

# Syllabus

## I. General Information

Instructor:	Dr. Piotr Filipczak
Phone/Email:	505-925-8876 / <a href="mailto:pfilipczak@unm.edu">pfilipczak@unm.edu</a>
Office Hours (on-campus):	Monday and Wednesday, 10:30 am to 11:30 am Tuesday and Thursday, 1:00 pm to 2:00 pm
Office Hours (online):	Tuesday and Thursday, 4:00 pm to 4:30 pm <a href="https://unm.zoom.us/j/97696043404">https://unm.zoom.us/j/97696043404</a> Meeting ID: 976 9604 3404
Office Number:	VAAS 132A
Course Section:	501
Meeting Room:	VAHS 110
Meeting Time:	Tuesday and Thursday (9:00 am to 12:45 pm)

## II. Course Description

Prerequisite: Biol 2710

The goal of this course is to provide theory and experience with protocols used to characterize and manipulate nucleic acids. This course will reinforce and build upon techniques learned in Biotechnology I. Techniques include DNA isolation and quantification, PCR, qPCR, gel electrophoresis, recombinant DNA technology, cloning, DNA sequencing, site-directed mutagenesis, tissue culture, and basic bioinformatics skills. Current issues and topics related to biotechnology will be explored.

## III. Resources

*Canvas (learning management system for communication, grades entry, resources navigation and selected assignments).*

## IV. Student Learning Outcomes

### **Outcome #1: Perform phenol-chloroform DNA isolation. Components:**

- Perform phenol-chloroform DNA isolation.
- Describe the function of the four basic steps of phenol-chloroform DNA isolation.
- Identify important technical considerations associated with working with DNA.

**Outcome #2: Analyze the quantity and quality of DNA in a sample. Components:**

- a. Describe how a spectrophotometer works.
- b. Utilize a spectrophotometer to quantify DNA samples.
- c. Interpret data provided by a spectrophotometer.
- d. Utilize an agarose gel to verify the quality of a DNA sample.

**Outcome #3: Utilize the polymerase chain reaction (PCR) to amplify and analyze genetic sequences. Components:**

- a. Explain the uses of the polymerase chain reaction and its importance in Biotechnology.
- b. Identify the essential components of a PCR reaction and technical consideration associated with their use.
- c. Explain the importance of primer design to the success of a PCR reaction.
- d. Describe the three steps of the PCR reaction e. Perform multiple PCR- based experiments and identify how PCR is used differently in those experiments.

**Outcome #4: Utilize real-time polymerase chain reaction (qPCR) to amplify and quantify a genetic sequence. Components:**

- a. Explain the fundamental principle underlying real-time PCR.
- b. Describe the applications of real-time PCR.
- c. Explain similarities and differences in real-time versus traditional PCR.
- d. Describe the different types of reporter methods used in real-time PCR.
- e. Conduct a real-time PCR experiment and interpret results.
- f. Explain the use of and interpret results from a Melt Curve Analysis.

**Outcome #5: Demonstrate the procedures required to determine the DNA sequence of a gene. Components:**

- a. Explain how the dideoxy or chain termination method of DNA sequencing works, both in manual and automated (i.e. dye terminator) sequencing reactions.
- b. Describe technical considerations associated with sequencing.
- c. Perform a sequencing reaction using fluorescently labeled dideoxynucleotides.
- d. Interpret a sequencing gel.
- e. Discuss goals and benefits of genome sequencing including the Human Genome Project.
- f. Describe the three steps of genome sequencing: preliminary sequencing, finishing and annotating.
- g. Describe "next generation" high-through put sequencing methods.

**Outcome #6: Perform the techniques required to clone a gene. Components:**

- a. Describe the process used to clone a gene.
- b. Identify the characteristics of a cloning vector.
- c. Perform a variety of previously learned techniques in order to clone a gene, including:
  - Ligation • bacterial transformation • antibiotic screening • mini-preps • restriction enzyme digestion
- d. Perform a variety of new techniques in order to clone a gene, including:
  - TA Cloning method • Blue-white screening.

**Outcome #7: Perform a PCR-based site-directed mutagenesis protocol. Components:**

- a. Define site-directed mutagenesis and explain the theory underlying PCR-based site-directed mutagenesis.
- b. Describe the uses of site-directed mutagenesis and its importance in biotechnology.
- c. Outline the function of the three steps utilized in PCR-based site-directed mutagenesis.
- d. Discuss technical considerations associated with site-directed mutagenesis, particularly primer design.
- e. Perform a site-directed mutagenesis experiment and interpret results.

**Outcome #8: Discuss techniques involved in DNA forensics and conduct a DNA fingerprinting protocol. Components:**

- a. Describe the basic premise underlying DNA forensics.
- b. Explain the uses of DNA forensics, including emerging uses.
- c. Explain what short-tandem repeat (STR) analysis is and why it is currently the forensic DNA technique of choice.
- d. Perform a basic DNA fingerprinting experiment (STR analysis) and interpret results.

**Outcome #9: Utilize online resources to perform basic bioinformatics tasks. Components:**

- a. Utilize Genbank to search for genomic sequences using gene name or accession number; interpret data found in Genbank entry and link to related entries.
- b. Utilize BLAST to compare genomic sequences, find unknown genomic sequences, and find homologous genes in different species; interpret data from BLAST search and link to related entries.
- c. Utilize on-line primer design software to design and evaluate PCR primers for a given genomic sequence.

**Outcome #10: Analyze scientific literature related to in-lab experiments. Components:**

- a. Explain aims and methods of assigned scientific papers.
- b. Interpret and critically analyze results and conclusions from scientific papers.
- c. Relate material found in literature to in-class experiments.

**Outcome #11: Discuss current topics of importance in Biotechnology. Components:**

Genetically Modified Organisms:

- a. Describe the impact of biotechnology and GM crops on the agricultural industry, both in the US and worldwide.
- b. Outline the pros and cons of GM crops, including environmental, societal, and health concerns.
- c. Identify GM crops currently available on the market, and those in production.
- d. Describe the role of the USDA and/or EPA in regulating genetically modified crops.
- e. Describe current regulations for labelling of biotechnology products.
- f. Describe methods used to identify GM crops including ELISA and PCR.

Gene therapy:

- a. Define gene therapy.
- b. Explain different methods used in gene therapy.
- c. Explain the history of gene therapy, including the current state of gene therapy in the U.S.
- d. Describe obstacles to using gene therapy in research and/or therapies.
- e. Outline ethical concerns associated with gene therapy.

**V. Course Requirements**

**Attendance:** In-person participation is required in this course. Student 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).

**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 (6x)	10 pts	60 pts	20.0%
Lab Reports (10x)	10 pts	100 pts	33.4%
Oral Presentations (4x)	10 pts	40 pts	13.3%
Poster presentation (1x)	30 pts	40 pts	13.3%
Final Exam	40 pts	60 pts	20.0%
<b>Total</b>	<b>NA</b>	<b>300 pts</b>	<b>100.0%</b>

- **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 at the end of April 2025.
- **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 Policy: <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 himself/herself and/or on colleague students, may be suspended from the class by the instructor at any time of the course with the consequent non-passing grade.

**Disruptive Behavior:** Disruptive behavior will not be tolerated and can lead to being dropped from the course at the instructor's discretion. No "guests" will be allowed unless they are explicitly invited to attend the class by the instructor.

**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 presenting material as your own that has been generated on a website, in a publication, by an artificial intelligence algorithm (AI), by another person, or by otherwise breaking the rules of an assignment or exam. Academic dishonesty is a violation of the Student Code of Conduct 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. For information specifically about AI usage—see <https://airesources.unm.edu/instructors/index.html>. Having academic integrity is paramount to your success in any class. Plagiarism or cheating is not tolerated. For more information, please consult the UNM Academic Integrity Policy The policy states in part: Each student is expected "to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or who otherwise fails to meet the expected standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course. Academic Dishonesty is defined as: "Academic dishonesty" includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

**Wellness:** If you do need to stay home due to illness or are experiencing a wellness challenge, please take advantage of the resources below. You can communicate with me via Canvas messaging or [jgodbout@unm.edu](mailto:jgodbout@unm.edu), and I will work with you to provide alternatives for course participation and completion. Let me, an advisor, or another UNM staff member know that you need support so that we can connect you to the right resources. UNM is a mask friendly, but not a mask required, community. If you are experiencing COVID-19 or any other infectious symptoms, please do not come to class.

**Support:** PASOS Resource Center (505) 925-8546, <mailto:pasos@unm.edu>. The Resource Center is an on-campus center that serves as a "one-stop" for all non-academic needs of UNM-Valencia students. Student Health and Counseling (SHAC) at (505) 277-3136. TimelyCare: Free 24/7 virtual care services (medical, emotional support, health coaching, self-care, basic needs support). LoboRESPECT Advocacy Center (505) 277-2911 can offer help with contacting faculty and managing challenges that impact your UNM experience.

**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 The UNM-Valencia Equal Access Services (Sarah Clawson, Coordinator), at (505) 925-8840 or by email at [msjclawson@unm.edu](mailto:msjclawson@unm.edu). Or the UNM-Albuquerque Accessibility Resource Center at [arcsrvs@unm.edu](mailto:arcsrvs@unm.edu) or by phone at 505-277-3506. Support (Accommodations) Contact me via email ([jgodbout@unm.edu](mailto:jgodbout@unm.edu)) or Canvas messaging or in office/drop-in hours. The UNM-Valencia Equal Access Services (Sarah Clawson, Coordinator), at (505) 925-8840 or by email at [sjclawson@unm.edu](mailto:sjclawson@unm.edu)., Or Accessibility Resource Center (<https://arc.unm.edu/>) at <mailto:arcsrvs@unm.edu> (505) 277-3506. Credit-hour Statement. This is a three credit-hour course. Class meets for two 75-minute sessions of direct instruction per week for sixteen weeks during the Fall 2024 semester. Please plan for a minimum of six hours of out-of-class work (or homework, study, assignment completion, and class preparation) each week. Support UNM Valencia Learning Commons (tutoring). Tutoring is available to you in math, science, writing, and other subjects through the Learning Commons: Learning and STEM Centers and Writing Center. In person tutoring is in these centers in the LRC (the building that also has the library). Tutoring in Zoom and, for writing, through email, is also available. Making use of tutoring is a fantastic way to use your resources and set yourself up to learn deeply and well in your courses. To schedule an appointment, please go to: Learning Commons Bookings If you are making an email appointment with the Writing Center, email your draft to [tutor@unm.edu](mailto:tutor@unm.edu) after you fill out the form above. If you have difficulty with the scheduling link above, would like an appointment in a subject not listed at that link, or



have a question, email [tutor@unm.edu](mailto:tutor@unm.edu). You'll get answers during business hours Monday through Friday. The webpage, with more details about available hours, is here: [Learning Commons: Tutoring Services webpage](#). Center for Academic Program Support (CAPS). Many students have found that time management workshops can help them meet their goals (consult (CAPS) website under "services").

**Title IX:** The University of New Mexico and its faculty are committed to supporting our students and providing an environment that is free of bias, discrimination, and harassment. The University's programs and activities, including the classroom, should always provide a space of mutual respect, kindness, and support without fear of harassment, violence, or discrimination. Discrimination on the basis of sex includes discrimination on the basis of assigned sex at birth, sex characteristics, pregnancy and pregnancy related conditions, sexual orientation and gender identity. If you have encountered any form of discrimination on the basis of sex, including sexual harassment, sexual assault, stalking, domestic or dating violence, we encourage you to report this to the University. You can access the confidential resources available on campus at the LoboRESPECT Advocacy Center (<https://loborespect.unm.edu>), the Women's Resource Center (<https://women.unm.edu>), and the LGBTQ Resource Center (<https://lgbtqrc.unm.edu>). If you speak with an instructor (including a TA or a GA) regarding an incident connected to discrimination on the basis of sex, they must notify UNM's Title IX Coordinator that you shared an experience relating to Title IX, even if you ask the instructor not to disclose it. The Title IX Coordinator is available to assist you in understanding your options and in connecting you with all possible resources on and off campus. For more information on the campus policy regarding sexual misconduct and reporting, please see <https://policy.unm.edu/university-policies/2000/2740.html> and CEEO's website. If you are pregnant or experiencing a pregnancy-related condition, you may contact UNM's Office of Compliance, Ethics, and Equal Opportunity at [ceeo@unm.edu](mailto:ceeo@unm.edu). The CEEO staff will provide you with access to available resources and supportive measures and assist you in understanding your rights. Pregnancy and Parenting Support information is available here. Support: Confidential services for students are available at LoboRESPECT Advocacy Center and the support services listed on its website, the Women's Resource Center and the LGBTQ Resource Center all offer confidential services and reporting. The Women's Resource Center supports all students, including those who are pregnant or are parents. UNM Pregnancy and Parenting Support information is available. UNM-Valencia has lactation stations located in LRC 112 (Tomé campus) and in the Workforce Training Center. Land Acknowledgement Founded in 1889, the University of New Mexico sits on the traditional homelands of the Pueblo of Sandia. The original peoples of New Mexico Pueblo, Navajo, and Apache since time immemorial, have deep connections to the land and have made significant contributions to the broader community statewide. We honor the land itself and those who remain stewards of this land throughout the generations and also acknowledge our committed relationship to Indigenous peoples.



We gratefully recognize our history. Resource: Division for Equity and Inclusion. Citizenship and/or Immigration Status All students are welcome in this class regardless of citizenship, residency, or immigration status. Your professor will respect your privacy if you choose to disclose your status. UNM as an institution has made a core commitment to the success of all our students, including members of our undocumented community. The Administration's welcome is found on our website: <http://undocumented.unm.edu/>. 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. Support: Many students have found that time management workshops or work with peer tutors can help them meet their goals. These and are other resources are available through PASOS (Pathways to Articulation and Sustainable Opportunities for Students), TRIO Student Support Services, and Student Learning Support at the Center for Teaching and Learning. Center for Academic Program Support (CAPS). Many students have found that time management workshops can help them meet their goals (consult (CAPS) website under "services"). Connecting to Campus and Finding Support: UNM-Valencia has many resources and centers to help you thrive, including opportunities to get involved, mental health resources, academic support including tutoring, resource centers, free food at Valencia Campus Food Pantry, and jobs on campus, and financial capability support. Your advisor, staff at the resource centers and Academic Affairs Office, and I can help you find the right opportunities for you.

VIII. Course Schedule

Week	Meating Date	Topic	Assignment
1	1/21 1/23	Course introduction. Genomic DNA isolation and measurement.	
2	1/28 1/30	Designing primers for specific amplification of genomic DNA sequences.	Quiz #1
3	2/4 2/6	Sequencing analysis of amplified DNA fragments.	
4	2/11 2/13	Performing a site-directed mutagenesis via PCR amplification.	Quiz #2
5	2/18 2/20	Using RT-qPCR for comparative analysis of number of copies of genes.	
6	2/25 2/27	Post-transcriptional silencing of gene expression using siRNA.	Quiz #3
7	3/4 3/6	Total RNA isolation, quantification and cDNA synthesis.	
8	3/11 3/13	Quantitative assessment of transcript levels using RT-qPCR.	Quiz #4
9	3/18 3/20	<b>Spring Break – No Meetings</b>	
10	3/25 3/27	Research Project (i)	
11	4/1 4/3	Research Project (ii)	Quiz #5
12	4/8 4/10	Research Project (iii)	
13	4/15 4/17	Research Project (iv)	Quiz #6
14	4/22 4/24	Preparation of posters for the UNM-Valenica Undergraduate Research Symposium 2025.	
15	4/29 5/1	Immunodetection and quantification of protein levels using Western blot (i)	Quiz #7
16	5/6 5/8	Immunodetection and quantification of protein levels using Western blot (ii)	
17	<b>Tuesday, 5/13 9:00 – 11:00 am</b>	<b>Final Exam</b>	