Course Syllabus
MBMB 637 Fluorescent Protein Technology and Yeast Genome Engineering
Academic Year 2025

Course ID and Title: MBMB 637
Fluorescent Protein Technology and Yeast Genome Engineering
ชมชม ๖๓๗
เทคโนโลยีโปรตีนฟลูออเรสเซนต์และวิศวกรรมจีโนมยีสต์

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: 2nd Semester

Academic Year: 2025

Date and Time: February 23 — 27, 2026 (9:00 AM — 4:00 PM)

Classroom: B205 Laboratory, Institute of Molecular Biosciences, Mahidol University

Pre-Requisites: None

Course Coordinator: Assoc. Prof. Chalongrat Noree, Ph.D.
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Instructor:

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Support Staff:

1. Naraporn Sirinonthanawech
   (*for assistance with confocal microscope operation on the DAY 5 morning session*)
   Email: naraporn.sir@mahidol.edu

Course Learning Outcomes (CLOs):
By the end of the course, students should be able to:

1. Illustrate PCR-based techniques that can be used for yeast genome engineering (**Knowledge**).
2. Employ PCR-based yeast genome engineering and fluorescent protein technology to ad-dress a biological problem or question (**Skills**).
3. Comply with research ethics and scientific integrity (**Ethics**).
4. Demonstrate the professional and interpersonal skills/character required to support the completion of assigned (group/individual) works and laboratory experiments (**Character**).

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcomes	Teaching Method	Assessment Method
1. Illustrate PCR-based techniques that can be used for yeast genome engineering (**Knowledge** – Aligned with **PLO1**).	1. Active learning 2. Discussion	1. Q&A during lecture 2. Discussion performance 3. Quiz / short exercise 4. Assignment
2. Employ PCR-based yeast genome engineering and fluorescent protein technology to ad-dress a biological problem or question (**Skills** – Aligned with **PLO2**).	1. Instructions 2. Discussion 3. Hands-on lab practice 4. Problem-based learning	1. Discussion performance 2. Lab performance 3. Problem-based learning (scientific content and inventive idea)
3. Comply with research ethics and scientific integrity (**Ethics** – Aligned with **PLO3**).	1. Discussion (about scientific integrity, responsibility, and safety practice) 2. Assignment 3. Writing lab report 4. Hands-on lab safety practice	1. Attendance (presence, absence, on-time?) 2. Task submission (on-time?) 3. Lab report writing (plagiarism?) 4. Lab performance (follow safety practice?)
4. Demonstrate the professional and interpersonal skills/character required to support the completion of assigned (group/individual) works and laboratory experiments (**Character** – Aligned with **PLO4**).	1. Discussion 2. Writing lab report 3. Individual or group assignment/presentation 4. Problem-based learning	1. Discussion performance (active participation?) 2. Lab report writing performance 3. Performance in the team (teamwork or leadership skills)

Course Description:

PCR-based yeast genome engineering; plasmid construction for yeast genome engineering; primer design for DNA cassette amplification; DNA cassette preparation by PCR and PCR purification; yeast culture; yeast transformation and selection; fluorescent protein technology; fluorescence microscopic analysis

(In Thai) วิศวกรรมจีโนมยีสต์ด้วยเทคนิคพีซีอาร์ การสร้างพลาสมิดสำหรับวิศวกรรมจีโนมยีสต์ การออกแบบไพรเมอร์เพื่อเพิ่มจำนวนคาสเซ็ทดีเอ็นเอ การเตรียมคาสเซ็ทดีเอ็นเอด้วยเทคนิคพีซีอาร์และการทำให้พีซีอาร์บริสุทธิ์ การนำดีเอ็นเอเข้าสู่ยีสต์และการคัดเลือกยีสต์ที่ได้รับดีเอ็นเอ เทคโนโลยีโปรตีนฟลูออเรสเซนต์ การวิเคราะห์ตัวอย่างด้วยกล้องจุลทรรศน์ฟลูออเรสเซนซ์

Course Schedule:

	Activities	Description	Time	Instructor
		DAY 1		
1	**Active Discussion/PBL: Overview and Background**	• To go over the concept of fluorescent protein technology and yeast genome engineering. • To introduce the research procedure related to yeast genome engineering to study the interaction and relationship between two different proteins (Asn1p and Tub1p).	9:00 AM – 4:00 PM	**CN**
2	**Lab: DNA Casette Amplification by PCR**	• To prepare the DNA cassette "*ASN1::GFP::NLS; kanR*".		
3	**Active Discussion**	• To recap lab objectives and workflow integration (DAY 1).		
		DAY 2		
1	**Lab: Preparing Agarose Gel**	• To be used for checking PCR product (DNA cassette).	9:00 AM – 4:00 PM	**CN**
2	**Lab: Agarose Gel Electrophoresis**	• To check the PCR product (DNA cassette).		
3	**Lab: PCR Purification**	• To purify the DNA cassette using a PCR purification kit.		
4	**Lab: Preparing Yeast Overnight Culture**	• To prepare a starter culture for making competent yeast cells.		
5	**Active Discussion**	• To recap lab objectives and workflow integration (DAY 2).		
		DAY 3		
1	**Lab: Preparing Log-Phase Yeast Culture**	• To prepare log-phase yeast cells for transformation.	9:00 AM – 4:00 PM	**CN**
2	**Active Learning and Computer Lab: Plasmid Construction and Primer Design**	• To discuss yeast genome engineering technique for tagging the protein of interest with a fluorescent protein.		

	Activities	Description	Time	Instructor
		• To retrieve nucleotide sequence of "ASN1" gene from yeast genome database, to construct the recombinant plasmid (in silico), and to design primers using "ApE" (A plasmid Editor software). • To locate primers on the plasmid template to find out the length of the expected PCR product (DNA cassette).		
3	**Lab: Preparing Competent Yeast Cells**	• To make competent yeast cells "*TUB1::mCherry; hygR*".		
4	**Lab: Yeast Transformation**	• To transform DNA cassette into competent yeast cells.		
5	**Active Discussion**	• To recap lab objectives and workflow integration (DAY 3).		
		DAY 4		
1	**Lab: Replica Plating**	• To transfer yeast transformants from non-selective to selective agar plates.	9:00 AM – 4:00 PM	**CN**
2	**Lab: Analyzing Transformants with Fluorescence Microscopy**	• To microscopically visualize yeast expressing Asn1p-EGFP-NLS and Tub1p-mCherry, and inspect if they colocalize.		
3	**Active Discussion**	• To recap lab objectives and workflow integration (DAY 4).		
4	**Reading Assignment**	• To have students find and read a research article that used fluorescent protein technology and yeast genome engineering to solve a biological question, and prepare a short summary presentation for DAY 5.		
		DAY 5		
1	**Student Presentation and Discussion**	• To have students present and share their reading assignment to the whole class.	9:00 AM – 4:00 PM	**CN**
2	**Final Recap and Reflection**	• To summarize the concept of PCR-based yeast genome engineering and fluorescent protein technology for cell biology studies. • To allow students to articulate and share what they've learned		

	Activities	Description	Time	Instructor
		or gained from this course to the whole class.		
3	**After Action Review (AAR)**	• To self-evaluate the achievement of CLOs and collect feedback and comments for course improvement.		

Assessment Criteria:

Assessment Criteria		Description (in Details)	Scoring Rubric
1	**Class Attendance (5%)**	Showing up in the class (**5%**)	• Full attendance (**4**) • ~ 80% attendance (**3**) • ~ 60% attendance (**2**) • < 50% attendance (**1**)
2	**Lab Report (25%)**	The presence of intro, methods, results, discussion, and conclusion **with no plagiarism** (**5%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		Data presentation (**5%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		Data analysis and interpretation (**5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		English and writing skills (**5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Report format and typing errors (**2%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		On-time submission (**3%**)	• On-time (**4**) • Late (2-3) • Very late (1)
3	**Quiz / Exercise (10%)**	Depending on the correctness and completion (**10%**)	**Raw scores will be adjusted to be in a range of 0-10%**
4	**Discussion / Presentation Performance (20%)**	Participation and presentation performance (**10%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)
		Professional and interpersonal characters (responsibility, teamwork, and leadership) (**5%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)

Assessment Criteria		Description (in Details)	Scoring Rubric
		Creative and high-order thinking skills (**5%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
5	**Reflection (10%)**	Knowledge sharing (**2.5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Inventive and creative thinking skills (**2.5%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
		Communication skills (**2.5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Professional and interpersonal characters (responsibility, teamwork, and leadership) (**2.5%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)
6	**Lab Performance (30%)**	Safety practice (**5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Responsibility (**5%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
		Lab skills (**10%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Need to be improved (**1**)
		Decision making and trouble-shooting skills (**10%**)	• 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

Percentage	Grade	Description
60—64	C	Fair
55—59	D+	Poor
50—54	D	Very Poor
0—49	F	Fail

Date of Revision: November 2025