



School of Molecular and Cellular Biology

MCB 320, Fall 2023

Mechanisms of Human Disease, 3 Credit Hours

Instructor

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Class Meeting Schedule

MCB 320 lectures begin on Monday, August 21, 2023. The class meets every Monday, Wednesday, and Friday from 2:00-2:50 PM in room 119 of the Materials Science and Engineering Building (119 MSEB), except on University-designated holidays. See the **Lecture and Assessment Schedule** for additional information.

Course Description and Goals

The advent of molecular biology and the Human Genome Project have dramatically increased our understanding of the mechanisms of human disease. The underlying molecular causes for many diseases have been elucidated. This course examines how abnormalities that occur at the molecular and cellular level manifest as pathologies affecting the structure and function of human tissues and organs. In addition, this course focuses on the pathophysiology of common human diseases and the environmental, genetic and epigenetic causes of specific disease types.

Although, the molecular causes/mechanisms of an overwhelming number of diseases have been partially explained, there is simply no way that we can discuss every disease or organ system in one course. Thus, our intention is not to make this course all-encompassing; rather, we will try to present the material in a conceptual framework, providing a survey of the topic for breadth and specific examples to add depth. With this in mind, we have two main goals for the course:

1. Students learn some fundamental concepts related to the mechanisms of human disease. Although we do think it is important to understand and have a good working knowledge of a specific disease, we are more concerned with students understanding the general principles common to a family of similar diseases.
2. Students synthesize and apply information from a variety of disciplines (*e.g.*, biochemistry, molecular biology, cell biology, genetics, physiology, pathology, endocrinology, immunology, etc.) to better understand the mechanisms of disease.

Learning to synthesize material from multiple disciplines is an important part of the intellectual process and can be extremely rewarding.

Course Prerequisite

MCB 252 (Cells, Tissues, and Development) or instructor consent.

Student Learning Outcomes

At the end of the course, through lectures, discussions, and assessments, students will be able to:

1. Demonstrate an understanding of essential concepts of human health and disease, including cell death, inflammation, and genetic and epigenetic mechanisms;
2. Describe how these essential concepts relate to the pathogenesis of common and important respiratory diseases, neoplastic diseases, reproductive disorders, metabolic disorders, and circulatory diseases
3. Demonstrate an understanding of the predisposing factors, causes, and pathophysiology and potential complications of such diseases;
4. Correlate clinical features with the causes and mechanisms of such diseases;
5. Recognize and describe how knowledge of physiologic and pathophysiologic processes can be used in the investigation, prevention, and management of disease;
6. Synthesize and apply biological information from a variety of sources and disciplines.

Course Website

You will be able to download relevant course information and lecture slides from the MCB 320 course website, which is hosted on the campus Moodle server (Learn@Illinois, <https://learn.illinois.edu/>). If you are registered for MCB 320, you can log into the campus Moodle server using your campus NetID and password and access MCB 320 course content.

Course Materials

The following items are required or recommended for MCB 320.

Recommended Lecture Slides

Download the lecture slides from the MCB 320 course website and use them as you take notes during lecture. Address: <https://learn.illinois.edu/>.

Recommended Textbooks

Coleman W. B. and Tsongalis G. J. (2018) Molecular Pathology: The Molecular Basis of Human Disease. 2nd ed. Academic Press. ISBN = 978-0128027615.

Rent or buy new/used copies of the textbooks from Amazon.com. Also, the UIUC Library has a licensed subscription to Science Direct, so you can freely access and download pdf copies of Molecular Pathology while logged into the campus network. Address: <https://www-sciencedirect-com.proxy2.library.illinois.edu/book/9780128027615/molecular-pathology>.

Other textbooks that you may want to consult for background information

Niederhuber J. E., et al. (2020) Abeloff's Clinical Oncology. 6th ed. Elsevier. ISBN = 978-0323476744.

Cox, M. M., et al. (2012) Molecular Biology, Principles and Practice, 1st ed. W. H. Freeman. ISBN = 978-0716779988.

Lodish, H., et al. (2008) Molecular Cell Biology, 6th ed. W. H. Freeman. ISBN = 978-0716776017.

Strachan, T. and Read, A. P. (2004) Human Molecular Genetics, 3rd ed. John Wiley and Sons. ISBN = 978-0815341826.

Kumar V, et al. (2007) Robbins Basic Pathology, 8th ed. Saunders Elsevier. ISBN = 978-1416029731.

Course Grades

Student grades in MCB 320 are based on a total of 500 points. There will be four 10-minute quizzes, each worth 15 points. There will be four 50-minute exams, each worth 110 points. Assessment scores will be posted in the MCB 320 Gradebook on the course website in Moodle, <https://learn.illinois.edu/>. Students are responsible for checking their scores in Moodle after each assessment and reporting any concerns to Prof. Bolton within 7 days of scores being posted.

4 Quizzes (15 points/quiz)	60 points
4 Exams (110 points/quiz)	440 points
Total	500 points

The point totals contained in the following table represent the use of the plus/minus grading system coupled with a 4.0 grade point system, which has been assigned by the University for each letter grade. The grade you earn in the course will be based on the points that you earn. Effort is reflected in points earned. We will adhere to the MCB 320 Standard Grade Scale when assigning grades to avoid capriciousness and to adhere to fairness and equity for all students.

MCB 320 Standard Grade Scale

Letter Grade	Point Ranges	Grade Point Value
A+	500-460	4.000
A	459-442	4.000
A-	441-425	3.667
B+	424-409	3.333
B	408-392	3.000
B-	391-375	2.667
C+	374-359	2.333
C	358-342	2.000
C-	341-325	1.667
D+	324-309	1.333
D	308-292	1.000
D-	291-275	0.667
F	274-0	0.000

Lecture and Assessment Schedule

Date	Day	Lecture Number and Topic
PART 1: Essential Concepts of Human Disease		
Aug 21	Mon	Introduction to MCB 320; 1. Cell Death
Aug 23	Wed	1. Cell Death
Aug 25	Fri	2. Inflammation and Tissue Remodeling
Aug 28	Mon	3. Chromosome Organization and Mutation
Aug 30	Wed	4. Human Genetics and Epigenetics
PART 2: Respiratory Diseases		
Sept 1	Fri	5. Introduction to the Respiratory System; QUIZ 1 (Lectures 1-4)
Sept 4	Mon	Labor Day
Sept 6	Wed	6. Cystic Fibrosis
Sept 8	Fri	7. Asthma and COPD
Sept 11	Mon	Review
Sept 13	Wed	EXAM 1 (Lectures 1-7)
PART 3: Neoplastic Diseases		
Sept 15	Fri	8. Introduction to Neoplasia
Sept 18	Mon	8. Introduction to Neoplasia; 9. Pulmonary Neoplasia
Sept 20	Wed	9. Pulmonary Neoplasia
Sept 22	Fri	10. Breast Neoplasia
Sept 25	Mon	10. Breast Neoplasia; 11. Prostate Hyperplasia and Cancer
Sept 27	Wed	11. Prostate Hyperplasia and Cancer; QUIZ 2 (Lectures 8-10)
Sept 29	Fri	12. Lymphoid and Myeloid Malignancy
Oct 2	Mon	12. Lymphoid and Myeloid Malignancy; 13. Colorectal Neoplasia
Oct 4	Wed	13. Colorectal Neoplasia
Oct 6	Fri	Review
Oct 9	Mon	EXAM 2 (Lectures 8-13)
PART 4: Reproductive Disorders		
Oct 11	Wed	14. Introduction to the Reproductive System
Oct 13	Fri	14. Introduction to the Reproductive System; 15. Male Infertility

Oct 16	Mon	16. Female Infertility I (Uterine Disorders)
Oct 18	Wed	17. Female Infertility II (Turner Syndrome and PCOS)
PART 5: Metabolic Disorders		
Oct 20	Fri	18. Introduction to Metabolism; QUIZ 3 (Lectures 14-17)
Oct 23	Mon	18. Introduction to Metabolism; 19. Obesity
Oct 25	Wed	19. Obesity; 20. Diabetes Mellitus
Oct 27	Fri	20. Diabetes Mellitus
Oct 30	Mon	21. Metabolic Syndrome
Nov 1	Wed	Review
Nov 3	Fri	EXAM 3 (Lectures 14-21)
PART 6: Circulatory Diseases		
Nov 6	Mon	22. Introduction to the Circulatory System
Nov 8	Wed	22. Introduction to the Circulatory System; 23. Hemostasis
Nov 10	Fri	23. Hemostasis
Nov 13	Mon	24. Hemostatic Diseases
Nov 15	Wed	25. Atherosclerosis and Coronary Artery Disease; QUIZ 4 (Lectures 22-24)
Nov 17	Fri	25. Atherosclerosis and Coronary Artery Disease; 26. Stroke
Nov 18-26		Fall Break
Nov 27	Mon	26. Stroke
Nov 29	Wed	27. Cardiomyopathy
Dec 1	Fri	28. Marfan Syndrome
Dec 4	Mon	Review
Dec 6	Wed	EXAM 4 (Lectures 22-28)

The lectures are divided into 6 parts according to distinct topics in human disease:

PART 1: Essential Concepts of Human Disease (4 lectures)

PART 2: Respiratory Diseases (3 lectures)

PART 3: Neoplastic Diseases (6 lectures)

PART 4: Reproductive Disorders (4 lectures)

PART 5: Metabolic Disorders (4 lectures)

PART 6: Circulatory Diseases (7 lectures)

Students are expected to have read the Student Code, <https://studentcode.illinois.edu/>, and to act accordingly. Course faculty and staff are in charge of the orderly conduct of class meetings and may exclude a student who does not comply with a reasonable request. Course faculty and staff are not responsible for any student's personal belongings. In addition, regular class attendance is expected of all students at the University, <https://studentcode.illinois.edu/article1/part5/1-501/>. Attendance at every lecture (if possible) is crucial, as some lecture material is not described in the suggested readings that are listed in the lectures. For lecture attendance and absence policies, see **Attendance Policy and Absences**.

Assessment Information

There will be four 10-minute quizzes outside of regular class time (3:00-9:00 PM via the MCB 320 course site in Moodle), each worth 15 points. There will be four 50-minute exams during regular class time (2:00-2:50 PM in 119 MSEB), each worth 110 points. The dates of the quizzes and exams are listed below. Participation in all quizzes and exams is crucial for completing the course.

Friday, September 1, 3:00-9:00 PM	Quiz 1
Wednesday, September 13, 2:00-2:50 PM	Exam 1
Wednesday, September 27, 3:00-9:00 PM	Quiz 2
Monday, October 9, 2:00-2:50 PM	Exam 2
Friday, October 20, 3:00-9:00 PM	Quiz 3
Friday, November 3, 2:00-2:50 PM	Exam 3
Wednesday, November 15, 3:00-9:00 PM	Quiz 4
Wednesday, December 6, 2:00-2:50 PM	Exam 4

The quizzes and exams will cover material from the lectures and will be in the form of multiple-choice questions. The instructor may provide students with information regarding the content of a specific exam during a review session prior to an exam. Review sessions prior to the exams may be shortened or canceled to compensate for unforeseen circumstances (e.g., school closure, additional class time needed for lecture completion, etc.).

The quizzes and exams in MCB 320 are *not* “open note” or “open book” assessments, so put all notes and books away before you log into Moodle for a quiz or receive an exam in class. In addition, “cheat sheets”, cell phones, headphones, ear buds, calculators, and non-essential electronic devices are prohibited. Also, each student must complete their own quiz/exam, and working together or communicating with others during a quiz/exam is *prohibited*. If you experience a computer/network crash during a quiz, restart the quiz in Moodle *immediately* and continue your attempt. After you submit your quiz, inform Prof. Bolton of the nature and duration of the computer/network crash. Visit the MCB 320 course site for additional announcements concerning each assessment. For assessment attendance and absence policies, see **Attendance Policy and Absences**.

Adding the Course after the Semester Starts

We understand that the University has an add deadline 10 days into the semester. However, 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 (<https://odos.illinois.edu/community-of-care/resources/students/religious-observances/>) to their instructors and the Office of the Dean of Students as early as possible in the semester. Information about accommodations can be found in the Student Code: <https://studentcode.illinois.edu/index.html>.

DRES Accommodations

If you require special accommodations, please contact 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 they begin the day you contact Prof. Bolton with a current letter of accommodation from DRES.

Attendance Policy and Absences

Regular class attendance is expected of all students at the University, <https://studentcode.illinois.edu/article1/part5/1-501/>. Attendance at every lecture (if possible) is crucial, as some lecture material is not described in the suggested readings that are listed in the lectures. Importantly, participation in all assessments is crucial for completing the course.

1. If you experience an *illness* that causes you to miss an assessment, you must submit confirmation of a visit with a medical practitioner within 24 hours of your absence. The confirmation cannot come from a relative, even if the relative is a medical practitioner.
2. The Student Assistance Center in the Office of the Dean of Students may provide informative letters to instructors due to a protracted illness of 3 or more days, certain emergencies, and 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 an absence letter 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. The Office of the Dean of Students is located in the Turner Student Services Building, 610 E. John Street, Champaign, 217-333-0050, <http://odos.illinois.edu/>. Instructions for absence letter requests can be found on the Office of the Dean of Students website, <https://odos.illinois.edu/community-of-care/resources/students/>.
3. Students with *foreseeable schedule conflicts* must provide written notification to Prof. Bolton at least 7 days before the assessment. A conflict exam/quiz may be given to students who find themselves in one of the following situations with documentation:
 - A regularly scheduled course for credit at the University that takes place during the scheduled assessment time
 - Scheduled activities of officially recognized groups such as athletic teams, performance groups, and the Urbana-Champaign Senate
 - Employment (if possible schedule your work shift around assessments)

- Religious observances that were documented on the Request for Accommodation for Religious Observances Form (<https://odos.illinois.edu/community-of-care/resources/students/religious-observances/>)
 - Travel associated with a job, secondary school interviews (if possible schedule interviews around assessments), or scientific conferences (not general meetings)
 - Significant and compelling circumstances beyond a student's control, including medical treatment related to illness or injury; pregnancy; legal matters; serious illness, injury or death of a family member; citizenship or naturalization processes; or acts of nature which cause destruction to a primary residence or disrupt air travel.
 - Absences that will *not* be excused include family events such as reunions, weddings, or serious illness of extended family member (aunt, uncle, niece, nephew, or cousin).
4. If you miss an assessment due to serious *unforeseen circumstances*, you are required to contact Prof. Bolton within 24 hours of the absence. You will have 48 hours from the absence to submit documentation to Prof. Bolton. Your instructor will evaluate the documentation and decide if a conflict or prorated assessment is an option. Failure to follow this procedure will result in a *score of zero for the missed assessment*.
 5. **Whether it is an *illness*, a *foreseeable conflict*, or an *unforeseen emergency* that prevents you from taking a scheduled assessment, an explanation and supporting documentation of the illness/conflict must be submitted to Prof. Bolton by e-mail.** You must make these arrangements for each assessment, and your request for a conflict will not be carried forward to subsequent assessments. Conflict (i.e., makeup) or prorated assessments will only be given to students who have a well-documented reason approved by Prof. Bolton. Importantly, **only one exam may be prorated in a semester for any and all absences**. There may be instances when students 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.

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 assessments, presentations, and materials distributed or used in this course. Review these policies at the following websites:

<https://studentcode.illinois.edu/index.html>; <https://studentcode.illinois.edu/article1/part4/1-401/>.

The following policies support and reinforce these policies.

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 and quizzes, the answers that your turn in for grading must be your own, formulated *during* the assessment 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, to ensure that it will be seen as your own. Failure to adhere to these standards, for any portion of an exam/quiz, may result in a grade of *zero for the entire exam/quiz, for all persons involved*. Use of a cell phone for any purpose during an exam/quiz, is prohibited. Use of any social or electronic media to share information, request information or make confidential information public is prohibited. Failure to adhere to these standards, for any portion of an exam/quiz, may result in a grade of *zero for the entire exam/quiz, for all persons involved*, or a more extreme penalty at the discretion of the instructor.

On 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, in order to ensure that it will be seen as your own. 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*.

On assignments, if you use a statement taken directly from any book or other publication, including the course textbook, you must provide a citation. That is, you must put the text in quotes and put the author of the publication in parentheses after the quotation. Failure to do so will result in zero credit for that answer. Further, using only the words of another author as your entire answer or as the majority of your answer to any question is never sufficient to earn credit. If the majority of your work has been taken directly from a publication, you are likely to receive no credit for the work, since you would not be demonstrating knowledge beyond the ability to copy. Even if you quote another, your answer must be substantially your own words, drawn from your own understanding of the material. Failure to adhere to these standards may result in *zero credit for the entire assignment*.

Course Material

Students are welcome and encouraged to make audio recordings of course lectures. However, the recorded material is the intellectual and copyrighted property of the instructor and the University of Illinois and may be made for personal use only. Video recordings of any kind are strictly prohibited. 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 prohibited.

Emergency Response Recommendations (<https://odos.illinois.edu/facilities/docs/Emergency-Response-Guide.pdf>)

The Department of Homeland Security and the University of Illinois at Urbana-Champaign Office of Campus Emergency Planning recommend the following three responses to an 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.
 - 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.