

Course Syllabus

MBMB 635 Environmental DNA (eDNA): technique for biodiversity conservation

Academic year 2025

Course ID and Title MBMB 635
Environmental DNA (eDNA): technique for biodiversity conservation
ชมชม ๖๓๕
การตรวจหาดีเอ็นเอของสิ่งมีชีวิตในสิ่งแวดล้อม (eDNA): เทคนิคเพื่อการอนุรักษ์ความหลากหลายทางชีวภาพ

Course Coordinator: Assoc. Prof. Kanokporn Triwitayakorn, Ph.D.
Tel. 02-441-9003 to 7 Ext. 1368, Mobile: 089-155-8964
Email: kanokporn.tri@mahidol.ac.th
Office and Lab: D301-1 (3rd floor, wing-D)
Institute of Molecular Biosciences, Mahidol University

Instructors:

1. Assoc. Prof. Kanokporn Triwitayakorn, Ph.D.
Email: kanokporn.tri@mahidol.ac.th
Website: <https://mb.mahidol.ac.th/kanokporn-profile/>

Teaching Assistant:

1. Nattaya Srisawad, Ph.D.
Email: nattaya.srs@mahidol.ac.th
Website: <https://mb.mahidol.ac.th/nattaya-profile/>

Support Staff:

1. Nawarat Suksee
2. Suthida Pansawat

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: March 9 – 13, 2026 (9:00 AM – 4:00 PM)

Classroom: D301 Laboratory, Institute of Molecular Biosciences, Mahidol University

Course learning outcomes (CLOs):

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

1. Apply molecular biology and genetics knowledge and techniques to design, perform, and interpret associated experiments. (CLO1 –Knowledge)
2. Exhibit essential laboratory skills in molecular biology and genetics techniques. (CLO2 – Skills)
3. Demonstrate scientific integrity, responsibility, and adherence to laboratory safety practices. (CLO3 – Ethics)
4. Demonstrate critical thinking, teamwork, interpersonal skills, and effectively communicate scientific concepts and findings. (CLO4 –Character)

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcome	Teaching Method	Assessment Method
Apply molecular biology and genetics knowledge and techniques to design, perform, and interpret experiments. (Knowledge – Aligned with PLO1).	<ul style="list-style-type: none"> • Problem-based learning • Group discussion • Assignment & mini-project 	<ul style="list-style-type: none"> • Laboratory performance • Discussion performance • Assignment evaluation
Exhibit essential laboratory skills in molecular biology and genetics techniques. (Skills – Aligned with PLO2).	<ul style="list-style-type: none"> • Hands-on lab practice • Lab demonstrations • Instructor-guided sessions 	<ul style="list-style-type: none"> • Laboratory performance • Practical skill evaluation • Lab report
Demonstrate scientific integrity, responsibility, and adherence to laboratory safety practices. (Ethics – Aligned with PLO3).	<ul style="list-style-type: none"> • Lab safety orientation • Supervised laboratory work • Ethics and safety discussion 	<ul style="list-style-type: none"> • Safety compliance • Lab performance • Assignment/report submission • Plagiarism check
Demonstrate critical thinking, teamwork, interpersonal skills, and effectively communicate scientific concepts and findings. (Character – Aligned with PLO4).	<ul style="list-style-type: none"> • Group activities • Scientific presentation • Discussion sessions 	<ul style="list-style-type: none"> • Group activity performance • Discussion performance • Presentation performance

Course description:

Introduction to eDNA; Overview of metagenomics and metabarcoding; The environmental DNA (eDNA) techniques for biodiversity research. The difference between genomes and metagenomes; Difference in standard methods for DNA barcode and metabarcoding; Metagenomics workflow and interpretation of the

analysis from whole-genome shotgun sequence; Metabarcoding marker, primer design, PCR library preparation, and taxonomic assignment.

ความรู้เบื้องต้นเกี่ยวกับดีเอ็นเอของสิ่งมีชีวิตในสิ่งแวดล้อม ภาพรวมของเมตาจีโนมิกส์และเมตาบาร์โค้ด เทคนิคดีเอ็นเอของสิ่งมีชีวิตในสิ่งแวดล้อมเพื่องานวิจัยความหลากหลายทางชีวภาพ ความแตกต่างระหว่างจีโนมและเมตาจีโนม ความแตกต่างระหว่างวิธีมาตรฐานสำหรับดีเอ็นเอบาร์โค้ดและเมตาบาร์โค้ด ขั้นตอนการทำเมตาจีโนมิกส์และการแปลผลการวิเคราะห์จากข้อมูลลำดับเบสของทั้งจีโนมด้วยวิธีช็อตกัน ดีเอ็นเอเครื่องหมายสำหรับเมตาบาร์โค้ด การออกแบบไพรเมอร์ การเตรียมพีซีอาร์ไลบรารี และการระบุทางอนุกรมวิธาน

Course Schedule (Tentative):

(Classroom D301 and Lab Classroom D301)

	Activities	Description	Time	Instructors and Assistants
Day 1				
1	Active lecture/Discussion: Overview of eDNA, Metagenomics, and Metabarcoding	To give over the concept of eDNA technique for metagenomics and Metabarcoding research	9.00 – 12.00	KT/NS
2	Lab: Extraction of eDNA from water	To isolate eDNA from the environmental samples	13.00 – 16.00	KT/NS
Day 2				
1	Lab: PCR	To prepare the barcode amplicons.	9.00 – 10.30	KT/NS
2	Lab: Agarose gel electrophoresis	To be used for checking PCR product	10.30 – 12.00	KT/NS
3	Lab: metagenomic analysis	Bioinformatics analysis & interpretation of metagenomic	13.00-16.00	KT/NS
Day 3 – 4				
1	Lab: metabarcoding analysis	Bioinformatics analysis & interpretation of metabarcoding results.	9.00 – 12.00	KT/NS
2	Lab: Practice and exercise in the identification of unknown species	- Practice on the identification of unknown species - Exercise: how to interpret results showing different case scenarios.	13.00-14.30	KT/NS

	Activities	Description	Time	Instructors and Assistants
2	Lab: Presentation, Discussion, and Summary	- Presentation, Discussion, and Summary	14.30 – 16.00	KT/NS
Day 5				
1	Student's Reflection	To provide students with opportunities to describe their learning experiences received from this course and how it can be applied to their future learning.	9.00 – 16.00	KT/NS
2	After Action Review	To collect comments, suggestions from students for further improvements of the course.		

Assessment Criteria:

Assessment method		Performance criteria	Scoring rubric
1	Class attendance & participation (10%)	Attendance and punctuality (5%)	Punctually (4) Seldom late (2-3) Moderately late (1) Frequently late or absent without notification (0) *Attending the class after 5 minutes is determined late
		Participation (5%)	Frequently participates (4) Moderately participates (2-3) Seldom participates (1) Never participates (0)
2	Assignment (15%)	Punctual assignment submission (1%)	On-time (4) 1 day late (3) 2 days late (2) 3 days late (1) 4 days late or later (0)
		Organization (2%)	Excellent (4) Above average (3) Average (2)

			Needs improvement (1)
		Content accuracy (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Supporting evidence (5%)	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	Discussion (15%)	Participation and performance (2%)	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 (8%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
4	Lab performance (30%)	Safety practice (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Lab plan (preparation and readiness) (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Lab skills (10%)	Excellent (4) Above average (3) Average (2)

			Needs improvement (1)
		Time management (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Troubleshooting skills (5%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
5	Lab report (5%)	Punctual submission (1%)	On-time (4) 1 day late (3) 2 days late (2) 3 days late (1) 4 days late or later (0)
		Report organization: intro, methods, results, discussion, and conclusion (1%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Data presentation, analysis, and interpretation (2%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
		Grammar and originality (1%)	Excellent (4) Above average (3) Average (2) Needs improvement (1)
6	Assignment and presentation (25%)		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

MBMB 635 Environmental DNA (eDNA): technique for biodiversity conservation

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: Nov 11, 2025