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:	1. Asst. Prof.Natee Jearawiriyapaisarn, Ph.D. 2. Asst. Prof.Alisa Tubsuwan, Ph.D.
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:	Second semester
Pre-requisites:	None

Course learning outcomes (CLOs):

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

1. Apply the knowledge of prime editing for generating precise genome engineering (**Knowledge**).
2. Conduct experiments related to prime editing technology (**Skills**).
3. Demonstrate scientific integrity, responsibility, and safety practices (**Ethics**).
4. Demonstrate critical thinking, teamwork, and interpersonal skills (**Characters**).
5. Effectively communicate scientific concepts and findings through discussions and presentations (**Characters**).

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcomes	Teaching Method	Assessment Method
1. Apply the knowledge of prime editing for generating precise genome engineering	1. Problem-based project 2. Discussion 3. Assignment	1. Laboratory performance 2. Discussion performance 3. Assignment
2. Conduct experiments related to prime editing technology	1. Hands-on lab practice	1. Laboratory performance 2. Lab report
3. Demonstrate scientific integrity, responsibility, and safety practices	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 critical thinking, teamwork, and interpersonal skills	1. Problem-based project 2. Discussion 3. Group activities	1. Laboratory performance 2. Discussion performance 3. Performance in group activities
5. Effectively communicate scientific concepts and findings through discussions and presentations	1. Discussion 2. Presentation	1. Discussion performance 2. 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 XXX and Lab Classroom XXX)

	Activities	Description	Time	Instructors and Assistants
Day 1				
1	Lecture/Discussion: Prime editing mechanism and workflow	To introduce/review the concept and workflow of prime editing.	9.00 – 1200	AT/NJ
2	Lab: Design of epegRNAs and nicking sgRNAs	- Lab safety orientation - To design epegRNAs and nicking sgRNAs for precise genome editing.	13.00 – 15.00	AT/NJ
3	Lab: Preparation of epegRNA and nicking sgRNA constructs (1)	- To generate oligo duplexes of epegRNA and nicking sgRNA.	15.00 -17.00	AT/NJ
Day 2				
1	Lab: Preparation of epegRNA and nicking sgRNA constructs (2)	- To perform digestion-ligation reactions.	9.00 – 12.00	AT/NJ
2	Lab: Preparation of epegRNA and nicking sgRNA constructs (3)	- To transform plasmid DNA into E. Coli.	13.00 – 17.00	AT/NJ
Day 3				
1	Lab: Genome correction by prime editing in HEK293T cells (1)	- To seed cells into culture plate.	9.00 – 12.00	AT/NJ
2	Lab: Preparation of epegRNA and nicking sgRNA constructs (4)	- To pick up bacterial colonies and culture in a liquid medium.	13.00 – 17.00	AT/NJ
Day 4				

1	Lab: Preparation of epegRNA and nicking sgRNA constructs (5)	- 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	AT/NJ
2	Lab: Genome correction by prime editing in HEK293T cells (2)	- To transfect plasmid into HEK293T cells.	13.00 -17.00	AT/NJ
Day 5				
1	Lab: Analysis of genome correction (1)	- To collect cells for analyses. - To do flow cytometry for analysis of transfection efficiency. - To extract DNA and perform allele-specific PCR for analysis of genome correction.	9.00 – 12.00	AT/NJ
2	Lab: Analysis of genome correction (2)	- 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	AT/NJ
3	Presentation, discussion, reflection, and after-action review	- To present 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	15.00 – 17.00	AT/NJ

		they can be applied to their future learning. - To collect comments, and suggestions from students for further improvements of the course.		

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	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: XXX 20XX