



**Berkshire Medical Center
School of Medical Laboratory Science**

Course Syllabus

Course No. MEDT 407

Course Title: Clinical Molecular Biology

Credits: 1 (through affiliated colleges/universities affiliation agreements)

Description:

Introduces the student to the basic fundamentals of molecular pathology, molecular diagnostics and common molecular techniques. Explains an overview of nucleic acids, proteins, gene expression and epigenetics. Describes common techniques in the clinical lab as it relates to microbes, inherited diseases and oncology. Discusses the impact of molecular genetics in medicine. Describes the controllable and non-controllable pre-analytical, analytical, and post-analytical variables that can affect testing. The student applies this theory in the molecular biology laboratory using current diagnostic techniques and instrumentation to correlate lab results with disease.

Primary Didactic Instructor: Jana McGinnis, M.S., MB(ASCP)
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Required text: Molecular Diagnostics: Fundamentals, Methods, and Clinical Applications, 3rd edition, Lela Buckingham, 2019

Reference material: Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 9th ed.
Nader Rafai, 2024

Self Study - Basic to Intermediate Level- Understanding Molecular Pathology: Methodologies and Applications

Lecture: 1 hour lectures, 10 lectures - November through January

Laboratory: 4 week clinical rotation in the Molecular Biology Department.
**See individual student schedule for dates



Course Goals and Objectives

Based on the didactic material and clinical instruction students will score an average of 75% or better on evaluation tools (i.e. exams, evaluations, etc) to demonstrate competency of the following objectives.

Upon completion of the Molecular Biology clinical and didactic course the student will:

1. Develop a basic understanding of protein function, genetic mechanisms, and the human genome.
2. Develop an entry-level knowledge of Molecular Biology tests used in the clinical laboratory and their importance in the diagnosis and treatment of disease.
3. Discuss physiological mechanisms that lead to specific genetic disorders and disease states.
4. Explain the fundamentals of molecular biology including nucleic acids, proteins, gene expression and epigenetics.
5. Discuss the current prevention and treatment for diseases and disorders related to molecular pathology.
6. Explain the principles and methods of each testing platform performed in the Molecular Biology laboratory and the clinical significance.
7. Compare the different types of probes used in the Molecular Biology laboratory.
8. Compare and contrast the different types of nucleic acid extraction and amplification methods.
9. Describe techniques used to identify DNA polymorphisms, detection of microorganisms, detection of inherited diseases and molecular oncology.
10. Explain the importance of quality control and apply it in the laboratory setting.
11. Determine appropriate specimen collection, processing, and analysis of patient specimens by following established procedures and resolve specimen issues.
12. Perform manual and automated testing on patient blood or body fluids that result in valid laboratory results in the Molecular Biology department.
13. Perform routine maintenance, trouble shooting, and quality control on instrumentation in the Molecular Biology department following established procedures.
14. Evaluate quality control data and determine course of action when quality control falls outside of range.
15. Interpret laboratory data generated from the Molecular Biology laboratory regarding test accuracy and abnormal values.
16. Evaluate laboratory data and give possible cause or diagnosis for patient results.
17. Organize workflow for efficiency in lab testing turn-around-times.
18. Practice established confidentiality guidelines.
19. Demonstrate professional and ethical conduct with all healthcare professionals, consumers, patients, and other laboratory students.

Basis for Student Evaluation

Lecture evaluation will consist of exams, a presentation and a final exam. The laboratory evaluation will consist of written exams, study questions, task lists, clinical performance and affective evaluation. The final grade will be composed of 50% lecture and 50% laboratory. See Molecular Biology grade sheet for specific breakdown.

Molecular Biology Lecture Outline

Fall

Lecture 1: Introduction to Molecular Biology:_DNA

Lecture 2: Introduction to Molecular Biology:_RNA

Lecture 3: Introduction to Molecular Biology:_Proteins

Lecture 4: Overview of Nucleic Acid Extraction Methods and Detection

****Quiz: Lectures 1-4***

Lecture 5: Nucleic Acid Amplification

Lecture 6: Nucleic Acid Amplification Part II

Lecture 7: Detection of Microorganisms

****Take home Assignment given after lecture 7 due for lecture 8***

Lecture 8: Inherited/Human Disease

Lecture 9: Molecular Detection of Cancer

Lecture 10: Other Molecular Methodologies

Affective behaviors

Didactic

Following appropriate training, during didactic instruction the student will:

1. Exhibit professional behavior during didactic instruction.
2. Attend lectures in a timely manner.
3. Respect other students and members of the laboratory.
4. Contribute to a positive learning environment.
5. Demonstrate an interest in the subject matter.
6. Comply with hospital and laboratory dress code and personal appearance policies.
7. Comply with institutional policies concerning safety and confidentiality.
8. Cooperate when situations arise and there is a necessary change in lecture schedule.
9. Participate in creating an inclusive learning environment.

Clinical

Following appropriate training, during clinical instruction the student will:

1. Comply with all hospital, laboratory, and school policies.
2. Demonstrate phone etiquette using BHS customer service standards.
3. Maintain a neat, clean, and orderly work area in the Molecular department.
4. Value the advice and opinion of others.
5. Accept responsibility for their own actions by notifying the instructor or supervisor of any errors.
6. Be dependable and punctual for the clinical experience.
7. Organize their time to complete assignments and daily training.
8. Accept constructive feedback and use it as a tool for improved performance.
9. Establish a good rapport with departmental staff and uphold the concept of teamwork.
10. Cooperate when situations arise and there is a necessary change in lecture schedule.
11. Comply with hospital and laboratory dress code and personal appearance policies.
12. Contribute to a positive, inclusive clinical training environment.

Attendance

Students follow the School of MLS attendance policy. Students are allotted 80 hours for personal time and sick time during the course of the internship. The Program Director and clinical department must be notified of any sudden absence as soon as possible. The main lab number may be called 24 hours a day to notify the lab of an absence. The Program Director should be emailed to document the absence.

Any coursework or clinical training missed over the 80 hours allowed, will require consultation with the Program Director as to the course of action to make up lost training time.

Snow days

Cancellation of classes or clinical training due to inclement weather will be at the discretion of the Program Director.