Course Syllabus: BMB 801 – Introduction to Molecular Biology
Fall Semester 2021 (mostly, at least initially) Online!

Course Information

Our course will be in person for the first day of class (9/1/21), meeting in the garden area in back of the Biochemistry Building from 9:10-10:00 am EST. We will have coffee and bagels starting at 8:45 a.m. Starting on Friday 9/3/21, we plan to transition to Zoom until the COVID situation has eased; class will be from 9:10-10:00 am EST. Recitations will be held on Tuesdays from 6:00-7:00 p.m. EST also via Zoom. Special review sessions by the instructors may also be arranged periodically depending upon student requests. Course documents and archived material are available on D2L.

Zoom Meeting Information

The meeting ID for the MWF lectures and Tuesday recitation is: **https://msu.zoom.us/j/95978109248**
Meeting ID: 959 7810 9248 Passcode: BMB801

Note: Zoom software is supported by MSU and is free to students. The Zoom application can be downloaded from https://zoom.us/download.

Contact Information for Course Instructors

Dr. Bill Henry	lectures 1-19	henryrw@msu.edu
Dr. David Arnosti (Course Coordinator)	lectures 20-42	arnosti@msu.edu
Diego Granados-Villanueva (Teaching Assistant)	lecture 38	granad17@msu.edu

We like to use first names for students and instructors; as graduate students you are now peer scientists-in-formation. You may indicate your preferred name (and pronouns, if desired) on your Zoom box to help people address you correctly, e.g. “Bill”, “Diego”, “David (he/his)”.

Course Description & Overview

Welcome to Biochemistry & Molecular Biology 801! The focus of this course is on cellular information management - DNA metabolism and gene expression. We will emphasize “*What*” we know and “*How*” we know it for a series of related topics. We also hope that you will come to appreciate “*Why*” these topics were pursued in the first place by some of the leading scientists who forged critical breakthroughs.

Required Textbook & Course Materials

No course textbook is *required*. Relevant topics will be covered in the instructors’ notes and slide presentations available on D2L.

Recommended Texts & Other Course Materials

Most course information for this course is derived from the primary literature. For additional background, we recommend *Molecular Biology of the Gene* (Watson, Baker, Bell, Gann, Levine & Losick) *Molecular Biology of the Cell* (Alberts, Johnson, Lewis, Raff, Roberts & Walter) or Lewin’s *Genes* (Krebs, Goldstein & Kilpatrick). We will provide lecture notes, outside papers, old exams, and class recordings online via D2L. Course lecture notes will be available online for students to read before class. We will

aim to have notes available at least a week in advance, so that students can read material before class – an important step for "flipped classrooms".
To access course material:

* Sign on to "D2L" https://d2l.msu.edu/d2l/loginh/
* Log on with your account name before the @ (e.g. arnosti) + password
  (the course is titled: FS21-BMB-801-001 Molecular Biology)
* Features
  1. Course Syllabus
  2. Course Announcements
  3. Background information on molecular biological techniques
  4. Lecture Notes (PDF format)

Note: For further studies of the primary literature, you will need to obtain your own copies of papers. As an MSU student, you can access most journals that are behind paywalls by going through the MSU library and entering the journal name: https://libguides.lib.msu.edu/eresources/ejournals

Study Groups

Although you will doubtlessly find it useful to review concepts on your own, we strongly encourage all students to also participate in student-organized study groups to discuss more general themes and approaches. We will facilitate introductions to your peers throughout the semester to make getting to know people, and getting together outside of class, easier.

Course Objectives & Expectations

The long-term mission of this course is to enable students to cognitively participate in the modern scientific enterprise. We will accomplish this goal by (1) enhancing your scientific knowledge base and (2) highlighting intellectual approaches to the scientific process. After completion of this course, students should be able to understand biological processes at a molecular level and communicate these details to an audience in a clear and concise manner. We additionally expect that students will begin to apply these principles to novel situations reflective of the scientific exploration process. The material presented in this course is expected to provide a solid foundation for success with comprehensive preliminary exams, expected in the near future for many of you.

Grading

Grades will be based on two oral exams (50%) and written assignments (45%), as well as credit for participation (5%). Two of the written assignments will be crafted in teams with collaboration among team members encouraged. These assignments will follow the general format for a NIH R01 grant submission, but in a much briefer format (5 page max). Details of the written assignments will be provided at a later date. The topic(s) for the individual oral exams will be derived from topics discussed in the class, and the content covered in the written assignments. We will test the student's knowledge of relevant material, as well as ability to interpret and design experiments. The purpose of using these diverse types of assessment is to solidify thinking about applying knowledge of processes and approaches, and to provide practice for the second year qualifying exam.

Technical Assistance

If you need technical assistance at any time during the course you can:

* Visit the MSU Help site at http://help.msu.edu
* Visit the Desire2Learn Help Site at http://help.d2l.msu.edu
* Call the MSU IT Service Desk at (517)432-6200, (844)678-6200, or e-mail at ithelp@msu.edu
* Request assistance navigating and requesting instructional design help: https://tech.msu.edu/service-catalog/teaching/instructional-design-development/
* Browser/mobile support for D2L can be found at: https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm
* Guide for internet speed: https://broadbandnow.com/guides/how-much-internet-speed-do-i-need.

For most courses, 25 Mbps should work. If there is no mandatory video component, then students may be able to interact with the course with a slower connection. However, some course activities require access to "high speed" internet.

Additional Policies

1. Attendance & Absences - We will record the classes (not breakout sessions, however) so that all students can access the presentations and discussions through D2L. We strongly encourage students to attend all class sessions, and a small percentage of the grade will reflect participation. If for any reason you are not able to attend a class, we understand! No need to provide a doctor's certificate in case of illness.
2. Academic Integrity/Cheating Policy - Your written exercises will represent the efforts of your team; as with all scholarly documents, plagiarism is not acceptable (https://msu.edu/unit/ombud./academic-integrity/plagiarism-policy.html). If you have concerns about the integrity of any work in the class, you can discuss with any of the instructors, or TA, or anonymously by contacting the MSU ombudsperson (https://ombud.msu.edu).
3. Accommodations for Persons with Disabilities - The instructors are here to serve you, and make this course a stepping stone in your professional development. Whether or not you have an officially recognized disability, we will seek to find accommodations for any obstacle to your success.
4. Learning Continuity Statement - If something arises that will interfere with attending on an ongoing basis, please let the instructors know, and we will work to find a solution. In case a student cannot complete the course for medical or other reasons, it is possible to obtain a deferral, allowing completion at a later date.
5. Course Continuity Statement – Bill Henry will supervise the first part of the course, and David Arnosti the latter portion. We will both be present for all classes, and in case of instructor illness will cover for each other. Our TA Diego Granados-Villaneuva will present weekly recitations, and will provide backup for the instructors. Communications about the course should normally be directed at the TA and/or the lead instructor for that portion of the course.

Lecture Schedule

Lecture #	Date	Instructor	Topic
Lecture 1	Sept 1	Both	Course Introduction
Lecture 2	Sept 3	Henry	DNA Structure & Genome Structure
Lecture 3	Sept 8	Henry	Centromeres & Telomeres
Lecture 4	Sept 10	Henry	DNA Topology
Lecture 5	Sept 13	Henry	DNA Topoisomerases
Lecture 6	Sept 15	Henry	Chromatin Remodeling I (Covalent Modification)
Lecture 7	Sept 17	Henry	Chromatin Remodeling II (ATP-dependent)
Lecture 8	Sept 20	Henry	DNA Replication I (Introduction & Overview)
Lecture 9	Sept 22	Henry	DNA Replication II (Origin Function)
Lecture 10	Sept 24	Henry	DNA Replication III (DNA Pol Function)
Lecture 11	Sept 27	Henry	DNA Replication IV (Licensing)
Lecture 12	Sept 29	Henry	DNA Repair I (Base Excision Repair)
Lecture 13	Oct 1	Henry	DNA Repair II (Nucleotide Excision Repair)
Lecture 14	Oct 4	Henry	DNA Repair III (Double strand break Repair)
Lecture 15	Oct 6	Henry	DNA Modification I – Restriction & Ligation
Lecture 16	Oct 8	Henry	Content Discussion & Exam Review
Lecture 17	Oct 11	Henry	Mitochondrial DNA Replication
Lecture 18	Oct 13	Henry	DNA Analysis & Methods
Lecture 19	Oct 15	Henry	DNA Modification II - CRISPR
Midterm Oral Exam (Week of October 11-15, times Arranged)			
Lecture 20	Oct 18	Arnosti	Reverse transcriptase and retroviruses
Lecture 21	Oct 20	Arnosti	Recombination I
Lecture 22	Oct 22	Arnosti	Recombination II
Lecture 23	*Oct 25?*	Arnosti	Overview of transcription and methods I
Lecture 24	Oct 27	Arnosti	Overview of transcription and methods II
Lecture 25	Oct 29	Arnosti	RNA polymerases, bacterial initiation
Lecture 26	Nov 1	Arnosti	The lac operon: a half-century of innovation
Lecture 27	Nov 3	Arnosti	Termination and attenuation
Lecture 28	Nov 5	Arnosti	Transcription: eukaryotes and archaea
Lecture 29	Nov 8	Arnosti	Eukaryotic RNA polymerases and basal factors
Lecture 30	Nov 10	Arnosti	Transcriptional activation and repression I
Lecture 31	Nov 12	Arnosti	Transcriptional activation and repression II
Lecture 32	Nov 15	Arnosti	Genome-wide and developmental regulation
Lecture 33	Nov 17	Arnosti	Capping and polyadenylation
Lecture 34	Nov 19	Arnosti	mRNA splicing I
Lecture 35	Nov 22	Arnosti	mRNA splicing II
Lecture 36	Nov 24	Arnosti	mRNA turnover
Lecture 37	Nov 29	Arnosti	miRNA, piRNA, and RNA interference
Lecture 38	Dec 1	Granados-Villanueva	Translation
Lecture 39	Dec 3	Arnosti	The ribosome; structure and function
Lecture 40	Dec 6	Arnosti	Alternative translational codes
Lecture 41	Dec 8	Arnosti	'omic analysis of translation
Lecture 42	Dec 10	Arnosti	Translational regulation
Final Oral Exam (Week of December 13-17, times Arranged)			

Written Assignments:

1. The 2.5% questions are short answer, paragraph-length exercises.

2. The 15% assignments are 3-5 page ONE SPECIFIC AIM proposals that loosely follow the flow of an NIH grant proposal, but much more concise. They are not intended to take enormous amounts of time and effort, but rather to give you a flavor for the types of thinking and writing that you will use later in your second-year qualifying exam proposals.

Due Dates for Written Assignments – upload to D2L before class (Total 45%)

1. Chromatin Remodeling – due Sept 17 ……. …….. (2.5%)
2. DNA Repair – due Oct 1 ..... (2.5%)
3. mini-NIH Proposal 1 (DNA Replication) - due Oct 4 ……..(15%)
4. Mitochondrial DNA Replication – due Oct 18.....(2.5%)
5. Recombination - due Oct 22..... (2.5%)
6. Transcription – due November 1 …… (2.5%)
7. mRNA splicing – due November 22 .....(2.5%)
8. mini-NIH Proposal 2 (Gene expression) - due December 6 ..... (15%)