

# BIMM 100 – Molecular Biology

## Fall 2010, 4 units

**Instructor:** Heidi Cook-Andersen, Office: 4002 Sanford Consortium for Regenerative Medicine

E-mail: [hcookandersen@ucsd.edu](mailto:hcookandersen@ucsd.edu) (Important: please use the subject line: 'BIMM 100').

E-mails sent before 8 AM Mon-Fri will generally be answered on the same day.

E-mails sent later than 8 AM will generally be answered the following weekday.

Phone: 858-246-2805 (please identify yourself as a student in BIMM 100).

Office hours: Tuesdays 11-12 noon at AP&M Prime 3880 starting October 10. There will be no office hours on Tuesday Oct 29 and Nov 26.

### Instructional Assistants/Tutors:

Hakim, Dominic

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Lee, Grace

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**Class website:** On Canvas: <https://canvas.ucsd.edu/courses/4950>

**Class hours:** Tuesdays & Thursdays, 9:30 – 10:50 AM, in Sequoyah 147.

**Important dates** (<http://blink.ucsd.edu/instructors/resources/enrollment-calendars.html>):

Friday, October 25: Deadline to drop the class without "W" on transcript.

Tuesday, October 29: MIDTERM (9:30-10:50 AM; in class).

Friday, November 8: Deadline to drop with "W" grade.

Thursday, December 12: FINAL EXAM (8:00A-10:59A)

- For other important dates, see the Class Schedule.

### Course Prerequisites:

1) BILD1 (The Cell)

2) Lab class, BILD 4 or BIMM 101 or BIBC 103, and

3) Organic chemistry: [CHEM 40A or CHEM 40AH and CHEM 40B or CHEM 40BH] OR BENG 120.

If you feel rusty on the material of the prerequisites, it is strongly recommended that you carefully read Chapters 1-3 and Chapter 5, pp171-182, of the *Lodish* 'Molecular Cell Biology' textbook (see below), which cover material that is considered prerequisite and will only be mentioned in passing during class. Prerequisite classes for BIMM100 cannot be waived.

**Purpose of the course:** Molecular Biology is the study of gene structure, function and regulation at the molecular level. It describes fundamental mechanisms, shaped by evolution, that underlie all known life on our planet - mechanisms that when impaired, for example by mutation or by parasitic interference, lead to human disease. You will be introduced to our current understanding of genome structure and gene expression and the key experimental observations and deductions made by scientists, which have shaped, and continues to shape, our knowledge in this rapidly developing field of biology. As you will learn, this is a field of intense research with new exciting discoveries reported daily.

**Learning objectives:** After taking this class, you should know the key concepts of the central dogma of molecular biology and how insights into these concepts have been gained through experimental observations. You should also be able to interpret, and predict the outcome of, basic experiments to study factors and pathways in molecular biology processes.

The specific topics covered include the composition of genomes and the basic mechanisms of replication, transcription, RNA processing, translation and RNA turnover, and how the complexes that perform these activities identify their targets, carry out their function and can be regulated to meet cellular needs.

Doing well in this class requires solid prior understanding of biochemistry and organic chemistry.

### **COURSE STRUCTURE:**

We all have different ways in which we learn best. In an attempt to teach to all students, the course is structured in a way that offers multiple learning tools. These include:

**Textbook:** Lodish et al. 'Molecular Cell Biology' 8<sup>th</sup> edition, Freeman, 2016 is optional, but highly recommended (earlier editions are okay as well, but require a little more work identifying the proper pages). There are copies on reserve in the Biomedical Library. It is a reasonable and clear reference to own if you will continue in the biomedical sciences and is also used in BICD 110 - Cell Biology. It will give you another view of the material treated in lecture. The subjects treated in lecture are the materials you will be tested on; however reading the same topics in the book explains the selection of topics a second time, sometimes in greater depth.

**Lectures:** Lectures will cover the central topics of molecular biology in the order indicated in the schedule, although the specific order can deviate a bit from that indicated depending on time. The order of the topics discussed during lectures is different from the order in the textbook. The lectures are divided into three sections covering: 1) Genes & Genomes, 2) Basic mechanisms of gene expression, and 3) Regulation of gene expression. Along the way, we will discuss key experiments and deductions that underlie the understanding of the different processes. The pages in the textbook corresponding to the material discussed during lectures are indicated in the schedule.

On the day before each lecture (or earlier), a copy of the lecture slides (in pdf format) will be uploaded on the course website. It is highly recommended that you download and print out the lecture slides so that you can follow the lecture by taking notes on it. They comprise a skeletal record of what happens in the lecture. However, you may find the lecture slides unintelligible without your own written notes. Therefore, don't think of them as a second, independent "book" you can read but instead as a collaborative record of the lecture that you will create.

**Clickers:** To achieve extra credit, you will need an i-clicker. New and used i-clickers are available at the Price Center bookstore. Make sure to get an i-clicker and not a different system (such as H-ITT or PRS). i-clickers 1 and 2 are both compatible with the class.

Clickers will be used for rapid feedback to foster interactive learning in a large classroom setting. Clicker questions (usually 5-10 per class) will be used during class time to make students think about, and discuss with each other, how the newly discussed material fits within the bigger picture of molecular biology, and how experimental observation and experimental design can address questions in molecular biology.

To obtain as much credit for clicker use as possible, please register your i-clicker ASAP, and no later than **Friday Oct 4**. A link for iClicker registration is provided on the **class website**, click 'iClicker Registration' on the left panel.

**Problem sets:** Problem sets will be posted on the class website on most Tuesdays during the quarter (see the schedule for the specific dates). Problem sets are used as a tool to promote understanding of the discussed topics through problem solving. It is optional to work through the assignments and they are not handed in. However, it is very strongly recommended to work through these either alone or in study groups.

To best prepare yourself for exams, I highly recommend you to sit down with each assignment and take them as if they were exams – i.e. write down your answers independently. Do this before hearing answers from other students, discussion sections and/or keys. Answer keys for the Problem Set for previous week will also be posted each Friday (i.e., after the Discussion section each week).

**Discussion sections:** Discussion sections will be held by IAs once a week, most weeks of the quarter (see Discussion section schedule). The discussions will be based on the Problem Sets posted the previous week. The IAs will lead a discussion based on the Problem Sets to make participating students arrive at the correct answers. The IAs will not provide the answers on their own. To get the most out of Discussion sections, it is therefore critical to have first worked through the Assignments alone or in study groups and then to participate in the discussion during the Discussion sections. Discussion sections are optional, but highly recommended. Active participation in Discussion sections helps your learning.

IAs will announce their personal office hours at the first meeting of the sections. If you cannot make it to your IA's office hour you are welcome to attend office hours of the other IA and/or the Professor. The time and location of Discussion sections and office hours will also be posted on the class website.

**Practice exams:** Practice exam questions will be posted about one week before each exam. As for Problem Sets, to best prepare yourself for exams, I highly recommend you to sit down with practice exam questions and take them as if they were exams – i.e. write down your answers. Again, do this before hearing answers from other students, discussion sections and/or keys. Before each exam, a review class will be held by IAs to go over practice exam questions and answer general questions you might have. Practice exam keys will be posted immediately after the review class.

### **EXAMS & GRADING:**

Your grade in BIMM 100 is based entirely on your final score (i.e., no curve). Your final score will be calculated the following way:

**Midterm (40% of final score):** The midterm exam is closed book and given during class time. It covers the material discussed up until the exam (see Schedule). The time of the midterm can be found in the schedule.

**Final Exam (60% of final score):** The final exam is given during finals week (see schedule). It is closed book and will cover the broader concepts of the entire course with focus on the specific material covered after the midterm.

**Please note:**

- Questions on the Midterm and Final will be in short answer format and must be answered in ink. Pencil can be used, but if so, no regrade can be requested.
- Pens and ID card (student ID or driver's license) are the only personal items you may have with you during the exam; any other items you bring (backpacks, phones turned OFF, etc) must be placed entirely under your seat and are subject to being moved at the IAs' and professor's discretion.
- There will be no scheduled make-up exams for the midterm or final. Failure to take the exam at the assigned time and place will result in a grade of zero for that exam. Extraordinary circumstances preventing you from taking an exam at the scheduled time must be submitted in writing and include official documentation of the cause as far in advance as possible to the instructor (Dr. Cook-Andersen). If an exception is made for these extraordinary circumstances, a make-up will generally be a 2-hour oral exam in Dr. Cook-Andersen's office.
- Requests to reconsider any grading must be submitted in writing along with your original exam to the instructor (Dr. Cook-Andersen) during class or office hours. Regrading is limited to grading mistakes, and is not granted for requests for more partial credit for incorrect answers. The full request must be received within one week of the exam return date. If regrading is granted, the entire exam will be regraded. If anything on the exam submitted for regrading is found to be altered, it will be considered a breach in academic honesty and will be grounds for failure of the course as well as any additional disciplinary actions as indicated by the policy to maintain academic honesty (see section on Academic Integrity below).
- Any student who is observed to look at and/or or otherwise found to copy off another student's paper during a midterm and/or final will be reported to the Academic Integrity Office according to university policy for an investigation into academic dishonesty (see section on Academic Integrity below).

**Clicker use (up to 4% of extra credit):** This is based entirely on clicker use, not on whether you get the answers right. For each lecture, usage of the clicker for the majority of questions during the lecture will result in full credit for that lecture. ***Note: It is your responsibility to remember to bring your clicker to every lecture and to make sure that batteries are charged; i.e. no clicker credit will be awarded retroactively if the clicker is not used or doesn't work during lecture.*** (However, with the expectation that all students forget their clicker once during the quarter, missing clicker use 1-2 lectures will still result in full extra credit for the quarter). To get credit for the whole quarter, make sure that your clicker is registered with the class no later than **Fri Oct 4**.

**DO NOT CHEAT** with clickers by having someone other than yourself use your clicker or by bringing and using someone else's clicker during class. This extra credit is intended only for students that attend class. Therefore, this will be considered a breach in academic honesty and will be reported to the Academic Integrity Office according to university policy for an investigation into academic dishonesty (see section on Academic Integrity below). Appropriate clicker use will be monitored by the instructor and IAs during class.

**Participation in Discussion Sections (1% extra credit):** As an incentive to actively participate in Discussion sections, 1% extra credit will be given to students attending at least 5 (of 7) Discussion sections.

**Survey completion (1% extra credit):** UCSD is conducting a survey to help learn how well we are preparing students for upper division classes. 1% extra credit will be given to students completing the quiz with demonstrated effort (i.e., no extra credit will be given for just providing random answers) by Friday, October 4. Your performance on the quiz will not otherwise affect your grade in the class. A link to the quiz will be provided as soon as it is available.

**Letter grades are assigned as follows:**

<u>Class Score</u>	<u>Letter grade</u>
90-100:	A
80-89:	B
70-79:	C
60-69:	D
Below 60:	F

+/- grades are given to those close to the next grade level.

*Since your own grade is not influenced in any way by how your classmates perform, working together with your classmates will only help everyone involved. Studying in groups is highly recommended!*

**TIPS ON HOW TO DO WELL:**

BIMM 100 (like many other university courses) is complex enough to reward the student who gives some thought to how to take it. The most important trick is to keep up. The pace is quick because BIMM 100 must cover the major concepts of molecular biology in less than 20 lectures.

The following practices will help you best prepare for the exams:

1. Print out lecture slides before each lecture.
2. Be present and take good notes during lectures (the lecturer will often use the board for explanation, which slows down the pace and allows you to take notes on the lecture slides).
3. **Actively participate** in thinking about, and in peer discussions of, clicker questions.
4. Read the textbook – preferably before class (planned topics and corresponding textbook pages are indicated in the Schedule).
5. Sit down and work through assignments and practice exams, writing down all answers to the best of your ability, **before** getting answers from Discussion Sections, Review Classes, posted keys or other students. These (along with clicker questions) will give you the best idea of how exam questions are formulated.
6. Actively participate in discussions of the assignments during **Discussion sections**.
7. **Work in Study groups!**
8. Do NOT “cram” last minute for the exams! Instead stay on top of the material throughout the quarter.

In addition, the “Review the Concepts” section at the end of each *Lodish* Chapter can give useful practice in problem solving.

Since your grade will be decided entirely from your final score and not based on how you do compared to other students in the class, it will never hurt you to help fellow students. In fact, research on learning has shown that whether you are on top of the material or are having a hard time understanding the concepts, you will improve your learning by discussing the material with other students. Participation in study groups and in peer discussion of clicker questions is therefore highly recommended.

A note of caution: Memorizing slides and texts is not an efficient method of learning for this class. While some memorization is required to become literate in molecular biology, the primary goal of the course, and what you will be primarily tested on, is understanding the key broader concepts of molecular biology and using this to formulate predictions and to interpret observations from simple molecular biology experiments as tested primarily through problem solving questions in the exams. These skills are best achieved by following the practices listed above.

### **CLASS POLICIES:**

**Attendance:** Attendance in class and during Discussion sections is optional, but very strongly encouraged. You simply will not do well in the class if you do not put in significant effort.

**Classroom etiquette:** Please refrain from eating, surfing the web, texting and engaging in conversations (except when prompted during clicker questions), or anything else that might distract others and yourself from paying attention during lectures. Please make sure to shut off cell phones. If you must leave class early, please sit in the back in an aisle seat so you can exit with the least amount of disruption to others.

**Academic integrity:** All suspicions of academic misconduct will be reported to the Academic Integrity Office according to university policy. Those students found to have committed academic misconduct will face administrative sanctions imposed by their college Dean of Student Affairs and academic sanctions imposed by me. The standard administrative sanctions include: the creation of a disciplinary record (which will be checked by graduate and professional schools); disciplinary probation; and attendance at an Academic Integrity Seminar (at a cost of \$75). Students can also face suspension and dismissal from the University; those sanctions are not at my discretion. Academic sanctions can range from loss of clicker credit, a score of zero on an exam, to an F in the class. The appropriate sanctions are determined by the egregiousness of the Policy violation. Students who assist in or are complicit with cheating could also be in violation of the university policy and face sanctions. Thus, students who become aware of their peers either facilitating academic misconduct or committing it should report their suspicions to me for investigation.

Please review UCSD's Policy on Academic Integrity, which can be found on this website:  
<https://students.ucsd.edu/academics/academic-integrity/>

***Note that we have devised methods for monitoring for cheating with clickers and exams in this class; please do not be tempted to cheat.*** In addition, it should be needless to say that it is much easier to pass this course, and any future courses that use this course as a prerequisite, by putting the energy into understanding the material of the course rather than into an attempt to pass the course by cheating.

**Letters of recommendation requirements:** Acceptance into programs to further your education can be very competitive. You should carefully choose letter writers who know you well and who can honestly state that you achieved one of the top scores in their class and that your

demonstrated enthusiasm, diligence and hard work makes the writer confident that you will be an excellent candidate for the school of application. Therefore, for me to write a letter of recommendation, you must have received an 'A' in the class and you must have been an active participant that I have had the chance to interact with during the quarter.

**Disabilities:** If you qualify for accommodations because of a disability, please submit to me an AFA letter from the Office for Students with Disabilities (OSD) as soon as possible, and no later than the second week of class, so that your needs may be addressed. The OSD determines accommodations based on documented disabilities. Please see guidelines at: <http://disabilities.ucsd.edu/>

**Responsibilities:**

It is my (and the IAs) responsibility to keep the class organized, to come to class well prepared and to provide students with multiple pathways to learning the topics, including lecture slides, explanations on the board, clicker questions, problem sets, practice exams, discussion sections, and office hours.

It is your responsibility to put a significant effort into the class, by coming to class with printed lecture slides, taking notes, actively participating in clicker questions/peer discussions, reading the textbook, working through assignments and actively participating in the discussion of assignments during IA discussion sections.

This way, BIMM 100 should be an enjoyable and exciting learning experience. Embrace this opportunity to understand the basics of molecular biology and, perhaps, one day you will make the next breakthrough in this rapidly growing field in biology and medicine!

ENJOY AND GOOD LUCK!

## BIMM 100 - Molecular Biology, Fall 2019, Cook-Andersen – Lecture Schedule

Date(\*\*)    Lecture#    Planned Topic    Lodish 8<sup>th</sup> ed(\*\*\*) (Chapter. Pages)

### Genes and Genomes

R Sept 26	1	Overview Central Dogma	
T Oct 1	2	DNA DNA Replication	2: 45-46; 5: 167-172 5: 197-203
R Oct 3	3	Telomeres DNA repair	8: 347-349 5: 203-212
T Oct 8	4	Genes & genomes DNA sequencing	8: 301-309 6: 243-245
R Oct 10	5	Noncoding & Mobile DNA PCR	8: 309-323 6: 239-241
T Oct 15	6	Recombinant DNA techniques Gene inactivation	6: 234-247, 249-253 6: 259-268

### Mechanisms of Gene Expression

R Oct 17	7	Transcription Northern Blotting	5: 176-179; 9: 363-373 6: 247
T Oct 22	8	Eukaryotic Transcription RNA Polymerase I/II/III	9: 373-380, 412-414
R Oct 24	9	rRNA, tRNA processing mRNA capping, polyadenylation	10: 461-468 10: 417-421, 430-434
T Oct 29		<b>MIDTERM EXAM</b> (in class; covers lectures 1-7)	
R Oct 31	10	pre-mRNA splicing Nuclear export	10: 423-428 10: 440-444
T Nov 5	11	Translation mRNA turnover	5: 183-197 10: 445-447



## ***Regulation of Gene Expression***

R Nov 7	12	<i>Transcriptional Regulation</i>	9: 356-360 9: 363-367, 378-381
T Nov 12	13	<i>Transcription Activators</i> <i>Chromatin</i>	9: 381-389, 396-397 8: 327-341
R Nov 14	14	<i>Chromatin remodeling</i> <i>Chromatin immunoprecipitation</i>	9: 390-396, 398-411 9: 373
T Nov 19	15	<i>Post-transcriptional gene regulation</i>	10: 435-440, 451-452 10: 456-457
R Nov 21	16	<i>Gene regulation by non-coding RNAs</i>	9: 409-411 10: 445-451, 452-461
T Nov 26	17	<i>The molecular biology of cancer</i>	
R Nov 28		<i>Thanksgiving, no class</i>	
T Dec 3	18	<i>Viral control of gene expression in host cells</i>	
R Dec 5	19	<i>TBD</i>	
R Dec 12		<b><i>FINAL EXAM (8-11AM), Location TBD</i></b>	

(\*PS#): Problem sets #1-7, for discussion during discussion sections, will be posted in the afternoons on Fridays of the week indicated along with answer key for the problem set for the previous week.

(\*\*): Classes are on Tu/Th 9:30-10:50 AM in Sequoah Hall Room 147.

(\*\*\*): Textbook: "Molecular Cell Biology", 8<sup>th</sup> edition, Lodish et al., 2016. Note: textbook is optional; older editions can also be used.