# Biology 208 (3 credits)
# Molecular Biology II – Genomics and Epigenetics

Meeting days/times:
Section 1: MWF 10:30 – 11:20 AM, Henry Lab 3
Section 2: MWF 1:30 – 2:20 PM, Henry Lab 2
Henry Lab 2
Instructor: Dr Mike Dohm, Office: Henry 6
Office hours: TBA

Required textbook: Two books are required: (1) *Essentials of Genetics*, 7th ed., 2010, by Klug et al. (ISBN: 9780321618696) and (2) Advanced Genetic Analysis, 2009, by Meneely (ISBN: 9780199219827). There may be additional readings provided by the instructor throughout the course.

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. Organization of the genome.
2. How sequencing technologies, software, and prior knowledge is incoprorated into a genome assembly.
3. How to locate a gene (or other element) by molecular genetic and bioinformatic approaches.
4. Local and genomic control of gene expression.
5. The role of sequence and imprinting on allele-specific patterns of inheritance.

Course prerequisites: Required courses: BI205/205L and BI206/206L.

Course assessment: Your grade will be the result of points earned from worksheets, exams, and a group project. Graded elements include: six (6) worksheets; two (2) mid-term exams; plus a cumulative, final exam.

Worksheets consist of problem specific scenarios with instructions on a particular genomics or bioinformatics problem. Students work together in teams to learn how to access databases or use bioinformatics tools to solve genomics problems, ranging from assembly of sequences to gene annotation to comparing sequences from different organisms for evidence of homology. The objective of the worksheets is to provide hands-on activities to illustrate lecture and textbook readings.

Project Readings. Student teams will identify readings from the journal Genome Biology, and act as lead presenters to the class. Students will find background readings to help explain the concepts and provide a PowerPoint presentation at the end of the class.

Exams, including the final, comprise between 15 and 20 questions (approximately 40% multiple choice, 60% short answer format). Each of the mid-term exams will have opportunities for bonus points (10% per exam); there are no bonus points possible for the Final). You may bring and use an instructor approved calculator if you wish. You may not use a cell phone or PDA during any exam, including the calculator function.

A total of 400 points may be earned throughout the semester; each item has the following value.

| Item | How many? | How often? | How many points? | Total points towards final grade |
|---|---|---|---|---|
| Worksheets | 6 | Every 3 weeks | 10 | 60 |
| Projects | 1 | | 40 | 40 |
| Exams | 2 | Every 6-7 weeks | 100 | 200 |
| Cumulative Final | 1 | Date TBA | 100 | 100 |

Final grade: Your letter grade will be based on the following point distribution out of 400 points possible.

| Points earned | Percent of total | Letter grade |
|---|---|---|
| 360 - 400 | > 90% | A |
| 320 – 359 | 80 – 89% | B |
| 280 – 319 | 70 – 79% | C |
| 240 – 279 | 60 – 69% | D |
| ≤ 239 | ≤ 60% | F |

Course and University Policy, Reminders, and notices:

1. Chaminade University abides by all aspects of the Family Educational Rights and Privacy Act (FERPA). Details of Chaminade's implementation of FERPA are available in your Student Handbook.
2. Class begins each time exactly on time (check your section schedule) – please be on time. Chronic tardiness will be viewed as absence from class. 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 lecture topics from your classmates who were in attendance.
3. You are expected to attend class and to come prepared: read your text before the material is to be presented in class; ask questions if you are unsure of material. I will suggest problems or questions from each chapter in your text or from the publisher's website for you to consider; these will not be graded, nor are they required. However, the more you do, the more practice and exposure you get to the material, the better you will do on my exams. BI208 exams are based on the same concepts and problems that the text questions address.
4. Return of graded material will generally be within one week after you take the graded assignment. For example, if an exam was taken on Monday, graded exams will be returned on the following Monday.

5. 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.
6. Makeup exam policy. If a student cannot attend a class in which an exam has been scheduled, the student must notify the instructor no later than the class prior to the scheduled exam. In the event of an emergency or an 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. Same day, but not scheduled time – 5%; next day 15%; 25% after three days. After 4 days, will receive a zero for that assignment or exam.
7. You are also 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.
8. 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.

# Lecture Topics and Textbook readings

Tentative Lecture Schedule, Topics, and Assigned readings. Check with instructor for updated schedule.

| Week | Topic | Klug Readings | Meneely readings |
|---|---|---|---|
| **1** | **Syllabus & course overview; Pretest** | | Ch1 |
| | **What is an "–ome?" Overview and review of genetics with emphasis on genomes and epigenetics** | | |
| **2** | **Genome sequencing & mapping; Sanger method; pyrosequencing** | Ch7 | |
| | | Ch18 | |
| | Instructor handout | | |
| | **Worksheet 1: Databases & alignment** | | |
| **3** | **Structure of the genome: single copy, multiple copy elements** | Ch14 | Ch3 |
| | **Worksheet 2: Contig assembly** | | |
| | **Introduction to Projects** | | |
| **4** | **Annotating the genome & Gene ontologies: Of genomic landmarks and biological processes** | | |
| | Instructor handouts | | |
| **5** | **Data mining sequence databases** | Ch18 | |
| | Instructor handouts | | |
| | Worksheet 3: DAVID | | |
| **6** | **Comparative genomics** | Ch18 | |
| | Instructor handouts | | |
| **7** | **Review** | | |
| | **Exam 1 in class** | | |
| **8** | **Finding genes: Mapping – connecting phenotypes to a DNA sequence** | Ch14 | Ch5 |
| | **Projects – compiling reading lists** | | |