# Biology 3052, Research Methodology; Syllabus

**COURSE:** Bio3052, Research Methodology, Spring 2021; 3 Units; Department of Biology

**INSTRUCTOR:** Dr. Mike Dorrell, 619-849-2962, mdorrell@pointloma.edu Rohr Science 158.
Office Hours: M,F 10:30 – 12:30, Wed. 1:00 – 2:00. Note: I sometimes have meetings during chapel or faculty meeting on Wed afternoon. However, I am in my office often. To set up an appointment, email me or just drop by and if I'm available, I'm happy to meet and help.

**LECTURE:** Thurs: 8 - 11; Library computer lab – Main lab

**Reader:** From University Readers (available online; details for ordering on canvas); You must order this reader and bring a copy with you to class.

***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 becomes an expression of faith. Being of Wesleyan heritage, we aspire 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.

**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 wetlab are integrated in modern scientific research.
4) Query various bioinformatic 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.

***Attendance:*** Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member has the option of filing a written report which may result in 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. See Academic Policies in the Undergraduate Academic Catalog. . *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 Facebook, 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.

***Academic Accommodations:*** If you have a diagnosed disability, please contact PLNU's Disability Resource Center (DRC) within the first two weeks of class to demonstrate need and to register for accommodation by phone at 619-849-2486 or by e-mail at DRC@pointloma.edu. See Disability Resource Center for additional information.

***Academic Honesty:*** 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.

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***Grading:*** **(approximate; I reserve the right to adjust percentages dependent on how the course proceeds)**

| | |
|---|---|
| General assignments and lab activities | 15% |
| Research grant proposal (final) | 30% |
| Grant review and study section | 7% |
| Class participation and attitude | 8% |
| Tests (1 midterm and final exam) | 40% |
| **Total** | **100%** |

**Grading: 93 – 100 = A, 90 – 93 = A-, 87 – 90 = B+, 83 – 87 = B, 80 – 83 = B-, 77 – 80 = C+, 73 – 77 = C, 70 – 73 = C-, 65 – 70 = D, <65 = F**

*(Partial instructor discression for borderline grades will be based on class attendance and participation)*

***Exams:*** 4/22, 8:00 am – Mid-term exam
6/8, 7:30 am - 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 the Class Schedules site. NO requests for early examinations or alternative days will be approved.

## Major projects / assignments

### Research Grant Proposal:

For this project, you will be working in pairs. The main assignment throughout this quad 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. I do not necessarily 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 question that you would focus on, and 4) design a few experimental suggestions to address the research focus. This will be a difficult assignment, but 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 I 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 an interesting (I won't go so far as to say enjoyable) exercise. Please come 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 | 3/4 | 1. Pre-class; Introduction; grant proposal assignment, plagiarism & writing concisely<br>2. Synchronous: Biology literature searches and proposal information (cont.)<br>3. Work on proposals (finding articles and narrowing topic) | Grant proposal information (Canvas),<br>Reader p. 1-14. |
| 2 | 3/11 | 1. Pre-class; Scientific methods and research methods. Going from topic to specific aims.<br>2. Synchronous; Reading articles efficiently<br>3. Work on proposals (finding articles and narrowing topic; start thinking aims)<br>***General research proposal idea (partner and general topic) due 3/9*** | Canvas activity<br>Reader p. 1-14. |
| 3 | 3/18 | 1. Pre-class; Intro to bioinformatics pages 1-3 (quiz at beginning of class)<br>2. Pre-class; What's wrong with my child (part 1)<br>3. Synchronous; 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 | 3/25 | 1. Pre-class; What's wrong with my child (cont.)<br>2. Synchronous; 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 | 4/1 | 1. Pre-class; Genome seq. and annotation, JASPAR and whole genome browsers & start BLAST (to dot plots)<br>2. Synchronous: BLAST alignment details<br>3. Work on proposals (background / significance and specific aims) | Reader p. 32-54. |
| 6 | 4/8 | 1. Pre-class; Major biological techniques – associated with bioinformatics…part 1<br>2. Synchronous; Work on proposals<br>**Draft of research proposal due on 4/10: Summary, intro, specific aims** | Reader p. 32-54.<br>Reader p. 55-72. |

| Week | Date | Topic | Reader Reference |
|---|---|---|---|
| 7 | 4/15 | 1. Pre-class; Major biological techniques – general…part 2<br>2. Synchronous; Analyzing figures<br>3. Work on proposals (feedback / methods) | Lecture slides / Canvas activity |
| 8 | 4/22 | 1. **Mid-term exam**<br>2. Work on Proposals (methods and description of how you will accomplish aims) | Reader p. 73-78 |
| 9 | 4/29 | 1. Pre-class; Hypothesis testing<br>2. Synchronous; Answer questions and help on hypothesis testing… and work on proposals | Reader p. 73-89. |
| 10 | 5/6 | 1. Pre-class; Testing for parametric data<br>2. Synchronous; Work on proposals and Testing for parametric data (homework) | Reader p. 79-89. |
| 11 | 5/13 | ***Draft of full proposal due, with printed copy in-class for peer review.***<br>1. Pre-class; Parametric statistics (t- and z-tests, Chi Square test)<br>2. Synchronous; Peer review of proposal drafts (get and give feedback) | Reader p. 98-126. |
| 12 | 5/20 | 1. pre-class; Parametric statistics; ANOVAs<br>2. Synchronous; parametric statistics help and questions. Final help with proposals<br>**Research proposals due on 5-20 by midnight on Canvas (no exceptions).** | Reader p. 98-126. |
| 13 | 5/27 | 1. pre-class; Non parametric data<br>2. Synchronous; help with non-parametric data and prepare for study sections | Reader p. 127-131. |
| 14 | 6/1 (Tues) or 6/3 (Thurs) | **Study sections meet**<br>--Study section 1 meets 8:00 – 11:00 on Tuesday, 4/28)<br>--Study section 2 meets 8:00 – 11:00 on Thursday, 4/30) | |

Final exam is on Tuesday, June 8th from 7:30 – 10:00, or Thursday June 10th from 10:30 – 1:00 in the main computer lab.

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# PLNU Undergraduate Syllabus Notification Page

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