

## Course Name: Introduction to Molecular Biology

Course Number: BB 331(listed on Canvas as BB\_331\_001\_S2018)

Location: LINC 368

Course Credits: 3 credits.

Instructor: Phil McFadden, Office 2151 ALS. Email: Phil.McFadden@oregonstate.edu  
Office hours: Right after class or by other arrangement.

Lecture schedule and dates: TR 1400-1520, 4/2/18 through 6/8/18

OSU Catalog Description of the Course: "Course dealing with the molecular basis of cellular function, with emphasis upon modern developments, and the foundation for practical applications of this knowledge. The course will involve the conceptual background necessary to appreciate the applications of molecular biology. Throughout the course opportunities will be given to discuss public policy issues and questions: What are the moral and practical problems that flow from identification of an individual as being at risk for a late-appearing genetic disorder, such as Huntington's disease or certain cancers? Does the scientific or public value of knowing the entire DNA sequence of the human genome justify a situation in which individual or small-scale research cannot be supported? What issues arise when the fruits of biological research, mostly publicly funded, are commercialized? Should a novel organism be patented? How can biotechnology be applied to environmental problems?"

Prerequisites: CH 122 [D-] or CH 202 [D-] or CH 222 [D-] or CH 225H [D-] or ( (CH 232 [D-] or CH 232H [D-] ) or (CH 262 [D-] or CH 262H [D-] or CH 272 [D-] ) )

**This course fulfills the Baccalaureate Core requirement for the Core, Synth, Sci/Tech/Soc category. It does this by:**

1. Analyzing relationships among molecular biology, technology, and society using critical perspectives or examples from historical, political, or economic disciplines. Students will learn to recognize and explain how the science and tools of molecular biology have emerged from past endeavors to solve scientific, technical and social problems. Students will learn to situate present day and near future explorations in historical context. In particular, students will critically examine current trends that are culminating in practical tools and procedures for precisely manipulating and editing the inherited genomes of organisms;
2. Analyzing the role of molecular biology and technology in shaping diverse fields of study over time. Students will learn to recognize and explain advances in the science of molecular biology and will learn to correlate those advances to resulting changes in social practices and attitudes at large;
3. Articulating in writing a critical perspective on issues involving molecular biology, technology, and society using evidence as support. As a class project, students will put together a "molecular biology impact statement" (MBIS) to study the scientific, technical and social impacts of a recently proposed project in molecular biology. For Spring 2018 this class will focus on the recent trend popularly known as "biohacking" that enables individuals or small groups or small companies to genetically modify

organisms, including humans, using new and readily available molecular biology technologies (such as DNA sequencing, PCR, and CRISPR/Cas9).

## Course Content (approximate schedule of topics and activities):

### Week 1-3

- First class meeting on Tuesday, April 3 will include a Molecular Biology pre-test.
- *Textbook topics include:* Scientific answers to long-standing questions of biological inheritance. Connecting codes -- DNA to RNA to protein. Gene structure and mechanism revealed by the foundational experiments of molecular biology.
- *In-the-news topics may include:* Social questions in reaction to gene splicing technologies. Policing the new Genie? -- The 1975 Asilomar Conference.
- *Class project: Put together a hotlist of designer biology projects- Can we? Should we?*
- *Exam 1 focus (Thursday, April 19) - The flow of genetic information: DNA makes RNA makes protein.*

### Weeks 4 - 6

- *Textbook topics include:* Amplification of nucleic acids. Genome sequencing. Explanatory hierarchies – genomes, transcriptomes, proteomes, metabolomes. Discovery and invention of new factors and vectors for manipulating genes and gene expression.
- *In-the-news topics may include:* Social and legal implications of bioinformatics. Privacy issues. Health promises and realities. Tackling cancer and other molecular diseases using advanced techniques and designer medicines. New insights into environmental and molecular toxicology. Aging and limits of DNA repair and cell maintenance. Who profits and who benefits from these and other advances in molecular biology?
- *Class project: Put together an opinion cloud on "biohacking" in the present era of cheap and easy tools for manipulating genomes.*
- *Exam 2 focus (Thursday, May 10) - The two-way street of progress: New techniques improve our understanding of how biology works; that improved understanding then spurs the invention of the next round of new techniques.*

### Weeks 7-10

- *Textbook topics include:* Which organisms can be genetically manipulated? Cloning and using ancient DNA. CRISPR technology for precision engineering of genomes. Gene drives for spreading new genomes across populations.
- *In-the-news topics may include:* Molecular machines built to order. Expanded genetic code. Synthetic cells. Molecular technologies and patent law. Limits of biological design and engineering costs. Shaping evolution. GMO mosquitoes for fighting the Zika epidemic.
- *Class project: Put together a Molecular Biology Impact Statement (MBIS) on the topic of "Biohacking: Menace or opportunity?"*
- *Final exam focus (Monday, June 11 at 2pm) - The CRISPR revolution (is it for real?). Applying what we have learned in BB331 to other molecular biology proposals of social relevance.*

## Evaluation of Student Performance

*Performance categories and weighting:* Attendance and classroom participation (20%); completion and timely submission of assignments related to class projects (30%); graded exams (50%).

*Final letter grade:* Students who perform within a standard deviation of the class average will be in the B range. Better performances will merit a letter grade in the A range while poorer performances are liable to receive a grade of C or lower. A grade of F is expected to be given only to students who do not participate as measured by failure to regularly attend class, failure to turn in an assignment, or failure to take an exam. Excused absences and makeup exams are not given lightly and require documented explanations that meet university guidelines.

## Learning Resources

- *Canvas.* Lecture notes, slides and links to outside information will be posted on Canvas.
- *Online textbook.* [Biochemistry Free for All](#) (we will limit our readings to [Chapter 7, sections 1-7, pp. 695-802](#)).
- *Online wikibook.* [An Introduction to Molecular Biology](https://en.wikibooks.org/wiki/An_Introduction_to_Molecular_Biology). [https://en.wikibooks.org/wiki/An\\_Introduction\\_to\\_Molecular\\_Biology](https://en.wikibooks.org/wiki/An_Introduction_to_Molecular_Biology)
- *Articles from the scientific literature will be frequently assigned. Some titles will require access through the OSU library. Please test the following link to ensure you have access to this type of learning resource: [A Map of Human Wanderlust \(Links to an external site.\)](#) (Nature magazine, Sept. 21, 2016, doi:10.1038/nature19472)*
- *Google Docs:* Group projects will often involve collaborations using documents and spreadsheets.

## Statement Regarding Students with Disabilities

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at <http://ds.oregonstate.edu>. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

## Expectations for Student conduct

Choosing to join the Oregon State University community obligates each member to a code of responsible behavior. Here is a link to the OSU [Statement of Expectations for Student Conduct](#): Please review these expectations and practice this code of behavior in all of your campus activities.