

Introduction to Biomolecular Engineering
BME 3406
Class Periods: MWF Period 9 (4:05 – 4:55 PM)
Location: WM0100
Academic Term: Spring 2024

Instructor: Carl Denard
Email: cdenard@ufl.edu
Office Hours: Thursdays 12-1 PM (Wertheim 494)

Course Description

Introduces chemical engineering students interested in bio-related careers to the chemical engineering discipline. Emphasizes the link between biology and chemical engineering and the interface between them.

Course objectives

Biomolecular Engineering has recently evolved as an integral part of chemical engineering education as it paves new career paths and advances in biotechnology and pharmaceutical industry. This 3-credit core course in chemical engineering introduces students to the fundamental foundations of biomolecular engineering and biochemistry.

With the fundamental knowledge in biomolecular engineering, students will understand and potentially explore emerging fields of biomedicine, bioenergy, biomaterials, synthetic biology, and biochemical engineering. The contents of the course incorporate and interface with the fundamentals of biology, biochemistry, molecular biology, and chemical engineering to better understand and engineer bio-related technologies and by the end of the course students will be able to:

- 1) Molecular-level understanding of the structure and function of biological systems.
- 2) Understanding of the core principles and technologies of molecular biotechnology.
- 3) Have basic knowledge of broad interdisciplinary fields of biology for career development.

Required textbook:

- 1) Molecular Cell Biology, 9th edition, Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon. Paperback ISBN:9781319208523
eTextbook rental is \$74.80

Other reference textbook:

- 1) Lehninger Principles of Biochemistry. David L. Nelson; Michael M. Cox | 2021 Eighth Edition | e-Book
ISBN:9781319322342 | Paperback ISBN:9781319228002.

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

| Outcome | Coverage* |
|---|-----------|
| 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | Medium |
| 2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors | Low |
| 3. An ability to communicate effectively with a range of audiences | |

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|---|-----|
| 4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts | Low |
| 5. An ability to function effectively on a team whose members together provide leadership, create a | |

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| collaborative and inclusive environment, establish goals, plan tasks, and meet objectives | |
| 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | Medium |
| 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies | Medium |

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Tentative schedule

| Date | Meeting | Topic | Reading | HW due |
|----------|-----------------------|---|------------------------|--------|
| Jan-8 | 1 | Syllabus overview, intro to biomolecular engineering | Ch. 1 | |
| Jan-10 | 2 | Evolution, cells, molecules, organisms | | |
| Jan-12 | 3 | Evolution, cells, molecules, organisms/Chemical foundations | Ch. 1/Ch. 2 | HW 1 |
| Jan-15 | No class-MLK | | | |
| Jan-17 | 4 | Chemical foundations | | |
| Jan-19 | 5 | Chemical foundations/Protein structure and function | Ch. 2/Ch. 3 | HW 2 |
| Jan-22 | 6 | Protein structure and function | Ch. 3/Instructor notes | |
| Jan-24 | 7 | Protein structure and function | | |
| Jan-26 | 8 | Protein structure and function | | |
| Jan-29 | 9 | Protein structure and function | | |
| Jan-31 | 10 | Enzyme fundamentals | Instructor notes | |
| Feb-2 | 11 | Enzyme fundamentals | | HW 3 |
| Feb-5 | 12 | Culturing and visualizing cells | Ch. 4 | |
| Feb-8 | 13 | Culturing and visualizing cells | | HW 4 |
| Feb-10 | 14 | Fundamental molecular genetic mechanisms | Ch. 5 | |
| Feb-12 | 15 | Fundamental molecular genetic mechanisms | | |
| Feb-14 | 16 | Fundamental molecular genetic mechanisms | | HW 5 |
| Feb-16 | 17 | Exam 1 | | |
| Feb-19 | 18 | Molecular genetic techniques | Ch. 6 | |
| Feb-21 | 19 | Molecular genetic techniques | | |
| Feb-24 | 20 | Molecular genetic techniques | | HW 6 |
| Feb-26 | 21 | Genes, chromatin, and chromosomes | Ch. 7 | |
| Feb-28 | 22 | Genes, chromatin, and chromosomes | | |
| Mar-1 | 23 | Transcriptional control of gene expression in prokaryotes | Instructor notes | HW 7 |
| Mar-4 | 24 | Transcriptional control of gene expression in prokaryotes | | |
| Mar-6 | 25 | Transcriptional control of gene expression in eukaryotes | Ch. 8 | |
| Mar-8 | 26 | Transcriptional control of gene expression in eukaryotes | | HW 8 |
| Mar-9-15 | No class/Spring Break | | | |
| Mar-18 | 27 | Post-transcriptional control of gene expression | Ch. 9 | |
| Mar-20 | 28 | Post-transcriptional control of gene expression | | |

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|------------|----|---|--------|-------|
| Mar-22 | 29 | Exam 2 | | |
| Mar-25 | 30 | Biomembrane structure | Ch. 10 | HW 9 |
| Mar-27 | 31 | Biomembrane structure | | |
| Mar-29 | 32 | Transmembrane transport of ions and small molecules | Ch. 11 | |
| Apr-1 | 33 | Transmembrane transport of ions and small molecules | | HW 10 |
| Apr-3 | 34 | Cellular Energetics/Metabolism | Ch. 12 | |
| Apr-5 | 35 | Cellular Energetics/Metabolism | | |
| Apr-8 | 36 | Cellular Energetics/Metabolism | | |
| Apr-10 | 37 | Cellular Energetics/Metabolism | | HW 11 |
| Apr-12 | 38 | Moving proteins into membranes | Ch. 13 | |
| Apr-15 | 39 | Moving proteins into membranes | | |
| Apr-17 | 40 | Moving proteins into membranes | | HW 12 |
| Apr-19 | 41 | Receptors, cell surface proteins, and signal transduction | Ch. 15 | |
| Apr-22 | 42 | Receptors, cell surface proteins, and signal transduction | | |
| Apr-24 | 43 | Receptors, cell surface proteins, and signal transduction | | HW 13 |
| April 29th | 44 | Final Exam (3 – 5 PM) | | |

Grade distribution

Exams: 23.3% for each exam (70% total)

HW: 30%

Exams

- Exams will be in person during class hours on Canvas.
- Make-up exams will only be allowed if the student has notified the instructor two weeks prior to the exam with a valid excuse (conference attendance, career fairs, job interview). Illness and medical issues will require documentation. If the circumstance is unforeseen, contact and inform the instructor as soon as possible. No make-up exam will be given if you do not contact the instructor within two days of missing the exam.

Homework

- HW is due before 11:59 PM on the due date. Feel free to discuss HW questions with your peers, but do not copy each other's work. Plagiarism will not be tolerated.
- Your lowest HW grade will be dropped.
- HWs will usually be multiple-choice questions on Canvas. You will have at least three attempts at answering HW questions.
- *HW are designed as study aid.*

Expectations

- Complete the assigned reading before class.
- Homework questions/problems may require you to read parts of the textbook in-depth.
- Participate in iclicker questions and class discussions.
- Attend class. Attendance is not mandatory, but highly recommended.

Grading Policy

| Percent | Grade | Grade Points |
|----------------|--------------|---------------------|
| 90.0 - 100 | A | 4.00 |

| | | |
|-------------|----|------|
| 86.7 - 89.9 | A- | 3.67 |
| 83.4 - 86.6 | B+ | 3.33 |
| 80.0 - 83.3 | B | 3.00 |
| 76.7 - 79.9 | B- | 2.67 |
| 73.4 - 76.6 | C+ | 2.33 |
| 70.0 - 73.3 | C | 2.00 |
| 66.7 - 69.9 | C- | 1.67 |
| 63.4 - 66.6 | D+ | 1.33 |
| 60.0 - 63.3 | D | 1.00 |
| 56.7 - 59.9 | D- | 0.67 |
| 0-56.6 | E | 0.00 |

- More information on UF grading policy may be found at:
<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving

solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

- **U Matter, We Care:**
- Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach

out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

- **Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

- **Sexual Discrimination, Harassment, Assault, or Violence**

- If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

- **Sexual Assault Recovery Services (SARS)**

- Student Health Care Center, 392-1161.

- **University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

- **E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

- **Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

- **Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

- **Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

- **Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

- **Student Complaints Campus:** <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

- **On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.