## **Spring 2024 - BTEC 1010: Fundamentals of Biotechnology I**

Instructor: Dr. Colleen Hough (she/her) – colleenh@uvu.edu

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**The best way to get a hold of me is email, canvas messages, or Teams!**

Class Times: T/Th 10-12:50pm (sec 002) in SB069 lab

Office Hours: T-Th 9-10am or by appointment. I can also be around after 3 in SB069 or SB052b but let me know you’re showing up.

Text: None – just handouts – also, everything will be on Canvas!

**Helpful student resources:** [**https://www.uvu.edu/studentcare/**](https://www.uvu.edu/studentcare/)

**Important dates:**

* **Wait list period ends Jan 16th; late fee and department approval begins - Jan 17th.**
* **The last date to drop with refund and without a grade showing on the transcript is Jan 29th.**
* **Last day to add classes (financial aid deadline too) is Jan 31tst.**
* **The last date to withdraw is Mar 18th.**
* **Classes end on Mar 23rd and finals “week” is Thursday April 25th – May 1st**

**MISSION**:

The goal of the course is to provide awareness of biotechnology-related careers, increase general scientific literacy, provide objective, critical thinking opportunities, and link biotechnology to real world scenarios. Objectives include:

1. Comprehension of basic biology concepts such as DNA replication, transcription, translation, and protein folding, gene expression, mutations and evolution, and plasmid manipulation in *E. coli*
2. Introduction to a myriad of biotechnological applications and associated bioethics involved
3. Providing hands-on laboratory and critical thinking experiences
4. Understanding laws and regulations for creating, testing, and manufacturing biotech products
5. Encouraging entrepreneurial creativity by providing an opportunity to “develop and market” a potential biotechnology product

**POLICIES:**

1. Classes begin M 1/8 & end Tu 4/23 (W 4/24 is interim day)
2. Holidays: MLK day 1/15, Pres Day: 2/19, Spring Break 3/11 to 3/15
3. **Attendance is imperative for participation in class activities, labs, and discussion, and lack thereof will be counted against your grade** – let the instructor know if you will need to miss a class. (You may have to make it up somehow, except labs, or forfeit the points).
4. Submit assignments on time or lose 3 points for every day the assignment is past due.
5. Plagiarism will result in zero credit (& ruin your personal and academic reputation forever).
6. Grading and assessment: Activities, discussions, labs, etc. are designed to allow you to increase your scientific literacy, explore your potential interests in Biotech, overcome any fears of science you may harbor, help you identify the science in your everyday world, and to let me gauge what activities were beneficial (or not) to your learning.
7. **I can’t stress participation enough!**  This is a general ed, scientific intro-type class so discuss, argue, sing, do an interpretive dance, whatever to get the class thinking about science and biotech! YOU ARE GRADED HEAVILY ON PARTICIPATION. IF YOU MISS HALF THE SEMESTER (or a third even) YOU WILL **NOT** GET AN “A” NO MATTER WHAT!
8. A final presentation from each student on an invention of their own will be required that incorporates not only the “invention” itself but also the manufacturing and marketing of the invention. Please be working on this or at least thinking about it throughout the semester!
9. If you loved the lab-work, come back for BTEC 2010!

**FORMAT:**

We will discuss history and current events in the biotechnology field, the central dogma of molecular biology, and information regarding what scientists in the biotech field do. We will explore various biotech applications (GMOs, medicine, diagnostics, laws, & manufacturing) and incorporate the bioethical implications of those technologies. Become aware of science in your everyday life! Throughout the semester you will gain experience in basic laboratory techniques, critical thinking, communication, and scientific analysis.

**TOPICS COVERED:** *Dates and topics subject to change*

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| --- | --- | --- | --- |
| **Week** | Date | **Topic** | **Assignment** |
| 1 | T – 1/9 | Syllabus; Principles of Curiosity video; What is a scientist discussion/scientific method worksheet done in class in groups | **Scientific method worksheet**; syllabus quiz *on Canvas* |
|  | Th – 1/11 | Career Review – What biotechies really do; notebooks | **Canvas Syllabus quiz due** |
| 2 | T – 1/16 | Cracking the Code of Life video (w/ study guide) |  |
|  | Th – 1/18 | Central Dogma 1; DNA replication (replication activity) | Pre-lab 1 due before lab |
| 3 | T – 1/23 | Central Dogma 2: Transcription – DNA to RNA -transcription activity and cheek cell DNA extraction lab | **Pre-lab 1 on DNA extraction due** |
|  | Th – 1/25 | Central Dogma 3; Translation – RNA to protein (codons and translation activity) |  |
| 4 | T – 1/30 | Central Dogma 1, 2, 3; DNA to RNA to Protein - putting it all together with Insulin | **Homework**: find your “In the News” article |
|  | Th – 2/1 | **In the News in-class assignment** | **Present your article** |
| 5 | T – 2/6 | Pipetman practice; safety; lab layout | **Read protocols** |
|  | Th – 2/8 | Bacterial transformation with pGlo plasmid | Lab, **Pre-lab 2 on transformations due** |
| 6 | T – 2/13 | Analyze transformations; Final presentation discussion |  |
|  | Th – 2/15 | pGlo plasmid restriction digests; paper cloning activity | Lab, **Pre-lab 3 on restriction digests due** |
| 7 | T – 2/20 | PCR of pGlo plasmid; finish paper cloning activity | Lab, **Pre-lab 4 on PCR amplification due** |
|  | Th – 2/22 | Pour/run agarose gels; analyze digests and PCR | Lab, **Pre-lab 5 on gel electrophoresis due** |
| 8 | T – 2/27 | Black Death Video; Midterm review | **Study!** |
|  | Th – 2/29 | Single Nucleotide Polymorphisms; Cookie-ase  |  |
| 9 | T - 3/5 | **Midterm**! **Notebook check 1**  | **Midterm in class** |
|  | Th 3 - 7 | Transgenics presentation; presentation prep  | **In-class assignment** |
| 10 | *3/12 - 14* | *Spring Break* | RELAX! STAY SAFE! |
| 11 | T – 3/19 | Cracking Your Genetic Code - **transgenics/personal genomics discussion questions** | **In-class assignment** |
|  | Th – 3/21 | **GMO Discussion** | **In-class assignment** |
| 12 | T – 3/26 | GMO lab intro; start GMO lab (DNA extraction/PCR);  | Lab; **Pre-lab 6 due** |
|  | Th– 3/28 | GMO lab (Run pre-poured gels)/ Analyze | Lab |
| 13 | T – 4/2 | Human Experimentation – **FDA empowerment: the cases of the tainted cough syrup and the thalidomide disaster**  | **In-class assignment** |
|  | Th– 4/4 | Biomanufacturing - Teamwork, quality, & variation – make some meds! | Activity |
| 14 | T – 4/9 | BioManufacturing - GMP and SOPs - let’s cook!  | Activity; **Homework:** **read opioid crisis papers** |
|  | Th – 4/11 | **Opioid crisis discussion** | **In-class assignment** |
| 15 | T – 4/16 | ELISA diagnostics | **Pre-lab 7 due**; Lab |
|  | Th - 4/18 | **Entrepreneurship Presentations** | **Oral presentations** |
| 16 | T – 4/23 | **Entrepreneurship Presentations** | **Oral presentations** |
| FINAL | T – 4/30 9am | **Written final exam and notebook check 2** | **Written Final** |

**Grading:**

A = ≥ 93% B = 83-86% C = 73-76 % D = 63-66%

A- = 90-92% B- = 80-82% C- = 70-72% D- = 60-62%

B+ = 87-89% C+ = 77-79% D+ = 67-69% E = Below 60

**ASSIGNMENTS, WORKSHEETS, AND QUIZZES**

|  |  |  |
| --- | --- | --- |
| **Activity** | **Description** | **Points**  |
| **Class Participation** |
|  | This is a student-centered classroom requiring participation in activities and discussions. This style of teaching helps you become more engaged and **responsible for your own learning**. Lab analyses and discussions help you think critically, express ideas, troubleshoot, and give and receive feedback.  | **Points lost with absences and/or low participation, (no points gained)** |
| **Assignments – discussions and homework** | **35 points total** |
| *Scientific Method* | What is a scientist? What is the scientific method and how do you apply it in your everyday life? | **5 points** – group assignment **in class** |
| *Science in the News* | Become aware of the biotech around you. Identifying relevant news articles about biotech will keep you informed about cutting edge science and how it is changing our world today. (submit reference and title in canvas) | **5 points** - very short, **in-class** presentation  |
| *Prep for final presentation*  | Start brainstorming ideas for a great biotech product to present to the class at the end of the semester. There are ideas in the assignment description on Canvas. Start formulating your ideas and researching the science.  | **5 points** – **group assignment in class** |
| *GMO Discussion* | Discuss the video and the ethical debate about GMOs. What are your opinions and are they based on science or society? | **5 points – group assignment in class** |
| *Genetic engineering (Transgenics) & Personal genomics* | Group discussion about Cracking *Your* Genetic Code video and the Transgenics PowerPoint. What are the medical and ethical issues involved in knowing your (or your family’s) genetic code? What are the implications of the widespread availability of genetic testing? What are gene drives and gene editing technologies? | **5 points** – movie and **group assignment in class** |
| *The FDA: the tainted cough syrup case and thalidomide case study* | Read and discuss the case studies on tainted cough syrup and early pharmaceutical regulations and the thalidomide case study and increased FDA regulations. How does these cases relate to CFR45 and CFR21? How are these regulations holding up in the modern, opioid-addicted U.S.? | **10 points** - **group assignment in class** |
| *The opioid crisis* | Read papers, google search, and discuss the history of and failures leading to the opioid crisis in the U.S. **Please read the papers before coming to class!** Questions will be split up in class and then presented by you to the class. | **5 points** - **group assignment in class** |
| **Quizzes and EXAMS** | **100 points total** |
| *1* | Quiz 1 - Policies/syllabus questions | **20 - Canvas** |
| *2* | Midterm - Central Dogma, pipetting, and DNA manipulation (plasmids, restriction digests, PCR, and bacterial transformations) | **40 – in class** |
| *3* | Final – mutations, GMO identification, transgenics, regulations, biomanufacturing, ELISA | **40 – in class** |
| **Pre-labs (DUE BEFORE LAB – NO MAKEUP) – on Canvas** | **35 points total** |
| *1* | Lab worksheet 1 – DNA extraction | **5** |
| *2* | Lab worksheet 2 – Bacterial transformation  | **5** |
| *3* | Lab worksheet 3 – Restriction digests | **5** |
| *4* | Lab worksheet 4 – Polymerase chain reaction (PCR) | **5** |
| *5* | Lab worksheet 5 – Agarose gel electrophoresis | **5** |
| *6* | Lab worksheet 6 – GMO identification | **5** |
| *7* | Lab worksheet 7 – ELISA diagnostics | **5** |
| **NOTEBOOKS for lab experiments** | **29** |
|  | Lab objective, protocols, data, and analyses recorded in your notebook | **15 and 14** |
| **ATTENDANCE SELFIES (on Canvas)** | **1 point total** |
|  | Take a pic in class of your work or yourself to show your attendance | **.1 each** |
| **Final Project: 10-Minute Talk – Entrepreneur Presentation – In CLASS** | **50** |
|  | You will create a biotechnology product idea of your very own. You are responsible for developing a 10-minute talk (PowerPoint, poster, props, something) to present the idea to the class. HAVE FUN. This project should take about 10-20 hours total over the course of the semester. There is a rubric on Canvas that I follow as I grade while you do your presentation. **IMPORTANT: someone else’s product (like from an existing company) is NOT YOUR PRODUCT. IT MUST BE YOUR OWN INNOVATION.**The scientific background does not have to be based entirely upon reality but should be thoughtful and include scientific rationale and a scientific explanation. You should DESCRIBE the basics on how you would do the science behind the product. You must also discuss the problems you encountered trying to “create” this product. And there WILL be problems – I mean it takes more than 10-20 hours to create a product irl. You should also include to whom you would market this product.  |  |
| **TOTAL POINTS POSSIBLE** | **250** |

**Accommodations**

Students needing accommodations due to a disability including temporary and pregnancy accommodations may contact the UVU [Accessibility Services](https://www.uvu.edu/accessibility-services/) at accessibilityservices@uvu.edu or 801-863-8747. Accessibility Services is located on the Orem Campus in LC 312. Deaf/Hard of Hearing students requesting ASL interpreters or transcribers should contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu. DHH is located on the Orem Campus in LC 312.

**A WORD ABOUT AI IN CLASS:**

AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to develop your own individual voice.  At the same time, you should learn how to use AI and in what instances AI can be helpful to you.

The use of generative AI tools (e.g. ChatGPT, Google Bard, etc.) is permitted in this course for the following activities:

* Brainstorming and refining your ideas;
* Fine tuning your research questions;
* Finding information on your topic;
* Drafting an outline to organize your thoughts; and
* Checking grammar and style.

The use of generative AI tools is not permitted in this course for the following activities:

* Impersonating you in classroom contexts, such as by using the tool to compose discussion board prompts/responses assigned to you or content that you put into a Teams/Canvas chat.
* Completing group work that your group has assigned to you, unless it is mutually agreed upon that you may utilize the tool.
* Writing a draft of a writing assignment.
* Writing entire sentences, paragraphs or papers to complete class assignments.

You are responsible for the information you submit based on an AI query (for instance, that it does not violate intellectual property laws, or contain misinformation or unethical content). Your use of AI tools must be properly documented and cited in order to stay within university policies on academic honesty.

Any student work submitted using AI tools should clearly indicate what work is the student’s work and what part is generated by the AI. In such cases, no more than 25% of the student work should be generated by AI. If any part of this is confusing or uncertain, please reach out to me for a conversation before submitting your work.

**Title IX** states that no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.  Students who believe they have been excluded from participation in, denied the benefits of, or discriminated against because of their sex may contact the EO/AA office to make a report, ask questions, or share concerns by email at: titleix@uvu.edu, in-person at BA-203, or by phone at: (801) 863-7999. To learn more about the Equity and Title IX office please visit us online at: <https://www.uvu.edu/equityandtitleix/>.