SCBI 372 I SCBE 411 Molecular Biology Applications

วทชว ๓๗๒ I วททส ๔๑๑ การประยุกต์ใช้ในชีววิทยาระดับโมเลกุล

Department of Biology, Faculty of Science, Mahidol University

Second Semester, Academic Year 2025 - 2026

Class Time: SCBI 372 Thursday 13.30 – 16.30 pm (N-516 Phayathai)

SCBE 411 Friday 9.30 – 12.30 pm (SC1-155 Salaya)

Course Coordinator

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Prerequisite

SCBI 270 or SCBE 207

Course Description

การประยุกต์นำชีววิทยาระดับโมเลกุลมาใช้ในการทดลอง วิธีการทดลองทางชีววิทยา หัวข้อทันสมัยในการทดลองเพื่อตอบปัญหาทางวิทยาศาสตร์ได้อย่างถูกต้อง ตัวอย่างและวิเคราะห์ตัวอย่างการทดลองตามความสนใจของนักศึกษา

The methodology to biological research; current topics in biological research with focus on the methodology aiming to answer specific questions; current scientific literature.

Course Goals

SCBI 372 I SCBE 411 Molecular Biology Applications provides students with the upper-level concepts in molecular biology and the techniques that lead to advancements in understandings and applications for environmental biology, agriculture, and medicine. The course format intends to integrate class lecture and scientific paper discussions and presentations with individual and collaborative writing assignments on contemporary and current molecular biology application topics. This aims to equip students with analytical skills to critically evaluate results/claims/news with scientifically-sound judgements. In addition, the course will touch upon the topics of genetically modified organisms (GMOs), gene therapy, gene editing by CRISPR-Cas9 system, or human gene editing, which are of global interest and raise many bioethical debates.

Class Schedule

Week	SCBI 372 Thu 13.30 (N-516)	SCBE 411 Fri 9.30 (SC1-155)	Topic	Assignment
1	Jan 8	Jan 9	Course Introduction, Model Organisms	HW1 out
2	Jan 15	Jan 16	Structure and Function of Genome and Nucleic Acid **Techniques & Applications:** Gel electrophoresis, restriction endonuclease, gene cloning, Southern blotting, *in situ* hybridization, karyotype, and fluorescent *in situ* hybridization (FISH), Polymerase Chain Reaction (PCR), and Sanger DNA sequencing - Model organism presentation	
3	Jan 22	Jan 23	Molecular Biology for Forensic Science ***Dr. Achirapa Bandhaya*** *(Interdisciplinary Graduate Studies)*	
4	Jan 29	Jan 30	Regulation of Gene Expression: Epigenetic Regulation **Application:** Chromatin immunoprecipitation, ChIP-Seq, iPS Cell	
5	Feb 5	Feb 6	Functional Genomics and Systems Biology **Application:** Next-generation sequencing, RNA sequencing, single-cell sequencing ***Dr. Varodom Charoensawan*** *(Research Department and Department of Biochemistry, Faculty of Medicine Siriraj Hospital)*	
6	Feb 12	Feb 13	Regulation of Gene Expression: Concepts and Current Trends ***Dr. Sittinan Chanarat***	

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			(Department of Biochemistry, Faculty of Science)	
7	Feb 19	Feb 20	Regulation of Gene Expression: **Techniques & Applications** DNA barcoding, Human Genome Project, qRT-PCR, RNA-Seq, Microarray, RNA interference (RNAi)	HW2 out
8	Feb 26	Feb 27	- Paper discussion Midterm Revision	
Midterm Mar 2 -6, 2026				
9	Mar 12	Mar 13	Genome Repair and Genome Editing **Techniques & Applications:** Western blotting, protein purification, co-immunoprecipitation, immunoassay**,** protein sequence alignment, and reporter gene **Techniques and Applications:** PCR-based mutagenesis, homologous recombination, knock-out mice, CRISPR-Cas9 technology	HW3 out
10	Mar 19	Mar 20	Synthetic Biology ***Dr. Chayasith Uttamapinant*** (School of Biomolecular Science and Engineering, VISTEC)	
11	Mar 26	Mar 27	Structure, Domain, and Modification of Protein **Techniques & Applications:** Crystallography and Cryo-EM ***Dr. Puey Ounjai*** *(Department of Biology, Faculty of Science)*	HW4 out
12	Apr 2	Apr 3	Proteomic and Metabolomic Applications	

Week	SCBI 372 Thu 13.30 (N-516)	SCBE 411 Fri 9.30 (SC1-155)	Topic	Assignment
			Dr. Nattawadee Panyain *(Department of Biochemistry, Faculty of Science)*	
13	~~Apr 9~~	Apr 10	- Paper discussion Final Revision	
14	Apr 16	Apr 17	Gene Therapy ***Dr. Kanit Bhukhai*** *(Department of Physiology, Faculty of Science)*	
15	Apr 23	Apr 24	Precision Medicine ***Dr. Somponnat Sampattavanich*** *(Siriraj Laboratory for Systems Pharmacology, Faculty of Medicine Siriraj Hospital)*	
Final Exam Apr 27 – May 8, 2026				

Guest Lecturers

Asst. Prof. Dr. Achirapa Bandhaya ผศ. ดร.อจิรภาส์ พันธัย (achirapa.ban@mahidol.ac.th)
Interdisciplinary Graduate Studies, Faculty of Science, Mahidol University

Assoc. Prof. Dr. Varodom Charoensawan รศ. ดร.วโรดม เจริญสวรรค์ (voradom.cha@mahidol.ac.th)
Research Department and Department of Biochemistry, Faculty of Medicine Siriraj Hospital and Integrative Computational BioScience Center, Mahidol University

Assoc. Prof. Dr. Sittinan Chanarat รศ. ดร.สิทธินันท์ ชนะรัตน์ (sittinan.cha@mahidol.edu)
Department of Biochemistry, Faculty of Science, Mahidol University

Dr. Chayasith Uttamapinant ดร.ชยสิทธิ์ อุตมาภินันท์ (chayasith.u@vistec.ac.th)
School of Biomolecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology (VISTEC)

Asst. Prof. Dr. Puey Ounjai ผศ. ดร.ป่วย อุ่นใจ (puey.oun@mahidol.edu)
Head, Center for Vectors and Vector-Borne Diseases
Department of Biology, Faculty of Science, Mahidol University

Dr. Nattawadee Panyain ดร.ณัฐวดี ปัญญาอินทร์ (nattawadee.pan@mahidol.ac.th)

Department of Biochemistry, Faculty of Science, Mahidol University

Asst. Prof. Dr. Kanit Bhukhai ผศ. ดร.คณิต ภู่ไข่ (khanit.bhu@mahidol.ac.th)

Department of Physiology, Faculty of Science

Asst. Prof. Dr. Somponnat Sampattavanich ผศ. ดร.สมพลนาท สัมปัตตะวนิช (somponnat.sam@mahidol.ac.th)

Director, Siriraj Research Excellence Center for Cancer Genomics and Precision Oncology

Co-director, Siriraj Laboratory for Systems Pharmacology, Department of Pharmacology, Faculty of Medicine Siriraj Hospital, Mahidol University

Class Format

Each 3-hr class will be generally divided into 2 sections: 2-hr of PowerPoint lecture and 1-hr of activity (class activity, paper discussion, or student presentation) or as the guest speakers see fit.

Class Readings

- Recommended Textbook: Watson JD, Baker TA, Bell S, Gan A, Levine M, and Losick R, **Molecular Biology of the Gene**. 7th ed. Pearson Education; 2014.
- Class materials are posted in the class **Google Classroom**

Evaluation

Assignments[a]	20 points
Attendance[b]	10 points
Midterm Exam	30 points
Term Group Assignment	10 points
Final Exam	30 points
Total	**100 points**

[a]Each assignment is worth 5 points.

[b]Attendance is mandatory. Each unexcused absence will result in **1-point** subtraction.

Office Hour

Appointment can be made by e-mail at pagkapol.pon@mahidol.edu for in-person or online Zoom meeting.