



MCB502, Fall

SYLLABUS

Advance Molecular & Cell Biology, 4 Credit Hours

Instructor/Instructional Team

Name: Drs. Brian Freeman & William Brieher

Office Location: B605 CLSL & 549 Morrill Hall, respectively

Contact Information (email and phone): bfree@illinois.edu & wbrieher@illinois.edu

Class Meeting Schedule

Scheduled Class Time: Lecture Tuesday & Thursday 8:30-10:00 am

 Discussion Friday 9:00-10:20 am or 10:30-11:50 am

Office Hours: by appointment

Course Overview and Description

Advanced Molecular & Cell Biology MCB502 is a core course for all in-coming MCB graduate students. It is also open to graduate students in other programs across the UIUC campus. The course objective is to delve in the process of scientific discovery. The broad area of molecular biology is explored through the lens of gene regulation whereas multiple topics are used to interrogate modern cell biology. Fundamental principles central to molecular and cell biology are discussed as well as the key experimental techniques that have been used to revamp the central theories driving both fields.

Course Prerequisites, Requirements met (general education, major, minor)

Graduate level course

Student Learning Outcomes

At the end of the course, through assignments, discussions, and activities, students will have a deeper understanding on how central theories in biology coalesce and realize how new discoveries can bring radical changes to what were considered established dogmas.

Text/Materials Information (both required and recommended)

Freeman: Recommended for background—Molecular Biology 5th edition by Robert F. Weaver
 Required—weekly assigned primary data publications posted on Moodle site

Brieher: Recommended for background—Molecular Biology of the Cell by Alberts, et al., 5th or 6th edition.

 Required—weekly assigned primary data publications posted on Moodle site

Course Website, Course Tools (Compass, Moodle, LON-CAPA, Zoom, etc)

Moodle at <https://learn.illinois.edu/> Login with NetID

Grading Information and Breakdown

Final grade is determined from the average scores received from the two sections taught by Drs. Freeman and Brieher.

Two exams are administered in Dr. Freeman's section with open notes and book but access to the web is prohibited. Exam material is sourced from the lecture material. First exam is worth 30% of final grade, 60% from second exam, and 10% is derived from the discussion section that includes a team presentation (i.e., journal club presentation; 5%) and a team-led discussion interrogating another team's journal club presentation (5%). Extra credit (1-2% grade bump) can be earned through enthusiastic participation during the discussions and lectures (i.e., Ask questions and inspire good discussions!).

Dr. Brieher's section is assessed in a similar way with two exams. The first is worth 30% of the final grade, 60% from the second exam, and 10% from the discussion sections. Exams in Brieher's section are also open book and open notes but access to the web is prohibited. Final grades are distributed on a curve.

Syllabus for Dr. Freeman's Section

Lecture 1: DNA structure; RNA Polymerase properties; σ factor 70

Techniques: Filter binding assay; Methylation-S1 nuclease

Lecture 2: Prokaryotic RNA Polymerase subunits; Transcription termination; σ factor cascades

Techniques: Förster resonance energy transfer (FRET); Run-Off transcription assay; Electrophoretic Mobility Shift Assay (EMSA); Radioactive-labeling of DNA; UV Crosslinking; DNA footprinting

Lecture 3: Transcription factors; Activation mechanisms; Lac Operon; DNA bending

Techniques: Promoter bashing; Linker-scanning mutagenesis; Genetic screening; DNA bending EMSA; Chromatin Immunoprecipitation (ChIP) assay

Lecture 4: CAP/CRP Promoter classes; Combinatorial Regulation; Proximal regulation by DNA bending

Techniques: DNA looping; Genetic suppressor screens

Lecture 5: Distal regulation by DNA looping; Kinase signaling; DNA contortion; Bacterial histone-like proteins; Packaging of Prokaryotic Genomes

Techniques: Plasmid concatemers; Topoisomerase assay; Fluorescent proteins; STORM imaging; 3C assay

Lecture 6: Lambda genetic switch

Techniques: Phage genetic screen; Northern blots; Real time RT-PCR; DNA Microarrays; RNA-Seq

****First Exam in the evening****

Lecture 7: Eukaryotic RNA Polymerase; General transcription factors; Basal promoter elements; CTD phosphorylation; Post-initiation events

Techniques: Epitope-tag pull-down assay; Helicase assay

Lecture 8: DNA packaging; Chromatin and transcription; Position effect variegation; Histone code; Boundary elements; CpG islands as markers of cancer

Techniques: Micrococcal nuclease assay; DNase I assay; Bisulfite PCR

Lecture 9: Phosphate signaling and the *PHO5* chromatin model; Lysine acetyltransferases; Chromatin remodelers; Histone chaperones

Techniques: In vitro chromatin templates

Lecture 10: Signaling pathways; Agonists & Antagonists; Transcription factor cascades; Intracellular hormone receptors; Combinatorial regulation; Response elements; Synergy

Techniques: Protein domain mapping; DNase-Seq

Lecture 11: Transcriptional coactivators; Post-translational modifications (PTMs)

Techniques: Two-hybrid; GST pull-down

Lecture 12: Ordered and cyclical transcription pathways; Utilization of PTMs

Techniques: Nuclear run-on assay

Lecture 13: Dynamic protein promoter complexes in vivo; Nuclear roles of molecular chaperones; Self-assembly vs. self-organization

Techniques: FISH; GFP; FRAP, FLIP, FLIM, Photoactivation, Protein Microarrays

Lecture 14: Genome organization; 3D genomes; Nuclear organization during cell cycle; Pioneering factors

Techniques: Chromosome conformation capture (3C) based assays

Lecture 15: ****In-class Second Exam****

General MCB Course Policies

For non-academic campus assistance and support:

- See Office of Diversity, Equity and Access (ODEA) information at the end of this document.

Student Advocacy Resources:

- For student-centered advocacy programs and services visit: mcb.illinois.edu/undergrad/advising/resources.

Contacting MCB Course Personnel:

- MCB course personnel are happy to assist students.
- Emails to instructors will only be answered if they come from an @illinois.edu account. We will only use this account in order to protect your educational information and profile. As a student, please remember that when you email a faculty member, it is important to include all pertinent information so that we can assist you in the most efficient and effective manner possible. This information includes:
 - The course rubric in the subject line
 - Your full first and last name
 - Your NetID (the first part of your illinois.edu email account)
 - Your UIN (9 digit number that can be found on your ICard)
 - The course that you are concerned about (the course personnel often work with multiple courses)
 - Your section letter/number
 - The previous email "thread" or previous communicated information pertinent to the situation
- Your cooperation will help us respond much more quickly to your concerns.

Policies:

- Unfamiliarity with policies is not a defense for not knowing what they cover.

Adding the Course after the Semester Starts:

- We understand that the University has an add deadline 10 days into the semester, but the University lets individual courses and/or programs determine their policies for late adds. We feel that students who choose to add a course late do so at their own discretion with knowledge that there may be points lost in the process.

Religious Observances and Practices:

- Students are required to submit the Request for Accommodation for Religious Observances Form (which can be found at www.odos.illinois.edu/.../Religious_Observance_Accommodation_Request_Form.docx) to their instructors and the Office of the Dean of Students requesting accommodation by the end of the second week of the course. Requests that are not submitted within this time frame may not be granted. Information about accommodations can be found in the Student Code: <http://studentcode.illinois.edu/>.

DRES Accommodations:

- We are committed to providing a learning environment where our students can succeed. If you require special accommodations, please contact us and the Disability

Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak Street, Champaign, call 217.333.4603, or email disability@illinois.edu. We will try to meet all accommodations once the process has started. Please note that accommodations are not retroactive to the beginning of the semester, but begin the day you contact your professor, instructor or coordinator with a current letter of accommodation from DRES.

- If a student believes that they need DRES accommodations, they should contact DRES at disability@illinois.edu.

Class Absences:

- Regular class attendance is expected of all students at the University. (http://odos.illinois.edu/studentAssistance/absence/revised_code.asp)
- If you find yourself ill, you must submit confirmation of a visit with a medical practitioner within 24 hours of your absence. The confirmation cannot be provided by a relative, even if the relative is a practitioner.
- The Office of the Dean of Students will only provide informative letters to instructors for protracted illness of 3 or more days, certain emergencies and to be present during the serious illness of immediate family members (parents, legal guardian, spouse/partner, siblings, children, or grandparents). These letters do not excuse you from class but merely provide information for the instructor to consider with regard to excusing the absence and permitting make-up work. Students must request absence letters from the Office of the Dean of Students after the student has returned to class but not more than 10 business days after the last date of absence.
- Absences that may be excused without a letter include circumstances beyond the student's control such as medical treatment, surgery related to prolonged illness or injury, pregnancy, legal matters, citizenship or naturalization processes, or acts of nature which cause destruction to a primary residence or disrupt air travel. All will require documentation.
- Absences that may also be excused without a letter include a conference or job, graduate or professional school interviews, though a best effort should be made to schedule these events to minimize class attendance disruption. All will require documentation.
- Absences planned for the items listed in previous bullet point must be communicated to your instructor or course coordinator at least two weeks in advance of the absence. Failure to do so may result in the loss of opportunity to reschedule the missed class period and the portion of the grade associated with this class period.
- Absences that will not be excused include family events such as reunions or weddings, or presence during serious illness of extended family members (aunt, uncle, niece, nephew, or cousin).
- Unplanned absences may result in the loss of opportunity to reschedule the missed class period and, therefore, the portion of the grade associated with this class period.
- Absences will be handled according to individual course policy.

Exam Absences:

- If you must miss an exam due to unforeseen circumstances, you are required to contact your instructor within 24 hours of the absence. You will then have 48 hours from the absence in which to submit documentation to your instructor. Course personnel will evaluate documentation and decide whether or not there will be an

option to compensate for the missed exam through either a make-up exam or proration. Failure to follow this procedure will result in a zero for the exam.

- If you find yourself ill, you must submit confirmation of a visit with a medical practitioner within 24 hours of your absence. The confirmation cannot be provided by a relative, even if the relative is a practitioner.
- If you must miss an exam for a conference or job, graduate or professional school interviews, the exam may be prorated. A best effort should be made to schedule these events around exams. You will need to be mindful that only one exam may be prorated in a semester for any and all absences. All will require documentation.
- There will be instances when a student must make an individual choice about their ability to perform on an exam and will need to accept any and all consequences for that choice.
- If the absence is a result of a protracted illness of 3 days or more, you should follow the procedure for obtaining a letter from the Office of the Dean of Students. The request may be made once the student returns to class but not more than 10 business days after the last date of absence.

Exam Conflicts:

- If you have a regularly scheduled University course that conflicts with the exam, you should complete the online Conflict Exam Request Form on the course website. This request must be made by 5:00 pm not less than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted. See in class provided course information for a specific deadline.
- If at all possible, work schedules should be adjusted to eliminate a conflict with scheduled exams. Please plan accordingly at the beginning of the semester. If eliminating a conflict is not possible, the student should complete the online Conflict Exam Request Form on the course website. This request must be made by 5:00 pm not less than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.
- Students that are formally participating in officially recognized groups, such as athletic teams and performing groups, with a conflict should request a conflict exam by 5:00 pm not less than 3 days prior to the exam via the online Conflict Request Form. Formal participation does not include general meetings of RSOs or any other recognized groups. Documentation of the event will be required prior to scheduling the conflict exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.
- Students with DRES accommodations should also submit the online Conflict Request Form by 5:00 pm no later than 3 business days prior to the exam. Requests made after 5:00 pm and less than 3 business days prior to the exam will not be granted.

Grades:

- The grade you earn in the course will be based on the points that you earn. Effort is reflected in points earned.

Academic Integrity:

- The Code of Policies and Regulations Applying to All Students will be applied in all instances of academic misconduct committed by students. This applies to all exams, presentations, assignments, and materials distributed or used in this course. You can review these policies at the following website:

<http://admin.illinois.edu/policy/code/index.html> and specifically here:
<http://studentcode.illinois.edu/article1/part4/1-401/>

- Science cannot exist without honesty. The faculty and staff in MCB require students, as scientists-in-the-making, to hold the highest standards of scientific and academic conduct. Any form of cheating on any graded work in courses is unacceptable.
- We require that all graded work be entirely your own, and that anything you write using the words of other writers be correctly attributed. Some specific points follow.
- On exams, the answers that you turn in for grading must be your own, formulated during the exam from your own understanding of the material and without any supporting information, be it written, verbal or electronic. Copying the work of another student, or allowing another to copy your work, or copying work from any other source, is unacceptable. Since we cannot always monitor you as you complete your work, we must rely upon appearance of your work from which to judge. If the work you submit resembles that of another student or another source too closely, we may conclude that it was not your original work. Always make a conscious effort to complete your work on your own and to protect it from the view of others. Failure to adhere to these standards for any portion of an exam may result in a grade of zero for the entire exam for all persons involved.
- Texting, or the use of a cell phone or any other device for any purpose, during an exam is prohibited. Doing so may earn you a zero or a more extreme penalty on the quiz or exam at the discretion of the instructor.
- Use of any social or electronic media to share information, request information or make confidential information public is prohibited. Any use of this type may earn you a zero on the exam or a more extreme penalty at the discretion of the instructor.
- On written or electronic assignments, the answers that you turn in for grading must be written in your own words, formulated from your own understanding of the material. While you may be working with other students in the course, you must formulate and submit your own answers. Copying or paraphrasing the work of another student, or allowing another to copy or paraphrase your work, is unacceptable. Since we cannot monitor you as you complete your work, we have only the appearance of your work from which to judge. If the work you submit resembles that of another student too closely, we may conclude that it was not your original work. Always make a conscious effort to complete your work on your own and to protect it from the view of others. You must also make a conscious effort to protect your passwords and accounts. Failure to adhere to these standards may result in a grade of zero for the entire assignment for all persons involved.

Electronic Media/Device Use:

- Use of any social or electronic media to share course information, request course information, or make confidential course information public is prohibited. Any use of this type may earn you a zero on an assignment or exam or a more extreme penalty at the discretion of the instructor.
- Any violation of the social media policy **on your account** may result in a zero on an assignment or exam or a more extreme penalty at the discretion of the instructor.
- Any social media sites created in relation to MCB courses must grant access to course personnel upon request. Failure to provide access will result in a failing grade in the course for the group/site's administrator(s).

Course Material:

- Students are welcome and encouraged to make audio recordings of course lectures.
- The material recorded is intellectual and copyrighted property of the University of Illinois Board of Trustees and may be made for personal use only.
- Posting of audio recordings or transcriptions on social or electronic media platforms is strictly prohibited.
- Posting or redistributing of course material in any format is strictly prohibited.

University Information of Student Safety - Active Threats:

- **General Emergency Response Recommendations** ([Emergency Response Guide](#)):
- Security Threat. The Department of Homeland Security and the University of Illinois at Urbana-Champaign Office of Campus Emergency Planning recommend the following three responses to any emergency on campus: **RUN > HIDE > FIGHT**

- **Only follow these actions if safe to do so.** When in doubt, follow your instincts - you are your best advocate!

- **RUN** – Action taken to leave an area for personal safety.
 - Take the time to learn the different ways to leave your building **before** there is an emergency.
 - Evacuations are mandatory for fire alarms and when directed by authorities! No exceptions!
 - Evacuate immediately. Pull manual fire alarm to prompt a response for others to evacuate.
 - Take critical personal items only (keys, purse, and outerwear) and close doors behind you.
 - Assist those who need help, but carefully consider whether you may put yourself at risk.
 - Look for **Exit** signs indicating potential egress/escape routes.
 - If you are not able to evacuate, go to an Area of Rescue Assistance, as indicated on the front page of this plan.
 - Evacuate to Evacuation Assembly Area, as indicated on front page of this plan.
 - Remain at Evacuation Assembly Area until additional instructions are given.
 - Alert authorities to those who may need assistance.
 - Do not re-enter building until informed by emergency response personnel that it is safe to return.
 - Active Threat: IF it is safe to do so, run out of the building. Get as far away as possible. Do NOT go to the Evacuation Assembly Area.

- **HIDE** – Action taken to seek immediate shelter indoors when emergency conditions do not warrant or allow evacuation.
 - Severe Weather:
 - If you are outside, proceed to the nearest protective building.
 - If sheltering-in-place due to severe weather, proceed to the identified Storm Refuge Area or to the lowest, most interior area of the building away from windows or hazardous equipment or materials.
 - Active Threat:
 - Lock or barricade your area.
 - Get to a place where the threat cannot see you.

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- Place cell phones on silent.
 - Do not make any noise.
 - Do not come out until you receive an Illini-Alert advising you it is safe.
 - **FIGHT** – Action taken as a last resort to increase your odds of survival.
 - Active Threat: If you cannot run away safely or hide, be prepared to fight with anything available to increase your odds for survival.

Student Resources/Where to go for Help:

We Care at Illinois

- For sexual misconduct support, response and prevention visit: wecare.illinois.edu

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: http://oiir.illinois.edu/sites/prod/files/SexualMisconduct_ResourceGuide.pdf

Safety and Emergency

University Police Department, Emergency, 9-911; Non-emergency, 217-333-8911

University Fire Department Emergency, 9-911

Crisis Line, 217-359-4141

Emergency Dean, 300 Turner Student Services Bldg., 610 E. John St., 217-333-0050

Counseling Center, 110 Student Services Bldg., 610 E. John St., 217-333-3704

McKinley Health Center, General Information, 217-333-2701

McKinley Mental Health Center, 1109 S. Lincoln, 217-333-2705

Dean of Students, 300 Turner Students Services Bldg, 610 E. John St., 217-333-0050

Local Sexual Assault Center, RACES, 217-384-4444

Women's Resources Center, 703 South Wright Street, 2nd Floor, 217-333-3137

Rape Crisis 24-hour Hotline, 217-384-4444

Suicide & Psychological Emergency, Suicide Prevention Team, 217-333-3704

SafeRides (free nighttime campus ride program), 217-265-RIDE (265-7433)

SafeWalks (free walking escort service by Student Patrol), 217-333-1216

Student Services and Advocacy

Office of the Dean of Students, 300 Student Services Bldg., 610 E. John St., 217-333-0050

Classroom Support, Teaching Skills, and Instructional Strategies

Center for Innovation in Teaching & Learning, 249 Armory Building, 217-333-1462

Counseling Services

Counseling Center, 110 Student Services Bldg., 610 E. John St., 217-333-3704

McKinley Mental Health Center, 1109 S. Lincoln Ave., 217-333-2701

Psychological Services Center, 3rd Floor, 505 E. Green St., 217-333-0041

Disability Services

Disability Resources and Educational Services (DRES), 1207 S. Oak St., 217-333-1970

Lesbian, Gay, Bisexual, Transgender Resource Center

LGBTB Resource Center, 323 Illini Union, 1401 W. Green St., 217-244-8863

Veterans Services

Veteran Student Support Services, Office of the Dean of Students, 610 E. John St., 217-333-0050

Center for Wounded Veterans in Higher Education, 908 W. Nevada St., 217-300-3515

General Study Skills Assistance

Office of Minority Student Affairs, 130 Student Services Bldg., 610 E. John St, 217-333-0054

Office of Minority Student Affairs Tutoring Services, 701 S. Gregory Dr., Suite 1, 217-333-7547

Writer's Workshop, 251 Undergraduate Library, 1402 W. Gregory Dr., 217-333-8796

**Additional academic assistance may be available through individual departments

Health Resources

Health Education, McKinley Health Center, 1109 S. Lincoln Ave., 217-333-2701

Alcohol & Other Drug Office, 2nd Floor Counseling Center, 610 E. John St., 217-333-7557

Sexual Health Educator, McKinley Health Center, 1109 S. Lincoln Ave., 217-333-2714

Dial-A-Nurse, McKinley Health Center (24-hour), 1109 S. Lincoln Ave., 217-333-2700

Health Resource Center, McKinley Health Center, 1109 S. Lincoln Ave., 217-333-6000

Health Resource Center, Room 40 Illini Union, 1401 W. Green St., 217-244-5994

McKinley Health Center, General Information, 1109 S. Lincoln Ave., 217-333-2701

Sexual Harassment/Assault & Acts of Intolerance/Hate Crimes

Office of the Dean of Students, 300 Students Services Bldg., 610 E. John St., 217-333-0050

The Office of Diversity, Equity and Access (ODEA):

- For non-academic support visit: diversity.illinois.edu
 - Discrimination & Harassment Prevention
 - Title IX
 - Accessibility & Accommodations
 - Inclusive Illinois