Biology 4978: Biological Research Proposal
Seattle Pacific University
Autumn 2016

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

In Bio 4978, you will write a proposal for a senior research project that addresses a biological question, explains how this question relates to the larger field, and describes an experimental plan to study this question (1 credit).

Goals and Objectives

Biology Department: The objectives 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 these courses 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 writing skills and your ability to critically analyze the scientific literature.

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

1. Meet weekly with Dr. Tenlen at a mutually agreed-upon time to discuss primary-literature papers, writing progress, and other aspects of the research proposal.
2. Design a research project that tests a specific question or hypothesis.
3. Identify at least 7 papers related to your research question. At least 4 of the 7 papers must be from the primary literature. Prepare an annotated bibliography, formatting each paper as described below, then providing a brief justification for how this paper will be

used in your proposal. The annotated bibliography is due to Dr. Tenlen by **5pm on Friday, Oct. 7, 2016** (email is acceptable).

UNC-Chapel Hill has a good guide on annotated bibliographies (follow the instructions and view the examples for Combination Annotated Bibliographies written as a paragraph in CSE format): http://writingcenter.unc.edu/handouts/annotated-bibliographies/

4. Read relevant background papers (both primary and secondary literature), and write a research proposal (see p. 3 and following for specific guidelines). To help in the writing process, rough drafts of specific sections will be due on the following dates (email is acceptable):
    a. Specific Aims & Research Context — due 5pm **Friday, Oct. 21**
    b. Background & Research Question(s)/Hypothesis — due 5pm **Friday, Nov. 4**
    c. Experimental Plan & Broader impact — due 5pm **Friday, Nov. 18**
    d. Complete rough draft, including project summary (submit via the Assignment link in Canvas) — due 5pm **Monday, Nov. 28**
5. A printed copy of the proposal must be submitted by the last day of the quarter - **5pm on Thursday, December 8, 2016** - to receive course credit.

Course Policies

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/20167/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 205.

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 205, please exit the lab in a calm and orderly fashion and assemble in Tiffany Loop. Please report to Dr. Tenlen, or to appropriate personnel (usually, Ashley Undag or Sue Martin).

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.

Research Proposal Format

Your research proposal will be written in the format of a Preliminary Proposal to the National Science Foundation, one of the largest funders of scientific research at the federal level. The Preliminary Proposal describes the rationale for the chosen research question, and attempts to convince the NSF review panel that the proposal's ideas have merit, and are worth funding. Favorably-reviewed Preliminary Proposals are invited to submit a full proposal, upon which the actual funding decision is made. If you're curious about NSF's instructions for writing a Preliminary Proposal, see section V-A of their website at:
http://www.nsf.gov/pubs/2011/nsf11573/nsf11573.htm

Your Research Proposal should be 6 pages (not counting Literature Cited), typed in 12 pt font, single-space (with space between sections), and should include the following sections:

1. **Project Summary**: As NSF describes in their instructions, the project summary provides "an overview of the proposed research... The summary should be written in the third person, informative to those working in the same or related field(s), and understandable to a scientifically or technically literate reader." It is like an abstract of a research paper, or the Cliff's Notes version of your proposal. About ½ page long.
2. **Specific Aims**: The Specific Aims communicate in a succinct way your research question(s) and what experiment(s) you will do to answer the question. Less than ½ page.
3. **Background:** What is known about the general topic you are researching? What is the importance of this question? About 1 ½ - 2 pages long.
4. **Hypothesis or Research Question**: Here is where you articulate the specific question you are interested in, and explain why it is relevant given the background information you presented. About 1 paragraph.
5. **Experimental Plan**: What experiments will you do to answer the question? Usually, this section is organized such that each Specific Aim is treated in order. About 3 pages. This section includes a description of the experimental technique & its appropriateness to answer your question, how you will perform the experiment, and what you would predict to observe based on your hypothesis/research question. About 3 pages.
6. **Intellectual Merit**: Why does this research matter? This section allows you to put your experimental plan in the context of the background information – how will these results advance our understanding of some aspect of biology? About 1 paragraph. [For more on how NSF defines "Intellectual Merit", see section VI-A of the above website.]
7. **Literature Cited** [note: for the final proposal, your literature cited section should NOT be annotated.]

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:
IMGT/HLA Sequence Database [Internet]. 2003- Release 2.9.0. Cambridge (England): European Bioinformatics Institute. [updated 2005 Jun 1; cited 2005 Jun 22]. Available from: http://www.cbi.ac.uk/imgt/hla/.

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 in 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

- "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 you with your writing