Course Syllabus
MBMB 645 Prime Editing Technique
Academic year 2025

Course ID and Title	MBMB 645 Prime Editing Technique ชมชม ๖๔๕ เทคนิคไพรม์อีดิติง
Course coordinator	Asst. Prof.Natee Jearawiriyapaisarn, Ph.D. Institute of Molecular Biosciences, Mahidol University Tel: 0-2441-9003 to 7 Ext. 1312, 1357 Email: natee.jea@mahidol.edu
Instructors:	Asst. Prof.Natee Jearawiriyapaisarn, Ph.D.
Support Staff:	Miss Pirut Thongngam
Credits:	1 (0-2-1)
Curriculum:	Master of Science Program in Molecular and Integrative Biosciences (elective course) Doctor of Philosophy Program in Molecular and Integrative Biosciences (elective course)
Semester offering:	First semester
Pre-requisites:	None

Course learning outcomes (CLOs) and their alignment with PLOs:

CLOs By the end of the course, student should be able to:	PLO1	PLO2	PLO3	PLO4
1. Apply knowledge of prime editing to achieve precise genome modifications in research (Knowledge).	✓			
2. Design and conduct experiments utilizing prime editing technology, analyze data, and interpret findings to advance genome engineering research (Skills).		✓		
3. Adhere to scientific integrity, implement safety practices, and demonstrate responsibility in experimental work and assignments (Ethics).			✓	
4. Demonstrate leadership, teamwork, effective research communication, and strong interpersonal skills in collaborative scientific environments (Characters).				✓

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcomes	Teaching Method	Assessment Method
1. Apply knowledge of prime editing to achieve precise genome modifications in research.	1. Problem-based project 2. Discussion 3. Assignment	1. Laboratory performance 2. Discussion performance 3. Assignment
2. Design and conduct experiments utilizing prime editing technology, analyze data, and interpret findings to advance genome engineering research.	1. Hands-on lab practice	1. Laboratory performance 2. Lab report
3. Adhere to scientific integrity, implement safety practices, and demonstrate responsibility in experimental work and assignments.	1. Lab safety orientation 2. Discussion 3. Lab report 4. Assignment	1. Laboratory performance 2. Discussion performance 3. Report and assignment submission 4. Assignment 5. Plagiarism detection
4. Demonstrate leadership, teamwork, effective research communication, and strong interpersonal skills in collaborative scientific environments.	1. Problem-based project 2. Discussion 3. Group activities 4. Presentation	1. Laboratory performance 2. Discussion performance 3. Performance in group activities 4. Presentation performance

Course description:

Prime editing technology; design of prime editing components; plasmid construction for expressing prime editing components; basic cell culture techniques and DNA transfection; genome editing analysis by PCR; next-generation sequencing and web-based programs

เทคโนโลยีไพรม์อีดิติง การออกแบบส่วนประกอบของไพรม์อีดิติง การสร้างพลาสมิดสำหรับการแสดงออกของส่วนประกอบของไพรม์อีดิติง เทคนิคการเลี้ยงเซลล์ขั้นพื้นฐานและการนำส่งดีเอ็นเอเข้าสู่เซลล์ การตรวจสอบการแก้ไขจีโนมด้วยเทคนิคพีซีอาร์ เทคนิคการวิเคราะห์หาลำดับนิวคลีโอไทด์ยุคใหม่และโปรแกรมบนเว็บ

Course Schedule (Tentative):

(Classroom C405 and Laboratory room D408, Institute of Molecular Biosciences, Mahidol University)

	Activities	Description	Time	Instructors and Assistants
Day 1: November 24, 2025				
1	Lecture/Discussion: Prime editing mechanism and workflow (1) Lab: Design of epegRNAs and nicking sgRNAs	To introduce/review the concept and workflow of prime editing. - Lab safety orientation - To design epegRNAs and nicking sgRNAs for precise genome editing.	9.00 – 12.00	NJ
2	Lab: Preparation of epegRNA and nicking sgRNA constructs (1)	- To generate oligo duplexes of epegRNA and nicking sgRNA. - To perform digestion-ligation reactions. - To transform plasmid DNA into E. Coli.	13.00 – 17.00	NJ
Day 2: November 25, 2025				
1	Lab: Genome correction by prime editing in HEK293T cells (1)	- To seed cells into a culture plate.	9.00 – 12.00	NJ
2	Lecture/Discussion: Prime editing mechanism and workflow (2)	To discuss the concept and workflow of prime editing.	13.00 – 16.00	NJ
3	Lab: Preparation of epegRNA and nicking sgRNA constructs (2)	- To pick up bacterial colonies and culture in a liquid medium.	16.00 – 17.00	NJ
Day 3: November 26, 2025				
1	Lab: Preparation of epegRNA and nicking sgRNA constructs (3)	- To isolate plasmid DNA. - To measure plasmid DNA concentration and purity. - To demonstrate and discuss how to screen positive clones by colony PCR. - To demonstrate and discuss how to confirm correct clones by DNA sequencing.	9.00 – 12.00	NJ

	Activities	Description	Time	Instructors and Assistants
2	Lab: Genome correction by prime editing in HEK293T cells (2)	- To transfect the plasmid into HEK293T cells.	13.00 – 17.00	NJ
Day 4: November 27, 2025				
1	Lab: Analysis of genome correction (1)	- To collect cells for flow cytometry analysis to assess transfection efficiency.	13.00 – 17.00	NJ
Day 5: November 28, 2025				
1	Lab: Analysis of genome correction (2)	- To collect cells, extract DNA, and perform allele-specific PCR for analysis of genome correction.	9.00 – 12.00	NJ
2	Lab: Analysis of genome correction (3)	- To perform agarose gel electrophoresis. - To demonstrate and discuss how to analyze and quantify genome editing efficiency by Sanger DNA sequencing and web-based tools (TIDER and ICE analysis).	13.00 – 15.00	NJ
3	Presentation, discussion, reflection, and after-action review	- To present the results achieved in the class. - To discuss the techniques and applications of prime editing. - To provide students opportunities to describe their learning experiences received from this course and how they can be applied to their future learning. - To collect comments, and suggestions from students for further improvements of the course.	15.00 – 17.00	NJ

Assessment Criteria:

Assessment method		Performance criteria	Scoring rubric
1	Class attendance & participation (10%)	Attendance and punctuality (5%)	Punctually (4) 5 minutes late (3) 10 minutes late (2)

			15 minutes late (1) > 20 minutes late or absent (0)
		Participation (5%)	Frequently participates (4) Moderately participates (2-3) Seldom participates (1) Never participates (0)
2	Assignment (15%)	Punctual assignment submission (1%)	On-time (4) 1 day late (3) 2 days late (2) 3 days late (1) 4 days late or later (0)
		Creativity (3%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Organization (2%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Content accuracy (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Supporting evidence (2%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Grammar and originality (2%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
3	Presentation/Discussion (15%)	Participation and performance (2%)	Active (4) Fairly active (2-3) Inactive (1)
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)

		Creative and high-order thinking skills (8%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
4	Lab performance (30%)	Safety practice (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Lab skills (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Time management (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Troubleshooting skills (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
5	Lab report (30%)	Punctual submission (2%)	On-time (4) 1 day late (3) 2 days late (2) 3 days late (1) 4 days late or later (0)
		Report organization: intro, methods, results, discussion, and conclusion (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Data presentation, analysis, and interpretation (15%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Grammar and originality (3%)	Excellent (4) Above average (3) Average (2) Needs improvement (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 range	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: July 31, 2025