

Course Syllabus
MBMB 641 Lentiviral Vectors
Academic Year 2025

Course ID and Title: MBMB 641 Lentiviral Vectors

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Instructor:

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Credits: 1(1-2-3)

Curriculum: Master of Science Program in Advanced Biomedical Technology and Venture Creation in Healthcare (Elective course)
Master of Science Program in Molecular and Integrative Biosciences (Elective course)
Doctor of Philosophy Program in Molecular and Integrative Biosciences (Elective course)

Semester: X^{XX} Semester

Pre-Requisites:

None.

Course Learning Outcomes (CLOs):

By the end of the course, students should be able to:

1. Describe the basic biology of LV vectors, the different generations of LV, the advantages and disadvantages of using LV vectors for gene therapy.
2. Apply the knowledge of LV vectors to design and produce LV particles.
3. Demonstrate scientific integrity, responsibility, and safety practices.
4. Demonstrate professional and interpersonal skills.

Course Learning Outcomes	Teaching Method	Assessment Method
1. Describe the basic biology of LV vectors, the different generation of LV, the advantages and disadvantages of using LV vectors for gene therapy	1. Lecture 2. Discussion	1. Q&A during lecture 2. Discussion performance 3. Quiz / short exercise 4. Assignment
2. Apply the knowledge of LV vectors to design and produce LV particles.	1. Discussion 2. Hands-on lab practice 3. Individual or group assignment/presentation (lecture and lab session)	1. Discussion performance 2. Lab performance 3. Problem-based learning (scientific content and inventive idea)
3. Demonstrate scientific integrity, responsibility, and safety practices.	1. Writing lab report 2. Hands-on lab safety practice	1. Lab report writing 2. Safety practice performance
4. Demonstrate professional and interpersonal skills.	1. Discussion 2. Individual or group assignment/presentation 3. Problem-based learning	1. Discussion performance 2. Teamwork performance 3. Project presentation performance

Course Description:

Lentiviral vector overview, Upstream bioprocessing of lentiviral vector, Downstream bioprocessing of lentiviral vector, Vector characterization and Quality control, Working safely with lentiviral vector

Course Schedule:

(Classroom **XXX** and Lab Classroom **C208 or D410**)

Lecture

- LV Overview: Introduction, Pseudotyped envelope proteins, Role of viral proteins, LV characteristics,
- Upstream Bioprocessing of LV: Cell Lines for LV production, Transient, stable and induced production, Upstream culture to produce LV.
- Downstream Processing of LV: Vector filtration, LV purification, LV concentration
- Vector characterization and Quality Control
- Working Safely with LV vector

Lab

- LV Manufacturing and controls: LV plasmid preparation, Upstream bioprocessing, Transient transformation, Downstream bioprocessing, LV vector product characterization, LV vector analytics, Safety, identity, potency, quality, and purity testing.

	Activities	Description	Time	Instructors and Assistants
Day 1				
1	Lecture: LV Overview	- To know the concept and biology of the lentiviral vector - To understand different LV generations	9:00 – 12:00	NK, NJ
2	Lecture: LV Vectors	- To understand the applications and limitations of lentiviral vector - To know how to work safely with LV vectors	13:00 – 16:00	
Day 2				
3	Lab: Plasmid preparation	To prepare the plasmids for LV production	9:00 – 10:30	Staff
4	Lab: HEK293T preparation	To prepare HEK293T cultures for AAV production	10:30 - 12:00	
5	Lab: Viral Packaging	To transfect LV plasmids into HEK293T cells for recombinant LV production	13:00 – 16:00	
Day 3				
6	Lab: LV particle collection and purification	To collect recombinant LV particles from HEK293T culture and purify LV particles	9:00 – 12:00	Staff
7	Lab: LV particle collection and purification (continue)	To collect recombinant LV particles from HEK293T culture and purify LV particles (continue)	13:00 – 16:00	
Day 4				
8	Lab: LV transduction in vitro	To use LV particles to infect target cell line	9:00 – 12:00	Staff
9	Lab: LV titration I	To determine the titer of purified LV particles	13:00 – 16:00	
Day 5				
10	Lab: LV titration II	To determine the titer of purified LV particles (continue)	9:00- 10:30	Staff
11	Discussion & Student's Reflection	To provide students opportunities to describe their learning experiences received from this course and to collect comments, suggestions from students for further improvements of the course.	10:30 – 12:00	

Assessment Criteria:

Assessment Criteria		Description (in Details)	Scoring Rubric
1	Class Attendance (5%)	Showing up in the class (5%)	<ul style="list-style-type: none"> • Full attendance (4) • ~ 80% attendance (3) • ~ 60% attendance (2) • < 50% attendance (1)
2	Lab Report (30%)	The presence of introduction, methods, results, discussion, and conclusion with no plagiarism (10 %)	<ul style="list-style-type: none"> • Complete (4) • ~ 80% complete (3) • ~ 60% complete (2) • < 50% complete (1)
		Data presentation (5%)	<ul style="list-style-type: none"> • Complete (4) • ~ 80% complete (3) • ~ 60% complete (2) • < 50% complete (1)
		Data analysis and interpretation (10%)	<ul style="list-style-type: none"> • Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
		On-time submission (5%)	<ul style="list-style-type: none"> • On-time (4) • Late (2-3) • Very late (1)
3	Discussion Performance (25%)	Participation and performance (10%)	<ul style="list-style-type: none"> • Active (4) • Fairly active (2-3) • Inactive (1)
		Communication and presentation skills (10%)	<ul style="list-style-type: none"> • Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
		Creative and high-order thinking skills (5%)	<ul style="list-style-type: none"> • Highly expressed (4) • Fairly expressed (2-3) • Not shown (1)
6	Lab Performance (40%)	Safety practice (10%)	<ul style="list-style-type: none"> • Excellent (4) • Good (3) • Fair (2) • Not solid (1)
		Responsibility (5%)	<ul style="list-style-type: none"> • Highly expressed (4) • Fairly expressed (2-3) • Not shown (1)
		Lab skills (15%)	<ul style="list-style-type: none"> • Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)

Assessment Criteria	Description (in Details)	Scoring Rubric
	Decision-making and trouble-shooting skills (10%)	<ul style="list-style-type: none"> • Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)

Student's achievement will be graded using symbols: A, B+, B, C+, C, D+, D and F, based on the criteria as follows:

Percentage	Grade	Description
80–100	A	Excellent
75–79	B+	Very Good
70–74	B	Good
65–69	C+	Fairly Good
60–64	C	Fair
55–59	D+	Poor
50–54	D	Very Poor
0–49	F	Fail

Date of Revision: September 30, 2023