Course Syllabus

MBMB 643 Omics in Gene Regulation Studies

Academic year 2025

Course ID and Title	MBMB 643 Omics in Gene Regulation Studies ชมชม ๖๔๓ โอมิกส์ในการศึกษาการควบคุมยีน
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 Office: A301 (3rd floor, wing-A) Lab: C303 (3rd floor, wing-C) Institute of Molecular Biosciences, Mahidol University
Instructor:	Asst. Prof.Natee Jearawiriyapaisarn, Ph.D.
Credits:	1 (1-0-2)
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. Critically evaluate the application of omics technologies to study gene regulation (**Knowledge**);
2. Design omics-based experiments to study gene regulation (**Skills: problem-solving**);
3. Demonstrate scientific integrity, and responsibility (**Ethics**);
4. Critically evaluate and present recently published literature in the field of omics and gene regulation (**Characters**).

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcomes	Teaching Method	Assessment Method
1. Critically evaluate the application of omics technologies to study gene regulation	1. Interactive lecture 2. Discussion	1. Class participation 2. Discussion performance 3. Assignment
2. Design omics-based experiments to study gene regulation	1. Problem-based learning 2. Discussion	1. Performance in problem-based learning class 2. Discussion performance
3. Demonstrate scientific integrity, and responsibility	1. Student presentation 2. Assignment	1. Presentation performance 2. Assignment submission 4. Assignment 5. Plagiarism detection
4. Critically evaluate and present recently published literature in the field of omics and gene regulation	1. Student presentation 2. Discussion	1. Presentation performance 2. Discussion performance

Course description:

Genome-Wide Association Study; Transcriptomics; Proteomics; Epigenomics; Multi-Omics Approaches; DNase I Hypersensitive Sites Sequencing (DNase-Seq); Assay for Transposase-Accessible Chromatin using Sequencing (ATAC-Seq); Chromatin Immunoprecipitation Sequencing (ChIP-Seq); Cleavage under Targets and Release using Nuclease (CUT&RUN); Chromosome Conformation Capture (3C) and its Derivatives

การศึกษาความสัมพันธ์ทางพันธุกรรมระดับจีโนม ทรานสคริปโตมิกส์ โปรตีโอมิกส์ อีพิจีโนมิกส์ แนวทางมัลติโอมิกส์ การวิเคราะห์หาลำดับนิวคลีโอไทด์ที่มีความไวต่อเอนไซม์ดีเอ็นเอสวัน (ดีเอ็นเอสซีค) การวิเคราะห์โครมาตินที่เข้าถึงได้ด้วยทรานส์โปเสสโดยเทคนิคการหาลำดับนิวคลีโอไทด์ (เอแทคซีค) การวิเคราะห์หาลำดับนิวคลีโอไทด์ของโครมาตินที่ถูกตกตะกอนด้วยแอนติบอดี (ชิพซีค) การตัดและปล่อยตำแหน่งเป้าหมายด้วยเอนไซม์นิวคลีเอส (คัทแอนด์รัน) การตรวจจับลักษณะรูปร่างของโครโมโซม (ทรีซี) และอนุพันธ์

Course Schedule (Tentative):

(Classroom XXX and Lab Classroom XXX)

	Activities	Description	Time	Instructors and Assistants
Day 1				
1	Lecture/Discussion: A refresher session	This class will start with a refresher session to review the basic principles of omics technologies and discuss how they can be used to study gene regulation.	9.00 – 10.30	NJ
2	Lecture/Discussion: Whole-genome chromatin profiling methods	The advanced whole-genome chromatin profiling methods, including DNase-Seq, ATAC-seq, ChIP-seq and its derivatives, CUT&RUN, and 3C and its derivatives will be introduced.	10.30 – 12.00	NJ
Day 2				
1	Lecture/Discussion: Globin gene regulation study: the pre-omics era	Since omics studies in globin gene regulation will be used as examples throughout the course, the topic “Globin gene regulation study: the pre-omics era” will be introduced through a series of evidence.	9.00 – 10.00	NJ
2	Lecture/Discussion: Dissection of globin gene regulation by multi-omics approaches (1)	A series of omics-based studies used to dissect the globin gene regulation will be introduced and discussed.	10.00 – 12.00	NJ
Day 3				
1	Lecture/Discussion: Dissection of globin gene regulation by multi-omics approaches (2)	A series of omics-based studies used to dissect the globin gene regulation will be introduced and discussed (cont).	9.00 – 12.00	NJ

Day 4				
1	Problem-based learning: Dissection of globin gene regulation by multi-omics approaches (3)	A group activity will be conducted in class with the objective of designing experimental studies that focus on studying gene regulation in the given problem.	9.00 – 12.00	NJ
Day 5				
1	Presentation and discussion	Students will be responsible for presenting an assigned research article that has been recently published. There will be a session for questions and answers, and discussions after the presentation	9.00 – 11.00	NJ
2	Reflection and after-action review	- To provide students opportunities to describe their learning experiences received from this course and how they can be applied to their future learning. - To collect comments, and suggestions from students for further improvements of the course.	11.00 – 12.00	NJ

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 (30%)	Punctual assignment submission (2%)	On-time (4) 1 day late (3) 2 days late (2) 3 days late (1) 4 days late or later (0)
		Creativity (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Organization (3%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Content accuracy (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Supporting evidence (3%)	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	Problem-based learning (30%)	Participation and performance (10%)	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 (15%)	Excellent (4) Above average (3)

			Average (2) Needs improvement (1)
4	Presentation and discussion (30%)	Organization (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Content (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Subject knowledge/Answering questions (10%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Presentation style (5%)	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