Course Syllabus
MBMG 515 Protein Technologies and Applications
Academic Year 2024

Course ID and Title: MBMG 515 Protein Technologies and Applications

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Instructors:

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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: 2nd 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.	1. Lecture 2. Discussion	1. Q&A during lecture 2. Discussion performance 3. Quiz / short exercise 4. Assignment

Course Learning Outcomes	Teaching Method	Assessment Method
2. Apply the knowledge of protein-based technologies to offer a promising solution for any biological problem.	1. Discussion 2. Hands-on lab practice 3. Problem-based project (final presentation)	1. Discussion performance 2. Lab performance 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

Course Learning Outcomes	Teaching Method	Assessment Method
		3. Performance in the team (teamwork or leadership skills) 4. Problem-based project presentation 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; Bioprocess

Course Schedule:

(Classroom C405 and Lab Classroom C410-C411)

	Activities	Description	Time	Instructors and Assistants
Hands-on Lab Practice: Fluorescent Protein Technology Monday, December 2, 2024				
1	**Lecture: Overview**	To go over the concept of fluorescent protein technology.	9:00 – 10:00 AM	**CN, IM, (assistants: NS1, NS2, NP)**
2	**Lab: PCR**	To prepare the DNA cassette "*ASN1::GFP::NLS; kanR*"	10:00 – 10:30 AM	
3	**Lab: Preparing Agarose Gel**	To be used for checking PCR product (DNA cassette).	10:30 – 11:30 AM	
4	**Lab: Agarose gel electrophoresis**	To check the PCR product.	12:30 – 4:00 PM	
5	**Lab: PCR purification**	To purify the DNA cassette.		
6	**Lab: Preparing Yeast O/N Culture**	To prepare a starter culture for making competent yeast cells.		
Hands-on Lab Practice: Fluorescent Protein Technology Tuesday, December 3, 2024				
1	**Lab: Preparing Yeast Log-Phase Culture**	To prepare log-phase yeast cells for transformation.	9:00 – 9:30 AM	**CN, IM (assistants:**

	Activities	Description	Time	Instructors and Assistants
2	**Lecture/Discussion and Computer Lab: Plasmid Construction and Primer Design**	• To discuss about yeast genome engineering technique for tagging protein of interest with fluorescent protein. • To retrieve nucleotide sequence of "*ASN1*" from yeast genome database, construct the recombinant plasmid (in silico), and design primers using "ApE" (A plasmid Editor software). • To locate primers on the plasmid template in order to find out the expected length of PCR product (DNA cassette).	9:30 – 11:30 AM	**NS1, NS2, NP)**
3	**Lab: Preparing Competent Yeast Cells**	To make competent yeast cells (*TUB1::mCherry*)	12:30 – 3:30 PM	
4	**Lab: Yeast Transformation**	To transform DNA cassette into yeast competent cells.		
5	**Discussion**	To discuss about experimental designs and applications of fluorescently-tagged proteins for *in vivo* studies.	3:30 – 4:00 PM	
Hands-on Lab Practice: Fluorescent Protein Technology Wednesday, December 4, 2024				
1	**Lab: Replica Plating**	To transfer yeast transformants from non-selective to selective agar plates.	9:00 – 9:30 AM	**CN, IM (assistants: NS1, NS2, NP)**
2	**Lab: Analyzing Transformants with Fluorescence Microscopy**	To microscopically visualize yeast expressing Asn1p-EGFP-NLS and Tub1p-mCherry, and inspect if they colocalize.	9:30 AM – 12:00 PM	

	Activities	Description	Time	Instructors and Assistants
3	**Recap**	To recap the techniques and applications of fluorescent proteins.	1:00 – 4:00 PM	
Bioprocess Friday, December 6, 2024				
1	**Lecture/Discussion: Bioprocess (ONLINE)**	To introduce the production of a value-added material/product from living source cells.	1:00 – 3:30 PM	**LH**
Protein Visualization and Protein Database Monday, December 9, 2024				
1	**Lecture/Discussion and Computer Lab: Protein Visualization and Protein Database**	To apply molecular visualization techniques for communicating protein science information	9:00 – 11:30 AM	**DT**
2	**Practice: Problem-Based Project**	To design and create innovative ideas/products. ***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.*	1:00 – 4:00 PM	**CS, SP**
Drug Design Wednesday, December 11, 2024				
1	**Lecture/Discussion and Computer Lab: Drug Design**	To create protein-ligand illustration for understanding drug design	9:00 – 11:30 AM	**DT**
2	**Practice: Problem-Based Project (Continued)**	To design and create innovative ideas/products.	1:00 – 4:00 PM	**CK**
Introducing MU-FRF Thursday, December 12, 2024				
1	**MU-FRF Visit**	To introduce the facility and scientific equipment available at	9:00 – 11:00 AM	**CK, CN, IM**

	Activities	Description	Time	Instructors and Assistants
		the Mahidol University – Frontier Research Facility.		
2	**Practice: Problem-Based Project (Continued)**	To design and create innovative ideas/products.	1:00 – 4:00 PM	**IM**
Phage Display Friday, December 13, 2024				
1	**Lecture: Phage Display**	To introduce the concept of phage display and its application	9:00 – 11:30 AM	**SP**
2	**Practice: Problem-Based Project (Continued)**	To design and create innovative ideas/products.	1:00 – 4:00 PM	**DT**
Preparation for Problem-Based Protein Presentation Proteomics & Mass Spectrometry Monday, December 16, 2024				
1	**Practice: Preparing Problem-Based Project Presentation/Pitching**	To prepare the group presentation/pitching for the assigned problem-based project.	9:00 AM – 12:00 PM	**SP, CS**
2	**Lecture/Discussion: Proteomics and Mass Spectrometry**	To introduce the principle of proteomic research and applications	1:00 – 3:30 PM	**CK**
Problem-Based Project Presentation Thursday, December 19, 2024				
1	**Group Presentation/Pitching**	To present students' innovative ideas/products.	9:00 AM – 12:00 PM	**All Teaching Staff**
2	**After Action Review (AAR)**	To collect feedback, comments, suggestions from students for further improvements.	1:00 – 3:00 PM	**CN**

Notes:
CK Chartchai Krittanai
CN Chalongrat Noree
CS Chonticha Saisawang
DT Duangrudee Tanramluk
IM Ittipat Meewan

LH Lalintip Hocharoen
SP Surapon Piboonponcanun
NS1 Naraporn Sirinonthanawech
NS2 Nawarat Suksee
NP Nuanwan Pongtanom

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 (10%)**	The presence of intro, methods, results, discussion, and conclusion **with no plagiarism** (**2%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		Data presentation (**2%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		Data analysis and interpretation (**2%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		English and writing skills (**2%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		Report format and typing errors (**1%**)	• Complete (**4**) • ~ 80% complete (**3**) • ~ 60% complete (**2**) • < 50% complete (**1**)
		On-time submission (**1%**)	• On-time (**4**) • Late (**1-3**)
3	**Quiz / Exercise (15%)**	Depending on the correctness and completion (**15%**)	**Raw scores will be adjusted to be in a range of 0-15%**
4	**Discussion Performance / Individual or Group**	Participation and performance (**5%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)

Assessment Criteria		Description (in Details)	Scoring Rubric
	Assignment (Presentation) (20%)	Professional and interpersonal skills (responsibility, teamwork, and leadership) (**5%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)
		Creative and high-order thinking skills (**10%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
5	**Problem-Based Project Presentation (20%)**	Scientific background (**4%**)	• Excellent and complete (**4**) • Good (**3**) • Fair (**2**) • Not solid (**1**)
		Innovative and creative thinking skills (**4%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
		Presentation skills (**4%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Not solid (**1**)
		Debate and argument skills (**4%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Not solid (**1**)
		Professional and interpersonal skills (responsibility, teamwork, and leadership) (**4%**)	• Active (**4**) • Fairly active (**2-3**) • Inactive (**1**)
6	**Lab Performance (30%)**	Safety practice (**5%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Not solid (**1**)
		Responsibility (**5%**)	• Highly expressed (**4**) • Fairly expressed (**2-3**) • Not shown (**1**)
		Lab skills (**10%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Not solid (**1**)
		Decision making and trouble-shooting skills (**10%**)	• Excellent (**4**) • Good (**3**) • Fair (**2**) • Not solid (**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
60—64	C	Fair
55—59	D+	Poor
50—54	D	Very Poor
0—49	F	Fail

Date of Revision: August 2024