| POINT 1902 LOMA NAZARENE UNIVERSITY | **Department of Biology**<br><br>**BIO 3052: Research Methodology**<br><br>**Lecture/Lab (3 units)** |
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| Fall 2022 | |

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| **Meeting days:** Thursday | **Instructor title and name:** Dr. Chloe E Kim |
| **Meeting times:** 1:30 pm- 4:30 pm | **Phone:** no office phone |
| **Meeting location:** Ryan Library 213 | **Email:** ekim1@pointloma.edu |
| **Final Exam:** 12/15/22 1:30 pm- 4 pm | **Office location:** Adjunct office in Biology Department, Rohr Science |
| **Additional info:** Reader from University Readers (ordering info on CANVAS). You must order and bring a copy with you to class. | **Office Hours:** Before/after each class or by appointment only |

**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.

## 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 TEXT

Reader from University Readers (ordering info on CANVAS). You must order and bring a copy with you to class.

## 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 drop date or, after that date, receive the appropriate grade for their work and participation. *Attendance at all exams is required, unless you have a doctor's note excusing you.*

## 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.

## SPIRITUAL CARE

PLNU strives to be a place where students grow as whole persons. To this end, we provide resources for our students to encounter God and grow in their Christian faith.

If you have questions, a desire to meet with the chaplain, or if you have prayer requests, you can contact the Office of Student Life and Formation.

## 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.

## LATE SUBMISSION POLICY

No late submissions are allowed. Pre-class portion assignments will be available to you at least one week in advance so that you have at least one week to complete those assignments. Draft and full research proposal are due by the due dates, no exceptions.

## 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. In particular, all homework, assignments, and laboratories are owned by Dr. Kim and may not be shared with other individuals or groups outside of the students registered for the BIO3052, Fall, 2022 section. It is a violation of copyright law to otherwise distribute these materials in any form.

## 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.

## 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.

## SEXUAL MISCONDUCT AND DISCRIMINATION

Point Loma Nazarene University faculty are committed to helping create a safe learning environment for all students. If you (or someone you know) have experienced any form of sexual discrimination or misconduct, including sexual assault, dating or domestic violence, or stalking, know that help and support are available through the Title IX Office at pointloma.edu/Title-IX. Please be aware that under Title IX of the Education Amendments of 1972, it is required to disclose information about such misconduct to the Title IX Office.

If you wish to speak to a confidential employee who does not have this reporting responsibility, you can contact Counseling Services at counselingservices@pointloma.edu or find a list of campus pastors at pointloma.edu/title-ix

## ASSESSMENT AND GRADING

**Grading:**

**(approximate; I reserve the right to adjust percentages as appropriate for how the course proceeds)**

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| General assignments and in-class assignments | 17% |
| Research grant proposal (final) | 30% |
| Grant review and study section | 8% |
| Attendance, Edpuzzles, participation, and attitude | 5% |
| Exams (1 midterm and final exam) | 40% |
| **Total** | **100%** |

**Sample Standard 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 | |

***Notes about grades:***
Plusses and minuses (e.g., B+/A-) will be determined at the instructors' discretion. Major factors in this decision will be class attendance and participation.

***Exams:*** 10/20/22 1:30 pm - Midterm exam

12/15/22 1:30 pm - Final exam

***Final examination policy:*** Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on CANVAS. NO requests for early examinations or alternative days will be approved.

## 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. **USE ME OFTEN FOR HELP, BUT DON'T EXPECT ME TO DO IT FOR YOU.** Further details and expectations will be given separately.

**Tentative Schedule:**

| Week | Date | Topic | Reader Reference |
|---|---|---|---|
| 1 | 9/1 | 1. Pre-class; Introduction; grant proposal assignment, plagiarism & writing concisely<br>2. Biology literature searches and proposal information<br>3. Pair expectation form<br>4. Work on proposals (finding articles and narrowing topic)<br><br>***General research proposal idea (partner and general topic) due 9/7 (Canvas)*** | Grant proposal information (Canvas), Reader p. 1-9. |
| 2 | 9/8 | 1. Scientific methods and research methods. Going from topic to specific aims.<br>2. Reading articles efficiently<br>3. Work on proposals (finding articles and narrowing topic; start thinking aims) | Canvas activity<br>Reader p. 1-14. |
| 3 | 9/15 | 1. Intro to bioinformatics pages 1-3 (quiz at beginning of class)<br>2. What's wrong with my child (part 1)<br>3. Intro to bioinformatics (4 – end)<br>4. Work on proposals (background / significance and specific aims) | Intro to bioinformatics (available on Canvas)<br><br>Reader p. 15 - 31 |
| 4 | 9/22 | 1. Pre-class; What's wrong with my child (cont.)<br>2. Chimera and parts of "what's wrong with my child" (finish)<br>3. Work on proposals (background / significance and specific aims) | Reader p. 15-31. |
| 5 | 9/29 | 1. Genome seq. and annotation, JASPAR and whole genome browsers & start BLAST (to dot plots)<br>2. BLAST alignment details<br>3. Work on proposals (background / significance and specific aims) | Reader p. 32-54. |
| 6 | 10/6 | ***1. Proposal work day (No Class)***<br>2. Pre-class; Major biological techniques – associated with bioinformatics…part 1<br>3. In-class; Work on proposals<br><br>***Draft of research proposal due on 10/8: Summary, intro, specific aims (no exceptions)*** | Reader p. 32-54. |

| Week | Date | Topic | Reader Reference |
|---|---|---|---|
| 7 | 10/13 | 1. Pre-class; Major biological techniques – general…part 2<br>2. Analyzing figures<br>3. Work on proposals (feedback / methods) | Lecture slides / Canvas activity |
| 8 | 10/20 | 1. **Midterm exam**<br>2. Work on Proposals (methods and description of how you will accomplish aims) | Reader p. 55-60 |
| 9 | 10/27 | 1. Hypothesis testing<br>2. Answer questions and help on hypothesis testing… and work on proposals | Reader p. 55-71. |
| 10 | 11/3 | 1. Pre-class; Testing for parametric data (Para vs. non-para; t- and z-tests)<br>2. Testing for parametric data (homework)<br>3. Peer-reviews in-class<br><br>***Draft of full proposal due. You must bring a printed copy in-class for peer review (no exceptions).*** | Reader p. 61-71. |
| 11 | 11/10 | 1. Pre-class; Parametric statistics (Chi Square test and ANOVAs)<br>2. Help with parametric stats<br><br>***Research proposals due on 11/10 by midnight on Canvas (no exceptions).*** | Reader p. 80-103. |
| 12 | 11/17 | 1. Pre-class: One way ANOVA and Tukey's pairwise tests<br>2. Pre-class: Two-way ANOVA<br>3. Pre-class: Understanding rank averages<br>4. Pre-class: Mann Whitney U statistical analysis<br>5. Non-parametric data<br>6. Prepare for study sections | Reader p. 104-108. |
| 13 | 11/24 | ***Thanksgiving Recess (No Class)*** | |
| 14 | 12/1 | 1. Study section I meets | |
| 15 | 12/8 | 1. Study section II meets | |

Final exam is on Thursday, 12/15/2022 from 1:30 pm– 4:00 pm in Ryan Library 213.