 375
Laboratory in Animal Behavior
Spring 2020 W 1-4 pm
Leidy 104

Course Faculty

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Synopsis:

This course will allow students to understand the variety, function, and evolution of complex behaviors in simple animals and how the genes governing these behaviors can be used to provide insight into human behavior and brain disease. The course is structured to allow students to experience what it is like to work in a neuroscience research laboratory. We will use the fruit fly (*Drosophila melanogaster*) as our model. Over the course of the semester, we will examine the underlying genetics of a variety of fly behaviors to understand aggression, taste, addiction, courtship, neurodegenerative diseases, and circadian rhythms. We will review both current and historical research advances in detail by focusing on primary literature. Students will be expected to design, analyze and interpret the behavioral experiments that are employed. Students will learn how to conduct animal behavior research, enhance their ability to critically read scientific literature, and improve their written and oral communication skills through paper presentations and written reports.

Specific Learning Objectives:

By the end of this course, students should be able to:

- Understand how simple model organisms can be used to investigate human behavior and disease and the limitations of such models
- Articulate the value of model organisms in biomedical research
- Present, critique, and evaluate research articles from primary literature
- Design and implement experimental procedures to assay specific animal behaviors

Pre-Requisites:

BIBB 109 and BIOL101/102 are ***pre-requisites*** for the course. The course will assume that students have a basic background in BOTH neuroscience and genetics.

Canvas

https://canvas.upenn.edu/
All course related material will be posted on this site.

Weekly Readings:

The assigned papers are to be read ***prior to class***. All reading material will be posted on the Canvas site. You must complete the assigned readings so that you are well-prepared for the discussions during class. Please do **all** required readings as they are assigned.

Grading:
Your final grade in the course will be determined as follows:

1. **Weekly Attendance and Participation:** 30%
2. **Peer Reviews (2):** 10%
3. **Instructor for a Day Assignment**: 25%
4. **News and Views Writing Assignment:** 15%
5. **Weekly Lab Notebook: 20%**

Attendance and Participation
30% of your grade will come from Attendance and Participation. Attendance is **required** for this course. Anyone who misses **more than two** class periods because of unexcused absences will automatically fail the course. For each class period, you may earn up to 3 points for Attendance and Participation; one point will be earned automatically for showing up to class; two additional points can be earned for participating in the paper discussion.

Peer Review Assignments
One of the requirements for this course (10% of total grade) is to complete **two** peer reviews of your fellow students' presentations (~1 page in length). An example for this assignment will be posted on Canvas. These assignments are due at 11:59 am on the Sunday afer the lab. Assignments turned in after the 11:59 am deadline will be considered **late** and will **not** be graded for credit.

Instructor for a Day (and Guest DJ for the day)
During the semester, each student will act as the **Instructor for a Day** (with a partner). Two students will present a primary research article and background information about the fly behavior under study. The papers will be chosen from those listed in the Schedule of Topics. Each presentation will last ~30-40 minutes. There will then be a ~15-20 minute discussion following the presentation during which all students are free to participate (to earn discussion points). You will work with your partner to create the entire presentation with each of you delivering half of it. THOUGH YOU ARE ONLY PRESENTING HALF OF THE PRESENTATION, YOU ARE RESPONSIBLE FOR KNOWING ALL THE INFORMATION WITHIN THE ENTIRE PRESENTATION.

"News and Views" Assignment
For the paper (and behavioral test) you present as the **Instructor for a Day**, you will write an ~1000 word (two to three pages, single-spaced, no more!) "News and Views" article in the spirit of the journal *Nature*. The details of the assignment are described later in the syllabus.

Lab Notebook (Weekly upload to Canvas--Thanks to Dave Garbe, Ph.D. for his guidance here)
For each lab experiment, you are expected to maintain an accurate and complete lab notebook that contains all the information needed for an outside observer to repeat the experiment that you do. Your objective is to ensure that you, or someone else, will be able to turn to your notebook at any future time and, from the description you have written, repeat the procedure. This includes keeping tallies of all flies used (even those discarded for any reason). Each student must keep his/her own individual notebook. You will upload your weekly Notebook entry to Canvas by 11:59 pm the Sunday after the lab. You are only required to do these notebooks during the 7 weeks of experiments (Week 6 through Week 14).

For each lab, you should record the following in your notebook:

A. Date Your lab notebook can become a legal document and the handwritten date is part of the legal record

B. Title for each experiment.

C. Aims of each experiment (a brief summary of *the why* as well as the what).

D. Procedure. You may paste in the handout from the presenters here. **Please be careful to annotate any deviations from the protocol and to carefully record precise amounts of reagents/flies used. Include # of flies used and discarded and reasons why those were discarded.**

E. All data and results obtained at the time you obtain them. If you realize that you need to correct an entry made previously, add the correction and date it appropriately.

F. Comments on significant results, explanations for unexpected findings, etc…-- written while data are still fresh in your mind (don't wait!).

G. Appropriate attribution. Many of the experiments that we do will involve group collaboration (some groups will work with mild-type flies; others with the mutant flies); this reflects what happens during collaborative science in the real world. You must credit the people involved in generating all data directly in your notebook. Complete and accurate citation is part of scientific integrity.

H. A brief and concise discussion of your data. At the end of each experiment, jot down the answers to such questions:

- **What did your experiments show?**
- **Was the result what you expected? If so, why; if not, why not?**
- **What problems did you encounter in doing the experiments?**
- **How would you alter the protocol for next time?**

Never be embarrassed to show your own data. A thoughtful discussion of ambiguous or negative results is worth more than mistreatment of nice data. **Don't record your data on scraps of paper or paper towels and rewrite later!!**

Note that some of the experiments will require video recording of fly behavior and the analyses may be performed outside of the lab.

Grading of lab notebooks:

Here is the rubric I will use to grade your lab notebooks.

	Poor	Fair	Good	Very Good	Excellent
1) Organization (Dates, Titles, Subheadings)	**1**	**2**	**3**	**4**	**5**
2) Goals and Procedure	**1**	**2**	**3**	**4**	**5**
3) Results	**1**	**2**	**3**	**4**	**5**
4) Data Interpretation/Discussion	**1**	**2**	**3**	**4**	**5**

Office Hours/Email Policy:

You are encouraged to attend office hours if you have any questions about the content or structure of the course and to work with the instructor on experimental design. Please only e-mail us if you have a question that can be answered in a few sentences or less. If you have a question that requires a longer response, please come to office hours.

Academic Integrity:

Please note that Penn has strict rules on academic integrity (see: https://catalog.upenn.edu/pennbook/code-of-academic-integrity/ Any violation of the rules will be reported to the Office of Student Conduct and will likely result in automatic failure of the course.

Course Absence Report:
The Course Absence Report (CAR) system has been designed to provide a consistent way for students to notify course instructors of short-term absences for one or more courses. It also provides a method for advising offices to track absences and coordinate support for students who miss classes. The submission of a CAR does not excuse you from your course obligations; students are still responsible for following up with each instructor directly and adhering to course policies and procedures as outlined in the course syllabus. All students enrolled in a class can submit a CAR during the current term using Penn InTouch.

All notifications of class absences must be sent to the instructor through the CAR *only*. If you will be absent for more than five days as a result of a University-approved excuse, please contact a CaseNet advisor with the College Office, who will notify your instructors directly.

Classroom and Laboratory Etiquette:
Cell phones/Smartphones should be turned off during class. Laptop computers should be used **only** for taking notes, not for sending instant messages, surfing the web, monitoring status updates on Facebook, or any other purpose. No food or drink is permitted in the lab.

Week	***DATE***	***Topic***	***Readings***	***Lab Activity***
1	1/22	***If Flies Ruled the World***	*None*	***The Hellstrom Chronicle***
2	1/29	***Learning to Fly***	*Benzer (1971); Vosshall (2007)*	**Basics of fly pushing, equipment familiarity and lab procedures**
3	2/5	***Push it…Push it Real Good: Fly Handling and History***	*Stocker and Gallant (2007); Morgan (1910)*	**Basics of fly pushing; set-up P1 crosses (*white*)**
4	2/12	***You Look so Fly: Generating Flies with Genetics***	*Benzer (1967); Spradling and Rubin (1982); Fischer et al., (1988);*	**Keep pushing: look at last week's vials; set-up P1 crosses (*Curly*, *Antennapedia*);** **Presentation Preferences DUE**
5	2/19	***Time Flies: Circadian Rhythms***	*Konopka and Benzer (1971); Bargiello et al., (1984); Sehgal (2017)*	***Set up F1 crosses (white);*** ***Participation #1***
6	2/26	***Bar Fly: Alcohol Sensitivity***	***Original Paper:*** *Devineni and Heberline (2009);* ***Review:*** *Kaun et al., (2012);* ***Method****: Maples and Rothenfluh (2011)*	***Evaluate P1 crosses (Curly, Antennapedia); Alcohol sensitivity*** ***Participation #2***
7	3/4	***Optogenetics***	***Original Paper:*** *Shroll et al., 2006* ***Review:*** *Boyden et al., 2005* ***Method****: Hornstein et al., 2009*	***Evaluate F2 progeny (white);*** ***Optogenetics Assay*** ***Participation #3***
8	3/11		**Spring Break: No Class**	
9	3/18	***Seizing Flies: The Bang Assay***	***Original Paper:*** *Pavlidis et al., (1994);* ***Review****: Parker et al., (2011);* ***Method****: Burg and Wu, 2012;*	***Bang Assay*** ***Participation #5***

10	3/25	***How do Flies Fall in Love: Courtship***	***Original Paper****: Ryner et al., (1996);* ***Review****: Hall (1994);* ***Method:*** *Boutros et al., (2017);*	***Courtship Assay*** ***Participation #6***
11	4/1	***(Not) Like a fly on S%&: Taste mutants***	***Original Paper:*** *Jiao et al., (2007);* ***Review:*** *Joseph and Carlson (2015);* ***Method****: Bantel and Tessier (2016);*	***Taste Assay*** ***Participation #7***
12	4/8		***NO CLASS***	
13	4/15	***Shoe Fly…Shoe: Fly Aggression***	***Orignial Paper****: Chowdhury et al., (2017);* ***Review:*** *Kravitz and Huber (2003); Chen et al., (2002);* ***Method*** *:Mundiyanapurath et al., (2007);*	***Aggression Assay*** ***Participation #8***
14	4/22	***Marty McFly: Parkinson's Disease in flies***	***Original Paper:*** *Greene et al., (2003);* ***Review:*** *Lessing and Bonini (2009**);*** ***Method:*** *Madabattula et al., (2015**);***	***Climbing Assay*** ***Participation #9***
15	4/29	***Back to where it all began***		***The Fly Room*** ***NEWS AND VIEWS ASSIGNMENT DUE 5/8***

NEWS AND VIEWS ASSIGNMENT

News and Views articles are brief and aim to introduce a scientist to significant new research in other fields. The goal of this assignment is to write an article about a specific topic that can be understood by a general scientific audience (e.g., one of your classmates); what you write needs to avoid specialized technical jargon. The basic template of an article is as follows:

Title: A short, snappy and relevant title to get the reader's attention.

Statement of the News: 1-2 sentences and ≤20 words

- summarizes the major finding(s) of the paper by emphasizing its relevance and impact on the field.

Opening paragraph geared to non-expert that:

- Briefly states motivation for the paper (1-2 sentences)
- Explicitly cites the study and topic
- States primary finding
- Briefly summarizes the implications

Paragraph(s) on background

Paragraph(s) on method (avoid being too technical)

Paragraph(s) on results

Final paragraph on the significance/implications of the work and future research directions

References: at least **5** (one can be the paper you are presenting)

Two figures (one created by you that captures the relevance/significance of the paper and one created by you using your actual experimental data) with captions written by you.

A total length of ~1000 words (1200 max).

Course Reference List

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Notes on Handling Drosophila
(Thanks to Dave Garbe, Ph.D. for these notes)

1. **Safety and environmental issues**: Working responsibly assures your safety and that of others in the lab. It protects the environment also increases the chance that you will generate high quality data:

- Dispose all contaminated waste into the correct receptacles and clean all spills with disinfectant
- No eating, drinking, chewing and applying cosmetics in the lab
- If you have cuts or abrasions on your hands, they should be dressed and you should wear gloves
- Chemicals and cultures should never be removed from the lab.
- Wash your hands before you leave the lab or if they become contaminated

2. **Aseptic technique**: Molecular biology reagents and preparations as well as microbiology cultures should be handled aseptically. This reduces the chance that your results will be invalidated by contamination from micro-organisms in the environment. It also protects you and the environment from potential contamination from your work.

3. **Pure fly cultures:** Just as extraneous contamination can mar your microbiology research, contamination of your fly cultures with flies from other receptacles or the environment can mar your work and that of others.

4. **Incubation**: Flies should be incubated in perfectly stoppered containers and should be 'awake' before they are placed upright in fly food

5. It is as important to **label** your laboratory materials as it is to keep a well-annotated notebook. Tubes should be labeled with contents, initials and date. You should label in such a way that another can correctly dispose your cultures if you are unable to do so.