

Biology 208L

Molecular Biology II Laboratory – Genomics & Epigenetics

Section 1: M 2:30-5:20 PM, Henry Lab 1
Section 2: F 2:30-5:20 PM, Henry Lab 3
Instructor: Dr Mike Dohm, Office Henry 6
Office hours: TBA

Special Attention: Laboratory safety policies as established by the Environmental Safety Office must be obeyed at all times during lab class: (1) No food or drink; (2) You must wear closed toes shoes; (3) You must wear a lab coat; (4) students are required to know location of MSDS and other lab safety equipment. Additional rules of conduct apply in the lab, which will be provided to you on our first meeting. Failure to comply with these rules will result in loss of points or depending on the infraction, you will be asked to leave the classroom. If you do not wear proper attire on Exam days, you will not be permitted to take the exam and will receive a failing grade for that task. Please respect the rules and do not make this an issue for us all.

Required textbook & reading: Lab manual (online and printed), additional handouts, online sources, and articles given by instructor. Your lecture textbooks, Essentials of Genetics, by Klug et al. and Advanced Genetic Analysis by Meneely will also be utilized. **Other required material:** Students are required to obtain a laboratory coat, now available at the Division of Natural Sciences & Mathematics office for \$5. Safety goggles will be provided. A notebook (cloth bound) and pen are also required materials students must bring to each lab meeting. A 3-ring binder for course handouts is recommended, but not required.

Course description: Genomics & Epigenetics is a one semester introduction to the study of genomes (the entirety of an organism's heredity information) and epigenetics, the heritable changes in gene expression as a result of changes other than DNA sequence alterations in biological organisms. Since the late 1990s, the discipline of genomics has witnessed a revolution in methods and discovery. The impact of this revolution can be seen in the food we purchase, the way our diseases are diagnosed, and perhaps even how we view ourselves. Through lecture and discussion, we will explore these topics and reflect upon how the technology and discovery in genomics impacts the environment and human society. We will discuss genome structure and how to locate elements like a specific gene to a particular region of the genome, incorporating use of new technologies like genome wide mutant screens and RNA interference, and nonMendelian inheritance as a result of epigenetic changes to DNA. Students will be introduced and gain experience with software tools to interrogate genomic data.

Program outcome: This course will introduce students to the foundational concepts of molecular genetics, genomics, and bioinformatics. Students will enhance abilities to discuss potential benefits and risks of genetic technology to the environment and or to human health and society.

Student learning outcomes: After taking this course, students will be expected to demonstrate an understanding of

1. How DNA melting curves can be used to investigate genome structure.
2. Using databases to develop and test hypotheses of genome structure.
3. How to recognize mutants derived from a RNAi knockdown experiment.
4. Distinction between microarray and qPCR sources of error.
5. Use of modern instrumentation to complement molecular genetic hypotheses about genome structure and patterns of inheritance.

Course prerequisites: Concurrent enrollment in BI208. Required courses: BI205/205L and BI206/206L. .

Course assessment: Your grade will reflect your work on two (2) exams, four (4) lab reports. You are expected to keep a laboratory notebook of your work and this will be inspected at random times through the course for a maximum of 20 points.

Lab reports. Four lab reports will be completed by each student. The four reports are centered on one major element of the course. **Lab report 1** will be based on a database assignment; **Lab report 2** will be based on

analysis of *Cot* curves for different sample sof DNA; **Lab report 3** will be based on results of a 2-color microarray experiment on *Drosophila* grown in a stressful environment; **Lab report 4** qPCR results from parental-specific patterns of inheritance. These are to be written up and submitted via the Moodle site for the course. After getting the graded report back from the instructor, these are to go into your lab notebook. Lab reports will generally follow the following format.

1. A statement of the purpose of that laboratory including a description of the importance of the experiment.
2. An outline of the materials and procedures. This includes relevant details such as dates, times, number of specimens, etc.
3. Tables or figures of results, together with a short written explanation of what is contained in them.
4. Preliminary conclusions

Format details, which are to follow standard scientific format, will be provided by the instructor. Laboratory work is a typically to be viewed as a group homework activity, but lab reports are individual activities. In lab, we conduct experiments and record observations. We will introduce you to how to conduct the analyses required to interpret your experiments. However, you can expect to spend time outside of class completing analysis and writing up results and conclusions from the experiments. Write-ups and analyses are to be turned in by each student and the work must be the work of the student only. However, data belong to the group and so data are shared between two or sometimes the entire class of students. Periodically, we will break into groups to discuss topics or work on problems introduced in lab. The purpose of the group activity is to give you opportunities to be more active learners, but also to be responsible to each other for the material. You will be given material in advance, and you must come to class prepared to discuss the material with your classmates.

Topic questions from each lab will be provided in handouts, and form the basis of quizzes and exams in the course. These topics will be discussed during lab procedures and are part of your reading assignments. Many of these questions will be used as the basis for Exam 1 and Exam 2.

Exams: Two lab exams will be given in class: Exam 1 on or about week 6; Exam 2 on or about week 14. You will be allowed to bring and use your lab notebook for these exams.

A total of 200 points may be earned throughout the semester; each item has the following value.

| Assignment | Points | Dates |
|--------------|---------------------|---|
| Reports | 80 pts, 20 pts each | Bi-weekly |
| Lab notebook | 20 pts | Evaluated at random times during semester |
| Exam 1 | 50 pts | 6 th week |
| Exam 2 | 50 pts | 14 th week |
| Total | 200 pts | |

Final grade: Your grade will be based on the following.

| Points earned | Percent of total | Letter grade |
|---------------|------------------|--------------|
| 180 – 200 | 90 – 100% | A |

| | | |
|-----------|----------|---|
| 160 – 179 | 80 – 89% | B |
| 140 – 159 | 70 – 79% | C |
| 120 – 139 | 60 – 69% | D |
| < 119 | < 60% | F |

Reminders and notices:

- By enrolling in this class, you agree to abide by and follow all laboratory policies and related safety regulations. The lab safety regulations are established by the office of the Dean of the Division of Natural Science and Mathematics apply to EVERYONE who uses the laboratories. These rules include, but are not limited to, proper use of instrumentation, use of personal protective equipment when directed to do so, use of lab coats during lab class, the requirement that you wear closed toe shoes and refrain from any eating or drinking in the lab. Please respect laboratory policies regarding proper attire; if you do not, you will be asked to leave and will be subject to fine under Division policy.
- In keeping with the computational demands of modern genetic analysis, Henry Lab 2 includes twelve laptops for our use. This mobile computer facility was designed and is now maintained by the Division of Natural Sciences and Mathematics so that you would have access to a state-of-the art academic computing environment. Money is simply not available to repair damaged, abused, or stolen computers. Therefore, each person has the obligation to use the computers responsibly. By using these facilities, you agree to abide by the Computer Use Policies posted in the classroom. These rules include, but are not limited to
 - No food or drink
 - You agree to adhere to the account setup procedures and use restrictions
 - No alterations of software or hardware configurations
 - No use of the computers for personal or commercial activities, (except where such activities are otherwise permitted or authorized under applicable University policies.
- Class begins each time exactly at 2:30. Please be on time. Chronic tardiness will be viewed as absence from class. Class ends at 5:20PM. **Please do not make a habit of asking about the length of a given lab assignment – all efforts have been taken to make sure exercises can be completed in the allotted time provided we come prepared.** If you miss or are tardy for class, please note that we will proceed without you and you will miss material; it is your responsibility to obtain missed topics from your classmates who were in attendance. Missed laboratory exercises only rarely can be made up after the fact.
- No make up exam will be granted in the event of an absence. If a student cannot attend a class in which a exam has been scheduled, the student must notify the instructor no later than the class prior to the scheduled quiz. For example, if an exam is scheduled for Thursday, then student must approach and receive permission for the absence no later than Wednesday; if an exam is scheduled for Monday, then student must approach and receive permission for absence no later than Friday . In the event of illness, a Doctor's note will be expected and accommodations will be made on a case-by-case basis. Lacking an authorized excuse, you may still be allowed to take the exam at a later time, but you will not be able to earn full credit for the assignment, in fairness to those students who took the exam on time.
- Use of music devices and cell phones is prohibited during all Natural Science and Mathematics classes at Chaminade, unless specifically permitted by your instructor. Use of cellphones and music devices in laboratories is a safety issue. In addition, use of cellphones and music devices in any class is discourteous and may lead to suspicion of academic misconduct. Students who cannot comply with this rule will be asked to leave class and may be subject to laboratory safety violation fines. Please refer any questions to the Dean of Natural Sciences and Mathematics.
- You are expected to have read and to abide by the "Student Rules of Conduct" which are available in your copy of Chaminade University's Student Handbook.
- Students with special needs who meet criteria for the Americans with Disabilities Act (ADA) provisions must provide written documentation of the need for accommodations from the CUH Counseling Center (Dr. June Yasuhara; phone 735-4845) by the end of week three of the class, in order for the instructor to plan accordingly. Failure to provide written documentation will prevent your instructor from making the necessary accommodations. Please refer any questions to the Dean of Students and review the procedures at http://www.chaminade.edu/student_life/sss/counseling_services.php.

Tentative list and dates of Labs with due dates for lab reports

| Laboratory | Topics |
|---------------|---|
| Lab 1 | Introduction, MacBooks and online databases Setup <i>Drosophila</i> stress test Review of molecular genetic techniques |
| Lab 2 | Sequence homology, alignment, and statistics of sequence identity Lab 1 – 2 report due Extract RNA and DNA from <i>Drosophila</i> RNA quality control |
| Lab 3 | Genomic elements and Cot curves with the ABI thermocycler cDNA to Oligonucleotide hybridization to microarray chips |
| Lab 4 | Cot curve analysis Lab 3 report due Microarray I: Introduction and 2-color gene expression experiment with <i>Drosophila</i> |
| Lab 5 | Microarray II: Processing, normalization, and analysis |
| Exam 1 | In class |
| Lab 6 | RNA interference as a genome wide mutant screen in <i>Drosophila</i> . |
| Lab 7 | Microarray III. RNAi to “knockdown” Lab 4 - 7 report due |
| Lab 8 | Epigenetics and Parental-specific allele expression qPCR I: Introduction and design of experiment to test for epigenetics in <i>Drosophila</i> |
| Lab 9 | qPCR II: Processing, normalization, and analysis. Analysis of epigenetics experiment |
| Lab 10 | Lab 8-10 report due qPCR III: qPCR as a means to verify microarray results |
| Lab 11 | Lab wrap up. |
| Exam 2 | |