

## BMB 400: MOLECULAR BIOLOGY OF THE GENE



### Welcome to BMB 400!

BMB 400 is an important course in your FRNSC curriculum as it not only expands the depth of your knowledge in molecular biology, but it also prepares you for future courses such as FRNSC 421W and FRNSC 821.

BMB 400 is a challenging course, so be sure to read through the syllabus where you'll find important resources and information that will help you achieve your personal goals.

Through *persistent preparation* and *active learning*, this course will empower you to more effectively learn the course material and perform well on the assignments.

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### My contact information:

Mitchell Holland, 014 Thomas Building (basement), [mmh20@psu.edu](mailto:mmh20@psu.edu), 865-5286

Office Hours: By appointment

### We'll meet in two places this semester:

Lecture will be held on MWF at 8:00-8:50 AM in 119 Thomas

**Required** recitation on W at 1:25-2:15 PM in 005 Life Sciences

### Required Text & Clickers:

Watson et al's *Molecular Biology of the Gene*, 7<sup>th</sup> Edition

Additional resources, but not required: Cox et al's *Molecular Biology: Principles & Practice*; Lehninger's *Principles of Biochemistry*

Clickers are required for this course (the *i>clicker system*). **BE SURE** to bring your clicker to every class & recitation. Enter your **Access Account ID** as your Student ID when you configure your clicker. For more information, go to <http://clc.its.psu.edu/Classrooms/Clickers/>. In addition, there is a Clicker information file posted on ANGEL.

### Course Resources:

You can find most of the material for this course at the BMB 400 site on CANVAS (<https://lmstools.ais.psu.edu/login.html>); for example, PowerPoint pdf's, recommended journal articles, the syllabus, and practice exam questions. In addition, you are strongly encouraged to use the University library system to search for journal articles on topics encountered throughout the course ([www.lias.psu.edu](http://www.lias.psu.edu)). This is an excellent way to supplement your knowledge on the challenging topics we'll be discussing.

**Learning Objectives:** *Accomplished through lectures, recitation sessions and active learning. Assessed through quizzes, exams, clicker questions and class participation.*

### ***PLEASE READ THE LEARNING OBJECTIVES***

*At the end of this course, you should better understand ...*

- ❖ ... the structure of proteins, DNA and RNA, including higher order complexes such as nucleosomes, chromosomes, and chromatin.
- ❖ ... the interactions that occur between macromolecules; e.g., protein/DNA interactions involved in the regulation of transcription.
- ❖ ... the details of DNA replication at the molecular level; e.g., understand how a sliding clamp helps to facilitate the replication process.
- ❖ ... the mechanisms of DNA mutation and mutation repair, including recombination and how recombination can help to facilitate mutation repair.
- ❖ ... the details of transcription at the molecular level; e.g., understand how a Rho-independent sequence helps facilitate the termination of transcription.
- ❖ ... the details of translation at the molecular level; e.g., understand how eIF4F helps to recruit ribosome complexes during initiation of translation.
- ❖ ... the details of regulating gene expression at the molecular level; e.g., understand how repressors, insulators and activators help to regulate expression.
- ❖ ... the elements and applications of important molecular biology laboratory techniques; e.g., PCR, qPCR, and Sanger and next generation DNA sequencing.
- ❖ ... how aspects of the course material relate to forensic DNA analysis; e.g., DNA extraction, qPCR, PCR/polymerase activity, STR locus structure, recombination and linkage of STR loci.

### **Graded Opportunities:**

- I. *Quizzes:* Nine (9) quizzes will be given throughout the semester, at the end of recitation classes. The schedule for each quiz can be found in the Tentative Agenda at the end of the syllabus, and a list of the lectures covered for each quiz is provided on CANVAS.
- II. *Exams:* Four (4) exams will be given throughout the semester. The schedule for each exam can be found in the Tentative Agenda at the end of the syllabus. **NOTE: Exams will be held from 6:00-7:30 PM at the designated locations.**

- III. *Literature Review*: Conduct a literature review for one of the replication, transcription or translation factors we cover in class (Parts 2 & 3). Write a five page summary of the findings, addressing how they relate to what we discuss in class and how they might impact how the material in class is presented in the future. A one page proposal is **due on 3 November**, identifying the factor to be studied and which paper(s) will be included in the review. Feedback will be provided NLT 8 November. Efforts will be made to limit the review of the same factor through the same papers, so you are encouraged to submit your proposals early, as they will be approved on a first-come, first-serve basis. The Literature Review is **due on 17 November 2016**.
- IV. *Daily Quizzes (DQs)*: Preparing for class will better engage students in the learning process. At the beginning of each class (following the **FIGURE it out** exercise, when applicable), a one question quiz will be given that reflects the material from the PowerPoint for class that day. Students will have approximately 1-3 minutes to answer the question.
- V. *Class Attendance*: Attendance is required at each class and recitation. This has historically resulted in the greatest possible preparation for students, and subsequently, the most positive outcome in the course. Clicker questions (**Clicker Q's**), **FIGURE it out** exercises, DDQs and other active learning approaches will be used to help students measure their understanding of the course material and to facilitate the learning process. Class material will typically come directly from the PowerPoints.

**Grading:**

*Quizzes (9)* = **150 pts (15%)**  
 15 pts each for the first 4 quizzes = 60 pts, 18 pts each for the last 5 quizzes = 90 pts

*Exams (4)* = **760 pts (76%)**  
 160 pts for exams 1, 180 pts for exam 2, and 210 pts for exams 3 & 4

*Literature Review (1)* = **50 pts (5%)**  
 Written research summary for one of the transcription or translation factors

*Daily Quizzes (35)* = **40 pts (4%)**  
 Answer at least 25 DQs correctly (2 pts lost for each incorrect answer below the first 10)

*Class/Recitation Attendance* = **0 pts**  
 5 pts lost for each absence **w/out** an acceptable excuse

TOTAL = **1000 pts (100%)**

*Grading Scheme:*

Grading will follow the University's guidelines. FRNSC students must receive a C or better ( $\geq 68\%$ ) in order to have the course count towards the FRNSC major. The following is a typical grading scheme used in previous semesters; 93-100 = A, 88-92 = A-, 84-87 = B+, 80-83 = B, 76-79 = B-, 72-75 = C+, 68-71 = C, 58-67 = D, <58 = F

**Exam Policy:**

All requests for a makeup exam or quiz must be made by sending an email to Dr. Holland *no later than two weeks prior* to the scheduled exam. If an unexpected illness keeps a student from attending an exam or quiz, an email must be sent to Dr. Holland prior to the class period in order for the student to be allowed to take a makeup.

No bathroom breaks are allowed during exams and quizzes, and nothing is allowed on your desk other than writing utensils and a calculator (when necessary).

**Academic Integrity:**

In an examination setting, unless the instructor gives explicit prior instructions to the contrary, violations of academic integrity shall consist of any attempt to receive assistance from written or printed aids, from any person or papers or electronic devices, or of any attempt to give assistance, whether the student doing so has completed his or her own work or not. Other violations include, but are not limited to, any attempt to gain an unfair advantage in regard to an examination, such as tampering with a graded exam or claiming another's work to be one's own. Failure to comply will lead to sanctions against the student in accordance with the [Policy on Academic Dishonesty](#) in the Eberly College of Science. All University and Eberly College of Science policies regarding academic integrity/academic dishonesty apply to the students enrolled in this course. Refer to the following URL for further details on the academic integrity policies of the Eberly College of Science: <http://science.psu.edu/current-students/Integrity/Policy.html>.

Matters of academic dishonesty will be turned over to the University disciplinary system and may result in a failing grade for the course.

**Disability Policy:**

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at [814-863-1807](tel:814-863-1807) (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>.

You must contact ODS and request academic adjustment letters at the beginning of each semester. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (<http://equity.psu.edu/ods/guidelines/documentation-guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying the appropriate adjustments. Please share this information and discuss the adjustments with your instructor as early in the course as possible.

**Mutual Respect and Cooperation:**

The Eberly College of Science Code of Mutual Respect and Cooperation (<http://science.psu.edu/climate/code-of-mutual-respect-and-cooperation/Code-of-Mutual-Respect%20final.pdf/view>) embodies the values that we hope our faculty, staff, and students possess and will endorse to make The Eberly College of Science a place where every individual feels respected and valued, as well as challenged and rewarded.

**How to be Successful in this Course:**

**Be prepared.** Study the PowerPoint presentations ahead of the class, actively participate in the **FIGURE it out** exercises, and read the assigned chapters of the text book and the journal articles. Come to every class and recitation, ask questions, and schedule one-on-one meetings with Dr. Holland if you need help. Make sure you **understand** the material, as the exams will be a series of short-answer questions (12-16) with a small number of multiple choice questions (2-4). Since the exams will primarily be short-answer questions, students should practice verbalizing, visualizing and writing out their understanding of the course material. Practice exam questions will be provided that are a valuable resource for targeting the material most likely to appear on the exams. Master the **learning pyramid!!** ☺

**Tentative Schedule**

<b>DATE</b>		<b>TOPIC</b>
1	21 AUG 17	<b>PART I: DNA, Genes, Proteins, and Chromosomes</b> <b>Chapters 1-7, 20 &amp; Recommended Papers</b>  <b>Introduction</b>
2	23 AUG 17	<b>Principles &amp; Structure of Macromolecules</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – INTRO, NO QUIZ</b>
3	25 AUG 17	<b>Structure of Macromolecules II</b>
4	28 AUG 17	<b>Structure of Macromolecules III – Supercoiling</b>
5	30 AUG 17	<b>Molecular Biology Techniques</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 1</b>
6	1 SEP 17	<b>Molecular Biology Techniques II</b>
	4 SEP 17	<b>LABOR DAY - NO BMB 400 CLASS TODAY</b>
7	6 SEP 17	<b>Nucleosomes, Chromosomes, &amp; Chromatin</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 2</b>
8	8 SEP 17	<b>Chromatin II &amp; Nucleosome Remodeling</b>
	11 SEP 17	<b>REVIEW SESSION during class time</b> <b>EXAM 1 in 201 Thomas (6:00-7:30 PM)</b>
9	13 SEP 17	<b>PART II: Replication, Recombination, Repair, and Transposition</b> <b>Chapters 8-11 &amp; Recommended Papers</b>  <b>DNA Replication</b> <b>NO RECITATION TODAY</b>

10	15 SEP 17	<b>DNA Replication II – Enzymes</b>
11	18 SEP 17	<b>DNA Replication III – Enzymes II</b>
12	20 SEP 17	<b>DNA Replication IV – Control</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 3</b>
13	22 SEP 17	<b>Mutation and Repair</b>
14	25 SEP 17	<b>Mutation and Repair II</b>
	27 SEP 17	<b>Recombination</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 4</b>
	29 SEP 17	<b>Recombination II – Enzymes</b>
15	2 OCT 17	<b>Recombination III – Transposition</b>
16	4 OCT 17	<b>NO BMB 400 CLASS or RECITATION TODAY</b>
17	6 OCT 17	<b>NO BMB 400 CLASS TODAY</b>
	9 OCT 17	<b>REVIEW SESSION during class time</b> <b>EXAM 2 in 201 Thomas (6:00-7:30 PM)</b>
18	11 OCT 17	<b>PART III: Gene Expression</b> <b>Chapters 12-15 &amp; Recommended Papers</b>  <b>Molecular Biology Techniques III &amp; Transcription Intro</b> <b>NO RECITATION TODAY</b>
19	13 OCT 17	<b>Transcription –RNA Polymerases &amp; Prokaryotic Cycle</b>
	16 OCT 17	<b>Transcription II – Eukaryotic Cycles</b>
20	18 OCT 17	<b>Transcription III – Eukaryotic Cycle &amp; RNA Splicing</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 5</b> <b>Guest Lecturer at Recitation</b>
21	20 OCT 17	<b>NO BMB 400 CLASS TODAY</b>
22	23 OCT 17	<b>Transcription IV – RNA Splicing</b>
23	25 OCT 17	<b>Transcription V – RNA Splicing &amp; Transport</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 6</b>
24	27 OCT 17	<b>Translation</b>
25	30 OCT 17	<b>Translation II – Ribosome Structure &amp; The Cycle</b>

26	1 NOV 17	<b>Translation III – The Cycle II</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 7</b>
27	3 NOV 17	<b>Translation IV – The Genetic Code</b>
	6 NOV 17	<b>REVIEW SESSION during class time</b> <b>EXAM 3 in 201 Thomas (6:00-7:30 PM)</b>
28	8 NOV 17	<b>PART IV: Regulation of Gene Expression</b> <b>Chapters 16-19 &amp; Recommended Papers</b>  <b>Prokaryotic Regulation</b> <b>NO RECEITATION TODAY</b>
29	10 NOV 17	<b>Prokaryotic Regulation II</b>
30	13 NOV 17	<b>Prokaryotic Regulation III</b>
31	15 NOV 17	<b>Prokaryotic Regulation IV &amp; <math>\lambda</math> Bacteriophage</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 8</b>
32	17 NOV 17	<b><math>\lambda</math> Bacteriophage II</b>
	20 NOV 17	<b>THANKSGIVING BREAK</b>
	22 NOV 17	<b>THANKSGIVING BREAK</b>
	24 NOV 17	<b>THANKSGIVING BREAK</b>
33	27 NOV 17	<b><math>\lambda</math> Bacteriophage III &amp; Eukaryotic Regulation</b>
34	29 NOV 17	<b>Eukaryotic Regulation II</b> <b>REMINDER: Recitation at 1:25 PM in 005 Life Sciences – QUIZ 9</b>
35	1 DEC 16	<b>Eukaryotic Regulation III</b>
36	4 DEC 17	<b>Eukaryotic Regulation IV</b>
	6 DEC 17	<b>REVIEW SESSION during class time</b> <b>EXAM 4 in 201 Thomas (6:00-7:30 PM)</b>
	8 DEC 17	<b>Forensic Molecular Biology – Wrap Up</b>