# Syllabus

## I. General Information


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|---|---|
| Instructor: | Piotr Filipczak, PhD |
| Email | pfilipczak@unm.edu |
| Phone: | 505-925-8876 |
| Office Hours: | Monday, 1:30 pm – 3:30 pm (VHS 110, Biotechnology Lab)<br>Tuesday, 1:30 pm – 2:30 pm (VHS 110, Biotechnology Lab)<br>Wednesday, 1:30 pm – 3:30 pm (VHS 110, Biotechnology Lab) |
| Office Number: | VAAS 132A |
| Course Section: | 501 |
| Meeting Room: | VHS 110 |
| Meeting Time: | Tuesday and Thursday, 9:00 am – 12:45 pm |


## II. Course Description

The goal of this course is to provide you with the core conceptual foundation and hands-on experience required to perform basic laboratory techniques used in a biotechnology laboratory. It is essential that these skills are mastered, since this will be the basis for all of the techniques used in future courses. This class will provide theory and experience in lab safety and measurement, bacterial transformations and cloning, recombinant DNA, gel electrophoresis, tissue culture and basic bioinformatics skills.

Students will master many of these objectives by conducting a research project focused on new gene pathways contributing to malignant phenotype of p53-mutaed lung cancers. In brief, students will clone recombinant DNA vectors which will be used as tools to study interaction between TET1 oncogene and its possible downstream target HMGB1. These vectors will help to answer the question if TET1 regulates transcription of HMGB1 gene by directly binding to its promoter. They will also identify if the mechanism of this possible interaction involves cytosine demethylase activity of TET1 protein.

## III. Resources

Canvas (*learning management system for communication, grades entry, resources navigation and selected assignments*). All study materials will be provided to students by the instructor on a weekly basis via this platform. There is no textbook that students are required to purchase.

## IV. Student Learning Outcomes

**Outcome #1: Discuss the elements of laboratory safety.**

a) Explain the four types of laboratory safety controls including how they are designed to keep laboratory workers safe.
b) Identify individuals and organizations responsible for workplace safety.
c) Recognize chemical, biological and physical hazards present in the biotechnology lab.
d) Demonstrate the safe handling, labeling and disposal of chemical, biological and physical hazards.

**Outcome #2: Demonstrate techniques of laboratory measurement.**

a) Explain the units of measurement used in the biotechnology laboratory.
b) Define key terminology used in measurement and solution making.
c) Demonstrate appropriate selection and usage of appropriate instruments for measurements based on the application they will be used for.
d) Demonstrate the ability to accurately use pipet-aids (serological pipets), micropipettors, and electronic balances.

**Outcome #3: Demonstrate the preparation of solutions.**

a) Solve basic equations used in making solutions including mass/volume solutions, percent solution, molar solutions, making dilute solutions using a concentrated stock.
b) Demonstrate the basic steps used in solution making including technical considerations and safety.
c) Demonstrate the ability to accurately use pH meters.

**Outcome #4: Perform a bacterial transformation with plasmid DNA.**

a) Explain the fundamentals of bacterial transformation.
b) Define plasmid or vector DNA.
c) Explain and utilize antibiotic selection.
d) Demonstrate correct standard practices used in working with bacteria.
e) Perform a bacterial transformation experiment and interpret results.
f) Calculate the transfection efficiency of a bacterial transformation.

**Outcome #5: Utilize a mini-prep to extract plasmid DNA from bacteria.**

a) Explain the purpose of a mini-prep Perform a mini-prep.
b) Explain the function of the major steps in an alkaline lysis mini-prep.

**Outcome #6: Utilize restriction enzymes to perform a restriction digest.**

a) Explain what restriction enzymes are and how they are used in the biotechnology laboratory.
b) Demonstrate an understanding of the technical considerations associated with using restriction enzymes, both singly and in a double digest.
c) Utilize restriction enzymes to cut lambda DNA and plasmid DNA.

**Outcome #7: Perform agarose gel electrophoresis.**

a) Explain how gel electrophoresis is used to separate macromolecules.
b) Demonstrate an understanding of how DNA migrates through an agarose gel and factors which can influence its' mobility.
c) Explain the use of loading dye, ethidium bromide and DNA size markers or ladders in gel electrophoresis.
d) Prepare and run agarose gels of different percentage e. Interpret agarose gel results and properly label a gel photograph.

**Outcome #8: Perform a basic subcloning experiment.**

a) Define subcloning.
b) Utilize previously taught skills to move a gene from one plasmid to another.
c) Interpret results from subcloning experiment.

**Outcome #9: Perform a ligation reaction.**

a) Describe the use of ligations and their importance in recombinant DNA.
b) Explain the chemical reaction involved in ligation and identify required reaction components.
c) Utilize a ligation reaction in a cloning experiment.

**Outcome #10: Demonstrate Cell Culture Techniques.**

a) Define cell culture.
b) Explain the usage of different cell lines, including immortalized and primary cells lines.
c) Demonstrate knowledge of the proper selection, preparation and storage of media.
d) Calculate quantities of reagents needed to formulate media.
e) Describe important technical considerations associated with performing cell culture.
f) Perform basic cell culture tasks, including starting cells, feeding, splitting & counting cells, harvesting cells.
g) Utilize an on-line database to search for cell lines and appropriate growth media.

**Outcome #11: Utilize online resources to perform basic bioinformatics tasks.**

a) Utilize PubMed to search for scientific papers by author, date, subject and relevance.
b) Utilize an on-line search program to perform a basic restriction enzyme search and design a simple subcloning experiment.

**Outcome#12: Discuss the history and the current state of the field of biotechnology.**

a) Define biotechnology.
b) Describe the many scientific disciplines that contribute to biotechnology.
c) Provide examples of historic applications of biotechnology.
d) Describe different types of biotechnology and their applications.

**Outcome #13: Discuss current topics of importance in Biotechnology – Stem Cells and Cloning.**

a) Explain what stem cells are and their origins.
b) Explain why stem cells are so useful in biomedical research.
c) Describe obstacles to using stem cells in research and/or therapies.

d) Outline the ethical, religious and political concerns associated with embryonic stem cells.
e) Identify the relationship between stem cells and cloning.
f) Differentiate between therapeutic and reproductive cloning.

## V. Course Requirements

**Attendance:** In-person participation is required in this course. Students who missed 15% of a class time (which stands for 5 meetings) may be dropped by the instructor with a W, F or D (depending on the stage of the course). Students who are late 15 minutes or longer for the class may be forbidden to participate in the meeting as they may not be able to engage in laboratory activities efficiently and safely.

**Technology & Computer Requirements:**

- Dependable computer
- Reliable internet connection
- Computer speakers
- Reliable web browser
- Microsoft Suite (PowerPoint and Word)
- Adobe Flash Player

## VI. Students Evaluation Criteria

| Type of Assignment: | Points per Assignment: | Total Points in this Category: | Percentage of the Final Grade: |
|---|---|---|---|
| Quizzes (8x) | 10 pts | 80 pts | 27% |
| Lab Reports (8x) | 10 pts | 80 pts | 27% |
| Oral Presentations (4x) | 10 pts | 40 pts | 13% |
| Poster presentation (1x) | 30 pts | 40 pts | 13% |
| Final Exam | 40 pts | 60 pts | 20% |
| **Total** | **NA** | **300 pts** | **100%** |

- **Quizzes:** Taken in class. One lowest score will be dropped from the final grade.
- **Lab Reports:** Completed digitally based on experimental procedures performed in class and submitted via Canvas.
- **Oral Presentations:** Given individually in class using a slide format.
- **Poster Presentation:** Created with a lab partner and presented at the UNM Valenica Research Symposium in December of 2026. This poster will document the success (or the lack of such) of students' efforts to clone recombinant DNA vectors for different versions of TET1 and HMGB1 genes.
- **Final Exam:** To be completed in class during the final week of the course.

**Grading scale:**

- 100 or higher: A+
- 94-99.99: A
- 90-93.99: A-
- 87-89.99: B+
- 83-86.99: B
- 80-82.99: B-
- 77-79.99: C+
- 73-76.99: C
- 70-72.99: C-
- 60-69.99: D
- below 60: F

## VII. Course Policies

**Academic Integrity:** All homework, quizzes and exams in this course must be completed by students as their original and individual work. No group work is allowed when it comes to completing these assignments. While taking quizzes and exams, only resources listed by the instructor (such as non-graphing calculator, scratch paper, periodic table etc.) are allowed. Use of any other resources such as but not limited to textbooks, unauthorized internet websites, personal notes are forbidden. Plagiarism or cheating is not tolerated. Any instance of this will result in a grade of zero for that assignment. For more details on academic integrity violation examples, please see the UNM Academic Dishonesty: https://policy.unm.edu/regents-policies/section-4/4-8.html.

**Compliance and Safety:** Students must read, understand and obey safety rules while present in chemical laboratory. That will be documented by signing safety contract during the first on-campus meeting. Student who does not obey the safety rules and brings the risk on themselves or colleague students, may be suspended from the class by the instructor at any time of the course with the consequent non-passing grade.

**Communication:** Email is the best way to contact your instructor. My typical response time is less than 24 hours during the workweek and less than 48 hours during the weekend. A summary of the most important information about the course will be posted every Monday via Canvas course shell. Small changes to the original schedule and course design are possible and will be announced by the instructor in a timely manner via Canvas or UNM-associated email.

**Accommodations:** UNM is committed to providing equitable access to learning opportunities for students with documented disabilities. As your instructor, it is my objective to facilitate an inclusive classroom setting, in which students have full access and opportunity to participate. To engage in a confidential conversation about the process for requesting reasonable accommodations for this class and/or program, please contact Accessibility Resource Center at arcsrvs@unm.edu or 505-277-3506.

**UAP 2720 and 2740.** Our classroom and university should foster mutual respect, kindness, and support. If you have concerns about discrimination, harassment, or violence, please seek support and report incidents. Find confidential services at LoboRESPECT Advocacy Center, the Women's Resource Center, and the LGBTQ Resource Center. UNM prohibits discrimination on the basis of sex (including gender, sex stereotyping, gender expression, and gender identity). All instructors are "responsible employees" who must communicate reports of sexual harassment, sexual misconduct and sexual violence to Compliance, Ethics and Equal Opportunity. For more information, please see UAP 2720 and UAP 2740.

**Credit-hour statement:** This is a three-credit-hour course. Class meets for three 50-minute sessions/two 75-minute sessions of direct instruction for fifteen weeks during the Fall 2025 semester. Please plan for a minimum of six hours of out-of-class work (or homework, study, assignment completion, and class preparation) each week.

**Respectful Conduct Expectations:** I am committed to building with you a positive classroom environment in which everyone can learn. I reserve the right to intervene and enforce standards of respectful behavior when classroom conduct is inconsistent with University expectations [and/or classroom community agreements]. Interventions and enforcement may include but are not limited to required meetings to discuss classroom expectations, written notification of expectations, and/or removal from a class meeting. Removal from a class meeting will result in an unexcused absence. [Insert number] or more unexcused absences may result in permanent removal and a drop from the course (see attendance policy). The University of New Mexico ensures freedom of academic inquiry, free expression and open debate, and a respectful campus through adherence to the following policies: D75: Classroom Conduct, Student Code of Conduct, University Policy 2240 – Respectful Campus, University Policy 2210 – Campus Violence.

**Responsible Learning and Academic Honesty:** Cheating and plagiarism (academic dishonesty) are often driven by lack of time, desperation, or lack of knowledge about how to identify a source. Communicate with me and ask for help, even at the last minute, rather than risking your academic career by committing academic dishonesty. Academic dishonesty involves claiming that work created by another source is your own original work. It is a Student Code of Conduct violation that can lead to a disciplinary procedure. When you use a resource in work submitted for this class, document how you used it and distinguish clearly between your original work and the material taken from the resource.

**Thriving and Finding Support:** Students are especially successful at UNM when they take advantage of support and get involved in campus and academic life. Your MyUNM login page provides direct links to wellbeing resources, including financial capability, mental health, food, jobs, and resource centers.

## VIII. Course Schedule

| Week | Meeting Date | Topic | Assignment |
|---|---|---|---|
| **1** | 8/18<br>8/20 | Main concepts in biotechnology, laboratory safety and introduction to research project. | |
| **2** | 8/25<br>8/27 | Aseptic techniques and an introduction to human in vitro cultures. | Quiz #1 |
| **3** | 9/1<br>9/3 | In vitro cytotoxicity assessment using a crystal violet assay. | Quiz #2 |
| **4** | 9/8<br>9/10 | Total DNA isolation and spectrometric analysis of DNA concentration. | Quiz #3 |
| **5** | 9/15<br>9/17 | PCR amplification and electrophoretic analysis of amplicons. | Quiz #4 |
| **6** | 9/22<br>9/24 | PCR amplification and electrophoretic analysis of amplicons (continue). | Quiz #5 |
| **7** | 9/29<br>10/1 | Bioinformatic analysis and restriction enzyme digestion of amplicons. | |
| **8** | 10/6<br>10/8 – No Class | Molecular cloning of amplicons into an expression vector. | |
| **9** | 10/13<br>10/15 | Molecular cloning of amplicons into an expression vector (continue). | Quiz #6 |
| **10** | 10/20<br>10/22 | Transformation of the cloned vectors into competent bacteria. | |
| **11** | 10/27<br>10/29 | Purification of cloned vectors using mini-prep protocol. | Quiz #7 |
| **12** | 11/3<br>11/5 | Purification of cloned vectors using mini-prep protocol (continue). | |
| **13** | 11/11<br>11/13 | Sequencing amplicons cloned into recombinant vectors. | Quiz #8 |
| **14** | 11/17<br>11/19 | Bioinformatic analysis of sequenced amplicons. | |
| **15** | 11/24<br>11/27 – No Class | Comprehensive data analysis and poster preparation. | Quiz #9 |
| **16** | 12/1<br>12/3 | Paper write-up, oral presentations, peer reviews and course summary. | |
| **17** | **12/3** | **Final Exam** | |