



Lahore University of Management Sciences

BIO221 –Genetics

Fall 2023

Instructor	Dr. M .Tariq (lead), Dr. Khurram Bashir
Room No.	9-315A & 9-319A
Office Hours	To be decided
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Secretary/Coordinator/TA	TBD
TA Office Hours	To be decided
Course URL (if any)	lms.lums.edu.pk
Lab	None

Course Teaching Methodology

- **Teaching Methodology:** All lectures will be in person but in case of covid surge lectures may be synchronous via zoom invites, and students will be guided to supplementary reading material.
- **Lecture Details:** Links to pre-recorded lectures will also be shared for listening to content ahead of lectures.

Course Basics

Credit Hours	4			
Lecture(s)	Nbr of Lec(s)	2 per week	Duration	75 minutes
Recitation	Nbr of Lec(s)	1 per week, will be scheduled with students	Duration	70 minutes
Tutorial	Nbr of Lec(s)	As per need	Duration	

Course Distribution

Core	Core course for Biology major students
Elective	Yes, can be taken as an elective
Open for Student Category	Freshmen, Sophomore, Juniors, Seniors
Close for Student Category	None

COURSE DESCRIPTION

It is one of the most fascinating course in biology which covers a great deal ranging from classical genetics to modern molecular genetics, emphasis on how new genes are discovered and how function of genes can be understood makes it really interesting. The intellectual framework of this course will introduce students to basic concepts in genetics and epigenetics. Both genetic and epigenetic inheritance patterns will be introduced with an emphasis on how they can be investigated and they play a role in development. This course is divided in different modules. For example, classical genetics will explain Mendelian laws, chromosomal theory of inheritance and gene interactions which explain deviations from Mendel's laws. Microbial genetics will explain how genetic analysis in microbes can be performed and specific examples of gene regulation will be introduced. Human genetics module will explain how genetics plays a major role by using alleles in humans to understand disease and development. Functional genomics will cover a great deal about forward and reverse genetics approaches to discover new genes and understand cellular function. Epigenetics will explain how genes can be switched OFF and ON and how chromatin structure and function can be inherited with altering basic nucleotide sequence of genes. Last but not the least, understanding quantitative genetics and population genetics will explain how mutagenic traits are investigated and how genes may evolve at a population level.

COURSE PREREQUISITE(S)

	None
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COURSE OBJECTIVES



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	<ul style="list-style-type: none">• To introduce the basic concepts in genetics and epigenetics inheritance• How monogenic and multigenic traits are analyzed• How new genes are discovered and analyzed using genetic analysis.• How genes may evolve and studied at a population level
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Learning Outcomes

	<p>At the end of course students will be able to understand:</p> <ul style="list-style-type: none">• Inheritance of monogenic and multigenic traits• How genotypes- phenotypes are linked and how different genetic pathways may interact and affect development• How genetic analysis differs among microbes, fruit flies and human and how genes may evolve• How gene function can be regulated through epigenetics
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Grading Breakup and Policy

Assignment(s): 10% (5 Assignments)

Home Work:

Quiz(s): 10% (5-10 Quizzes)

Class Participation:

Attendance:

Exam1: 20%

Exam2: 20%

Exam3: 20%

Exam4: 20%

Grading will be absolute.

Examination Detail

	<p>Yes/No: Yes</p> <p>There will be total four exams spanned throughout the course after each module. Exams will be scheduled after consultation with students on a date/time feasible for all.</p> <p>Duration: 180 mins (May vary if taken online)</p> <p>Exam Specifications: Closed Book, No cell phones, no notes, nothing extra help.</p>
	<p>Yes/No: Yes</p> <p>Duration: 120~180 mins (May vary if taken online)</p> <p>Exam Specifications: Closed Book, No Calculator. No cell phones.</p>

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



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COURSE OVERVIEW			
Lecture	Topics	Recommended Readings	Objectives/ Application
1-5 (MT)	Classical genetics: Introduction to genetics and epigenetic, Mendelian genetics, chromosomal theory of inheritance, Patterns of autosomal and sex chromosome inheritance, test cross, back cross, allele, homozygote, heterozygote dominant trait, recessive trait, genotype and phenotype, Genetic Linkage and Chromosome mapping, Recombination Genotype to phenotype, complementation, epistasis	Chapter 2, 3 4 and 6: Introduction to genetic Analysis by Griffiths et al.,	Basic concepts of genetics covering how genes and chromosome were discovered and how they are inherited in next generations. How genotype can be correlated to phenotype and how genetic interactions can be studied
	Exam 1		
6-9 (MT)	Microbial Genetics: conjugation, transformation, transduction, genetic screen in bacteria, lac operon	Chapter 5 : Introduction to Genetic Analysis by Griffiths et al.,	
10-11 (MT)	Human genetics: Mendelian pedigree patterns, Autosomal and Sex linked patterns of inheritance, cytoplasmic inheritance, Markers (RFLPs, STRs, SNPs etc, Genetic Mapping of Mendelian characters, Lod score Analysis	Chapter 3 and 6: An introduction to Human Molecular Genetics by Jack J Pasternak Chapter 2: Introduction to genetic Analysis by Griffiths et al.,	How Mendelian traits can be traced in humans and how they can be mapped and studied in humans in contrast to model organisms e.g. pea plant and Drosophila melanogaster
12-15 (MT)	Epigenetics: Chromatin structure and nuclear organization, transcription machinery and chromatin remodeling, euchromatin and heterochromatin, position effect variegation, heritable gene silencing chromatin modifications and epigenetic informations, non coding RNAs, X chromosome inactivation, dosage compensation, cellular memory and imprinting	Chapter 10: Introduction to Genetic Analysis by Griffiths et al.,	To familiarize the students with fundamental concepts in the area of epigenetics covering histone modifications, cell memory and X chromosome inactivation which are important in normal development
	Exam 2		
16-19 (KB)	Mutagens, mutations, DNA Repair: Transposons, Types of mutations, molecular basis of mutations, Mechanism of DNA Repair	Chapter 13 and 14: Introduction to Genetic Analysis by Griffiths et al.,	To introduce different type of Mutagens which are the sole source of pathogenic mutations and how DNA repair mechanism works to proof read these mutations
20-22 (KB)	Genomics and transgenics: Forward genetics, reverse genetics, gene isolation and manipulation	Chapter 11: Introduction to Genetic Analysis by Griffiths et al.,	Students will be introduced to different approaches which can be used to isolate and study gene at the molecular level.
	Exam 3		
23-25 (KB)	Population genetics: Hardy Weinberg equilibrium, factors effecting genotypic and allelic frequency, inbreeding/assortative mating, mutation Recombination, Migration, Selection and Genetic Drift	Chapter 19: Introduction to Genetic Analysis by Griffiths et al.,	To get familiarize with Genetic composition of a population and how different factors are involved to maintain the genetic composition of particular population
26-28 (KB)	Quantitative genetics: Inheritance of complex traits, causes of variation, continuous verses discontinuous traits, genotype and phenotype distribution, Heritability, selection, QTL analysis	Chapter 20: Introduction to Genetic Analysis by Griffiths et al.,	What is the difference between discontinuous traits which are under control of genes and continuous traits which are the results of interaction of environment and genes. How these traits can be studied and how multiple genes which are involved in their development can be identified.
	Exam 4		



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- I. **Introduction to Genetic Analysis by Griffiths**, Wesler, Lewontin, Gelbart, Suzuki, Miller (eighth edition): Photocopies of selected chapters
- II. **Chromatin and Gene Regulation: Molecular mechanisms in epigenetics by Brian M. Turner**: Photocopies of selected chapters.
- III. **Genetics: Analysis of genes and genomes** (sixth edition) by Daniel L. Hartl and Elizabeth W. Jones: Photocopies of selected chapters
- IV. **Genetics by Monroe W. Strickberger** (3rd edition). Photocopies of selected chapters
- V. **An introduction to Human Molecular Genetics. Jack J Pasternak** 2nd Edition.(Selected chapters)

Academic Honesty

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 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 behaviour 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: BIO221-Final exam, mid-term exam, quiz number or assignment number

File name: BIO221-LUMS-ID-type of work i.e., exam number, assignments number etc.