Syllabuses summer 2013
Undergraduate Research - BIOL 4910 022 CRN 39651
Experiential learning - Authentic research in biology 3 Credits
Tomer Avidor-Reiss, Ph.D.

When and Where?
Each student will be involved with 3 activities: Lectures, Section and Independent-Research

For the 1st half of the semester (May 13 – Jun 21):
Lecture time will be on Monday 1-2 pm in Bowman-Oddy Room 1099
Section time will be Tuesday 12-4 pm in Bowman-Oddy Room 1099

For the 2nd half of the semester (Jun 24 – August 2):
Section time will be on Monday 12-4 pm in Bowman-Oddy Room 1099
Lecture time will be Wednesday 1-2 pm in Bowman-Oddy Room 1099

In addition each one of you will have 3-4 periods of Independent-Research a week of about 1-2 hours. This independent research will take place in the morning 6-10 am or evening 5-9 pm. Once you are organized into teams you will set these times between you (see table below).

Each team is made of three students: Student A, Student B, and Student C,

Shift	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
6-10 am	Student A	Student B	Student C	Student C	Student A		
5-9 pm	Student B	Student A	Student A	Student C	Student B		

Program Description

This course is part of a 5-course program that provides research experience and comprehensive understanding of the scientific process. To accomplish this, students will perform authentic research, learn how to establish research questions, how to pursue funding for their research, report on the research progress, and finally, write a paper that summarizes their research findings.

Course 1: Students will establish a research question that they can answer using a genetic approach in fly testes, make a mutant collection to answer the question, and write a research grant about it.

Course 2: Students will screen for cellular phenotypes called for by their research question, and write a progress report based on their findings.

Course 3: Students will map the mutant of interest using positional cloning, and make a poster summarizing their research goals and findings for a meeting.

Course 4: Students will identify the mutant candidate gene using bioinformatics and genomic sequencing, and prepare a presentation for a conference about his or her research.

Course 5: Students will demonstrate that the gene mutation they identified causes the phenotype they observe using molecular biology and rescue experiments, then write a paper about their findings.

Course 1 Goal:

The goal of Course 1 is to teach you: how to select a research topic, write a grant, perform mutagenesis, and establish a mutant collection directed to research a particular subject.

Course lectures

Lecture times are divided into four parts. These parts are:
1) Introductory lectures to familiarize the student with the course, the fly genetics, and fly testes as a model organ system for cell biology.
2) How to write a grant and present your research for peer review.
3) Student presentations and peer review.
4) Reading original research papers on mutant collections (optional depends on time availability)

Course sections

Student will learn:
1) Learning basic skills in fly genetics
2) Writing a research log
3) Learning schemes of genetic crosses
4) Summarizing the finding

Each section will start with a short quiz intended to examine if critical concepts learned in the previous section are clear for students. Then students will learn the skills necessary to perform their research, how to read, write, and follow schemes of genetic crosses.

Independent research time

Each student will need to come 3-4 times a week in the morning or evening to separate males from females, make crosses, and analyze flies.

Each shift the student will make sure one of their partners collected separate males from females in the previous shift.

Student will indicate they came to the shift and write a summary of what they did in the group log.

Course resources

Introductory information on fly genetics:

- "How to design a genetic mating scheme: a basic training package for Drosophila genetics". Roote J, Prokop A. G3 (Bethesda). 2013 Feb;3(2):353-8. doi: 10.1534/g3.112.004820. Uploaded to blackboard as: "Drosophila introduction"

Introductory review papers on Drosophila testes

- "Drosophila Spermiogenesis: Big things come from little packages" by Fabian L and Brill JA. Spermatogenesis. 2012 Jul 1;2(3):197-212.

Introductory review papers on centrosome

- "Centrioles, centrosomes, and cilia in health and disease" By Nigg EA and Raff JW. Cell. 2009 Nov 13;139(4):663-78.
- "Towards a molecular architecture of centriole assembly" By Gönczy P. Nat Rev Mol Cell Biol. 2012 Jun 13;13(7):425-35. doi: 10.1038/nrm3373.
- "Clockwise or anticlockwise? Turning the centriole triplets in the right direction!" By Uzbekov R and Prigent C. FEBS Lett. 2007 Apr 3;581(7):1251-4.

Papers that will be discussed

- **"**Toward a comprehensive genetic analysis of male fertility in Drosophila melanogaster" by Wakimoto BT, Lindsley DL, and Herrera C. Genetics. 2004 May;167(1):207-16.
- "The Zuker collection: a resource for the analysis of autosomal gene function in Drosophila melanogaster" by Koundakjian EJ, Cowan DM, Hardy RW, and Becker AH. Genetics. 2004 May;167(1):203-6.

Grading

Grades will be determined based on 7 factors with an approximate weight as follows:

Lecture Attendance and participation:	10%
Section Attendance and participation:	10%
Independent research attendance and performances:	20%
Quizzes:	10%
Assignments	10%
Oral Presentation:	20%
Grant proposal:	20%

Lecture and Section Attendance and Participation:

Unexcused absences will not be tolerated, and excused absences should be rare and supported by a physician's note or other piece of documentation.

Rubric: Full grade (1 point) – coming to class on time and being there from beginning to end.

0.8 or fewer points - coming to class late or leaving before or during class.

0 points – unexcused absence.

Students must participate in discussions, activities, and demonstrate that they prepared for class. Students are expected to have read the assigned reading material, analyzed it critically, and have done the extra background analysis needed to comprehend the material. Prior to coming to class students are required to research all aspects of class matrial until they understand it or come to class with prepared questions about things not understood.

Rubric: Full grade (1 point) - student made 2 or more meaningful contributions to the discussion.

0.8 points - student that made 1 contribution to the discussion.

0.5 points - student that listen attentively to the discussion.

0 points - unexcused absence from class or not listening to the discussion.

Lecture matrial such as power point will be available before class in blackboard and students are required to read it to be prepared for class.

Independent research attendance and performances:

Unexcused absences will not be tolerated, and excused absences should be rare and supported by a physician's note or other piece of documentation.

In case of inability of a student to attend to his scheduled term of fly collection, the student must contact his group mates and ask them to attend to the flies instead of him.

Students must fill out a log that indicates that they came to their independent research time and collected the flies. This log must be available to the other students in their group and the instructor to make sure they performed the written operation when they collected flies.

Rubric: Full grade (1 point) - student attended to his flies and crosses.

0.5 points - student attended to his flies but not the crosses.

Student that failed to come and collect the flies or make sure that sombody else tend the flies, will lose 5% of the total grade in the course.

Quizzes:

To test comprehension, students should expect short quizzes at the beginning of each section time. Each student will get a feedback on his or her performance on a quiz. Students will need to retake quizzes until they get a perfect score. The average grade of all attempts related to particular quiz will be the final grade for that quiz.

Original research paper writing assignments:

Before the discussion of each research paper you must submit an assignment. All writing assignments must be uploaded to blackboard, brought to class as hard copies, and handed in on the due date. Because this preparation is critical for your participation in class, failing to submit this assignment before the first discussion of each paper will result in getting 0 points for the assignment.

Read the paper and write (or copy and paste) your answer to the following 3 questions into text box of Blackboard:

1) How was the reading experience?

2) Please write 3 points of interest to discuss in class (be prepared to share them in class)

3) Please write in 100 words.

1. **Background** - What is the subject? What is known about it? Why is this important?
2. **Question** - What is not known? How significant is this question?
3. **Hypothesis** - What is the author's hypothesis? What is the basis of this hypothesis? Is it significant?
4. **Method** - How did the authors study it? What are the advantages and limitations of the method?
5. **Results** - What did the authors find? Explain each finding in detail using the 7-rule.
6. **Conclusion** - What is the author's interpretation? Would you agree with that?
7. **Future direction** - What is next?

Rubric:

<table>
<tr><th>Weight</th><th>Subject/Grade</th><th>4</th><th>3</th><th>2</th><th>1 or 0</th></tr>
<tr><td>15%</td><td>Reading experience</td><td rowspan="2">Satisfactory:
Clear and concise supported statement</td><td rowspan="2">Statement needs a few improvements</td><td rowspan="2">Statement needs substantial improvement</td><td rowspan="2">Rudimentary or missing statement</td></tr>
<tr><td>15%</td><td>Points of interest</td></tr>
<tr><td>10%</td><td>Background</td><td rowspan="7"><u>Satisfactory</u>:
Clear, supported by evident, Concise, and Include an evaluation</td><td rowspan="7"><u>Can be improved</u>:
Slight improvement is needed</td><td rowspan="7"><u>Requires substantial improvement</u>:
Substantial improvement is needed</td><td rowspan="7"><u>Deficient</u>:
Attempt was done to address the subjects
Or
<u>Missing</u>:
No attempt to do assignment</td></tr>
<tr><td>10%</td><td>Question</td></tr>
<tr><td>10%</td><td>Hypothesis</td></tr>
<tr><td>10%</td><td>Method</td></tr>
<tr><td>10%</td><td>Results</td></tr>
<tr><td>10%</td><td>Conclusion</td></tr>
<tr><td>10%</td><td>Future direction</td></tr>
</table>

Oral presentation:

Students will make an oral presentation to the class about their research proposal. Students in the same group will divide between themselves the proposal to equivalent parts. Presentation will consist of a multi-slide powerpoint presentation that includes: Titles, Figure panels, and the notes of the presenter with what the presenter is planning to say. At the end of the presentation the group will answer questions raised by the peer review committee and defend their proposal. Rubric:

Weight		Grade: 4	3	2	1 or 0
Introductory statement: 1-3 sentence statement that describes the presentation subject, conclusion and significance					
5%		Clear, concise and explain significance	Can be improved	Requires substantial improvement	Missing
Prsentation background: one or more slides that provide becground and contecst to the whole presentation					
5%		Clear and concise presentation and figures	Can be improved	Requires substantial improvement	Missing
Presentation question and/or hypothesis: Slides that describe the presentation question and/or hypothesis					
5%		Clear, concise and explain significance. Clear and concise figures	Can be improved	Requires substantial improvement	Missing
Research approach: explaining the approach and its advantages and disadvantages					
5%	[4]	Clear and concise explanation and figures. Includes advantages and limitations	Can be improved	Requires substantial improvement	Missing
Expected outcome and pitfalls					
50%	Background Question/ Hypothesis Method Expected Results Conclusion What then?	<u>Satisfactory</u>: At least 4 of the 7 subjects is clear, supported by evidence, concise, and includes an evaluation	<u>Can be improved</u>: Slight improvement is needed in at least 4 of the 7 subjects	<u>Requires substantial improvement</u>: Substantial improvement in at least 4 of the 7 subjects	<u>Deficient</u>: Missing 2 or more of the grade points
General					
10%	Slide Titles	Described concisely the take home message	vague, too long or not to the point	Do not include the slide premise	Missing
10%	Cohesiveness of presentation	There is clear connection in the transition between slides	There is connection in the transition between slides that can be improved	The transition between slides needs major improvements	Missing
5%	Presentation mechanics	Students faced the audience and pointed to all slide elements at the appropriate time.	Students inconsistently faced the audience or pointed to slide elements.	Students rarely faced the audience and pointed to the slide elements .	Students did not face the audience and point to the slide elements.
5%	Questions and answer section	Question content is repeated and not its tone and answer is the point	Inconsistent question repeating or answer question tone or answer is unfocused	Failing to repeat question and provide answer that needs major improvements	Failing to repeat question and provide irrelevant or wrong answer

Grant proposal: (20%):

The final term paper will be a grant proposal including:

a) Title

b) A short statement of research

c) 1 page summary intended for a general audience

d) 6 page research description

e) Bibliography

Research description

1. **Background** - What is the subject? What is known about it? Why is this important?
2. **Question** - What is not known? Why is this question important?
3. **Hypothesis** - What is your hypothesis? What is the basis of this hypothesis? Why it is significant?
4. **Method** - How do you plan to perform the research? What are the method's advantages and limitations?
5. **Expected Results** - What are your expected results if your hypothesis is correct or incorrect? What are potential pitfalls that can prevent you from getting any progress?
6. **Conclusion** - What conclusion are you expecting to make
7. **Future direction** - What is next?

Rubric:

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</table>

All writing assignments format: Use Arial font 11. Page margins are 1 inches. Use single-spaced pages. Remember, scientific writing should always be simple, clear, and concise.

Statement on academic dishonesty: Students handing in assignments that do not represent their own work will receive a failing grade in this course.

Grades:

	100-93 A	92-90 A-
89-87 B+	86-83 B	82-80 B-
79-77 C+	76-73 C	72-70 C-
69-67 D+	66-63 D	62-60 D-
59- 0 F		

We will use Blackboard all the time. Announcements will be routinely posted on Blackboard with your assignments. Please check it often.

Instructor:

- Tomer Avidor-Reiss, Ph.D.
- Offices: Wolfe Hall room 4259B
- Email: Tomer.AvidorReiss@utoledo.edu
  Please make sure the subject line start with: "BIOL 4910 022 CRN 39651"
- Website: Go to "https://blackboard.utdl.edu/webapps/login/", Log in using UTID and University of Toledo password and then select "BIOL 4910 022 CRN 39651"

Office Hours:

- By appointment and during the hour after class; Room: Wolfe Hall room 4259B

Important dates:

- Holidays: May 27 (Memorial day) – *No class*

Suggested literature:

Scientific Writing and Communication Papers, Proposals, and Presentations by Angelika H. Hofmann

Description (as appears on http://www.oup.com/us/catalog/general/subject/LifeSciences/~~/dmlldz11c2EmY2k9OTc4MDE5NTM5MDA1Ng)

A practical presentation carefully introduces such basic writing mechanics as word choice and word location, sentence structure, and paragraph organization before moving into manuscript planning and organizational strategies. Extensive hands-on guidance for composing scientific documents and presentations then follows.

Relevant and multi-disciplinary examples taken from real research papers and grant proposals by writers ranging from students to Nobel Laureates illustrate clear technical writing as well as common mistakes that one should avoid. Examples are drawn from a broad range of scientific disciplines including medicine, molecular biology, biochemistry, ecology, geology, chemistry, engineering, and physics.

Writing guidelines and revision checklists warn scientists against common pitfalls and equip them with the most successful techniques to revise a scientific paper, review article, or grant proposal.

Eight chapters on grant writing demonstrate how to write successful grant applications and how to avoid the most common application mistakes.

Experimental Design for Biologists by David J. Glass

Publication Date: November 28, 2006 | ISBN-10: 0879697350 | ISBN-13: 978-0879697358 | Edition: 1

Book Description as appears at the book web site (http://www.amazon.com/Experimental-Design-Biologists-David-Glass/dp/0879697350):

"The effective design of scientific experiments is critical to success, yet graduate students receive very little formal training in how to do it. Based on a well-received course taught by the author Experimental Design for Biologists fills this gap. 'Experimental Design for Biologists' explains how to establish the framework for an experimental project, how to set up a system, design experiments within that system, and how to determine and use the correct set of controls. Separate chapters are devoted to negative controls, positive controls, and other categories of controls that are perhaps less recognized, such as "assumption controls," and "experimentalist controls." Furthermore, there are sections on establishing the experimental system, which include performing critical "system controls." Should all experimental plans be hypothesis-driven? Is a question/answer approach more appropriate? What was the hypothesis behind the Human Genome Project? What color is the sky? How does one get to Carnegie Hall? The answers to these kinds of questions can be found in Experimental Design for Biologists. Written in an engaging manner, the book provides compelling lessons in framing an experimental question, establishing a validated system to answer the question, and deriving verifiable models from experimental data. Experimental Design for Biologists is an essential source of theory and practical guidance in designing a research plan".

How to give a good talk.

Alon U. Mol Cell. 2009 Oct 23;36(2):165-7.

Abstract: "We depend on talks to communicate our work, and we spend much of our time as audience members in talks. However, few scientists are taught the well-established principles of giving good talks. Here, I describe how to prepare, present, and answer questions in a scientific talk. We will see how a talk prepared with a single premise and delivered with good eye contact is clear and enjoyable".

Style: Lessons in Clarity and Grace (10th Edition) by Gregory G. Colomb and Gregory G. Colomb

This book explains how to write clearly, simply and concisely