



Lahore University of Management Sciences

BI0511 – Fundamentals of Molecular Techniques

Fall 2023

Instructors	Dr. Muhammad Shoaib (MS), Dr. Khurram Bashir (KB)
Room No.	9-429 (MS); 9-319 (KB)
Office Hours	To be decided
Email	mshoaib@lums.edu.pk ; khurram.bashir@lums.edu.pk
Telephone	8563 (MS); 8397 (KB)
Secretary/Coordinator/TA	To be decided
TA Office Hours	To be decided
Course URL (if any)	lms.lums.edu.pk
Lecture	To be decided
Lab	To be decided

Course Teaching Methodology

- **Teaching Methodology:** All lectures will be in person on campus unless the university does not allow students to come to campus. In the latter case, all lectures will be synchronous via zoom invites, however, students will be guided to supplementary reading material.
- **Lecture Details:** There will be no pre-recorded lectures. However, links to related reference material available online from different sources will be provided, if necessary.

COURSE BASICS

Credit Hours	Three (3)			
LECTURES	Lectures per week	Two (2)	Duration	75 minutes each
Schedule	Tuesdays & Thursdays		Venue	
RECITATION	Sessions per week	N/A	Duration	N/A

Course Distribution

Core	Core course for graduate students
Elective	Yes, for undergraduate students
Open for Student Category	Sophomore, Juniors, Seniors (Biology majors and minors)
Close for Student Category	None

COURSE DESCRIPTION

Over the past two decades a number of cutting-edge technologies have been introduced which permit investigators to study cellular processes and function. As a result there are numerous tools available to modern day molecular and cell biologists who are interested in studying genes, proteins as well as cell and organismal biology. This course has been designed to cover the modern experimental aspects of molecular and cellular biology.

COURSE PREREQUISITE(S)

	Students enrolled in this course are expected to have taken an introductory level course in molecular biology (BIO216) and have a firm grasp of structure and function of nucleic acids and proteins.
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COURSE OBJECTIVES

	The objective of this course is to impart theoretical as well as experimental aspects of various molecular and cell biology techniques to students with emphasis on how to design experiments as well as critically interpret/analyze data.
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Learning Outcomes

After taking this course students should be:

- Knowledgeable about methods used for manipulating genes, and analyzing proteins and nucleic acids
- Knowledgeable about the various approaches and instruments used for studying cells
- Knowledgeable about next-generation technologies and their applications in molecular biology
- Able to understand how experiments are designed and how their results interpreted
- Able to critically evaluate raw experimental data and draw conclusions
- Capable of troubleshooting technical problems

Grading Breakup and Policy

Midterm Examination: 30%

Assignments: 20%

Quiz (3-5): 15%

Final Examination: 30%

Attendance: 5%

Examination Detail

Midterm Exam	Yes/No: Yes Combine Separate: Combined Duration: 3 hours Preferred Date: None Exam Specifications: Short answer questions
Final Exam	Yes/No: Yes Combine Separate: Combined Duration: 3 hours Exam Specifications: Short answer questions

Makeup Policy

- Please refer to Student Handbook 2019-20, page 37, article 25, titled "Makeup Policy for Graded Instruments".
- "In case N-X policy is implemented for an instrument having multiple sub instruments then petitions will not be accepted for that instrument".

Code of Conduct

1. Students are required to show up in classes fully prepared for the lecture and ensure that their videos are on and mics are muted in case of online lectures.
2. Quiz will be announced ahead of time, students must ensure their devices are charged and they have a stable internet connection (including smartphones) in case of online lectures.
3. All assessments including quizzes and exams will be timed. Make sure that you are able to start them on time.

COURSE OVERVIEW

Lecture	Topics	Recommended Readings	Instructors
Lecture #1	Studying enzymatic activity in vivo and in vitro		KB
Lecture #2-4	Polymerase chain reaction Quantitative Polymerase chain reaction		KB
Lecture #5-6	Molecular Cloning <ul style="list-style-type: none">• Restriction & Modifying enzymes• DNA isolation		MS



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	<ul style="list-style-type: none"> Electrophoresis Detection and quantification of DNA and RNA		
Lecture #7-8	Mammalian Tissue Culture <ul style="list-style-type: none"> Transient and stable transfections Cell survival/Viability assays 		MS
Lecture #9	Western Blotting		MS
Lecture #10-11	Microscopy based Imaging techniques High Content imaging, FRET, Live cell imaging, FRAP		MS
Lecture #12	Flow Cytometry (FACS) – technology and applications		MS
Lecture #13-15	Genome editing approaches CRISPR-Cas9-based Knock-out and Knock-In		MS
	MID-TERM EXAM		
Lecture #16	Sanger sequencing		MS
Lecture #17-20	Omics approaches in molecular biology DNA sequencing (Exome, EdU-seq), RNA seq (mRNA, CAGE, PRO-seq, GRO-seq)		MS
Lecture #21-22	Methods for studying epigenome DNA methylation Chromatin IP, CUT&RUN, CUT&TAG, nanoTAG-seq Accessibility assays (ATAC-seq and ATAC-seq) Proximity assays (DamID-seq, PUB-seq)		MS
Lecture #23-25	Proteomics <ul style="list-style-type: none"> Protein-protein interactions Protein-nucleic acid interactions Mass Spec based proteomics Quantitative proteomics 		MS
Lecture #26	Recombinant protein production and purification		MS
Lecture #27	Transgenic animals and plants		MS
Lecture #28	Gene therapy		MS
	FINAL EXAM		

Textbook(s)/Supplementary Readings

- Brown, T.A. (Terence A.) Gene Cloning and DNA Analysis : An Introduction — 6th edition (ISBN 978-1-4051-8173-0), WILEY-BLACKWELL, A John Wiley & Sons, Ltd., Publication
- All further readings are to be extracted by students from the web unless otherwise suggested



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A student-teacher relationship is purely based on honesty, integrity and inspiration. Where teacher's role is to make every effort possible to inspire his students about the subject and develop independent thinking and a problem solving attitude about every concept, students are required to uphold values of truth and honesty and eagerness to learn. In this whole learning process honesty, integrity and commitment by students play a major role in their long-term success. It means a student perform all academic work, assignments, exams, quizzes and never gets involved in any unfair activity falling under academic dishonesty like cheating, unauthorized aid of any kind, plagiarism etc. I have also trusted my students, I never invigilate them in exams and trust that they will demonstrate extremely high level of integrity and honesty because if you fail to uphold these core values you will miserably fail in life on every step in the long run. Remember, it's better to fail a small exam rather than cheat and fail in life. Any instances of academic dishonesty in this course (intentional or unintentional) will be dealt with swiftly and severely. Potential penalties include receiving a failing grade on the assignment in question or in the course overall. For further information, students should make themselves familiar with the relevant section of the LUMS student handbook.

Harassment Policy

SSE, LUMS and particularly this class, is a harassment free zone. There is absolutely zero tolerance for any behavior that is intended, or has the expected result of making anyone uncomfortable and negatively impacts the class environment, or any individual's ability to work to the best of their potential.

In case a differently-abled student requires accommodations for fully participating in the course, students are advised to contact the instructor so that they can be facilitated accordingly.

If you think that you may be a victim of harassment, or if you have observed any harassment occurring in the purview of this class, please reach out and speak to me. If you are a victim, I strongly encourage you to reach out to the Office of Accessibility and Inclusion at oi@lums.edu.pk or the sexual harassment inquiry committee at harassment@lums.edu.pk for any queries, clarifications, or advice. You may choose to file an informal or a formal complaint to put an end of offending behavior. You can find more details regarding the LUMS sexual harassment policy [here](#). To file a complaint, please write to harassment@lums.edu.pk

SSE Council on Equity and Belonging

In addition to LUMS resources, SSE's **Council on Belonging and Equity** is committed to devising ways to provide a safe, inclusive and respectful learning environment for students, faculty and staff. To seek counsel related to any issues, please feel free to approach either a member of the council or email at cbe.sse@lums.edu.pk

Rights and Code of Conduct for Online Teaching

A misuse of online modes of communication is unacceptable. TAs and Faculty will seek consent before the recording of live online lectures or tutorials. Please ensure if you do not wish to be recorded during a session to inform the faculty member. Please also ensure that you prioritize formal means of communication (email, lms) over informal means to communicate with course staff.

Whenever you write an email and submit exams, assignments and all work your file name should follow following instructions in subject of email as well as in file name.

Subject of email: BIO511-Final exam, mid-term exam, quiz number or assignment number

File name: BIO511-LUMS-ID-type of work i.e., exam number, assignments number etc.