



The University of Texas at El Paso  
College of Health Sciences  
Clinical Laboratory Science Program



**Course Title:** *CLSC 4111 Molecular Diagnostics Laboratory*  
**Course Number:** CLSC 4111  
**Semester:** Summer 2023  
**Course Hours:** T-W-Th-F - 1:00 pm – 4:00 pm  
**Course Location:** CHS 137  
**Credit Hours:** 1  
**Co-Requisites:** CLSC 2311 (Credit hours: 3)  
**Course Instructor:** Elizabeth Camacho, MATS, MT (ASCP) Molecular Diagnostics Certificate  
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**Office hours:** **Monday:** By Appointment

**Healthy People 2020:**

This course is aligned to the Healthy People 2020 Task force ([www.healthypeople.gov](http://www.healthypeople.gov)) initiative.

**REQUIRED COURSE TEXTBOOK:**

**Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. 2019.**  
**Buckingham, .A. Davis, Philadelphia, PA.**

**COURSE DESCRIPTION:**

This laboratory course focuses on the practical application of molecular diagnostics in the clinical laboratory. Students will learn to perform technical molecular biology assays on proteins, DNA, RNA that can be used in the diagnosis of human diseases.

## **COURSE OBJECTIVES:**

At the completion of the course, the student should be able to:

### **A. Cognitive**

1. Understand the difference between Quality Control and Quality Assurance in the molecular laboratory
2. Understand the importance of good pipetting techniques
3. Understand and perform simple and serial dilutions
4. Describe methods for quantification of nucleic acids
5. Report results for molecular testing
6. Follow a protocol to perform testing
7. Understand the use and purpose for isolating DNA, RNA and proteins
8. Explain the principle of electrophoresis as it applies to nucleic acids and proteins
9. Explain the function and mechanisms of restriction endonucleases
10. Compare and contrast the various blotting procedures (Southern, Northern and Western)
11. Explain the principles of Polymerase Chain Reaction (PCR) and Reverse Transcription-Polymerase Chain Reaction (RT-PCR)
12. Describe some of the applications of molecular technology in the Clinical laboratory.
13. Differentiate the advantages and disadvantages of Western Blot, DNA, plasmids and RNA testing
14. Briefly describe the importance of quality control on Western Blot, DNA, plasmids and RNA procedures
15. Describe the procedure, look at prepared gels (if applicable), interpret results, and evaluate the significance of results for the tests listed above
16. Define terms and describe quality control procedures as they relate to all molecular technology procedures
17. Describe the procedure, look at prepared gels (if applicable), interpret results, and evaluate the significance of results for the tests listed above
18. Define terms and describe quality control procedures as they relate to all molecular technology procedures.
19. Fully understand the importance of pre-analytical, analytical and post-analytical concerns in the molecular laboratory

### **B. Affective**

To show the appropriate responsible behaviors, students will demonstrate:

1. A positive attitude by being prepared for lecture and laboratory sessions completing assigned tasks on time and displaying self-motivation.
2. Organization by utilizing time effectively, sequencing and prioritizing tasks for completion with time constraints and maintaining a neat clean work.
3. Attention to detail by diligently pursuing accuracy and documenting data accurately and legibly.
4. Problem solving ability by explaining purpose of each step in diagnosis, interpretation, procedure, recognizing discrepancies in techniques or procedures and repeating necessary lab tests when necessary.

5. Dependability by following directions, working independently after being given directions.
6. Stability and self-confidence by approaching and performing routine tasks confidently without assistance and maintaining composure.
7. Appropriate interpersonal skills by cooperating and communicating effectively with classmates and instructors and displaying courteous, considerate behavior and appropriate appearance.
8. Ethical behavior and integrity by respecting confidentiality of patient information, complying with professional standards and code of ethics, adhering to safety policies and abiding by all rules and regulations of the institution.
9. Understand the importance of molecular technology for the diagnosis of disease.

C. Psychomotor Objectives:

Given the appropriate equipment, the student will be able to:

1. Perform correct pipetting techniques.
2. Select reagents, perform procedures, interpret results, and evaluate the significance of the results for all determinations listed below:
  - a. DNA, RNA and protein isolation
  - b. Polymerase Chain Reaction
  - c. Reverse-Transcription
  - d. Agarose and Polyacrylamide gel electrophoresis
  - e. Restriction digestion of genomic DNA
  - f. Allelic discrimination of unknown samples
  - g. Western Blotting
3. Assemble and prepare appropriate materials and equipment for the performance of test procedures and determine acceptability of results of all tests described in steps 2 and 3.
4. Perform molecular testing using safe laboratory practices.
5. Understand the importance of cognitive and technical reliability in pre-analytical, analytical and post-analytical performance and reporting of tests in the molecular laboratory.

**CLASS POLICIES:**

**ACADEMIC DISHONESTY POLICIES**

**Academic dishonesty.** Academic dishonesty of any type **WILL NOT** be tolerated. Students found guilty of academic dishonesty will be subject to disciplinary action including but not limited to the possibility of a failing exam grade, failure of the course and possible dismissal from the University.

*Regent's Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22.* "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, submission for credit of any work or materials that are attributable in whole or in part to another person **(including copying homework or other material from another individual)**, taking an

examination for another person, any act to give unfair advantage to student or the attempt to commit such acts.”

*Section V, Sub-section K of the CLS student handbook states:*

1. Absolute honesty and integrity are a critical aspect of your chosen profession. Confidentiality of patient information is another. These must be strictly observed.
2. Any student who falsifies patient records and/or results, cheats on quality control results, interferes with laboratory functions, deliberately cheats on any CLS program exam or exhibits any of the behaviors listed in the Probation/Dismissal policy will be considered to be in violation of both the UTEP and CLS program policies, and may be subject to immediate dismissal from the clinical practicum and the CLS program itself.
3. If such a dismissal is warranted, a detailed signed statement will be permanently placed in the student's files

**CELL PHONE AND LAPTOP COMPUTER POLICY.** Usage of cell phones during class periods is not conducive to learning and is disruptive to others. Cell phones must be turned to silent and must not be used during class. Individuals violating this policy will be asked to leave class and may not receive credit for that day's activities.

Laptop computers can be used for specific on class assignments (student will be notified when to bring the laptop). Checking email, doing other work or playing games during class is expressly forbidden. Students violating this policy will lose the privilege of using a computer during the class period.

**AUDIO AND VIDEO RECORDING. No audio and video recording will be allowed with the exception of those that meet accessibility accommodation. Any student found to be in violation of this policy will be subject to disciplinary action that may include dismissal from the course, the CLS program and from the University.**

**Attendance.** Students must attend the laboratory section of the course. *Due to the nature of the course, NO MAKE-UP LABORATORIES WILL BE OFFERED.* Students who must miss laboratory with an EXCUSED ABSENCE ONLY will be asked to complete a written and/or online assignment in place of the laboratory over the material covered which goes over the material missed in the laboratory. Pre-planned vacations, family activities (with the exception of funerals) or non-emergency doctor appointments for yourself or other family members *are not* considered excused absences. Proof of school-related absences must be provided. The student will still be held responsible for the material covered during the missed laboratory period. Those students missing laboratory without authorization or approval will be given a grade of “0” for that period.

***IT IS THE STUDENT’S RESPONSIBILITY TO DROP THE COURSE WITH A GRADE OF “W” BY THE OFFICIAL COURSE DROP DEADLINE.***

**Exam administration policy.** When examinations are administered, students are to place book bags, papers and other personal belongings at the front of the room. Students will spread around

the room when seating themselves. Students will return examination papers in to the exam monitor before leaving the room for any reason; once a student has left the room, he/she may not continue with the examination.

**Behavioral Conduct.** The student is expected to conduct themselves in a respectful and professional manner. No disrespect toward the instructor or other students will be tolerated. Students found to be acting contrary to this policy will be referred to the Program Chair and may be subject to disciplinary action.

**Students with disabilities.** If you have or suspect a disability and need accommodation, you should contact The Center for Accommodations and Support Services (CASS) at 747-5148. You can also email the office at [cass@utep.edu](mailto:cass@utep.edu) or go by the Union Building East, Room 106. For additional information, visit the CASS website at <http://sa.utep.edu/cass/>. It is the responsibility of the student to notify the instructor that CASS accommodation guidelines are needed.

**University Counseling Center.** If you have personal issues and require assistance, counseling services and resources are available online and in person through the Division of Student Affairs. You can access these services online (<http://sa.utep.edu/counsel/>), by phone (747-5302) or in person.

**Counseling Center**  
**202 Union West**  
**El Paso, Texas 79968**

#### **COURSE INSTRUCTION FORMAT:**

**Online learning tools (Blackboard).** Students are expected to actively take notes, ask questions and be engaged in laboratory and activities. Therefore, PowerPoint lectures or supporting materials may be posted to the Course Blackboard by section as study aids for exams only. Supplemental material including homework assignments or additional reading will be posted on blackboard for students to download.

It is the student's responsibility to come prepared for the course. This means that the student should read the material in the text and complete any assignments prior to attending class.

**Exams and Quizzes.** Students can be asked about any material that has been covered in the laboratory for practical exams and quizzes. Calculators will be allowed for quizzes and exams as needed. Formats of exams or quizzes may include those listed below:

#### **Standard Written and Technical Practical Exams [40% of course grade]**

- Multiple choice
- True/False
- Fill-in-the-Blank
- Short Answer
- Essay
- Flowchart or diagram
- Practical application problems

### **Quizzes (15-20 min) [30% of course grade]**

- Multiple choice
- True/False
- Fill-in-the-blank
- Short Answer
- Flowchart or diagram
- Practical application problems

### **HOMEWORK ASSIGNMENTS [30% of course grade]**

**Case studies/Other Assignment** Groups may be given case studies describing molecular technique issues relating to the material within the covered section. Students must answer the questions posed by the case studies. Material included in the case studies may be asked on practical and final exams or in quizzes

#### **LATE ASSIGNMENT POLICY**

If a student fails to complete the lab report by the next lab period, the student will receive a “0” for that portion of the grade. If a student is absent for a lab the student will receive a zero for that portion of their grade. If you cannot abide by the criteria for a legitimate reason (death, illness, etc.) inform me as soon as possible, bring necessary documentation, and we will consider the situation to find an alternate way to evaluate that portion of your final grade. *No make ups will be offered.*

### **COURSE GRADING SUMMARY**

- 30% Theoretical basis of Molecular Diagnostics [Quizzes] in person at beginning of laboratory.
- 30% Homework- Assignments
- 40% Comprehensive Final Exam

**\*\*\*Students will not be given the opportunity to make up exams or quizzes that have been missed due to UNEXCUSED absence. Regularly scheduled doctor’s appointments,planned vacations and other non-emergencies do not count as excused absences.**

#### **Course Grading Scale:**

<b>A</b>	<b>90-100%</b>
<b>B</b>	<b>80-89%</b>
<b>C</b>	<b>75-79%</b>
<b>D</b>	<b>70-74%</b>
<b>Failing</b>	<b>69% and below</b>

**Any score less than 75% is considered unacceptable for students seeking to continue in the CLS program.**

**Minimum Required Score for students seeking entry to the CLS program.** Students seeking admission into the Clinical Laboratory Sciences Program are required to achieve a cumulative

grade of **75% or above in all CLS prerequisite courses**. Students not achieving a minimum of 75% must re-take the course and achieve a 75% or above to be considered for acceptance.

### **Grade Appeals Process**

Those students who believe that they have been evaluated unfairly have options for appeal. The due process procedure is as follows (<http://sa.utep.edu/studentlife/#grade-grievance>; *CLS student handbook, section XI*):

**Step 1:** Attempt to resolve the difficulty with the faculty member.

**Step 2:** If the dispute cannot be resolved in Step 1, the student may appeal to the program director within 5 school days stating the evidence for the continued dispute in writing.

**Step 3:** If the matter remains unresolved, a written complaint outlining the evidence and reason for the dissatisfaction of the decision must be submitted to the Assistant Dean of the College of Health Sciences. The Assistant Dean will call upon the Due Process Committee to review and make recommendations to the Assistant Dean based on statements, written evidence, and interviews with all parties involved.

**Step 4:** If an unsatisfactory solution has been reached, the complainant will then notify the Dean within five (5) school days, who will pursue the matter with the Vice President for Student Affairs.

# *Tentative Laboratory Schedule*

*The following lab schedule depend upon availability of reagents*

<b>LAB</b>	<b>DATE/TIME</b>	<b>TENTATIVE TOPICS</b>
<b>1</b>	Tuesday June 13 <b>Quiz</b> <b>Chapter 15</b> <b>Chapter 1</b> <b>Chapter 2</b>	<b>Quiz</b> – Introduction to Molecular Diagnostics Laboratory, Syllabus, Safe Laboratory Practice, equipment supplies location, cleansing laboratory rotors, rack and glassware (autoclave). Agarose gel introduction.
<b>2</b>	Wednesday June 14  <b>Quiz</b> <b>Chapter 3</b> <b>Chapter 4</b>	<b>Quiz</b> – Pipetting Techniques, pipetting microplates and weight boats, Calculations/Dilutions/ Conversion/Solutions/Normality/Molarity. Molecular Laboratory Book: Mathematics for the Clinical Laboratory L.J. Doucette, Resolution and detection of nucleic acids/agarose gel preparation Prepare Agarose gel, Load samples, Perform Electrophoresis Plating of <i>E. coli bacteria</i> -
<b>3</b>	Thursday June 15  <b>Quiz</b> <b>Chapter 3</b> <b>Chapter 4</b>	<b>Quiz</b> – Genes in a Bottle Cell culture <i>E. coli bacteria</i> - overnight
<b>4</b>	Friday June 16  <b>Quiz</b> <b>Chapter 5</b>	<b>Quiz</b> Nucleic Acid extraction methods – Introduction to DNA Analysis, WBC/ DNA Extraction from whole blood, quantitation of genomic DNA electrophoresis and using the spectrophotometer. Pellet overnight cell culture <i>E. coli bacteria</i> and freeze
<b>5</b>	Tuesday June 20  <b>Quiz</b> <b>Chapter 10</b> <b>Chapter 11</b>	<b>Quiz</b> DNA isolation from <i>E. coli</i> bacteria – DNA quantitation (Spectrophotometer and nanodrop) and agarose electrophoresis Linear, circular and supercoiled DNA structures Skills: Bacterial DNA isolation and quantification CASE STUDY – Enteric pathogens Skills: Polymerase chain reaction set up and run



<b>6</b>	Wednesday June 21 <b>Quiz</b> <b>Chapter 10</b>	<b>Quiz</b> PTC = Taste Strips – DNA extraction from buccal cells – PCR of PTC status - Restriction Digestion Hae III and Analysis
<b>7</b>	Thursday June 22 <b>Quiz</b> <b>Chapter 5</b>	<b>Quiz</b> <b>Cont.</b> PTC status - Restriction Digestion Hae III and Analysis
<b>8</b>	Friday June 23 <b>Quiz</b> <b>Chapter 6</b> <b>Assignment</b>	<b>Quiz</b> Restriction Digestion Hae III and Analysis – PTC – Bitter Taste cont.
<b>9</b>	Tuesday June 27 <b>Quiz</b> <b>Chapter 2</b> <b>Chapter 5</b>	<b>Quiz –</b> Perform Western Blot  <b>Assignment 1 Due</b>
<b>10</b>	Wednesday June 28 <b>Quiz</b> <b>Chapter 12</b> <b>Assignment</b>	<b>Quiz –</b> RFLP - Crime Scene
<b>11</b>	Thursday June 29 <b>Quiz</b> <b>Chapter 14</b> <b>Assignment</b>	<b>Quiz -</b> CRISPR Gene
<b>12</b>	Friday June 30 <b>Quiz</b> <b>Chapter 14</b> <b>Assignment</b>	<b>Quiz</b> CRISPR Gene
	<b>Tuesday</b> <b>July 4<sup>th</sup></b>	<b>No Lab – 4<sup>th</sup> of July – OFFICIAL HOLIDAY</b>
<b>13</b>	<b>Wednesday</b> <b>July 5<sup>th</sup></b>	<b>No Lab - HOPE Health Fair</b>

<b>14</b>	<b>Thursday</b> <b>July 6</b> <b>Quiz</b> <b>Chapter 13</b> <b>Assignment</b>	<b>Quiz –</b> <b>CRISPR Gene - Debate</b>  <b>Assignment 2 Due</b>
<b>15</b>	<b>Friday</b> <b>July 7</b> <b>Quiz</b> <b>Chapter 9</b> <b>Chapter 7 and 8</b>	<b>CRISPR GENE</b> <b>FINAL EXAM</b>  <b>Lab -Finalize assays from previous labs</b> <b>Check all equipment and supplies and return to storage</b>

*HOPE YOU HAVE A WONDERFUL EXPERIENCE  
LEARNING ABOUT MOLECULAR TECHNIQUES!*