

**Course Syllabus**  
**MBMG 515 Protein Technologies and Applications**  
**Academic Year 2023**

**Course ID and Title:** MBMG 515 Protein Technologies and Applications  
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**Credits:** 2(1-2-3)**Curriculum:** Master of Science Program in Molecular Genetics and Genetic Engineering (Required course)

Doctor of Philosophy Program in Molecular Genetics and Genetic Engineering (Required course for students from B.Sc.)

**Semester:** 2<sup>nd</sup> Semester**Pre-Requisites:**

None.

**Course Learning Outcomes (CLOs):**

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

1. Describe protein-based technologies that can be used for protein/proteomic research and/or innovation development.
2. Apply the knowledge of protein-based technologies to offer a promising solution for any biological problem.
3. Deliver creative/innovative idea of the use of protein-based technologies and applications with appropriate ICT skills.
4. Demonstrate scientific integrity, responsibility, and safety practices.
5. Demonstrate professional and interpersonal skills.

**Alignment of Teaching and Assessment Methods to Course Learning Outcomes:**

Course Learning Outcomes	Teaching Method	Assessment Method
1. Describe protein-based technologies that can be used for research study and/or innovation development.	<ol style="list-style-type: none"> <li>1. Lecture</li> <li>2. Discussion</li> </ol>	<ol style="list-style-type: none"> <li>1. Q&amp;A during lecture</li> <li>2. Discussion performance</li> <li>3. Quiz / short exercise</li> <li>4. Assignment</li> </ol>
2. Apply the knowledge of protein-based technologies to offer a	<ol style="list-style-type: none"> <li>1. Discussion</li> <li>2. Hands-on lab practice</li> </ol>	<ol style="list-style-type: none"> <li>1. Discussion performance</li> <li>2. Lab performance</li> </ol>

<b>Course Learning Outcomes</b>	<b>Teaching Method</b>	<b>Assessment Method</b>
promising solution for any biological problem.	3. Problem-based project (final presentation)	3. Problem-based project presentation performance (scientific content and innovative idea)
3. Deliver the idea of the use of protein-based technologies and applications with appropriate ICT skills.	1. Discussion 2. Writing lab report 3. Individual or group assignment/presentation (lecture and lab session) 4. Problem-based project (final presentation)	1. Discussion performance 2. Lab report writing performance 3. Presentation performance (lecture and lab session) 4. Problem-based project presentation performance (appropriate use of ICT?)
4. Demonstrate scientific integrity, responsibility, and safety practice.	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?)
5. Demonstrate professional and interpersonal skills.	1. Discussion 2. Writing lab report 3. Individual or group assignment/presentation 4. Problem-based project (final presentation)	1. Discussion performance (active participation?) 2. Lab report writing performance 3. Performance in the team (teamwork or leadership skills) 4. Problem-based project presentation

Course Learning Outcomes	Teaching Method	Assessment Method
		performance (teamwork)

### Course Description:

Proteomics; Expression Profiling by 2D Electrophoresis; Mass Spectrometry; Bioinformatics Tools for Proteomic Analysis; Phage Display; Protein Database and Protein Visualization; Drug Design; Fluorescent Protein Technology

### Course Schedule:

(Classroom C405 and Lab Classroom C410-C411)

	Activities	Description	Time	Instructors and Assistants
<b>Hands-on Lab Practice: Fluorescent Protein Technology Monday, November 27, 2023</b>				
1	<b>Lecture: Overview</b>	To go over the concept of fluorescent protein technology.	9:00 – 10:00 AM	<b>CN, IM, (assistants: NS, NP)</b>
2	<b>Lab: PCR</b>	To prepare the DNA cassette “ASN1::GFP::NLS; kanR”	10:00 – 10:30 AM	
3	<b>Lab: Preparing Agarose Gel</b>	To be used for checking PCR product (DNA cassette).	10:30 – 11:30 AM	
4	<b>Lab: Agarose gel electrophoresis</b>	To check the PCR product.	12:30 – 4:00 PM	
5	<b>Lab: PCR purification</b>	To purify the DNA cassette.		
6	<b>Lab: Preparing Yeast O/N Culture</b>	To prepare a starter culture for making competent yeast cells.		
<b>Hands-on Lab Practice: Fluorescent Protein Technology Tuesday, November 28, 2023</b>				
1	<b>Lab: Preparing Yeast Log-Phase Culture</b>	To prepare log-phase yeast cells for transformation.	9:00 – 9:30 AM	<b>CN, IM (assistants: NS, NP)</b>
2	<b>Lecture/Discussion and Computer Lab: Plasmid Construction and Primer Design</b>	<ul style="list-style-type: none"> <li>To discuss about yeast genome engineering technique for tagging protein of interest with fluorescent protein.</li> <li>To retrieve nucleotide sequence of “ASN1” from yeast</li> </ul>	9:30 – 11:30 AM	

	<b>Activities</b>	<b>Description</b>	<b>Time</b>	<b>Instructors and Assistants</b>	
		<p>genome database, construct the recombinant plasmid (in silico), and design primers using “ApE” (A plasmid Editor software).</p> <ul style="list-style-type: none"> <li>To locate primers on the plasmid template in order to find out the expected length of PCR product (DNA cassette).</li> </ul>			
3	<b>Lab: Preparing Competent Yeast Cells</b>	To make competent yeast cells ( <i>TUB1::mCherry</i> )	12:30 – 3:30 PM		
4	<b>Lab: Yeast Transformation</b>	To transform DNA cassette into yeast competent cells.			
5	<b>Discussion</b>	To discuss about experimental designs and applications of fluorescently-tagged proteins for <i>in vivo</i> studies.	3:30 – 4:00 PM		
<b>Hands-on Lab Practice: Fluorescent Protein Technology</b>					
<b>Wednesday, November 29, 2023</b>					
1	<b>Lab: Replica Plating</b>	To transfer yeast transformants from non-selective to selective agar plates.	9:00 – 9:30 AM	<b>CN, IM</b> <b>(assistants: NS, NP)</b>	
2	<b>Lab: Analyzing Transformants with Fluorescence Microscopy</b>	To microscopically visualize yeast expressing Asn1p-EGFP-NLS and Tub1p-mCherry, and inspect if they colocalize.	9:30 AM – 12:00 PM		
3	<b>Recap</b>	To recap the techniques and applications of fluorescent proteins.	1:00 – 4:00 PM		
<b>Proteomics and Mass Spectrometry</b>					
<b>Thursday, November 30, 2023</b>					
1	<b>Lecture/Discussion: Proteomics and Mass Spectrometry</b>	To introduce the principle of proteomic research and applications	9:00 – 11:30 AM	<b>CK</b>	

	<b>Activities</b>	<b>Description</b>	<b>Time</b>	<b>Instructors and Assistants</b>
2	<b>MU-FRF Visit</b>	To introduce the facility and scientific equipment available at the Mahidol University – Frontier Research Facility.	1:00 – 3:00 PM	<b>CK, CN, NS</b>
<b>Protein Visualization and Protein Database Monday, December 4, 2023</b>				
1	<b>Lecture/Discussion and Computer Lab: Protein Visualization and Protein Database</b>	To apply molecular visualization techniques for communicating protein science information	9:00 – 11:30 AM	<b>DT</b>
2	<b>Practice: Problem-Based Project</b>	To design and create innovative ideas/products. <i>Note: Students will be divided into groups to work on a problem-based project about using protein-based techniques to create a novel product / innovation.</i>	1:00 – 4:00 PM	<b>CS, SP</b>
<b>Drug Design Wednesday, December 6, 2023</b>				
1	<b>Lecture/Discussion and Computer Lab: Drug Design</b>	To create protein-ligand illustration for understanding drug design	9:00 – 11:30 AM	<b>DT</b>
2	<b>Practice: Problem-Based Project (Continued)</b>	To design and create innovative ideas/products.	1:00 – 4:00 PM	<b>CK</b>
<b>Bioprocess Thursday, December 7, 2023</b>				
1	<b>Lecture/Discussion: Bioprocess</b>	To introduce the production of a value-added material/product from living source cells.	9:00 – 11:30 AM	<b>LH</b>
2	<b>Practice: Problem-Based Project (Continued)</b>	To design and create innovative ideas/products.	1:00 – 4:00 PM	<b>IM</b>
<b>Phage Display</b>				

	Activities	Description	Time	Instructors and Assistants
<b>Tuesday, December 12, 2023</b>				
1	<b>Lecture: Phage Display</b>	To introduce the concept of phage display and its application	9:00 – 11:30 AM	<b>SP</b>
2	<b>Practice: Problem-Based Project (Continued)</b>	To design and create innovative ideas/products.	1:00 – 4:00 PM	<b>DT</b>
<b>Preparation for Problem-Based Protein Presentation Wednesday, December 13, 2023</b>				
1	<b>Practice: Preparing Problem-Based Project Presentation/Pitching</b>	To prepare the group presentation/pitching for the assigned problem-based project.	9:00 AM – 12:00 PM	<b>SP, CS</b>
<b>Problem-Based Project Presentation Thursday, December 14, 2023</b>				
1	<b>Group Presentation/Pitching</b>	To present students' innovative ideas/products.	9:00 AM – 12:00 PM	<b>All Teaching Staff</b>
2	<b>After Action Review (AAR)</b>	To collect feedback, comments, suggestions from students for further improvements.	1:00 – 3:00 PM	<b>CN</b>

**Notes:**

**CK** Chartchai Krittanai  
**CN** Chalongrat Noree  
**CS** Chonticha Saisawang  
**DT** Duangrudee Tanramluk  
**IM** Ittipat Meewan  
**LH** Lalintip Hocharoen  
**SP** Surapon Piboonponcanun  
**NS** Naraporn Sirinonthanawech  
**NP** Nuanwan Pongtanom

#### Assessment Criteria:

	Assessment Criteria	Description (in Details)	Scoring Rubric
1	<b>Class Attendance (5%)</b>	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> </ul>

Assessment Criteria		Description (in Details)	Scoring Rubric
			<ul style="list-style-type: none"> <li>• &lt; 50% attendance (1)</li> </ul>
2	<b>Lab Report (10%)</b>	The presence of intro, methods, results, discussion, and conclusion <b>with no plagiarism (2%)</b>	<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 (2%)	<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 (2%)	<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>
		English and writing skills (2%)	<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>
		Report format and typing errors (1%)	<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>
		On-time submission (1%)	<ul style="list-style-type: none"> <li>• On-time (4)</li> <li>• Late (1-3)</li> </ul>
3	<b>Quiz / Exercise (15%)</b>	Depending on the correctness and completion (15%)	<b>Raw scores will be adjusted to be in a range of 0-15%</b>
4	<b>Discussion Performance / Individual or Group Assignment (Presentation) (20%)</b>	Participation and performance (5%)	<ul style="list-style-type: none"> <li>• Active (4)</li> <li>• Fairly active (2-3)</li> <li>• Inactive (1)</li> </ul>
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (5%)	<ul style="list-style-type: none"> <li>• Active (4)</li> <li>• Fairly active (2-3)</li> <li>• Inactive (1)</li> </ul>
		Creative and high-order thinking skills (10%)	<ul style="list-style-type: none"> <li>• Highly expressed (4)</li> <li>• Fairly expressed (2-3)</li> <li>• Not shown (1)</li> </ul>
5	<b>Problem-Based Project Presentation (20%)</b>	Scientific background (4%)	<ul style="list-style-type: none"> <li>• Excellent and complete (4)</li> <li>• Good (3)</li> <li>• Fair (2)</li> <li>• Not solid (1)</li> </ul>



Assessment Criteria		Description (in Details)	Scoring Rubric
		Innovative and creative thinking skills (4%)	<ul style="list-style-type: none"> <li>Highly expressed (4)</li> <li>Fairly expressed (2-3)</li> <li>Not shown (1)</li> </ul>
		Presentation skills (4%)	<ul style="list-style-type: none"> <li>Excellent (4)</li> <li>Good (3)</li> <li>Fair (2)</li> <li>Not solid (1)</li> </ul>
		Debate and argument skills (4%)	<ul style="list-style-type: none"> <li>Excellent (4)</li> <li>Good (3)</li> <li>Fair (2)</li> <li>Not solid (1)</li> </ul>
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (4%)	<ul style="list-style-type: none"> <li>Active (4)</li> <li>Fairly active (2-3)</li> <li>Inactive (1)</li> </ul>
<b>6</b>	<b>Lab Performance (30%)</b>	Safety practice (5%)	<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 (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>
		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>Not solid (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

<b>Percentage</b>	<b>Grade</b>	<b>Description</b>
60–64	C	Fair
55–59	D+	Poor
50–54	D	Very Poor
0–49	F	Fail

**Date of Revision:** July 2023