Syllabus
Cell 3334 Section 0001
Term: Spring 2026

Instructor: Brent Bill, Ph.D.
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(The **best** way to contact me is to use the Canvas email system.)

Office Hours: Monday 10:00 AM- 11:30, Tuesday 12:30 PM-2:00 PM or by appointment.

Course Overview:
We cover the essential processes of the cell. Specifically emphasizing cellular chemistry, membrane dynamics and transport, cell signaling (communication), and the Central Dogma, ie. DNA -> RNA -> Protein (Francis Crick 1957).

Cell Biology is designated as a "Real World Problem Solving" course. We would like to collect data on your performance, so that we can make future classes better. Please see Canvas for more information. Your Mini-grant Essays (see below), as the capstone assignment, will be anonymized, and faculty from all over the University may read your work, and potentially members of the Southern Association of Colleges and Schools Commission on Colleges (our accreditation body). They will use your work to determine if this course and the University as a whole are helping you develop the appropriate skills and problem-solving techniques to function as real-world biologists.

Course Objectives:
Biology 3334 is an **intensive** course with a lot of material. Dr. Bill's teaching philosophy highlights the importance of hard work and immersion in the field. It will be **critical that you keep up** with reading, studying, and assignments. We attempt to cover equivalent material to Cell Biology classes across the country that investigate the molecular basis for cellular function, and assumes prior exposure to General Biology I (1306 or equivalent) and Organic Chemistry I. The course will build on the cellular concepts introduced in General Biology, complementing the introductory course by providing a more thorough presentation of the major aspects of cellular functioning.

1) Our understanding of Cell Biology has grown rapidly fueled by evolving technologies including microscopy, cell culture, recombinant DNA technology, Nucleic Acid sequencing, antibody production, site-directed DNA Modification, and the incorporation of systems and synthetic biology. The first objective of this class is to recognize these advancements and understand their implications for cell biology.
2) The process of science requires the application of current knowledge. Therefore, we will discuss classical experiments that illustrate how researchers have approached these problems in the past. Through this analysis, you should start to develop strategies for developing your own scientific approaches.

3) Inherent within the scientific method is a constantly evolving knowledge base. Scientist routinely form hypotheses based on the existing knowledge base, and then proceed to strengthen the support for or negate the initial fact that was the focus of the study; therefore, the third goal of the class is to utilize the current knowledge base of Cell Biology to form a new hypothesis and evaluate its potential.

Student Learning Outcomes:

1) Describe the diversity of life (and viruses) and how it is separated at the cellular level.
2) Describe types of stem cells and how they are used.
3) Compare and contrast the 4 major macromolecules, and how they are studied with examples.
4) Compare and contrast the types of microscopes utilizes and their benefits or Caveats.
5) Understand the processes by which molecules traverse the membrane and discuss these processes in reference to action potentials and the Electron Transport Chain.
6) Describe mechanisms by which cells acquire information from the extracellular space and transduce these signals to change cell behavior and physiology.
7) Describe the Central Dogma and discuss how a protein is made from DNA to secretion at the molecular level.
8) Describe how the processes of the Central Dogma can be regulated - specifically focusing on the Lac Operon.
9) Synthesize your acquired knowledge to develop a proposed novel experiment.

Required Textbooks and Readings:

1) BASIC CELL AND MOLECULAR BIOLOGY 4e: WHAT WE KNOW AND HOW WE FOUND OUT Gerald Bergtrom, 2020, *University of Wisconsin - Milwaukee*, bergtrom@uwm.edu, University of Wisconsin Milwaukee UWM Digital Commons. This text is open source and is available for free in Canvas.

2) This course requires the use of The SimUText for Cell Biology. This is an external website/resources that is used to complete homework. You will be **required to purchase** access to this material - Licenses available at the bookstore or upon login.

   a. Please follow the instructions on Canvas to subscribe to SimUText for Cell Biology at University of Texas, Tyler.

   b. Upon completion of your module, please check the “My Work.” All questions that you have completed will show up in a darker color with a check box. If it remains white, it has not recorded your work. Please verify that your work has been recorded, as you are responsible for verifying that your work has been properly recorded.

c. Problems or questions? Visit SimUText Support to search our Knowledge Base and view Video Tutorials.

d. If you are not able to find the answer to your question, you can submit a support request from the support page (link from Canvas) or (http://simbio.com/support/simutext)

Special Course Notes: --

1) Regular Canvas access is required. carefully read all announcements. Canvas and student email should be checked **DAILY** for new announcements or messages. All official communication should be through the Canvas email system.

   a. On Canvas you will find lectures, assignments, and much more that will be essential for you as you complete this course. Dates are tentative and subject to change; therefore, it is critical to pay attention to The Canvas Announcement System and modifications given during lectures. Course grades will be maintained in Canvas. **Please note that the percentage at the end of the grade book display will not necessarily be a good indicator of your grade in the class (see below).**

2) The faculty recommends obtaining the downloadable version of Microsoft office from the University for all work. https://www.uttyler.edu/it/office365/365-students.php. As stated on the website, the online version is scaled down, and is missing functionality, that we use in our class.

3) This course requires you to use external websites (i.e. Pubmed) and a citation manager to complete homework. These are free to use but require access to the internet. You can use any that work with your computer's operating system, and the library provides support for several versions. LeanLibrary is the suggested citation manager.

Assignments and point values:

1. Introduction Video	5
2. Pre-Test	10
3. Exams	
a. Exam 1	99
b. Exam 2	99
c. Exam 3	99
4. Comprehensive Final Exam	150
5. SimUText by SimBio	
a. DNA Explored	30
b. Action Potential Explored	30
c. Cellular Respiration Explored	30

	d. Transcription and Translation Explored	30
	e. Gene Regulation Explored	30
	f. Mitosis Explored	30
6.	Video Lecture/Canvas Quizzes	
	a. Stem Cells and Organ Transplantation	10
	b. Protein Folding and Disease	10
	c. Channelopathies	10
	d. Organellar Disorders	10
	e. Genomic Medicine	10
	f. Cancer	10
7.	Multiple Choice Exam Study Questions	
	a. Exam 1	5
	b. Exam 2	5
	c. Exam 3	5
	d. Final Exam	5
8.	Group Assignments and Worksheets	
	a. Synthetic Biology	5
	b. Signal Transduction	5
	c. Central Dogma Walkthrough (individual)	5
	d. Central Dogma Medicine	5
9.	Final Essay Topic	5
10.	Final Essay (Mini-Grant)	75
Total Points		**822**

Grading Scale:

A	760 or greater
B	660 to 759
C	560 to 659
D	520 to 559
F	below 519

Late Work: **No late work will be accepted!** All assignment due dates are listed. Part of learning to be a scientist is learning time management. When you are in a job or working on grants - deadlines are final! If you miss the deadline, you cannot submit; therefore, this will be good practice for your future career. If for some reason you cannot attend class or turn in an assignment, please reach out to Dr. Bill to determine if a deadline extension can be granted.

Make-Up Exams

You must take the exams on the scheduled dates. Please check your calendars now, so that you do not have conflicts. If an absence cannot be avoided, the professor must be notified in advance. If a student is unable to take an exam when scheduled, following appropriate documentation of the absence, the professor will arrange a make-up exam or provide an oral version depending on the nature of the absence. Dr. Bill does not guarantee that the exam will be the same format or questions as the in-person exam.

Acceptable Documentation: University Note: Have your professor or coach email me a letter explaining the reason for the absence due to a prescheduled University excused absence or civil documentation: If there are other extenuating circumstances, please provide the obituary, police report, court documents, or other evidence explaining the absence.

If you are sick do not attend class or meet in person with other students. Email Dr. Bill, and we can make alternative arrangements. Zoom is available via Canvas, so that you could meet with Dr. Bill or other students virtually.

Attendance Policy: UT Tyler attendance policy applies: see the Class Attendance policy in the catalog. Attendance will be assessed to meet with the Census policy, Canvas activity and class work will be utilized as a secondary measure of attendance.

Graded Course Requirements Information *TEC 51.9705 (HB 2504):*
***Pre-test*:** This is a pretest that is designed to give me an idea of what you know, so I can better determine the material and the level at which it should be covered. There is no material to study - I just want to know what you remember from previous classes. Please answer truthfully with the best answer choice, and if you do not know select the "I do not know" choice. At the end of the quiz, you will see the score that you obtained. After I have recorded the data, everyone that takes the quiz will get their scores adjusted to the full 10 points.

***Group Worksheets*:** The discussion assignments are to provide you a chance to apply the knowledge learned during class. They focus on Synthetic Biology, Cell Signaling, and the intersection of the Central Dogma with Medicine. Worksheets and materials will be provided, and the group will turn in a combined worksheet for the grade. Every student should turn in their own worksheet, but please cite your classmates as it will facilitate more rapid turn-around with the grading.

***Video Lectures and Associated Quizzes*:** There will be 6 online "quizzes." These quizzes will be based on previous lecture material and a video lecture. Each quiz will be 10 multiple choice questions. You can take the quiz as many times as you like, and the scores are averaged for all attempts. Whatever score is present as of the closure date will be recorded as the final grade. Closure dates are listed on the calendar. Closure time in 11:59 PM.

Quiz 1: Stem Cells
Quiz 2: Protein Folding Diseases
Quiz 3: Channelopathies
Quiz 4: Organelle Disorders (Mitochondrial, Peroxisomal, and Lysosomal)
Quiz 5: Future of Genetics in Medicine
Quiz 6: Cancer and its treatments

***Multiple Choice Exam Questions*:**

Prior to each exam, students should post 1 multiple-choice exam question to the multiple-choice question discussion board on Canvas based on the material for the upcoming test. The top questions will be placed on the exam. Each question posting is worth 5 points. You should include the following information.

1) The Question
2) Five possible answers, only 1 of which can be "all of the above", "none of the above", "both a and b", etc.
3) Your choice for the correct answer
4) The Rationale of why this is the correct answer

Please note that all four components should be there to receive full credit.

An Example:
Who was the first woman to win the Nobel Prize (Physics) and the first person to win a second Nobel Prize in a different discipline (Chemistry)? Hint: Her husband and daughter also have been awarded Nobel Prizes!

A) Linus Pauling
B) Rosalind Franklin
C) Marie Curie
D) Gerty Cori
E) None of the above

The correct answer is C - Marie Curie.
Rationale: She won the Physics prize in 1903 for describing radiation and the Chemistry prize in 1911 for discovering the elements Radium and Polonium. Her husband shared her 1903 prize, and her daughter won in 1935 for the synthesis of new radioactive elements. Linus Pauling is the only other person to win two Nobel prizes in different fields (Chemistry 1954 and Peace 1962). Rosalind Franklin was involved in the description of the structure of DNA, unfortunately she died prior to the Nobel Prize for the structure of DNA, and prizes cannot be awarded posthumously; therefore, she did not win the Nobel. Gerty Cori was the first woman to win the Nobel Prize in Medicine and Physiology for her work on the catalytic conversion of glycogen.

The purpose of this assignment is to make you critically think about the material prior to the exam. It will give me an idea of how well you are following the course material and let me know of any misconceptions that I might want to review prior to the exam. Lastly, since the top questions will be on the exam, it will give you the opportunity to know answers to some of the exam questions.

Final Grant*:*

The Final Grant requires you to apply all the knowledge you have acquired during the semester and apply it by proposing a novel experiment(s) based on the cell biological techniques and principles. The format will be similar to a grant that scientists are required to

write to obtain funding for proposed research projects. It also serves as a good review of the material for your final exam. Formatting and Content will be discussed in class.

This is a difficult assignment, so you can use any resource that you can obtain: journal articles, websites, discussions with the professor, i.e. Dr. Bill, or any other friend/relative/scientific genius you can rope into helping you. You may work individually or in groups up to 4 people of you choosing; however, if you work with others, you must cite your coworkers on the document, and all will receive the same grade. Every student is required to turn in their own assignment. Please note all students will attach have to attach their curriculum vitas to be included in the group.

You will have to do outside research for this project.

One resource that you may find helpful is the University Writing Center. It is available free of charge. You should plan early, as you will have to make an appointment, although a limited number of walk-in (zoom) slots are available. Their website is: https://www.uttyler.edu/writingcenter.

Exam Policies:

Exam questions will be drawn from the lectures, student written multiple choice questions, SimBio Modules, and assigned video lectures. They will be multiple choice. A 3-inch X 5-inch index card (piece of paper) will be allowed for each of the exams. You may fill the front and back with whatever you would like; however, they must be handwritten (no typed documents).

You are expected to follow the **University Honor Code**. All forms of cheating will be prosecuted harshly. Please note - cell phones are not allowed during any of the exams in this class. Phones should be kept on the table in front of you face down during the exam. The usage of a phone during the exam is grounds for an automatic 0. The professor may video the exams to validate any instances of cheating.

Final Exam:

The final exam will cover new material between exam 3 and the end of the class; as well as **comprehensive material**, meaning that it will cover all material from the class. It will be important for you to keep your previous exams, the pre-test, quizzes, notecards, and assignments as study guides. The final exam is scheduled Monday, April 27, 2026 at 8:00 A.M. in our normal classroom. You will be able to utilize a handwritten 4-inch X 6-inch index card for the final exam, front and back. All other information is identical to the above Exam Policies.

Extra Credit:

There will be an opportunity to receive up to 25 points extra credit by writing extra credit essays. For each presentation, video, or paper that you attend, watch, or read; you will write a short 2-paragraph essay.

The first paragraph should summarize the topic of the presentation. Start by identifying if this was primary or secondary information (did they or their lab perform the research or is this a summary of the field.

For primary articles, please pay specific attention to their approach to problem solving – What was the hypothesis? What approach did they follow to answer the questions they proposed?

For secondary articles, please highlight what you feel is the perspective of the author? Are they just summarizing the information or do you feel they were trying to persuade you of something? Are they providing any new analyses of the data that were not provided in previous works?

The second paragraph should focus on something that you found interesting. *** please note that I am not looking for what the authors are telling you is interesting rather *what you personally think!* The second paragraph should conclude with a question that you had inspired by the presentation, video, or paper.

Each Essay is worth 5 points, and you can upload up to 5 in the Extra Credit section on Canvas. Please note, it is my view that as a scientist, you will continually be formulating questions as you acquire new knowledge; therefore, "I did not have any questions, the speaker did a good job." Is not an acceptable concluding sentence. That tells me that you only passively listed to the material, and points will be deducted from the 5-point total.

Options include:

- The Biology Department Seminar: Fridays, from 1-2 P.M.
- Darwin Day (Feb 12-13): Lectures at TJC and UT Tyler.
- The movies at UT Tyler or TJC for Darwin Day.
- Papers: Found in the Extra Credit Section of Canvas.
- Video Seminars: Found in the Extra Credit Section of Canvas.
- The Physiology candidate presentations.
  # These talks will be held in our lecture session. I will have a special rubric for you to fill out for these talks. These will have an earlier deadline than the other extra credits; however, they also provide you the opportunity to help us decide the identity of the next UT Tyler Assistant Professor of Physiology.

<u>Class Expectations</u>

- Be Courteous and on time for classes, with assignments, and when meeting with group members.
- Silence cell phones and other electronic devices, and do not answer your phone while in class.
- Discussion is welcomed during the lecture, so please feel free to ask/answer questions, seek clarification, etc. If you need extra help, or we are pressed for time during class, please see me during office hours or ask the question in the Q&A. If I do not get questions - I will assume you understand, and I can move on - I know from experience

this is not always the case and given the opportunity, I will move fast. But I really appreciate the chance to diverge from the slides and get more in depth or clarify topics.

- You are strongly urged to attend class, this is a **fast-paced class**, and we will be covering and large amount of material. It is **your responsibility to keep up** with the material. Staying on top of the material will be critical to success. Tradition dictates 3 hours of study time per hour of classroom time. Therefore, you should plan to spend at least 9 hours a week outside of class time on this course.
- Please do not hesitate to ask questions! Please realize, that if submitted via email, I may not receive the question and answer it immediately; however, I will try my best. For example, if you email me Tuesday night at 11:45 P.M. the night before the exam, you may not get an answer until the next day, which may not be prior to the exam.
- If I am meeting with someone, please wait your turn. Do not just walk in and sit down. In some instances, we are discussing grades or other private matters, and it is unprofessional to interrupt.
- Due to unforeseen circumstances, I may use zoom office hours instead of in-person, if working with a student I may turn on the waiting room feature, if so please hang out until I can bring you in.
- Participate: Staying actively engaged in the lectures will increase your retention. It also helps me to understand if the class is understanding the material. Therefore, throughout the lectures there are class questions. Please volunteer to answer if you think you know it. I will move around the room, so if the same people are answering do not be surprised if you get called on.

Artificial Intelligence Statement (Based on a policy from Clemson University and OpenAI. (2021). GPT-3 API. Retrieved from https://beta.openai.com/docs/api-reference/introduction):

You **are allowed** to use AI on assignments or to study for class.

AI is not be used for extra credit. For a philosophical discussion of AI in the classroom please read: https://emergingethics.substack.com/p/why-were-not-using-ai-in-this-course. I think that it is actually a very important thought experiment that reframes this course as well as all of your college experiences.

Learning to use AI is an emerging skill – the programs and webtools using it are proliferating rapidly, and I assume many will try to leverage it for your work. I look at this much as I do other tertiary sources; therefore, be aware of the limits of these software systems.

A. AI is vulnerable to discrimination because it can inadvertently (or intentionally) perpetuate existing biases present in the data it is trained on. For example, if an AI system is trained on data that contains a bias against a certain group of people, the system may make decisions that are unfair or discriminatory towards that group. There are several reasons why AI systems can perpetuate discrimination:

i. Bias in the training data: If the training data contains biases, the AI system may learn and replicate those biases in its decision-making.
ii. Lack of diversity in the training data: If the training data does not include a diverse range of examples, the AI system may not perform well on diverse inputs, which may lead to discrimination.
iii. Lack of transparency: Some AI systems can be difficult to understand and interpret, making it challenging to detect and correct for biases.
iv. Lack of accountability: Without proper oversight and accountability, it can be difficult to identify and address discrimination in AI systems.
v. It is important to keep in mind that these biases can be unconscious, unintended and hard to detect, but they can have serious consequences if they are not addressed.

B. AI can be a valuable tool for augmenting human decision-making and critical thinking, but it is not a replacement. Remember you job as a scientist is to generate new information that does not exist. Therefore, a trained AI that regurgitates what is known may not be that useful.

C. AI is a tool, just like a pencil or a computer. However, unlike most tools you need to acknowledge using it. Pay close attention to whatever information you use in your own work that is produced from AI and explain how/what you used at the end of assignments. Basic attribution rules apply. Cite everything,

    a. I would suggest using your prompt as the article title in your citation manager.
    b. The software name (Open AI, ChatGPT, etc.) as the Author
    c. The date that you access the query can be the publication date – Day, Month and year.
    d. Enter the website for access.

D. If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get better outcomes. Prompt engineering is the most critical part of effective AI use. This will take time and practice.

E. Don't trust anything the systems says. Assume it is wrong, unless you already know the answer and can verify with trusted sources. It works best for topics you deeply understand. Please note you must check sources that the AI platform provides there are publicized instances that have noted the use of non-existent constructed citations.

F. Use your best judgement to determine if/where/when to use these tools. They don't always make products easier and/or better. You should also realize that most of these tools are not designed to work with the scientific literature, rather they rely heavily on popular works and older works that are open to the public; therefore, content and style make actually be worse than what you can do yourself.

Large language models and chatbots are ""look back"" machines. They don't advance knowledge (yet). For example, ChatGPT-5 uses data from August 2025 and earlier (a lot has happened since August☺). This also assumes you have the latest update if you chose to install the application (It could be older) There is no replacement for your original thought.

Calendar of Topics, Readings, and Tentative Due Dates

Week #	*Date*	*Class Topic*	*Readings*	*Assignments Due*
Week 1	M 1/12	Introduction to Cell Biology – The Why!	Syllabus, Chapter 1	
	W 1/14	The Diversity of Life and Viruses.	Chapter 1	
	F 1/16	Microscopes	Chapter 1	Introduction Video, Pretest
Week 2	M 1/19	No Class Martin Luther King Holiday	"Nothing in the world is more dangerous than sincere ignorance and conscientious stupidity." MLK Jr.	
	W 1/21	Cell Culture, Stem Cells, Organoids, **Experimental Design**.	Chapter 1	Video lecture quiz on stem cells.
	F 1/23	The Chemistry of Life - The Macromolecules: Carbohydrates, Lipids	Chapter 2	
Please note: 1/26 is the Census Date. I will be required to report attendance at this point. Please see https://www.uttyler.edu/registrar/policies/census_date.php for further details regarding Census.				
Week 3	M 1/26	The Chemistry of Life - The Macromolecules: Nucleic Acids	Chapter 3	
	W 1/28	Nucleic Acid Sequencing	Chapter 3	
	F 1/30	Proteins	Chapter 3	SimUText: DNA Explored
Week 4	M 2/2	Protein Domains and Synthetic Biology	Chapter 6	
	W 2/4	Working with Proteins	Chapter 6	Synthetic Biology Worksheet
	F 2/6	Review for Exam 1		Multiple choice question exam 1, video lecture quiz protein folding and disease

Darwin Week Feb 7-13! Volunteer opportunities, Booths, Movies, and Keynote Lectures!				
Week 5	M 2/9	Physiology Candidate #1: Dr. Allen.	Video Lecture: Enzymes, Regulation of Metabolism, and the Importance of Post Translational Modification.	
	W 2/11	Exam 1		
	F 2/13	Physiology Candidate #2: Dr. Marting	Video Lecture: Introduction to membranes Reading: Chapters 16, 17.1-17.5	
Week 6	M 2/16	Movement through membranes	Chapters 16, 17.1-17.5	
	W 2/18	The Action Potential: an example of ion flow through a membrane.	Chapters 16, 17.1-17.5	
	F 2/20	**Discuss the mini-grant assignment.**		Video lecture quiz on channelopathies
Week 7	M 2/23	The Electron Transport Chain: an example of ion flow through a membrane	Chapter 7.1-7.4	SimUText: Action Potential Explored
	W 2/25	Cell-Cell interactions	Chapter 17.10	
	F 2/27		Video Lecture on Cell Signaling – Dr. Bill at TAS Conference – No in person meeting. Reading: Chapter 17.11-17.12	SimUText: Cell Respiration Explored
Please note: Tuesday, March 2 is the Last Day to Register for Spring Graduation.				
Week 8	M 3/2	Cell Signaling Discussion	Chapter 17.11-17.12	Video lecture quiz on organellar disorders
	W 3/4	Studying Cell Signaling	Chapter 17.11-17.12	Cell signaling group worksheet.

	F 3/6	Physiology Candidate #3: Dr. Kelly		Multiple choice for exam 2, Extra Credit Rubrics for Physiology Candidates!
Spring Break! Officially March 9-13.				
Week 9	M 3/16	Review for Exam 2	Video Lecture: The Gene, Genetics, and the genome Reading: Chapter 8 to 8.3.2	
	W 3/18	Transcription	Chapter 10.1-10.3	
	F 3/20	Exam 2		
Week 10	M 3/23	Transcription	Chapter 10.1-10.3	Mini-Grant Topic
	W 3/25	Transcript Modification and miRNA Regulation	Chapter 10.4, 13.2.3	Video lecture quiz over the genomic medicine
	F 3/27	Transcript Modification and miRNA Regulation	Chapter 10.4, 13.2.3	
Please note that Monday, March 30, is the last day to withdraw from classes (W).				
Week 11	M 3/30	Translation	Chapter 11.5-11.6	SimUtext Transcription and Translation Explored.
	W 4/1	Translation	Chapter 11.5-11.6	
	F 4/3	Endomembrane System	17.6.2-17.9.1	Individual Central dogma worksheet Part 1
Week 12	M 4/6	Endomembrane System	17.6.2-17.9.1	
	W 4/8	How to: Studying Gene Function in Disease		Group central dogma worksheet Part 2
	F 4/10	Review for Exam 3		Multiple choice for exam 3
Week 13	M 4/13	Prokaryotic Gene Expression	Chapter 12.1,12.2,12.5,12.6	
	W 4/15	Exam 3		

	F 4/17	Eukaryotic Gene Expression		Gene Regulation Explored
Week 14	M 4/20	How To: Studying Gene Expression		SimUText Mitosis Explored
	W 4/22	The Cell Cycle and Cancer	Chapter 19	Video lecture quiz over cancer
	F 4/24	Review for Final		Multiple choice question for the final, Extra credit essays, Final essay (mini-grants).
Week 15: Final: April 27, 8:00-10:00 AM, Final is comprehensive!				
Spring Commencement: May 1 and 2nd, Final Grades Due May 5 (available shortly after).				