BB 492, BB 592 – Genetic Biochemistry
Spring 2016

Time and place:
Monday, Wednesday, Friday
10:00–10:50
Room 102 Owen

Instructor:	Michael Freitag
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Teaching assistants:	Hayati Wolfenden, ALS XXXX (wolfendn@oregonstate.edu) Lindsay Winkenbach, ALS XXXX (winkenbl@oregonstate.edu)
Office Hours:	Michael Freitag, Wednesday and Friday, 11 am - noon (or by appointment) Hayati Wolfenden, Monday, 11 am – noon, ALS2162, and by appointment Lindsay Winkenbach, Tuesday, 2 – 3pm, ALS2040, and by appointment TAs will announce weekly "group appointments", likely after 2 pm on Friday "Major Groove" – Tuesday and Wednesday, 6 – 8 pm, Valley Library
Textbook:	*Biochemistry*, Fourth Edition, by Mathews, van Holde *et al.*

Purpose
This course is focused on information transfer in molecular biology, including:

- genome structure, nucleotide metabolism, nucleic acid structure,
- DNA replication, mutagenesis and DNA repair,
- transcription, RNA processing, transcriptional regulation of gene expression,
- protein synthesis, protein processing.
- Important techniques of molecular biology.
- Selected examples of regulatory phenomena will be discussed in detail. Students will access background information and older seminal studies important in shaping our understanding of biochemical genetics and molecular biology as a field of research.
- We provide a setting in which students are trained in critically evaluating original research results through questions and extended discussions.
- We will build a "research resource". Biochemistry is an experimental discipline, thus intimate knowledge of the appropriate techniques is essential. Students will be exposed to various technologies and resources that molecular biologists utilize to conduct research. Their availability on campus will also be discussed.

Learner Outcomes
After attending this class, students will be able to:

- Explain genome structures of pro- and eukaryotes;
- Explain the *de novo* and salvage pathways for nucleotides;
- Acquire a working knowledge of the biochemistry related to the transmission of genetic information and its expression (DNA replication, DNA repair, transcription and translation).
- Gain an understanding of how genetic processes are regulated at the level of transcription and translation.
- Explain how chromatin regions are generated and maintained and how epigenetic modifications control chromatin and transcription;
- Apply genetic, cytological and biochemical tools that can be used to investigate epigenetic phenomena.
- Display an understanding of key concepts relevant to molecular biology via reading and discussing primary research papers, and performance on written examinations and group homework assignments.

Learner Expectations

- Student will come prepared for lectures by studying the assigned text, handouts or lecture notes prior to class. **Do not read just one page at a time; read the whole chapter and refer back to specific pages depending on each upcoming lecture.**
- Read the assigned primary research papers and discuss them in your group **before** lectures. Groups will be called upon to explain and discuss specific figures in class. Performance will be part of the final grading.
- Significant time is required for studying the assigned readings, lectures, and notes throughout the term. ***Studying for exams at the last minute will likely result in a poor grade.***
- **The instructor and TA's are here to help you**! In turn, you are expected to arrange to come to Office Hours if help is needed. **DO NOT WAIT UNTIL THE LAST WEEK BEFORE EXAMS!**
- **For graduate students (BB 592):** Significant time and effort will be spent on preparing term papers; grades will be assigned relative to the scientific rigor evident in the final product.

Learning aids

- Lecture notes are posted on the BB 492/592 Canvas site. There may be minor changes ***after*** each lecture has been given.
- Problems from the book are recommended as checkpoints for your progress. Make use of the student exercises that come with your textbook.
- Additionally, recommended reading materials and study questions will be posted on Canvas.
- Question-Answer sessions in preparation for exams may be announced if necessary.

Evaluations and grading

- Two non-cumulative 200 point examinations.
- Group homework assignments (short, 3-4 page critiques of papers discussed in class; 100 points total)
- **Graduate students (BB 592):** term paper (100 points of the grade).
- Homework assignments (all individually graded) are based on papers that are required reading (total 24% of grade). Assignments are due *before* the relevant discussion starts, preferably submitted as an MS Word file.

Considerations for all participants in discussions:

Please be always prepared by at the very least reading the applicable chapter and paper to be discussed. Read the whole chapter ahead of time and refresh specific pages after the lectures and discussions to retain the material.

Considerations for discussions and homework assignments:

The way to read a paper is to go through the abstract, read the introduction, then the results and discussion and refer to the methods if necessary. For figures to present it's helpful to know about the methods and be able to explain them. Be critical, especially when it comes to the discussion ("Does the title match the findings?", "Do the authors over-interpret data?", "Are there other/better valid methods?"). Evaluate how well the paper is written (style, clarity, citations). Try to encourage questions and discussion.

Graduate students (BB 592) Term Paper: The paper assignment entails a critical analysis of a ***recent***, ***full-length***, ***primary*** research publication, dealing with any topic covered this term. The appropriateness of the article should be discussed with the instructor prior to May 8th or by sending a pdf of the paper to freitagm@onid.orst.edu. The paper should take the form of a written Journal Club presentation, in which the student presents a clear summary and critical analysis of the paper. The following questions should be considered: Is the paper a significant contribution to knowledge? If so, why? Are experimental methods clearly described? Do the authors adequately consider alternative models? Are the experiments convincing? Are the conclusions drawn justified based on the reported results? What are the most important future directions for the work? ***Please make sure to substantiate your opinions by citing from the literature.***

Recommended length: 5–6 pages, double-spaced.

Due date: Sunday, May 29th, midnight. Earlier submission is strongly encouraged.

University Policies – A reminder:

Please note: "Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later than the first week of the term. In order to arrange alternative testing, the student should make the request at least one week in advance of the test. Students seeking accommodations should be registered with the Office of Services for Students with Disabilities."

The University rules on civility and honesty can be found at: http://oregonstate.edu/admin/stucon/regs.html

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- Cheating-use or attempted use of unauthorized materials, information or study aids
- Fabrication-falsification or invention of any information
- Assisting-helping another commit an act of academic dishonesty
- Tampering-altering or interfering with evaluation instruments and documents
- Plagiarism-representing the words or ideas of another person as one's own

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

Use of cellular phone call, texting, messaging and twitter functions is not permitted in the classroom during lectures.

Feel free, however, to use phones to look up information during class (not during exams).

"The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office."

Prerequisites and Co-requisites

This is a sequence professional course to meet the requirements of majors in biochemistry and biophysics. It must be taken in order. PREREQUISITES: CH 336; BB 490/590; BB491/591.

Approximate schedule BB 492/592 Spring 2016

Date	Lecture	Topic	suggested reading Textbook chapter(s)	
3/28	1	Course overview, genomes, genes, chromatin	24	**Freitag**
3/30	2	Nucleotide metabolism	22	**Johnson**
4/1	3	Nucleotide metabolism, nucleic acid structure	22, 4	**Johnson**
4/4	4	Nucleic acid structure, supercoiling, stability	4	**Johnson**
4/6	5	DNA replication (parts: polymerases and others)	25	**Johnson**
4/8	6	DNA replication (process and fidelity)	25	**Johnson**
		Rest of the course is taught by Freitag		
4/11	7	Methods: Sequencing, PCR, gene targeting	4B, 24A, 26A	
4/13	8	DNA replication in eukaryotes	24, 25, review on canvas	
4/15	9	Discussion 1: Eukaryotic Replication	paper on canvas	
4/18	10	Telomeres	review on canvas	
4/20	11	DNA damage and repair	26	
4/22	12	Discussion 2: DNA repair	paper on canvas	
4/25	13	DNA repair	26	
4/27	14	DNA recombination and rearrangements	26	
4/29	15	Introduction to transcription	27	
5/2	**Monday**	**MIDTERM EXAM (covers lectures 1 to 14)**		**50 min**
5/4	16	Eukaryotic transcription	27	
5/6	17	Discussion 3: Transcription	paper on canvas	
5/9	18	RNA processing, reverse transcription	27	
5/11	19	Protein synthesis: Genetic code, mRNA, tRNA	28	
5/13	20	Protein synthesis: tRNA, Ribosomes	28	
5/16	21	Protein synthesis: Translation	28	
5/18	22	Protein targeting and degradation	28	
5/20	23	Discussion 4: Codon bias and translation	paper on canvas	
5/23	24	Gene regulation: principles in prokaryotes	29	
5/25	25	Regulation of transcription: prokaryotes	29	
5/27	26	Regulation of transcription: Eukaryotes, chromatin	29	
5/30		**Memorial Day (no class)**		
6/1	27	Regulation of translation	29	
6/3	28	Discussion 5: Gene regulation by chromatin	paper on canvas	

6/7 Tuesday FINAL EXAMINATION (6 PM; covers lectures 15 to 28) – full time