Course Specification

Name of Institution Mahidol University

Campus/Faculty/Department Institute of Molecular Biosciences

Salaya Campus

Section 1 General Information

1. Course Code and Title

In Thai ชมพพ ๕๑๕ เทคโนโลยีโปรตีนและการประยุกต์

In English MBMG 515 Protein Technologies and Applications

2. Number of Credits 2 (1-2-3)

3. Curriculum and Course Type

3.1 Program of Study In Thai: วิทยาศาสตรมหาบัณฑิต สาขาวิชาพันธุศาสตร์ ระดับโมเลกุลและพันธุวิศวกรรมศาสตร์ (หลักสูตรนานาชาติ)

In English: Master of Science Program in Molecular Genetics and Genetic Engineering (International Program)

3.2 Course Type Required course

4. Course Coordinator and Lecturers

Course Coordinator: Assoc. Prof. Chartchai Krittanai, Ph.D.
Institute of Molecular Biosciences, Mahidol University
Tel: 02 441 9003-7 ext. 1410
E mail: ckrittanai@gmail.com

Lecturers: Assoc. Prof. Albert J. Ketterman, Ph.D.
Assoc. Prof. Chartchai Krittanai, Ph.D.
Assoc. Prof. Surapon Piboonpocanun, Ph.D.
Dr. Chalongrat Noree, Ph.D.
Dr. Chonticha Saisawang, Ph.D.
Dr. Duangnapa Kovanich, Ph.D.
Dr. Duangrudee Tanramluk, Ph.D.
Dr. Phattara-orn Havanapan, Ph.D.

5. Semester/Class Level

5.1 Semester	Semester 2 / M.Sc. year 1
5.2 Number of Students Allowed	5-20 Students

6. Pre-requisites -

7. Co-requisites no

8. Study Site Location Rooms C405, D401, Institute of Molecular Biosciences

9. Date of Preparation/Latest Revision of the Course Specifications 14 October 2020

Section 2 Aims and Objectives

1. Aims of the Course

Upon completion of this course, students are able to:

(1) Acquire new knowledge and innovation in protein technologies and applications

(2) Integrate and apply comprehensive knowledge in protein technologies and applications to solve scientific research questions

(3) Analyze and present lab data by using appropriate information and communication technologies

(4) Demonstrate scientific integrity, responsibility, and safety practice

(5) Demonstrate teamwork, interpersonal skills and responsibilities for the work assignments

2. Objectives of Course Development/Revision

According to the TQF regulations for curriculum revision every 5 years, the Molecular Genetics and Genetic Engineering program has taken the hearings from our stakeholders into consideration with the main issue about separation of the lectures (students taking early during their first year) and the hands-on laboratory practice (taking at the end of their first year) causing the difficulty for the students to get the

entire picture of the Molecular Biology concepts and techniques. Therefore, the new curriculum is substantially transformed by integrating all scattered courses into a well-coordinated and sequential series as “modules”, starting from nucleic acids (central of lives), transitioning to proteins (functioning for lives), and lastly, the cells (living as lives). Thus, it will be more practical as the Molecular Biology concepts, use of scientific equipment, hands-on practice, and related computation are all presented together at once, for any subject being focused, so that students can capture the whole picture of that without confusion.

Section 3 Course Description and Implementation

1. 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

โปรติโอมิกส์ อิเลคโตรโฟริซิสของโปรตีนแบบสองมิติ เทคนิคแมสสเปกโตรเมทรี เครื่องมือทางชีววิทยาสารสนเทศในการวิเคราะห์โปรติโอมิกส์ การแสดงแอนติบอดี้บนผิวเฟจ ฐานข้อมูลโปรตีนและการสร้างภาพโปรตีน การออกแบบยา เทคโนโลยีโปรตีนเรืองแสง

2. Number of Hours Per Semester

Lecture (Hours)	Extra Class (Hours)	Laboratory (Hours)	Self-Study (Hours)
15	-	30	45

3. Number of Hours per Week for Individual Advice

Giving individual advice: 1 hour / week

After-action review: 1 hour/week

On-line advice (email or other method): 1 hour / week

Section 4 Development of Student Learning Outcomes

1. Brief summary on knowledge and skills expected to be acquired by the students

Students will be able to integrate comprehensive knowledge in protein technologies and applications and related disciplines to solve scientific research problems, demonstrate the experimental skills, analyse and discuss results and demonstrate teamwork, interpersonal skills and responsibilities for the work assignments.

2. Description of teaching methodology used to achieve the outcomes stated in 1

Course is taught using lectures, hands-on practice, problem-based learning and discussion. Teaching materials include lecture notes, textbooks, documents and visual aids.

3. Measurement and evaluation methods for each learning outcome according to the standard (See TQF 2)

1. Moral Standard and Ethics

1.1 Expected outcome on morality and ethics

- (1) To possess self-discipline, punctuality and responsibility
- (2) To demonstrate honesty and non-plagiarism
- (3) To conduct experiments and present data with scientific integrity

1.2 Teaching methods

(1) Lecture

(2) Hands-on practice

(3) Group/individual assignment

1.3 Evaluation methods

(1) Class attendance and responsibility for assigned work

(2) Behavior in class discussion participation

(3) Laboratory performance

(4) Plagiarism detection

2. Knowledge

2.1 Expected outcome on knowledge

● (1) To explain concepts, principles of protein technologies and applications

● (2) To acquire new knowledge and innovation in protein technologies

● (3) To integrate and apply knowledge of protein technologies and applications with other related disciplines to answer scientific or research questions.

2.3 Evaluation methods

(1) Written examination

(2) Presentation

(3) Report

3. Cognitive Skills

3.1 Expected outcome on cognitive skills

● (1) To integrate and apply theoretical and practical knowledge to solve scientific problems and propose creative solution

● (2) To appropriately plan, conduct experiments and manage assigned work to achieve goals

O (3) To systematically deliver laboratory data and assigned work to scientific community

3.2 Teaching methods

(1) Problem-based learning

(2) In-class discussion

3.3 Evaluation methods

(1) Presentation

(2) Report

(3) Written examination

4. Interpersonal Skills and Responsibility

4.1 Expected outcome on interpersonal skills and responsibility

● (1) To demonstrate responsibility for both individual and group assignments

● (2) To demonstrate leadership skill in team working and work effectively and cooperatively in team

4.2 Teaching methods

(1) Problem-based learning

(2) In-class discussion

(3) Group assignment

4.3 Evaluation methods

(1) Direct observation

(2) Class participation and behavior in class

(3) Group presentation

(4) Report

5. Numerical Analysis Skills, Communication and Information Technology Skills

5.1 Expected outcome on numerical analysis skills, communication and information technology skills

● (1) To systematically use information technology in data analysis and presentation

O (2) To be able to use a wide range of appropriate information and communication technologies in making report, oral and poster presentation

5.2 Teaching methods

(1) Problem-based learning

(2) In-class discussion

(3) Group assignment

5.3 Evaluation methods

(1) Oral and poster presentation

(2) Report

Section 5 Lesson Plan and Evaluation

5.1 Lesson Plan

Topics	Time	Format	Instructors	Room
30 November 2020				
PCR of mCherry DNA cassette	09:00 – 12:00	Lab	CN / SP	D401
Primer design	13:00 – 15:00	Lecture / Computer	CN	
Yeast culture preparation	15:00 – 15:30	Lab	CN / SP	
1 December 2020				
Yeast competent cell preparation	09:00 – 12:00	Lab	CN / SP	D401
Yeast transformation	13:00 – 16:00	Lab		
2 December 2020				
Replica plating	09:00 – 10:00	Lab	CN / SP	D401
Screening transformants under fluorescent microscope	10:00 – 12:00	Lab		
Discussion	13:00 – 15:00	Discussion		
3 December 2020				
Phage Display	09:00 – 11:00	Lecture	SP	C405
Protein visualization and database	13:00 – 15:00	Lecture / Computer	DT	Computer Lab
4 December 2020				
Drug design	09:00 – 12:00	Lecture / Computer	DT	Computer Lab
Proteomics	13:00 – 15:00	Lecture	CK	C405
7 December 2020				
Expression profiling by 2D electrophoresis: Protein extraction	09:00 - 12:00	Lab	AJK / CK / PH / CS	D401
Determination of protein concentration	13:00 – 15:00	Lab		

First dimension separation by Isoelectric focusing (IEF)	15.00 - 16.00	Lab		
8 December 2020				
Sample equilibration and Second dimension separation by SDS-PAGE	09:00 – 12:00	Lab	AJK / CK / PH / CS	D401
Gel staining and de-staining	13.00 - 15:00	Lab		
Mass spectrometry	15.00 – 16.30	Lecture	DK	C405
9 December 2020				
Image analysis, Spot excision	09.00 - 11.00	Lab	AJK / CK / PH / CS	D401
Mass spectrometry	11.00 – 12.00	Lab		
Database search and protein identification	13.30 – 15.30	Lab		Computer Lab
14 December 2020				
Written exam	10:00 – 12:00	Exam	CK	C405
Problem-based Inquiry	13:00 – 15:00	Poster preparation	staff	C405

Teaching staffs:

AK	Albert Ketterman	**DK**	Duangnapa Kovanich
CK	Chartchai Krittanai	**DT**	Duangrudee Tanramluk
CN	Charlongrat Noree	**PH**	Phattara-Orn Havanapan
CS	Chonticha Saisawang	**SP**	Surapon Piboonpocanun

Supporting staffs

NP	Nuanwan Phungthanom	**NS**	Naraporn Sirinonthanawech

5.2 Evaluation Plan for Learning Outcome

Learning Outcome	Activity	Evaluated in Week	Evaluation Ratio
1. Acquire new knowledge and innovation in protein technologies and applications (2.1.1, 2.1.2, 2.1.3)	Quiz, Written examination	1-2	20%
2. Integrate and apply comprehensive knowledge in protein technologies and applications to solve scientific research questions (3.1.1, 3.1.2, 3.1.3)	Problem-based learning, presentation (oral and poster)	1-2	20%
3. Analyze and present lab data by using appropriate information and communication technologies (5.1.1, 5.1.2)	Presentation (report, lab notebook)	1-2	20%
4. Demonstrate scientific integrity, responsibility, safety practice (1.1.1, 1.1.2, 1.1.3) with teamwork and interpersonal skills (4.1.1, 4.1.2)	Lab performance. Scientific skills and safety practices, participation in group assignment and class attendance.	1-2	40%

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

Percentage	Grade	Description
55–59	D^+	Poor
50–54	D	Very Poor
0–49	F	Fail

Section 6 Teaching Resources

1. Textbooks and Core Instructional Materials

1.1 Green M.R. and Sambrook J. (2012). Molecular Cloning: A Laboratory Manual (Fourth Edition). Cold Spring Harbor Laboratory Press. pp. 2,028.

1.2 Proteome Research: New Frontiers in Functional Genomics (1997) Edited by Marc R. Wilkins, Springer-Verlag, Berlin.

1.3 Proteomics: From Sequence to Function (2001) Edited by S.R. Pennington and M. Dunn, Springer-Verlag, New York.

2. Essential Documents and Information

2.1 Hung, C. L. and C. C. Chen (2014). "Computational approaches for drug discovery." Drug Dev Res 75(6): 412-418.

2.2 Interactive tutorial of EGFP chromophore formation. Carl Zeiss Co., Ltd. 1. Biophysical technique, Chapter 3 in Mass Spectrometry / Ian Campbell.

2.3 Mass spectrometry: principles and applications 3rd ed. / Edmond de Hoffmann and Vincent Stroobant. (http://www.usp.br/massa/2014/qfl2144/pdf/MassSpectrometry.pdf)

2.4 Introducing Proteomics: From Concepts to Sample Separation, Mass Spectrometry and Data Analysis. / Josip Lovric.

3. Recommended Documents and Information

3.1 Craggs TD. Green fluorescent protein: structure, folding and chromophore maturation. Chemical Society Reviews. 2009;38(10):2865-75.

3.2 EMD Chemicals, Inc. KOD Hot Start DNA Polymerase User Protocol. Available at https://www.merckmillipore.com/TH/en/product/KOD-Hot-Start-DNA-

Polymerase,EMD_BIO-71086?ReferrerURL=https%3A%2F%2Fwww.google.co.th%2F&bd=1#anchor_USP.

3.3 Geneaid Biotech Ltd. GenepHlow™ Gel/PCR Kit Instruction Manual. Available at http://www.geneaid.com/sites/default/files/DFH6_0.pdf.Interactive tutorial of EGFP chromophore formation. Carl Zeiss Co., Ltd. <http://zeiss-campus.magnet.fsu.edu/tutorials/fluorescentproteins/egfpchroma/indexflash.html.

3.4 Noree C, Sato BK, Broyer RM, Wilhelm JE. Identification of novel filament-forming proteins in *Saccharomyces cerevisiae* and *Drosophila melanogaster*. The Journal of cell biology. 2010 Aug 23;190(4):541-51.

3.5 Petracek ME, Longtine MS. PCR-based engineering of yeast genome. Methods in enzymology 2002 Jan 1; 350:445-469). Academic Press.

3.6 Tsien RY. Nobel lecture: constructing and exploiting the fluorescent protein paintbox. Integrative Biology. 2010;2(2-3):77-93.

Section 7 Evaluation and Improvement of Course Implementation

1. Strategy for Course Effectiveness Evaluation by Students

1.1 Evaluation of student performance (online)

1.2 Student evaluation of course quality (online)

(1) Course content

(2) Course management

(3) Suggestions

(4) Overall opinion

1.3 Faculty evaluation of course quality

(1) Course content

(2) Course management

(3) Suggestions

(4) Overall opinion

2. Strategy for Teaching Evaluation

2.1 Student evaluation

2.2 Faculty evaluation (direct observation, student performance)

3. Teaching Improvement

3.1 Course improvement meeting among teaching staff before and after the course

3.2 Workshop on active learning for outcome-based education and online courses

4. Verification of Standard of Learning Outcome for the Course

4.1 Analysis of students' learning outcomes using scores from class attendance, assignments and examinations.

4.2 Brainstorming of students about the course learning outcomes and teaching and assessment approaches.

4.3 Monitoring the course learning outcomes, exam questions, marking schemes, student assessment criteria by the program executive committee.

5. Revision Process and Improvement Plan for Course Effectiveness

5.1 Establish student learning outcomes at both program and course levels

5.2 Regularly hold meetings among faculty members to review the courses before semester starts and throughout the semester as needed.

5.3 Gather and respond to stakeholder feedbacks.