

Course Syllabus
SCBC 421 Frontiers in Molecular Biosciences
Academic Year 2026

Course ID and Name: SCBC 421 Frontiers in Molecular Biosciences
Course Coordinator: Thaned Kangsamaksin, Ph.D. (thaned.kan@mahidol.ac.th)

Instructors:

1. Danaya Pakotiprapha, Ph.D. (DP)
2. Kanlaya Katewongsa, Ph.D. (KK)
3. Kattika Kaarj, Ph.D. (KA)
4. Patompon Wongtrakoongate, Ph.D. (PW)
5. Sarawut Jitrapakdee, Ph.D. (SJ)
6. Thaned Kangsamaksin, Ph.D. (TK)
7. Vorthon Sawaswong, Ph.D. (VS)
8. Waradon Sungnak, Ph.D. (WS)

Credit: 2 (2-0-4)

Curricula: Bachelor of Science Program in Biomedical Science
Module B: Molecular Medicine

Semester Offering: First Semester

Prerequisite: SCBM 224 Biochemistry

Course Description:

Novel scientific research and studies on a new era of bioscience; revolutionary breakthroughs in genetic engineering, genomic medicine, and synthetic biology; application of CRISPR genome editing in genetic research and medicine; therapeutic applications in cancer therapy and stem cells

Course Learning Outcomes (CLOs)

Upon completion of this course, students are able to:

1. Explain the mechanism of CRISPR-Cas9 gene editing, interpret experimental data, and evaluate the applications and limitations of CRISPR-Cas9 studies in functional genomics, disease modeling, and therapeutic research.
2. Describe the fundamental principles and recent advancements on genomics and epigenomics studies, identifying the roles of sequencing technologies and their applications on biomedical research and personalized medicine.
3. Explain the principles of chemical and synthetic biology and critically assess case studies demonstrating the application of chemical and synthetic biology in agriculture, food, and medicine.
4. Explain the principles and applications of translational and personalized medicine and critically assess case studies that demonstrate implementation of genomic and molecular data in disease prevention, diagnosis, and treatment.
5. Explain the principles of organoids, Lab-on-chip, 3D bioprinting, and demonstrate the application of these techniques in biosciences such as medical or agricultural field.
6. Explain the fundamental principles of nanomedicine, including the physicochemical properties of nanomaterials relevant to biomedical applications and critically discuss benefits, limitations, and future directions of nanotechnology in medicine.
7. Describe how artificial intelligence (AI) and big data-driven approaches differ from conventional scientific methods, how big data is instrumental in training AI models, and recognize examples of AI applications and big data in molecular biosciences.

8. Explain key ethical, legal, and societal issues arising from recent advances in molecular biosciences and construct well-reasoned arguments on topics such as gene editing, data privacy, and equitable access to biotechnology regarding the responsibilities of the scientists for the public.

Course Schedule:

Time: Wed and Fri, 13:00–15:00

Venue: B301

Lecture	Date	Topic	Instructor
1	Aug 7, 2026	CRISPR: Genome Editing Technologies I	SJ
2	Aug 14, 2026	CRISPR: Genome Editing Technologies II	SJ
3	Aug 19, 2026	Advances in Genomics and Epigenomics I	VS
4	Aug 21, 2026	Advances in Genomics and Epigenomics II	VS
5	Aug 26, 2026	Chemical Biology & Synthetic Biology I	DP
6	Aug 28, 2026	Chemical Biology & Synthetic Biology II	DP
7	Sep 2, 2026	Self-Study/Q&A	DP, SJ, VS
8	Sep 4, 2026	Midterm Examination (L1–L6)	TK
9	Sep 9, 2026	Translational & Personalized Medicine I	TK
10	Sep 11, 2026	Translational & Personalized Medicine II: Frontier Techniques – Organoids, Lab-on-a-Chip, 3D Bioprinting	KA
11	Sep 16, 2026	Nanomedicine I	KK
12	Sep 18, 2026	Nanomedicine II	KK
13	Sep 23, 2026	AI & Big Data in Molecular Biosciences	WS
14	Sep 25, 2026	Bioethics and Societal Impact of Molecular Innovations	PW
15	Sep 30, 2026	Self-Study/Q&A	TK, KA, KK, WS, PW
16	Oct 2, 2026	Final Examination (L9–L14)	TK

Course Assignments

1. Reading assignments by instructors

Assessment Criteria

Written examination / Assignment 60%

Paper discussion / participation 40%

Students must receive a score of 60% or more to pass the course.

Appeal Procedure

Should the students have any appeal regarding the assessments or grade, inquiry can be made to the instructors and/or the course coordinator immediately either by direct contact, telephone or email.