



Department of Biology

BIO3052: Research Methodology

3 Units

Fall 2023

Tuesday 1:30 pm – 4:30 pm

Library Computer Lab, LW213

Final Exam: Tuesday 12/12, 1:30 – 4:00 pm

Instructor title and name:	Dr. Heidi Woelbern
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Office location and hours:	Rohr Science 164 + Office Hour Link (select an appointment slot which will set up a meeting reminder for both of us)

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Description

This course builds upon the basis of the scientific method that students are exposed to as freshmen. It focuses on teaching students how to develop biological questions, search databases to obtain background information, design scientific experiments, and analyze data. The course will focus more specifically on how research data is obtained (A below), how experimental knowledge and data are dispersed amongst the scientific community (A and B), and how these data are used as a base for correlating new data and upon which new experimentation is based (A and B).

A. Research design:

- Practice methods by which novel questions worthy of addressing are identified.
- Determine how scientific inquiry is used to address these questions from a research standpoint along with how to predict outcomes of experiments.
- Identify and use appropriate statistical analyses to analyze data, arrive at valid conclusions, and appropriately design follow-up or repeat experimentation.

B. Bioinformatics:

- Introduce the various databases available to researchers.
- Introduce the idea of implementing bioinformatics into question identification and experimental design.
- Introduce the idea of implementing bioinformatics for the analysis of real data and correlation of conclusions into previous scientific knowledge.

Program and Course Learning Outcomes

Students will be able to

- 1) Analyze primary literature and, based on the data and conclusions presented, determine appropriate questions for subsequent experimentation.
- 2) Critically analyze data and judge conclusions using appropriate statistics and scientific logic.
- 3) Explain how bioinformatics and wet-lab are integrated in modern scientific research.
- 4) Query various bioinformatics databases available online and interpret the information obtained from these databases.
- 5) Create, write, and defend a biologically-related research proposal based on existing primary literature found through PubMed or other related scientific publication databases and feasible, existing scientific experimental techniques.

Required Texts and Recommended Study Resources

This course includes a BIO3052 reader which is available for purchase directly from [Cognella](#) or at the PLNU bookstore.

Excel: If you don't have Excel, you can download a free version from here:

<https://products.office.com/en-us/student/office-in-education>

Course Credit Hour Information

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a three- unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 112.5 total hours meeting the course learning outcomes.

Assessment and Grading

In-class assignments	17%	(85 points total)
Research grant proposal (final)	30%	(150 points total)
Grant review and study section	8%	(40 points total)
Class participation and attitude	5%	(25 points total)
<u>Tests (1 midterm and final exam)</u>	<u>40%</u>	<u>(200 points total)</u>
Total	100%	

Grade Scale Based on Percentages

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

Exams: 10/17, 1:30 pm Mid-term exam
12/12, 1:30 pm Final exam

Research Grant Proposal: For this project, you will be working in pairs. The main assignment will be for you to write a relatively short (6-8 page), basic grant proposal. This can be on any biologically relevant topic that you are interested in. We do not expect this to be at the level of submission and funding, but this is a substantial portion of your grade and should be treated as such. Your proposal should demonstrate the ability to 1) research a topic, 2) integrate, analyze, and understand several recent primary literature articles on the topic, 3) generate a reasonable research project for your focus, and 4) design a few experimental suggestions to address the research focus. This will be a difficult assignment, but it is a very important exercise. All of science rests on one's ability to integrate previous knowledge and expand on that knowledge in order to continue to propagate our scientific understanding. Beyond that, the ability to adequately describe your ideas for funding is key to any job, particularly in the sciences, whether you are interested in pursuing a career in research, medicine, teaching, or any other science-related field. The best ideas in the world will never come to fruition if they aren't funded. The hardest part of the assignment will be to assemble the information and get your ideas together, so we strongly suggest once again that you don't procrastinate on this assignment. To help make sure you don't procrastinate, you will notice a few interim deadlines throughout the schedule.

This project will thus incorporate most of the principles taught in this course while allowing everyone to practice these principles on a topic of your choice / interest. We will work on the main principles of this extensively together throughout the semester, but you are expected to do most of

your work on this project outside of class. I STRONGLY suggest not waiting until the end to do this. You will not be happy with yourself or your grade if you procrastinate. If you work reasonably, but diligently throughout, my hope is that you will find this to be interesting and rewarding. Please see me, or any of your other professors, for help throughout. I plan to help you get started (if needed) and then hope that you will work on your own and come to me often with specific questions for direction. Further details and expectations will be given separately.

Final Examination Policy

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the [Class Schedules](#) site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by the beginning of the class session when they are due—including assignments posted in Canvas. *There is a 10% deduction per day it is late. Late work beyond one week, will receive a 0.* Incompletes will only be assigned in extremely unusual circumstances.

State Authorization

State authorization is a formal determination by a state that Point Loma Nazarene University is approved to conduct activities regulated by that state. In certain states outside California, Point Loma Nazarene University is not authorized to enroll online (distance education) students. If a student moves to another state after admission to the program and/or enrollment in an online course, continuation within the program and/or course will depend on whether Point Loma Nazarene University is authorized to offer distance education courses in that state. It is the student's responsibility to notify the institution of any change in his or her physical location. Refer to the map on [State Authorization](#) to view which states allow online (distance education) outside of California.

PLNU Copyright Policy

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Academic Honesty Policy

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See [Academic Policies](#) for definitions of kinds of academic dishonesty and for further policy information.

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g, ChatGPT, iA Writer, Marmot, Botowski) to generate ideas, but you are not allowed to use AI tools to generate content (text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities. Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will issue an academic accommodation plan ("AP") to all faculty who teach courses in which the student is enrolled each semester.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course and/or if they do not wish to utilize some or all of the elements of their AP in that course.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC.

PLNU Attendance and Participation Policy

Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. If the student is absent for more than 10 percent of class sessions, the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university withdrawal date or, after that date, receive an "F" grade.

Participation and Cooperation: Class participation counts for 5% of your grade. Much of this course will be interactive. You will be expected to work with online databases on the library computers as we go. In addition, you are expected to actively participate in class discussions. We will be using a semi-discussion style format, and we expect you to volunteer to answer questions and also to ask questions whenever you are confused. You should read ahead so that you can participate effectively and for your own learning benefit.

Use of Computers: This course requires significant use of computers and as such, is located in the computer lab. We realize that this brings with it many temptations to use the computers for things other than classwork, particularly when we are lecturing. Use of phones or computers for Instagram, YouTube, or any similar uses that have nothing to do with class is strictly forbidden. *You may think that you are great at multi-tasking, but substantial research shows that using these other websites significantly reduces students' ability to learn, remember, and apply content being taught at the same time.* Please save these activities for another time and make the most of your learning experience. Being caught using these other sites will result in a warning the first time, followed by grade reductions after that.

Tentative Schedule:

Week	Date	Topic	Textbook Reference
1	8/29	<ol style="list-style-type: none"> 1. Introduction; grant proposal assignment (CANVAS) 2. In class: Biology literature searches 3. Expectation setting 4. Work on proposals (finding articles and narrowing topic) 	Reader p. 1-14
2	9/5	<ol style="list-style-type: none"> 1. Prior to class: Scientific methods and research methods overview 2. In class: Reading articles efficiently 3. Work on proposals (Start thinking about your aims). <p>General research proposal idea due by 9/5 (Canvas)</p>	Reader p. 1-14.
3	9/12	<ol style="list-style-type: none"> 1. Prior to class: Intro to bioinformatics 2. In class: Intro to bioinformatics 3. Work on proposal (background/significance and specific aims) 	Intro to bioinformatics (CANVAS) Reader p. 15-31.
4	9/19	<ol style="list-style-type: none"> 1. Prior to class: What's wrong with my child (continued) 2. In class: Chimera 3. Work on proposals (background/significance and specific aims) 	Reader p. 15-31.
5	9/26	<ol style="list-style-type: none"> 1. Prior to class: Genome sequencing and annotation 2. In class: JASPAR and Blast 3. Work on proposals (background/significance and specific aims) 	Reader p. 32-54.
6	10/3	<ol style="list-style-type: none"> 1. Prior to class: Major biological techniques associated with bioinformatics 2. In class: Analyzing data from figures of published articles 3. Draft of research proposal due on 10/5: Summary, intro, specific aims (Canvas) 	Reader p. 32-54.
7	10/10	Mid-term exam	

Week	Date	Topic	Textbook Reference
8	10/17	FALL BREAK – No lecture Work on proposals (feedback/methods)	
9	10/24	1. Prior to class: Hypothesis testing 2. In class: Work on proposals (Finding techniques to include in your proposals. Methods and description of how you will accomplish your aims)	Reader p. 73-89.
10	10/31	1. Prior to class: Testing for parametric data (Para vs. non-para; t- and z-tests) 2. In class: Complete the testing for parametric data homework	Reader p. 79-89.
11	11/7	1. Prior to class: Parametric statistics (Chi Square and ANOVAs) 2. In class: Help with parametric stats. 3. Peer-Reviews In-Class. You must bring a draft of your full proposal, with printed copy in class for peer review.	Reader p. 98-121.
12	11/14	Research proposals due by 9:00am on 11/11 through Canvas (no exceptions). 1. Non parametric data 2. In class: Prepare for study sections	Reader p. 122-126.
13	11/21	THANKSGIVING WEEK – No Class	
14	11/28	1. Study section I meets 1:30 – 4:30	
15	12/5	1. Study section II meets 1:30 – 4:30	

Final Exam Tuesday 12/12/23 at 1:30pm