

**BIO 4979: Biological Research  
Seattle Pacific University  
Winter 2020**

**Instructor:** Jenny Tenlen, Ph.D.

*Office hours: MWF 1:30 pm – 3:00 pm,  
or by appointment, or drop in when my  
door is open.*

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*“Seattle Pacific University seeks to change the world and engage the  
culture by graduating students of competence and character,  
cultivating people of wisdom, and modeling a grace-filled community.”  
[SPU Mission Statement]*

## **Course Description**

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In Bio 4979, you will conduct research as outlined in your research proposal, present it at an undergraduate or professional symposium, and write a paper summarizing your findings. (2-12 credits). For each credit, you are expected to work a minimum of 40 hours per quarter (about 4 - 5 hours each week).

## **Goals and Objectives**

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**Biology Department:** The Student Learning Outcomes of the Biology Department can be found online at: <http://spu.edu/academics/college-of-arts-sciences/biology/about/mission-goals-and-objectives>. Specific objectives for BIO 4979 are:

1. To design a research project.
2. To become better acquainted with research techniques in the field of developmental biology and the evolution of development (evo-devo).
3. To use statistical analyses to interpret findings.
4. To improve your skills in writing, presenting, and critically analyzing the scientific literature.

These objectives support Student Learning Outcome 3 (“Students use appropriate supporting data and analyses to effectively communicate in oral and written forms.”), and Student Learning Outcome 5 (“Students participate in authentic laboratory or field research.”)

**University Objectives:** The mission statement and goals of Seattle Pacific University can be found online at: <http://spu.edu/about-spu/mission-and-signatures>.

## **Course Outcomes & Expectations**

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1. Undergo necessary lab safety training, and observe lab safety rules at all times.
2. Perform experiments as described in proposal.

3. Use and maintain all lab equipment properly, keep lab space neat and tidy, and inform your research supervisor of any issues (ordering needs, broken equipment, etc.) as soon as they come up.
4. Attend regular lab meetings with Dr. Tenlen at a time to be arranged. The purpose of these meetings is to update each other on progress, to work through hurdles, and to discuss next steps. [This applies only to students doing research with Dr. Tenlen. Students doing research off-campus are encouraged to meet regularly with their research supervisor.]
5. Maintain a detailed and accurate lab notebook. Dr. Tenlen reserves the right to check your lab notebook at any time. [For students doing research off-campus, Dr. Tenlen may contact your research supervisor directly to gain feedback on your progress.]
6. Write a progress report (if you are continuing on in BIO 4979) or a research paper (if this is your last quarter of BIO 4979). See below for writing instructions. Reports are due by the last day of the quarter: **11:59 pm on Thursday, March 19, 2020**. Reports should be uploaded to Canvas via the provided link.
7. **(If doing research with Dr. Tenlen):** If Winter quarter will be your last quarter enrolled in BIO 4979, you must submit your lab notebook as a single PDF. The PDF should include a title page (research project title, your name, email address, quarter), Table of Contents, and all lab notebook entries and other documents generated as part of your research. Lab notebooks are due by the last day of the quarter: **11:59 pm on Thursday, March 19, 2020**. Reports should be uploaded to Canvas via the provided link.
8. Prior to the end of your last quarter of BIO 4979, you should present your research (either oral or poster presentation) at a Murdock, Erickson or other conference.

## Course Policies

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*Plagiarism and Academic Integrity:* Plagiarism is the representation of someone else's work as your own. Neglecting to properly cite references is the most common example of this. Plagiarism and other breaches of academic integrity (e.g. cheating or copying another student's work) will not be tolerated and will be dealt with severely. The first offense will result in a failing grade for the assignment in question. The second offense will result in a failing grade for the course and your actions will be reported to the University registrar. Please ask questions IN ADVANCE if you are not sure about what constitutes plagiarism, at this stage it is simply a learning exercise (i.e., not a breach of academic integrity) and you will be able to rectify the situation. *Once a paper is submitted, however, you will be held to the above guidelines.* Since a significant part of your grade in this course will involve written responses, it is a critical that you fully understand this policy.

Any instance of cheating or interfering with another student's ability to learn will not be tolerated. In either case, the guidelines from the Academic Integrity section of the Undergraduate Catalog will be followed. See the SPU undergraduate catalog for more information on academic integrity (<http://spu.edu/catalog/undergraduate/20190/academic-policies-procedures/integrity>).

*Lab safety:* Please observe all lab safety procedures. Goggles and appropriate footwear must be worn at all times in the lab. If you have concerns about handling or disposing of specific chemicals and reagents, please let Dr. Tenlen know. Material Safety Data Sheets for all harmful substances are available in the Safety Manual notebook in Eaton 105.

*Inclement weather:* The University maintains an Emergency Closure Hotline (206-281-2800). In the event of inclement weather or an emergency that might close the university, please call the Hotline for the most up-to-date closure information or check the SPU website. Both will be updated before 6:00 a.m.

*Emergencies:* If there is an emergency while working in Eaton 105 that requires evacuation, please exit the lab in a calm and orderly fashion and assemble in Tiffany Loop. Please report to appropriate personnel (Daniel Wright, Levi Clum or Sue Martin), or to Dr. Tenlen.

*Disabilities statement:* In accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, students with specific disabilities that qualify for academic accommodations should contact Disabled Student Services (DSS) in the Center for Learning (<http://www.spu.edu/depts/cfl/dss/index.asp>). DSS in turn will send a Disability Verification Letter to the course instructor indicating what accommodations have been approved.

### **Progress Report Format (if continuing on in BIO 4979)**

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Your progress report is a summary of what you have accomplished during the quarter, a reflection on the current state of your project, and a record of your goals for the coming quarter. Your report should be typed, 12-pt font, double-space, no longer than 3 pages, and should include the following:

- title of your project
- the goals of your project (big-picture question and specific goals to address that question), including any background information that helps to provide the context for your research question.
- summary of methods and results - you don't need to provide step-by-step protocols, but you should describe the general methods, the rationale for each method (i.e. why did you do it), and the outcome of the experiments (whether it was successful or not, including figures/tables as evidence).
- an overall summary of where you are in your project as it relates to your long-term goals, and description of future goals - what do you hope to accomplish, why, and how?

### **Research Paper Format (if this is your last quarter of BIO 4979)**

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Your final research paper will be written in the format of a Research Article in the journal Development, a key journal in the field of Developmental Biology. Development's information for authors is posted at: <http://dev.biologists.org/content/manuscript-prep>

Your research paper should be 6 - 10 pages (not including Literature Cited, Figures and Tables), typed in 12 pt font, single-space (with space between sections), and should include the following sections (adapted from Development's criteria):

1. **Title:** should be descriptive, no more than 32 characters (including spaces). Some titles are written to describe the main result (the "take-home message"). Other titles are more general, focusing on the phenomenon being researched.
2. **Summary:** "The summary should: succinctly and clearly introduce the topic of the paper; highlight the most important results; and explain any conceptual advances arising from them." The summary (also known as an abstract) should be around 200 words (max: 250 words), and should not include references.
3. **Introduction:** The Introduction should help the reader understand the nature of the research, and provide context for the big-picture question. What is known about your system and question? What gaps in our understanding does your project address? What hypothesis or question are you testing? You may use the Introduction you wrote for your Research Proposal, but it should be updated to take into consideration any new papers or insight that has arisen since you wrote your proposal.

4. **Materials and Methods:** The Methods section should communicate clearly what was done in the experiment, but should not be written like a cookbook. What materials did you use? How did you set up the experiment, and collect data? Finally, be sure to describe what controls were done in the experiment (and why those controls were needed). When including specific reagents and equipment, company names should be provided in parentheses. For example, “LB was supplemented with 50 mg/ml of carbenicillin (Sigma).”
5. **Results:** The Results section should describe what you learned about each of the experiments. This section presents the data objectively, but does not interpret/analyze the data. Describe any observations that were made about the adults or progeny on your plate, including what percent embryonic lethality you observed, or whether there were any progeny at all. Be sure to include all controls. You may wish to include informative drawings or data tables to help communicate your results.
6. **Discussion:** In the Discussion section, you should interpret/analyze the data you presented in the Results section. How do your experimental results compare to your predictions? Based on the overall hypothesis you were testing, what did you learn from your results? How do your results fit into the broader context? You should also describe possible sources of errors, or weaknesses in the experimental design. Since the Discussion section is more subjective than the Results section, there is no right or wrong answer to these questions. However, I will be looking for evidence that you have thought about your data in relation to the hypothesis, and can propose at least one alternative method to test the hypothesis.
7. **References:** see below for formatting guidelines.
8. **Figures and Tables:** Figures and Tables come after the References. Figures and Tables should be numbered (Figure 1, Table 1, etc.), and should include a brief caption that describes what is shown. Figures and Tables should be presented in the order in which they are referred to in the text (all Figures first, then all Tables).

#### **Guidelines for citing sources:**

The format for your citations and references should follow Development's guidelines at <http://dev.biologists.org/content/manuscript-prep#references> and copied below:

For citations in the text of the paper, please use the following format:

One author - (Jones, 1995) or (Jones, 1995; Smith, 1996).

Two authors - (Jones and Kane, 1994) or (Jones and Kane, 1994; Smith, 1996).

More than two authors - (Jones et al., 1995) or (Jones et al., 1995a; Jones et al., 1995b; Smith et al., 1994; Smith et al., 1995).

(note that if you cite two or more papers together, they should be listed chronologically, with the earliest paper listed first.)

For your Literature Cited section, please use the following format:

- References are listed in alphabetical order according to the surname and initials of the first author.
- Initials should follow all surnames in the list of authors; insert a full stop and space after each initial and place parentheses round the date followed by a full stop.
- Use bold for authors' names.

Journal articles;

**Rochlin, M. W., Itoh, K., Adelstein, R. S. and Bridgman, P. C.** (1995). Localization of myosin IIA and B isoforms in cultured neurons. *J. Cell Sci.* **108**, 3661-3670.

Sections of a book:

**Matlin, K. S. and Caplan, M. J.** (1992). Epithelial cell structure and polarity. In *The Kidney: Physiology and Pathophysiology* (ed. D. W. Seldin and G. Giebisch), pp. 447-473. New York: Raven Press Ltd.

Online book:

**Griffiths, A. J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C., Gelbart, W. M.** (2000). Introduction to genetic analysis [Internet]. 7th ed. New York: W. H. Freeman & Co.; [cited 2005 May 31]. Available from: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=iga>.

Website:

The Wnt homepage [Internet]. 2013. Stanford: Roel Nusse. [updated 2013 Jun; cited 2014 Mar 30]. Available from: <http://www.stanford.edu/group/nusselab/cgi-bin/wnt/>.

Properly citing references:

Every idea, concept or fact that you obtain from another source must be cited properly in your literature review, to avoid the appearance of taking credit for ideas not your own. Proper citation also allows your own interpretations and ideas to come to the forefront. Below is an example of a paragraph I wrote for my last publication:

To address the issues above, it is essential to be able to disrupt gene function in *H. dujardini*. However, no such method exists for Phylum Tardigrada. RNA interference (RNAi) is a robust and well-conserved mechanism for gene silencing in many organisms, including nematodes and arthropods (Hannon 2002; Cerutti and Casas-Mollano 2006). In *C. elegans*, RNAi is systemic and heritable; injection of double-stranded RNA (dsRNA) into the intestine or germline of adults can disrupt gene activity in injected animals and in their progeny (Fire et al. 1998).

The first two sentences are my own assertions, so they are not cited. The third sentence (RNA interference...) is a statement that is well-supported in other papers, so I cited two other reviews that document how robust and well-conserved RNAi is. The last sentence reports a fact about RNAi (that it is systemic and heritable), so I cited the original research paper that established this fact. It is not proper to include all citations at the end of a paragraph – they should appear immediately after the statement is made.

There are several resources available to help you properly cite sources and avoid unintentional plagiarism.

- “The Writer’s Handbook: How to Avoid Plagiarism”: a helpful guide from the Writing Center at the U. Wisconsin-Madison.  
[http://writing.wisc.edu/Handbook/QPA\\_plagiarism.html](http://writing.wisc.edu/Handbook/QPA_plagiarism.html)
- “Plagiarism: It’s Your Call”: a tutorial from Stanford University that asks you to determine whether or not the provided text is an example of plagiarism.  
<http://skil.stanford.edu/module6/paraphrasing.html>

DO NOT HESITATE to ask me if you have questions – I’m always happy to help.