**BIO 102B Cell & Molecular Biology Spring 2023**

**Instructor:** Pablo D. Jenik ([pjenik@fandm.edu](mailto:pjenik@fandm.edu); 717-358-4431; LSP 354A).

**Office hours:** Tuesdays 9-11 AM, Thursdays 2-4 PM or by appointment (or drop by my office)

**Lectures** (LSP257):Mondays, Wednesdays, Fridays 11:00-11:50 AM

**Labs** (LSP343)**:** Wednesdays 1:30-4:20 PM

**Q&SC tutor (aka QUEST peer leader):** Anthony Tepetitla

**Course outline**

Cell and molecular biology, the study of cells and their components, is an extremely broad field of inquiry. It forms the bases for our understanding of other areas of biology such as genetics, physiology, development, and mechanisms of disease. This course is a survey of the main concepts of cell and molecular biology. It consists of five modules:

**Module 1: Introduction to the structure and chemistry of cells**

Topics: the structure and properties of atoms and molecules; an introduction to prokaryotic vs. eukaryotic cells and their components.

**Module 2: Cellular macromolecules: structure and function**

Topics: how biological macromolecules are synthesized and how their structure determines their function: proteins, enzymes and bioenergetics; lipids and membranes; polysaccharides; nucleic acid (DNA and RNA) structure.

**Module 3: Genetic information, its flow and regulation**

Topics: how genetic information is stored in the genome and how it is maintained through the generations and expressed via RNA and proteins: DNA replication, mutation and repair; transcription and post-transcriptional processing of RNA; translation and the genetic code; transcriptional regulation.

**Module 4: Intracellular dynamics**

Topics: how do cells work: the cytoskeleton; direct and indirect protein sorting; vesicle transport.

**Module 5: The cell in context**

Topics: how cells communicate and respond to each other and the environment: cell signaling; cell cycle and its regulation.

**Course learning outcomes**

The course is an introduction to the discipline. By the end of the class, you should be able to:

1. have an appreciation for the scientific process, through the learning of specialized vocabulary (“to speak like a cell biologist”), the practice of problems, the performance of experiments, and the critical analysis of classic and recent data.
2. prioritize reasoning over information, well-supported questioning over dogmas, discussion over the unconditional acceptance of the instructor's words.
3. analyze data generated using the techniques learned in lab and lecture.
4. understand the structure of a primary scientific publication.
5. make connections between the concepts of cellular and molecular biology and their applications in different areas of human affairs.
6. discuss the structure of the cell and the function of its various compartments.
7. explain the connections between the structure and the function of biomolecules.
8. describe the encoding and flow of information from DNA to proteins, and the regulation of the localization of the proteins in the cell.
9. describe the importance of the cell’s responses to the environment.

**Expectations**

The goal of the class is that **you learn the contents and skills** outlined above, and not to weed you out, or to sort you by ability. **I believe all of you are capable of such learning.** I promise to do my best to support you, so you can match or exceed the course expectations. I will work with you on any and all of the materials, and I encourage you to come see me to office hours whenever you have questions. I will also urge you to use all the resources the Q&SC and Academic Services have to offer.

This is an introductory class, and assumes no previous specialized knowledge. I understand that there will be people with different levels of exposure to biology and chemistry, depending on which science courses you took in high school or college. This class will be accessible to all.

You are highly encouraged to come prepared to class, by viewing and/or reading the assigned material. The goal of the class meetings is to highlight, discuss, and elaborate what I think are the most important points of each subject, through lectures, problems, and group activities.

I expect your active participation in the course. Participation means coming prepared to ask and answer questions, and to be involved in the class activities discussions. Merely attending class does not count as participation.

**Attendance and courtesies**

Attendance to lecture is not mandatory, but it is strongly recommended. **You will miss important content and discussions if you don’t come to class, and your performance will suffer accordingly.** Attendance to lab is mandatory (see the lab syllabus for details).Please be on time for lecture and laboratory. Late arrivals are disruptive and disrespectful to the entire class. You are allowed to use your computer or tablet only to take notes for class.

**Academic Honesty**

I am going to trust you, and that you will behave according to the College’s Policies and Procedures concerning Academic Honesty in the College Catalog online (<http://www.fandm.edu/catalog/academic-honesty>). ***You will be held to the highest standard***; any incident of plagiarism or dishonesty will be immediately reported to the Dean of the College. Remember this: College is a place where you learn and practice how to behave like a professional. Cheating might get you a better grade here, but it will lead to bad consequences in the real world.

**Commitment to an inclusive and equitable classroom environment**

In this class, we strive to create an inclusive classroom environment, where everyone feels welcome and treated with dignity and respect. We embrace the idea of an intellectual community that is enriched by diversity in all of its dimensions, including race, ethnicity, national origin, gender identity, sexual orientation, disability, religious and political identity, and socioeconomic status. Our class should be a safe space where we can engage with difficult ideas and challenging topics without feeling--and making others feel--threatened.

In order to do so, we will practice a few basic principles in class:

• Be open to feeling uncomfortable at times as a part of the learning process.

• Only one person should speak at a time; at all other times, you should be an active, engaged, and respectful listener.

• Speak clearly and loudly enough for everyone in the class to understand you. Do not assume that everyone in the class is a native speaker of English or that everyone is a hearing person.

• Be aware of how much you are talking and make sure others have a chance to contribute to the discussion. I will work to provide a space for everyone to participate.

• Critique the idea, not the person expressing it; base your arguments on solid evidence.

• At all times, keep in mind not only the intent of your comment, but the impact it will have on other members of the class.

• Each person is an expert of their own lived-in experience.

**Textbooks and other resources**

The suggested textbook is **Freeman and others, “*Biological Science*”, 7th edition, Pearson** **(2020)**. This is the same textbook that was used in some sections of BIO 110/101. **Older editions are essentially the same as the latest one.** There are copies on reserve at Martin Library.

Another excellent choice is **Alberts and others, “Essential Cell Biology”, Norton (3rd edition and later)**. There is one copy of the 3rd edition on reserve at Martin Library.

There will be links in Canvas for free Open Educational Resources (free textbook chapters) for as many topics as I can find.

I will provide you with brief external videos that illustrate or explain certain topics, or short lectures recorded by myself. Some sites other students found helpful include (but are not limited to): Khan Academy, Amoeba Sisters, and Organic Chem Tutor.

**Homework assignments and in-class activities**

You will have short homework assignments about once a week. They are due in two days. They can be done **individually or in pairs**. The goal of these exercises is to potentiate the learning process by having you apply the content you saw in class, and to practice for the exams. It also helps you and me realize which topics are not being understood. Homework will be graded on a three-point scale: not turned in (0); turned in, some issues with completeness or correctness (1); turned in, mostly or totally complete or correct (2). **I will drop the lowest grade from the grade calculation. No make-ups for homework assignments.**

We will also have in-class group activities, including the discussion of a paper from the primary literature. They’ll also be graded on a 0-2 scale (absent from class or not turned in, incomplete, complete).

**Deadline extensions**

If any significant issues arise that may lead to needing extra time to turn in work, please reach out to me as soon as possible, so we can discuss options.

**Exams**

There will be four exams. Each of the first three will cover the lecture material up to that point, while the fourth and final exam will also integrate all the topics from the course. Exams are mandatory. Excused absences require a written authorization from a Dean or the Student Wellness Center.

**Communication**

I will communicate via e-mail in Canvas or to your F&M address. I *expect you to check your Canvas inbox and F&M e-mail regularly.* E-mail is also the best way to reach me. I will normally respond within 24 hours, but I may not read my email in the evenings, and only in a limited fashion during weekends.

**Grading Breakdown**

Exam I 12%

Exam II 13%

Exam III 13%

Final exam 15%

Homework assignments 12%

In-class activities 10%

Laboratory 25%

**Lecture schedule (subject to change)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week** | **Day** | **Date** | **Class #** | **Topic** | **Textbook chapters reading** |
| 1 | W | Jan 18 | 1 | Module 1: Intro to the class |  |
| F | Jan 20 | 2 | Module 1: The chemistry of cells | Freeman Ch. 2 |
| 2 | M | Jan 23 | 3 | Module 1: Cellular organization | Freeman Ch. 7.1-7.3 |
| W | Jan 25 | 4 | Module 2: Protein structure and function | Freeman Ch. 3 |
| F | Jan 27 | 5 | Module 2: Protein structure and function | Freeman Ch. 3 |
| 3 | M | Jan 30 | 6 | Module 2: Bioenergetics and enzymes | Freeman Ch. 81.-8.4 |
| W | Feb 1 | 7 | Module 2: Bioenergetics and enzymes | Freeman Ch. 8.1-8.4 |
| F | Feb 3 | 8 | Module 2: Sugars | Freeman Ch. 5 |
| 4 | M | Feb 6 | 9 | Module 2: Lipids and membranes | Freeman Ch. 6 |
| W | Feb 8 | 10 | Module 2: Lipids and membranes | Freeman Ch. 6 |
| F | Feb 10 | 11 | Module 2: DNA structure | Freeman Ch. 4.1-4.2 |
| 5 | M | Feb 13 | 12 | Module 2: DNA structure | Freeman Ch. 4.1-4.2 |
| W | Feb 15 | 13 | Overflow |  |
| F | Feb 17 | 14 | **Review session**  **Take-home EXAM I (material to 2/15)** |  |
| 6 | M | Feb 20 | 15 | Module 3: DNA replication, mutation and repair | Freeman Ch. 15, 16.4 |
| W | Feb 22 | 16 | Module 3: DNA replication, mutation and repair | Freeman Ch. 15, 16.4 |
| F | Feb 24 | 17 | Module 3: Transcription and RNA processing | Freeman Ch. 17.1-17.2 |
| 7 | M | Feb 27 | 18 | Module 3: Transcription and RNA processing | Freeman Ch. 17.1-17.2 |
| W | Mar 1 | 19 | Module 3: Transcription and RNA processing | Freeman Ch. 17.1-17.2 |
| F | Mar 3 | 20 | Module 3: Transcription and RNA processing | Freeman Ch. 17.1-17.2 |
| 8 | M | Mar 6 | 21 | Module 3: Genetic code and translation | Freeman 16.2-16.3, 17.3-17.5 |
| W | Mar 8 | 22 | Module 3: Genetic code and translation | Freeman 16.2-16.3, 17.3-17.5 |
| F | Mar 10 | 23 | Module 3: Transcriptional regulation | Freeman 18, 19.1-19.3 |
| 9 | M | Mar 13 |  | **Spring break** |  |
| W | Mar 15 |  | **Spring break** |  |
| F | Mar 17 |  | **Spring break** |  |
| 10 | M | Mar 20 | 24 | Module 3: Transcriptional regulation | Freeman 18, 19.1-19.3 |
| W | Mar 22 | 25 | **Review session**  **Take-home EXAM II (material to 3/8)** |  |
| F | Mar 24 | 26 | Module 4: Cytoskeleton | Freeman Ch. 7.6 |
| 11 | M | Mar 27 | 27 | Module 4: Cytoskeleton | Freeman Ch. 7.6 |
| W | Mar 29 | 28 | Module 4: Protein sorting and vesicle trafficking | Freeman Ch. 7.4-7.5 |
| F | Mar 31 | 29 | Module 4: Protein sorting and vesicle trafficking | Freeman Ch. 7.4-7.5 |
| 12 | M | Apr 3 | 30 | Module 4: Protein sorting and vesicle trafficking | Freeman Ch. 7.4-7.5 |
| W | Apr 5 | 31 | Module 4: Protein sorting and vesicle trafficking | Freeman Ch. 7.4-7.5 |
| F | Apr 7 | 32 | Module 5: Cell-cell interactions and cell signaling | Freeman Ch. 11.3 |
| 13 | M | Apr 10 | 33 | **Review session**  **Take-home EXAM III (material to 4/5)** |  |
| W | Apr 12 | 34 | Module 5: Cell-cell interactions and cell signaling | Freeman Ch. 11.3 |
| F | Apr 14 | 35 | Module 5: Cell-cell interactions and cell signaling | Freeman Ch. 11.3 |
| 14 | M | Apr 17 | 36 | Module 5: Cell-cell interactions and cell signaling | Freeman Ch. 11.3 |
| W | Apr 19 | 37 | Module 5: Cell cycle and mitosis | Freeman Ch. 12 |
| F | Apr 21 | 38 | Module 5: Cell cycle and mitosis | Freeman Ch. 12 |
| 15 | M | Apr 24 | 39 | Overflow |  |
| W | Apr 26 | 40 | **Paper discussion** |  |
|  |  | **TBA** |  | **Review session during Reading Days**  **FINAL** |  |