

Course Syllabus
SIPS 521
Academic Year 2026
Department of Physiology
Faculty of Medicine Siriraj Hospital, Mahidol University

Course ID and name:	SIPS521: Physiological Biochemistry
Course coordinator:	Assoc. Prof. Sorachai Srisuma, MD, PhD
Instructors:	Assoc. Prof. Suwattanee Kooptiwut, MD, PhD Assist. Prof. Sompol Tapechum, MD, PhD Assoc. Prof. Sorachai Srisuma, MD, PhD Assoc. Prof. Panapat Uawithya, MD, PhD Assoc. Prof. Reawika Chaikomin, MD, PhD Assoc. Prof. Narawut Pakaprot, MD, PhD Assoc. Prof. Chantacha Sitticharoon, MD, PhD Instr. Thaksaon Kittipassorn, MD, PhD Assist. Prof. Rujapope Sutiwisesak, MD, PhD Instr. Patamat Nitiwarangoon, MD, PhD Instr. Thanus Teeratitayang-gool, MD, Diploma Thai Board of Anesthesiology
Credits:	2 (2-0-4) (lecture – laboratory – self-study)
Curriculum:	Masters of Science Program in Medical Physiology
Course type:	☐ Core ☐ Required ☒ Electives
Semester offering:	1/2026
Prerequisite:	None
Date of Latest Revision:	August 23, 2026

Course Description:

Core biochemistry: structure and mechanism of enzymes; structures and metabolism of biological molecules with physiological significance including lipid, lipoprotein, carbohydrate, protein, amino acid, nucleic acid; introduction to bioenergetics; intercellular and intracellular signaling; structures of chromosome and gene; regulation of gene expression. Applied biochemistry in medical physiology: omic studies; blood, lymph and circulating blood cells,

hemostasis; neurochemistry, neuroendocrine regulation of food intake and body mass; liver functions; integration of metabolism, effect of gut microbial metabolites on human physiology; pathogenesis of obesity, diabetes, dyslipidemia and the metabolic syndrome

Course-level Learning Outcomes (CLOs)

Upon completion of this course, students are able to:

1. Explain the essential biochemical principles governing human body functions and regulatory mechanisms.
2. Analyze biochemical alterations and physiological adaptations in response to homeostatic disturbances and common clinical conditions.
3. Evaluate experimental, laboratory data to interpret metabolic and biochemical shifts in physiological states.
4. Formulate scientific perspectives collaboratively during professional discussions regarding biochemical changes in complex organ systems.

Constructive Alignment of CLOs and Program's ELOs

CLOs	ELO1	ELO2	ELO3	ELO4
1	R			
2	R			
3		R		
4				R

Remarks: Show the level of the course management with the symbols I, R, P, and M.

Program's Expected Learning Outcomes

1. Demonstrate the current medical physiological knowledge for common clinical application.
2. Evaluate the scientific research and major research developments.
3. Perform medical physiology research with a technique in an ethical way to test an idea or hypothesis in an area of interest.
4. Communicate knowledge and ideas of medical physiological research clearly to peers and the scientific community at national level.

Course Schedule and teaching/assessment plan

No.	Date	Topic	Hours			CLOs	Teaching & learning strategy	Assessment (in-class)	Lecturers
	Time		Lecture	Laboratory	Self Study				
		Week 1: Aug 23-29, 2026							
1	M, Aug 24, 26 6.00 – 6.30 p.m.	Introduction, course objectives	0.5	-	1	all	Lecture/ online live	In-class Q&A	Dr.Sorachai
2	T, Aug 25, 26 5.00 – 6.00 p.m.	Amino acid structure, classification and physiological roles	1	-	2	1	Lecture/ asynchronous	post-learning exercise	Dr.Panapat
3-	W, Aug 26, 26 5.00 – 6.00 p.m.	Enzyme structure, enzyme mechanisms, kinetics, allosteric regulation and coenzymes 1	1	-	2	1	Lecture/ asynchronous	post-learning exercise	Dr.Panapat
4	Th, Aug 27, 26 6.30 – 7.30 p.m.	Enzyme structure, enzyme mechanisms, kinetics, allosteric regulation and coenzymes 2	1	-	2	1	Lecture/ asynchronous	post-learning exercise	Dr.Panapat
5	F, Aug 28, 26 5.30 – 6.00 p.m.	Hemoglobin and myoglobin: structural properties, and physiological roles	0.5	-	1	1	Lecture/ asynchronous	post-learning exercise	Dr.Sorachai
		Week 2: Aug 30 – Sep 5, 2026							
6	W, Sep 2, 26 6.00 – 7.00 p.m.	Problem-solving: Abnormalities arising from amino acid structure or protein structural defects	1	-	2	2,4	Collaborative Discussion / Online Live (Gen-AI literature searching enabled)	performance rubric	Dr.Panapat

7	Th, Sep 3, 26 7.00 – 8.00 p.m.	Molecular Basis of Physiological Processes: DNA/RNA, Chromosomes, and Protein Synthesis	1	-	2	1	Lecture/ asynchronous	post-learning exercise	Dr.Sorachai
		Week 3: Sep 6-12, 2026							
8	T, Sep 8, 26 6.00 – 7.00 p.m.	Problem-solving: Enzyme kinetics in clinical scenarios	1	-	2	2,3,4	Data-driven Learning / Online Live (Biochemical data calculation)	performance rubric	Dr.Panapat
9	Th, Sep 10, 26 5.00 -5.30 p.m.	Omics in physiology	0.5	-	1	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Rujapope
		Week 4: Sep 13-19, 2026							
10	T, Sep 15, 26 6.00 – 8.00 p.m.	KSA 1: Mechanisms of gene regulation: transcription factors, epigenetics, microRNAs	2	-	4	2,3,4	Collaborative Discussion / Online Live (Molecular pathways integration)	performance rubric	Dr.Rujapope
11	W, Sep 16, 26 6.00 – 7.00 p.m.	Glycolysis, gluconeogenesis, glycogen metabolism, pentose phosphate pathway and their regulation 1	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Rujapope
12	Th, Sep 17, 26 6.00 – 7.00 p.m.	Glycolysis, gluconeogenesis, glycogen metabolism, pentose phosphate pathway and their regulation 2	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Rujapope
13	F, Sep 18, 26 6.00 – 7.00 p.m.	Receptor and intracellular signalings	1	-	2	1,2	Lecture/ online live	In-class Q&A	Dr.Suwattanee
		Week 4: Sep 20-26, 2026							

14	M, Sep 21, 26 6.00 – 7.00 p.m.	Intracellular signalings 2	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Sompol
15	W, Sep 23, 26 6.00 – 7.00 p.m.	Oxidative phosphorylation	1	-	2	1	Lecture/ online live	In-class Q&A	Dr.Thaksaon
16	F, Sep 25, 26 6.00 – 7.00 p.m.	Fatty acid metabolism, lipogenesis, ketogenesis and lipoprotein transport 1	1	-	2	1	Lecture/ online live	In-class Q&A	Dr.Suwattanee
		Week 5: Sep 27 – Oct 3, 2026							
17	W, Sep 30, 26 7.00 – 8.00 p.m.	Fatty acid metabolism, lipogenesis, ketogenesis and lipoprotein transport 2	1	-	2	1	Lecture/ online live	In-class Q&A	Dr.Suwattanee
18	F, Oct 2, 26 5.00 – 6.00 p.m.	Q&A 1	1			All	Open Q&A	Informal review	All
	Sat, Oct 3, 26 9.00 a.m. – 12.00 p.m.	Summative Exam 1: No. 2 – 17							
		Week 6: Oct 4-10, 2026							
19	M, Oct 5, 26 6.00 – 7.00 p.m.	Amino acid metabolism, urea cycle, nitrogen balance, protein turnover and physiological regulation	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Sorachai
20	T, Oct 6, 26 5.00 – 6.00 p.m.	Energy metabolism: Energy expenditure measurement	1	-	2	2,3	Lecture/ Asynchronous (Metabolic data analysis techniques)	post-learning exercise	Dr.Sorachai

21	W, Oct 7, 26 6.00 – 7.00 p.m.	KSA 2: Energy metabolism in exercise, fed state and fasting	1	-	2	2,4	Collaborative Discussion / Online Live (Case scenarios reasoning)	performance rubric	Dr.Chantacha
		Week 7: Oct 11-17, 2026							
22	M, Oct 12, 26 6.00 – 7.00 p.m.	KSA 3: Insulin signaling and role of carbohydrate metabolism in diabetes and obesity	1	-	2	2,3,4	Data-driven Active Learning (Interpretation of laboratory profiles)	performance rubric	Dr.Suwattanee
23	Th, Oct 15, 26 5.00 – 6.00 p.m.	Blood, lymph, blood cell metabolism and function	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Thaksaon
		Week 8: Oct 18-24, 2026							
24	T, Oct 20, 26 6.00 – 7.00 p.m.	KSA 4: Pathogenesis of dyslipidemia and metabolic syndrome	1	-	2	2,3,4	Collaborative Discussion / Online Live (Precision diagnostics approach)	performance rubric	Dr.Patamat
25	W, Oct 21, 26 6.00 – 7.00 p.m.	Hemostasis and regulation	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Thanus
26	To be announced (TBA)	Hepatic metabolism: Detoxification, bile production, and systemic metabolic integration	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Reawika

27	TBA	Liver function test: Biochemical markers for hepatic health	0.5	-	1	2,3	Lecture/ Asynchronous (Clinical diagnostic data reasoning)	post-learning exercise	Dr.Patamat
28	TBA	KSA 5: Liver function test interpretation and metabolic dysfunction-associated steatohepatitis	1	-	2	2,3,4	Data-driven Learning / Online Live (Clinical informatics interpretation)	performance rubric	Dr.Patamat
29	TBA	Role of gut microbiota in health and disease	1	-	2	1,2	Lecture/ Asynchronous (Advanced microbiome science trends)	post-learning exercise	Dr.Reawika, Dr.Patamat
30	TBA	KSA 6: Biochemistry of prebiotics, probiotics and gut health and roles in metabolic syndrome	1	-	2	2,3,4	Collaborative Discussion / Online Live (Personalized wellness profiles)	performance rubric	Dr.Reawika, Dr.Patamat
31	TBA	Neurochemistry	1	-	2	1,2	Lecture/ asynchronous	post-learning exercise	Dr.Narawut
32	TBA	Neuroendocrine regulation of food intake, energy balance and body weight	1	-	2	1,2	Lecture/ online live	In-class Q&A	Dr.Chantacha
33	TBA	KSA 7: Neurochemical disruptions in neurological disorders	1	-	2	2,4	Collaborative Discussion / Online Live	performance rubric	Dr.Narawut

							(Clinical case mapping)		
34	TBA	Q&A2	1	-		All	Open Q&A	Informal review	All
	Sat, xxx x, 26 9.00 a.m. – 12.00 p.m.	Summative Exam 2: No. 19 – 33							
		Total hours of the study	31		62				

* KSA – knowledge-synthesizing activities

Course Assignments

- In-class post-learning exercise (administered across 16 asynchronous/synchronous lectures
- Participation in knowledge-synthesizing activities (assessed with rubric across nine interactive discussion sessions.

Assessment Criteria & Grade Distribution

- 70% Summative examination (administered twice to assess CLO1, CLO2, and CLO3).
- 30% Performance in discussion/KSA classes (assessed 9 times via the concise rubric below to measure CLO4)

* Note: students must achieve a minimum score of 50% in each individual CLO to pass this course.

Class Participation and Discussion Rubric (Revised 2026)

Scoring Scale: 5 = Excellent | 4 = Good | 3 = Satisfactory | 2 = Developing | 1 = Unacceptable

	5	4	3	2	1
1. Ideation & Engagement <i>Measurable Action:</i> Volunteering & initiating	Initiates scientific ideas or perspectives voluntarily and frequently.	Offers relevant ideas or insights voluntarily when prompted.	Contributes answers or ideas only when directly called upon.	Rarely contributes; remains passive during group work.	Fails to contribute any ideas or refuses to answer.
2. Scientific Quality <i>Measurable Action:</i> Analyzing & backing with data	Analyzes cases deeply and justifies views with empirical data.	Explains relevant mechanisms accurately and correctly.	States basic facts from memory without mechanical depth.	Provides irrelevant info that deviates from the clinical topic.	Shows no scientific substance or pre-class preparation.
3. Professionalism & Collaborative spirit <i>Measurable Action:</i> Responding & building on ideas	Actively and respectfully pays attention and builds on peers/instructor's ideas to move discussion forward.	Pays attention and responds to peers/instructor appropriately and politely.	Listens but occasionally loses focus or interrupts others.	Disengages from the group (e.g., uses mobile devices).	Fails to pay attention; disrupts the class or displays disrespectful behavior.

GRADE SCALE

A	80% to 100%, with all CLOs passed (minimum 50% each)
B+	65% to <80%, with all CLOs passed (minimum 50% each)
B	50% to <65%, with all CLOs passed (minimum 50% each)
F	< 50%

Actions Based on CLO Status:

I-1	Retake the exam and/or complete the assigned work within one month after the exam results are announced, if at least one CLO (CLO1-3) is failed.
I-2	Complete the assigned work and undergo a new evaluation within the next semester if all CLOs are failed.
I-3	Repeat the course when it is next offered, if all CLOs are failed.

Appeal Procedure

Students may inquire about their scores or grades directly with the course coordinator through in-person contact, telephone, or email within one week of the scores or grades being announced. Additionally, an appeal process is available through the program.