

**Course Syllabus**  
**MBMB 624 Adeno-associated Viral Vectors**  
**Academic Year 2025**

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**Course ID and Title:** MBMB 624 Adeno-associated Viral Vectors

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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<sup>XX</sup> 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 AAV vectors, the different types of AAV, the advantages and disadvantages of using AAV vectors for gene therapy.
2. Apply the knowledge of AAV vectors to design and produce AAV 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 AAV vectors, the different type of AAV, the advantages and disadvantages of using AAV 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 AAV vectors to design and produce AAV 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:

Adeno-associated viral vector overview, Upstream bioprocessing of adeno-associated viral vector, Downstream bioprocessing of adeno-associated viral vector, Vector characterization and Quality control, Working safely with adeno-associated viral vector

### Course Schedule:

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

#### Lecture

- AAV Overview: AAV characteristics, AAV protein capsid, Role of viral proteins, AAV serotypes and tissues, Capsid tropism, AAV vector genome design, Lytic and latent AAV lifecycle stages
- Upstream Bioprocessing of AAV: Cell lines for AAV production, Transient, stable and induced production, Upstream culture to produce AAV.
- Downstream Processing of AAV: Vector filtration, AAV purification, AAV concentration
- Vector characterization and Quality Control
- Working Safely with AAV vector

#### Lab

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

	<b>Activities</b>	<b>Description</b>	<b>Time</b>	<b>Instructors and Assistants</b>
<b>Day 1</b>				
1	Lecture: AAV Overview	- To know the concept and biology of the AAV viral vector - To understand different AAVs serotypes	9:00 – 12:00	NK, AM
2	Lecture: AAV Vectors	- To understand the applications and limitations of adeno-associated viral vector - To know how to work safely with AAV vectors	13:00 – 16:00	
<b>Day 2</b>				
3	Lab: Plasmid preparation	To prepare the plasmids for AAV 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 AAV plasmids into HEK293T cells for recombinant AAV production	13:00 – 16:00	
<b>Day 3</b>				
6	Lab: AAV particle extraction	To extract recombinant AAV particles from HEK293T culture	9:00 – 12:00	Staff
7	Lab: AAV particle collection and purification	To purify AAV particles	13:00 – 16:00	
<b>Day 4</b>				
8	Lab: AAV particle collection and purification (continue)	To purify AAV particle (continue)	9:00 – 12:00	Staff
9	Lab: AAV titration	To determine the titer of purified AAV particles	13:00 – 16:00	
<b>Day 5</b>				
10	Lab: AAV Transduction in vitro	To use AAV particles to infect target cell line	9:00- 10:30	Staff
11	Discussion and 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	Staff

**Assessment Criteria:**

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

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

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