

# BIOE120, BIOLOGY FOR ENGINEERS (3 credits)

Fall 2012

*Prerequisite:* Permission from Department

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**COURSE INFORMATION:** Lecture: TuTh 9:30am-10:45am KEB 1110  
Course Websites: <http://www.elms.umd.edu>  
Resources Website: <http://lib.guides.umd.edu/BIOE120>.

**INSTRUCTOR:** Dr. Idalis Villanueva  
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Office Hours: Monday and Wednesday (11:00 to noon) or by appointment

**TEACHING ASSISTANT:** TBD

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## A. COURSE OBJECTIVES

- a. Students will understand from a fundamental and quantitative perspective, the functions and interactions of biological systems
- b. Students will learn about methods of data analysis and tools used in bioengineering experimentation
- c. Students will recognize the roles of bioengineers in biology and how biology is integral in bioengineering
- d. Students will develop active problem solving skills (e.g., inquiry, critical analysis, and discussion)

## B. MATERIALS

### Textbook (Strongly Recommended):

- Karp, G. Cell and Molecular Biology, 6<sup>th</sup> Edition, 2010 (Hardcover ISBN: 978-0-470-48337-4 or binder-ready ISBN: 978-0-470-55655-9)

### Basic Scientific Calculator (Required):

- (Texas Instruments TI-30X-IIS or similar): Can be obtained in any retail store; It is MANDATORY that each student bring a scientific calculator to every class. Graphic calculators will not be allowed and may be confiscated during a quiz or exam.

### Clicker (Required):

- Clickers will periodically be used for quizzes and in-class activities. It is MANDATORY that each student bring a registered clicker to every class. The University allows students to register clickers at their UMD Portal page (<http://my.umd.edu>) under the Academics and Testudo Tab. Mobile phones, internet devices and computers CANNOT be used in place of clickers. Clickers must be registered by the second lecture!
- If you have issues with your clicker you may go to the Computer and Space Science (Bldg 224, room 1400). New batteries can be purchased at the UMD Bookstore.

### Supplementary Textbooks (Optional):

- Alberts et al., Molecular Biology of the Cell, 5<sup>th</sup> Edition, 2008 (ISBN: 0815341059; ISBN: 978-0815341055)
- Bolsover et al., Cell Biology: A Short Course, 2011 (ISBN: 978-0-470-52699-6); *this book is intended for students that have not taken a biology course prior to this class*
- Dunn JO., and Clark VA. Basic Biostatistics: A Primer for the Biomedical Sciences. 4<sup>th</sup> Edition, 2009 (ISBN: 978-0-470-24879-9); *this book is intended for students that have not taken a statistics course prior to this class*

### C. UM LIBRARY RESEARCH GUIDE

For more information on searching for scientific journal articles, identifying plagiarism, or other library resources go to <http://lib.guides.umd.edu/BIOE120> .

### D. ACADEMIC INTEGRITY

The University of Maryland is a leader in setting national models for student-administered honor codes. The Honor Council serves to educate the university community (faculty, undergraduate and graduate students, and parents) about the University of Maryland Code of Academic Integrity. The Code aims to resolve issues related to academic dishonesty. That means there is **NO TOLERANCE** for acts of dishonesty such as plagiarism, submitting the same assignment for two or more courses without authorization, cheating, fabrication of results, intentionally assisting another student to engage in academic dishonesty, forging signatures, or anything else related to the stipulations of the Code. For more information on the Code of Academic Integrity or the Student Honor Council, visit <http://www.studenthonorcouncil.umd.edu/whatis.html>

Students are asked to sign the following pledge for every exam, assignment, and project:

*I pledge on my honor that I have not given or received any unauthorized assistance on this examination/assignment/quiz/project.*

### E. CLASSROOM POLICY

- Courtesy:** Students in a university-level environment are expected to treat their instructor with respect at all times. Please direct to the instructor as “Dr. Villanueva” during lectures, exams, and office hours/sessions.
- Participation and Attendance (Late arrival/early departure):** Students are encouraged to attend and participate in lectures as part of your Participation grade. Please come to class on time to prevent disruption. If a student arrives late to the lecture, the student should quietly enter the back of the room to minimize any interruption. If the student needs to leave early, please sit at the end of a row near a door and leave as quietly as possible. The grading for class participation will consider active participation and use of clickers in class as well as the use of discussion boards in ELMS.
- Class Etiquette:** Every student is expected to treat his/her peers and instructor with respect. Students are to refrain from any destructive or harassing commentary during class. They are expected to be quiet when their peers or instructor are talking. Disruptive or harmless commentary is prohibited during class or office hours. Any additional disruptions such as talking, eating, using headphones, or packing your materials before the lecture has ended is to be limited. Disruptive behavior will be weighed on a case-to-case basis and in extreme situations may result in third party involvement (i.e., Office of Student Conduct).
- Email the instructor or TA:** For their own privacy, students should use their registered umd.edu address. Students cannot expect to receive grades and exam or HW scores over email. When

emailing the instructor or TA, students should refrain from using text messaging or any type of informal language. Emails that do not adhere to these guidelines should not expect a response.

- e. **Excused absences:** Students can be excused from assignments, projects, and exams (with the exception of the final exam) as long as proper notification and documentation is provided to the instructor. Students that are absent for a quiz, cannot make-up the quiz, regardless of the reason for the absence. The excused absences for all other lecture material are found in the following headings.

*Illness:*

In the case of an excuse due to illness, the student needs to notify the instructor the reason for the absence. The student needs to provide reasonable documentation (i.e., doctor's note) to the instructor. In those cases where an excused absence precipitates an assignment, appropriate arrangements should be made with the instructor. Proper documentation does not include a signed note by the student or by peers/family members.

If a student is absent during test days due to an illness, the student should notify the instructor about the absence within 12 hours of the same business day. Upon returning to class, the student needs to bring proper documentation, signed by a health care professional, in order for an arranged make-up to occur.

*Religious Observance:*

If a student predicts that he/she will have an excused absence for religious observances, it is the student's responsibility to notify the instructor IN PERSON of such absence via a TYPED and signed notification within 2 WEEKS of the start of the semester. The notification must identify the religious holiday(s) and the date(s) the student will be absent. The predicted absence must be re-confirmed with instructor at least 24 hours in advance. Failure to do so may result in loss of credits during absence!

*Athletic or University-Sponsored Activities:*

If a student athlete predicts that he/she will have an excused absence for university-sponsored activities, it is the student's responsibility to bring a memorandum from the Department of Intercollegiate Athletics indicating the dates the student will be absent. It is the student's responsibility to notify the instructor in advance by bringing the aforementioned notification within 2 WEEKS of the start of the semester. The predicted absence must be re-confirmed with instructor at least 24 hours in advance. Failure to do so may result in loss of credits during absence!

*Unexcused absences:*

If the student is planning a vacation or travel time, the student needs to make sure that the travel time does not interfere with any activities during lecture. Travel time is NOT considered an excused absence! If the student overslept and did not make it to class, the absence is not excused. Any additional absence of a similar nature is NOT excused!

- f. **Making up missed work due to excused absence:** In the case of an excused absence, appropriate arrangements should be made with the instructor. At the discretion of the instructor, any make-up material will be in the form of an oral, in-person assessment. For University emergencies (e.g., inclement weather), an announcement will be posted in Blackboard; class will be rescheduled for a mutually convenient time.

- g. Students with disabilities:** Students with a disability needing accommodations, indicated by university policy, must provide signed documentation from the campus's Disability Support Service Office (<http://www.counseling.umd.edu/DSS/>). Students are responsible for presenting this letter to their instructors by the end of the drop/add period.
- f. Use of wireless devices:** The use and handling of wireless phones or any electronic, portable device during lecture (e.g., cell phones, camera phones, iPOD/iPAD) is not permitted! Any activity involving the use of these devices such as taking pictures, texting, blogging, chatting in social media, and so on is also not allowed. All devices MUST be silenced and PUT AWAY during lectures and on exams. If during exams, students are caught using any of these wireless devices, the exam can be confiscated and the student may be forwarded to the Office of Judicial Programs for review. Some exceptions to this rule may apply but must be pre-approved by the instructor upon receiving official documentation indicating its need throughout the course.
- g. Quizzes:** Quizzes will be short (~5-10 minutes) and unannounced. They will be given during class using the clickers and could cover material introduced that same day. No make-up quiz will be given, regardless of the absence! There will be no curve for quizzes!
- h. Exams:** Students are not allowed to bring or use any graphic calculators or wireless devices to any exam. If the student brings a graphic calculator to class, it can be confiscated until the end of the exam. The instructors and the teaching assistants are not responsible for the grading that occurs as a result of the student not bring the approved calculator to the exam. No hats, sunglasses or any piece of clothes wear/jewelry that may be used as a tool for academic dishonesty is permitted. Use of these during the test can result in confiscation of the exam. Curved exams are uncommon. It is in the discretion of the instructor to do so and may not occur every time. There is no curve done on end of semester grades.
- i. Use of course material:** Class lectures and other materials provided are copyrighted and may not be reproduced for anything other than personal use unless a written permission from the instructor is provided.
- j. Regrade:** Regrades in this course are uncommon. However, if you still feel that the quiz, project, assignment, or exam was graded incorrectly and would like a revision, a formal request for the regrade is needed. The student must provide a type-written note along with his/her name, section, and signature. In the note, specify the problem that needs a regrade and indicate a valid reason why a regrade should be considered. This note must be attached along with the graded material and handed to the instructor in person!!!! Once both documents are handed to the instructor, the instructor will consider the student's regrade request and decide on a case-to-case basis if a regrade is needed. If a regrade is needed, the entire work will be re-evaluated with further scrutiny. At the discretion of the instructor, points will be removed or added to the regraded material. Following the instructor's decision for a regrade and/or following review, no more changes to the grade or any additional regrade requests can be made. Students have 48 hours from the date the graded material is returned in class to request the re-grade. After that time, no re-grade requests will be considered.
- k. Faculty and Student expectations**
- Students can expect** the instructor to be professional, explain new and previously unlearned concepts and information during lectures and answer questions related to new topics, hold office hours for additional clarification of concepts taught in lectures, exams and HW, return graded material within 7-10 business days, respond to emails within a reasonable time, accommodate students with learning disabilities, and assist you with professional development to the best possible extent.
  - Students are expected to** be professional, follow the guidelines provided in this document with respect to the course, follow the University's Code of Academic

Integrity, come to class prepared by reading textbook and provided handouts in advance and bringing the clicker to class, be aware of deadlines, not be disruptive in class, and refrain from using electronic devices during class and in exams.

#### **F. GRADING SCALE:**

Grades for this class will be considered on a weighted scale as follows:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	< 60.00%

2 mid-term exams (15% each), Final Exam (30%), Homework (12%), Project (15%), Quizzes (8%), Participation / Attendance (5%)

Two midterm exams and a final exam will be given. The midterms will be weighed equally. The midterms and final exam will be comprehensive. No grades will be provided by email!

**G. HOMEWORKS:** Homework will periodically be assigned based on textbook reading assignments and lecture material. Homework will be assigned one week prior to the due date in Blackboard. Typically, HW is due on specified Fridays unless indicated otherwise in the course outline or in Blackboard. In the cover page of the HW, write the academic integrity pledge and sign your name along with the date and time that you turned in the HW. No emailed homework or portions of the homework will be accepted! Any late homework that is turned in the same business day will undergo a 20% deduction for tardiness. No homework will be accepted after the established timeframe.

#### **H. PROJECT:**

**This project will be divided into two parts. Parts 1 will comprise a written component and part 2 will contain an oral component. The class will be divided groups of 2-3. Students are allowed to select their own group member(s). However, all students must draft and abide to the contract provided in the syllabus (see part 1 for more information). There is no room for quotes or plagiarism in this or any of the sections for each part of the project. If you are unsure if you are plagiarizing an idea or sentence, please refer to <http://lib.guides.umd.edu/BIOE 120> for more guidance.**

#### **Part I (Sub-Total: 10%)**

Each group needs to identify an ORIGINAL scientific journal article in an area of interest. The scientific journal article must not be a review article and should not be older than 2006! The journal article selected between the groups may not be repeated. To avoid this, each group must provide the title, author, and year of the selected journal article to the instructor by email by a designated deadline. In case a selected journal article is repeated, the instructor will notify the pertinent groups by email.

#### *Portion A: Contract (3%)*

Every student group will need to complete a contract document that will be provided by the instructor in BlackBoard. Every group member must revise, make additions, and sign the contract accordingly. The contract is to be sent to the instructor by email. After revision, students may need to re-sign the final contract. The contract to be sent to the students will contain the following information:

- a) Name of group members and section
- b) Title of their project

- c) Expectations from each student (every student should draft what they expect each member to do and how much or little work are they allowed to do)
- d) Plan of action in case a group member is not cooperating; *it is recommended that the group keeps all copies of the emails in case further action is to be taken*
- e) Procedure on how the group will re-assign tasks if a student drops the course before completing the project?
- f) Steps needed to ensure uniform formatting of project
- g) Any additional information that is important for the group
- h) Signatures

Before the contract is approved by the instructor, it is recommended that the group sends the instructor a draft of the contract. Any recommended changes by the instructor should be addressed before the final contract is approved. Keep in mind that everyone in the contract will be held accountable and can result in an automatic expulsion from the group and a zero in their project if they do not abide to what is written in the contract!

*Portion B: Written Report (7%)*

Part 1 Portion B of the project is worth 140 points (40 points for the online peer evaluations and 100 points for the written report). The structure for the written report is as follows:

- 1- Cover Page (1 page; will not be counted for the page limit; each student will type their name and indicate the sections they contributed to in the project and sign their name next to the entry; the cover page should contain the academic integrity pledge; be sure to include the journal article title along with the names of the authors, journal name, journal volume, and year of publication)
- 2- Background (½-1 pages; provide a brief description of the theory and motivation behind the journal article; summarize, in your own words, the hypothesis the authors tested)
- 3- Methods (1-2 pages; In your own words, describe those methods that included bioengineering techniques described in the course (e.g., statistics, laboratory protocols, instrumentation))
- 4- Results (1-2 pages; describe to the best of your ability the results the authors found)
- 5- Discussion (½-1 page; describe to the best of your ability the discussions and conclusions the authors found)
- 6- References (no page limit; will not be counted for the page limit; do not use Wikipedia or similar search engine as your reference! References could be books, scientific journal articles, short papers, patents and should be properly cited in the text in numerical form and in the reference page using the NLM style for authors, editors, and publishers <http://www.ncbi.nlm.nih.gov/books/NBK7256/>). Include at least 5 separate references.

The format for the project is as follows: Single or 1.5 line spacing, Times New Roman (no less than 10 point!), Margins should not be less than 0.75 inches. Figures, tables, and schematics are included as part of the methods, results, and innovation/application sections. The report in its entirety (not including cover page and reference pages) should not exceed 6 pages!

The tentative grading rubric for the written report is as follows:

- 1. Cover Page (10 points; not included in final page count)
  - a. Academic integrity pledge statement included in cover sheet \_\_\_\_\_/ 2
  - b. Each group member typed and signed their name \_\_\_\_\_/ 3
  - c. Each section assigned to the group member was identified \_\_\_\_\_/ 3
  - d. Name of author(s), article title, and publication page and year included \_\_\_\_\_/ 2
- 2. Background (15 points)
  - a. Brief description of the background \_\_\_\_\_/ 5
  - b. Brief summary of motivation \_\_\_\_\_/ 5
  - c. Summary of hypothesis to be tested \_\_\_\_\_/ 5

3. Methods (12 points)
  - a. Summarize any results, protocols, or techniques that included any topic covered in the course \_\_\_\_\_/ 9
  - b. Properly cited each figure, graph, table in the figure legend \_\_\_\_\_/ 3
4. Results (15 points)
  - a. Summarize the main findings in the article with minimal use of numbers in text \_\_\_\_\_/ 10
  - b. Identified why the results selected are important for the report \_\_\_\_\_/ 5
5. Discussion (12 points)
  - a. Summarize the article in the group's own words (not one person's input!) \_\_\_\_\_/ 4
  - b. Discuss how the results relate to the overall goals of the paper \_\_\_\_\_/ 4
  - c. Include one paragraph discussing a limitation to the paper \_\_\_\_\_/ 4
6. References (3 points)
  - a. Provided proper in-text citations \_\_\_\_\_/ 3
  - b. Followed NLM style in reference section \_\_\_\_\_/ 3
7. Formatting/Grammar (6 points)
  - a. Followed guidelines (margins, line spacing, font size, figures, tables) \_\_\_\_\_/ 3
  - b. Did not have major grammatical errors and misspellings \_\_\_\_\_/ 3

Each group will receive a rubric, their graded material and a comments page. Any comments or suggestions should be addressed in part 2 of the project.

**Additional Deductions: I expect the project to be a group effort! This means that I do not want to see a report with different sections that were compiled the night before the due date. The flow of the words must be uniform and it should be clear that there is a single writing style and format (not written and drafted by one person but rather by the group). If I read a "broken" report, keep in mind that there will be deductions at the discretion of the instructor!**

**Part 2 (Sub-total: 5%)**

Each group has to prepare a 5-7 minute PowerPoint presentation and summarize to the class the background, goals, and main findings of the selected journal article for Part 1. There will be an additional 2-3 minutes for questions by the class. In addition, each group needs to turn in to the instructor the PowerPoint presentation as well as a one page handout, both in PDF format. The handout should contain important definitions as well as 3 quiz-worthy questions with answers that are relevant to their presentation. This material should be emailed to the instructor 24 hours before their assigned presentation date. Include the group number and names of the group members in the email. Make sure the information is accurate as select material could be used for a future exam!

The presentation and handout material will be judged by the instructor and the TA. Part 2 of the project is worth 60 points (20 points for the handout, 40 points for the oral presentation). The tentative grading rubric for the presentation and the handout are defined below:

*Handout:*

- 1- Provided proper handouts (slides, definitions, and main topics) as an electronic copy to instructor \_\_\_\_\_/ 4
- 2- Content is sound, organized, and easy to follow; references were included as needed \_\_\_\_\_/ 4
- 3- No grammatical mistakes or misspellings \_\_\_\_\_/ 4

*Oral Presentation:*

- 1- Students were confident and poised while presenting with the material and answering questions from the class \_\_\_\_\_/ 4
- 2- Students used a clear voice and maintained a good pace \_\_\_\_\_/ 4
- 3- Students did not use filler words when speaking, content was clearly supported with references, and slides contained no misspelling or grammatical mistakes \_\_\_\_\_/ 12
- 4- Purpose of journal article is clearly stated; the information presented is logical and flow well \_\_\_\_\_/ 8
- 5- Students maintained audience interest \_\_\_\_\_/ 4
- 6- Students used time adequately to present topics without rushing \_\_\_\_\_/ 4

*Additional Deductions for Project (Part 1 and Part 2):*

The project is a GROUP effort, which means that EVERYONE must present a portion of the presentation as well as contribute to the question and answer session. Failure to demonstrate each student's contribution to the project will result in an automatic 20% reduction in the final project grade! Proper formatting and following the instructions correctly is also important. Failure to do so will result in a 10% deduction from the final project grade! If the project exceeds the page limit, there will be a 15% deduction. If handouts are not provided, there will be a 15% deduction.

Project Grade (Part 1 and Part 2):

The grade is collective and not individual! Therefore, make sure that everyone's section is up to par and that there are no mistakes that will compromise the group's grade.

**I. TIPS FOR SUCCESS IN THE CLASS:**

- f. **Attend** class every time. Regular attendance is essential for success in this course and is correlated to your final grade.
- g. The **general rule of thumb for studying** for university-level courses is that for one lecture hour, study time should increase 2-fold. That means that for a 3-hour credit course, nine hours of study time should be anticipated (3 hours of lecture + 6 hours of study time).
- h. Be **consistent** (turn in every assignment on time).
- i. **Read the syllabus** constantly to keep track of the assignments, projects, quizzes, and exams.
- j. **Schedule study time** (do not confuse staring at your text with quality study time)
- k. **Review your notes** after lecture.
- l. **Find a study group or tutor.** Either can help improve your grade.
- m. **Challenge yourself** (success in school is the result of hard work and persistence, not 'brains').
- n. **Do not be afraid of asking questions**, even if you think they may be thought of as 'dumb'.
- o. **Do not let your work pile up** or you will get behind.
- p. **Use the library.**
- q. **Do not try to cram information** at the last minute for a test.
- r. **Memorizing in this course is not enough** to guarantee a passing grade.
- s. **If you are having trouble, talk to me IMMEDIATELY.** Don't seek help too late into the semester.

**J. NEED HELP?:**

We encourage you to drop in during the scheduled office hours of the instructor and GTA, or email to arrange an appointment if the office hour times do not work with your schedule. Please consider forming study groups and using the Blackboard site for additional discussion. If you have difficulty



taking notes, exams, understanding important concepts, make use of the Learning Assistance Services at <http://www.counseling.umd.edu/LAS/> to participate in their workshops.

**K. TENTATIVE SCHEDULE OF LECTURES, READING, ASSIGNMENTS, AND EXAMS:**

Lecture	Date	Lecture Topic	Reading Assignment (before class)	Due Dates
1	8/30	Introduction; Syllabus; Cell Structure and Function	Ch 1 p. 3-12, 16-18	
2	9/4	Chemistry Review: Units, Bonds, Acids, Buffers	Ch 2 p. 32-39	
3	9/6	Chemistry Review: Carbohydrates, Lipids	Ch 2 p. 39-48	
4	9/11	Chemistry Review: Proteins, Nucleic Acids	Ch 2 p. 49-63, 74-76	HW 1 (9/11/12)
5	9/13	Bioenergetics and Membrane Transport	Ch 3 p.85-105; Ch 5 p. 173-182	
6	9/18	Enzyme Kinetics and Linearization	Ch 3 p. 105-112	Project Part 1 (Portion A) 9/18/12
8	9/20	Anaerobic and Aerobic Metabolism		
7	9/25	Bacterial Growth and its use for making Sustainable Fuels Sources	Handouts/Slides	
8	9/27	Applications 1: Ecological Engineering and Wastewater Treatment	Handouts/Slides	
<b>9</b>	<b>10/2</b>	<b>Mid-Term #1 (Lectures 1-8)</b>	<b>During Class</b>	
10	10/4	Eukaryotic Cell Cycle and Division	Ch 14 p 561-589	
11	10/9	Special Talk: Dr. Robert Fischell (meeting place and time TBD)		
12	10/16	Genes: Structure and Function	Ch 10 p. 386-399	
13	10/18	Genetics: Replication and Repair	Ch 14 p. 534-542, 552-558	HW 2 (10/18/12)
14	10/23	Genetics: Transcription and Translation	Ch 11 p. 421-430, 437-444, 457-467	
14	10/23	Methods 1: Measuring and quantifying gene expression	Handouts/Slides	
15	10/25	Cell-Cell Communications	Ch 7 p. 230-244	
16	10/26	Cell-Environment Interactions	Ch 15 p. 604-608	Project Part 2 (Portion B) 10/26/12
17	10/30	TBD and/or Review Session		
<b>18</b>	<b>11/1</b>	<b>Mid-term 2 (Lectures 10-17 although there may be materials from earlier lectures)</b>		
19	11/6	Basic Biostatistics: Standard deviation, Z-test, Workshops	Supplementary Book	
20	11/8	T-test, p-value, hypothesis testing, workshops	Supplementary Book	
21	11/13	Basic Biostatistics Chi-square:, ANOVA, Regression, Correlation; workshops	Supplementary Book	HW 3 (11/13/12)

22	11/15	Student Presentations	Handouts	Project Part 3
23	11/20	Student Presentations	Handouts	
24	11/22	TBD and/or Review Session		

25	11/27	<b>Mid-Term #3 (Lectures 8-12; but there may be material from first exam)</b>		
26	12/4	Methods 3: Microscopy	Ch 18 p. 715-728	
27	12/6	Applications 2: Stem Cells	Handouts/Slides	HW 4 (12/6/12)
28	12/11	Applications 3: Biomedical Devices and Tissue Engineering of Organs	Handouts/Slides	
29	12/14	<b>Final Exam (Comprehensive) 8:00am-10:00am</b>		