

## Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: <https://catalog.uvu.edu/>

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**Semester:** Spring

**Course Prefix:** BTEC

**Course Title:** Advanced Nucleic Acids  
Laboratory

**Year:** 2025

**Course and Section #:** 2040-201

**Credits:** 3

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### ***Course Description***

Catalog: Teaches advanced nucleic acid modification and analysis methods. Includes site-directed mutagenesis, DNA sequencing, and RNA analysis methods, high-resolution DNA melting for genotyping and real-time PCR to quantitate DNA in samples. Incorporates methods to mutate 2 genes using CRISPR gene editing technology followed by RT-PCR to analyze gene expression (RNA isolation, creating cDNA, followed by real-time PCR).

This course teaches advanced techniques used in genetic engineering and gene expression. These include principles of in vitro mutagenesis, DNA sequencing, high-resolution DNA melting, real time PCR, RT-PCR, and CRISPR gene editing. You should also learn the scientific method, troubleshooting, data analysis, and how to think and perform independently.

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### ***Course Attributes***

This course has the following attributes:

- General Education Requirements
- Global/Intercultural Graduation Requirements
- Writing Enriched Graduation Requirements
- Discipline Core Requirements in Program
- Elective Core Requirements in Program
- Open Elective

Other: *Click here to enter text.*

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### ***Instructor Information***

**Instructor Name:** Biotech Professor

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### ***Student Learning Outcomes***

Course Learning Outcomes as per catalog:

1. Construct site-directed alterations of DNA sequences.
2. Determine the sequence of DNA molecules.
3. Isolate RNA molecules.
4. Analyze RNA molecules.
5. Construct DNA copies of RNA molecules

Also found on Canvas syllabus:

The overall goal of the course is to provide students with conceptual and practical knowledge in the field of nucleic acid biology. This advanced course is designed to be a stepping-stone to your work in a real-world laboratory, and thus emphasis is placed on independent work and troubleshooting.

Objectives include:

Developing hands-on skills in manipulating DNA and RNA

Developing an understanding of the operating principles of advanced instrumentation used in DNA and RNA analysis

Developing independent laboratory abilities and troubleshooting skills

Developing the ability to communicate effectively about complex biological topics through open discussion of experimental outcomes.

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## ***Course Materials and Texts***

No textbook. Handouts, canvas files, and internet connection

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## ***Course Requirements***

<b>Activity</b>	<b>Description</b>	<b>Points</b>
<b>Small presentation</b>	Next generation sequencing presentation	<b>10</b>
<b>Quizzes</b>	There will be quizzes covering each module ( <b>30, 30, 30 points</b> )	<b>90</b>
<b>Activity</b>	You will complete a CRISPR model/worksheet in class or home	<b>10</b>
<b>Class Participation/ Instructor evaluation</b>	Labs require participation. Because this course emphasizes hands-on training in the laboratory and includes advanced concepts and techniques, attendance and active participation in each session are crucial. You will not earn points for regular attendance and class participation; this is expected of you. However, absence or lack of fully engaged participation will result in loss of up to 5 points per lab session. Additionally, I will evaluate you on your preparedness for each session, active participation intellectually and at the bench, and experimental success.	<b>Only lost points here</b>
<b>Notebooks</b>	Lab notebooks will be graded at least twice during the semester. Employers require that lab notebooks be kept up to date at all times, and this course will uphold that standard as well. To encourage continual maintenance of notebooks, dates for notebook checks will not be announced in advance; you should ALWAYS be ready for a notebook inspection.	<b>60</b>
<b>Independent project outline</b>	You need to sketch out your independent project so you know what needs to be purchased and when you need to do each step. The outline must align to each step of the scientific method.	<b>15</b>
<b>Independent project proposal</b>	Learning techniques is a fun and useful for building your resume and skill set. However, these are just potential tools, and techniques change and improve all the time. A more important skill is to learn how to ask interesting scientific questions and design experiments to address them. You will implement the methods you've learned in your biotech courses to design an assay to answer a scientific inquiry. Based on these methods, or any other great techniques/ideas you've learned or created, you will produce a formal research proposal to test your hypothesis. Write up your idea, your experimental design, and explain how it will address the question. Include background about the issue, specific aims,	<b>30</b>

	reagents and equipment needed (budget), the protocols used, and the predicted or possible outcomes.	
<b>Final Presentation</b>	Scientific discourse is a skill that must be developed. To develop that skill and to strengthen your critical thinking skills, you will create a short presentation presenting your objectives, design and possible results and conclusions for your independent project.	<b>15</b>
<b>TOTAL</b>		<b>230</b>

Grading scale:

A = 93% & above      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

### Required or Recommended Reading Assignments

Handouts, independent research, video tutorials. See above.

### General Description of the Subject Matter of Each Lecture or Discussion

<b>Module</b>	<b>Lab activity</b>
Mutagenesis	pGlo plasmid preps. Spec DNA (dilute if necessary); Set up mutagenesis PCR. Prepare plates. DpnI digest and transformation. Analyze for GFP expression.
Sequencing	Sequencing primer prep. Pick colonies from tx plates (green and blue colony) and plate on a grid to mail to McLab. Intro to Sanger sequencing. Sanger activity. Analyze sequencing results. NGS presentation
CRISPR gene editing	Identify crDNA target for GFP gene (from pGLO sequence) and design guide RNA plasmid; Prep sgRNA/Cas9 plasmid for cloning; anneal oligos to create target for cloning. Digest and phosphatase vector, ligate to CRISPR-GFP annealed oligos; transform ligations and plate. Pick colonies and streak on plate for sequencing to verify clones. Bacterial transformation of verified clones PLUS pGLO plasmid into bacterial expression strain (T7). Assay for cas9 expression by adding IPTG to serial dilutions of GFP-expressing cultures/plates. Analyze for Knocked-down GFP expression.
Indie projects and proposals	Think about what you need to address your question. What is your hypothesis and what will your experiments be? Use the scientific method to design your project. Outline, proposal, reagents ordered, equipment, data analysis.
Bioinformatics	Exploring SNPs using UCSC Genome Browser; Bioinformatics tools <a href="https://genome.ucsc.edu/training/">https://genome.ucsc.edu/training/</a>
Real time PCR	Food Poisoning qPCR and standard curve analysis
RNA/cDNA	Isolate RNA; cDNA synthesis
Gene expression/RT-PCR	RT-PCR for confirmation of gene editing.
Genotyping	High resolution DNA melting to genotype ABCC11 alleles

### Required Course Syllabus Statements

## Generative AI

### 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 ideas;
- Fine tuning your research questions (not answers);
- Finding references for 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.

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### Using Remote Testing Software

This course does not use remote testing software.

This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

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## *Required University Syllabus Statements*

### Accommodations/Students with Disabilities

Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU [Accessibility Services](#) at [accessibilityservices@uvu.edu](mailto:accessibilityservices@uvu.edu) or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at [DHHservices@uvu.edu](mailto:DHHservices@uvu.edu)

DHH is located on the Orem Campus in BA 112.

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## **Academic Integrity**

At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their [rights and responsibilities](#). In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in [UVU Policy 541: Student Code of Conduct](#).

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## **Equity and Title IX**

Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – [TitleIX@uvu.edu](mailto:TitleIX@uvu.edu) – 800 W University Pkwy, Orem, 84058, Suite BA 203.

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## **Religious Accommodation**

UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.

To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at [accessibilityservices@uvu.edu](mailto:accessibilityservices@uvu.edu). If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a [specially dedicated space](#) for meditation, prayer, reflection, or other forms of religious expression.