Course Syllabus

MBMB 651 Thalassemia: From Bench to Bedside

Academic year 2025

Course ID and Title MBMB 651 Thalassemia: From Bench to Bedside

ชมชม ๖๕๑ ธาลัสซีเมีย จากห้องปฏิบัติการสู่การรักษา

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Support staff: Miss Nattrika Buasuwan

Miss Usa Nuttapolwat

Credits: 2 (1-2-3)

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. Discuss the fundamental concepts of thalassemia, covering the topic from its molecular biology to clinical manifestations, diagnosis, and treatments (**Knowledge**);
- 2. Conduct laboratory diagnosis of thalassemia (Skills);
- 3. Demonstrate scientific integrity, responsibility, and safety practices (Ethics);
- 4. Demonstrate critical thinking, teamwork, and interpersonal skills (Characters).
- 5. Effectively communicate laboratory findings through discussions and presentations (Characters).

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

Course Learning Outcomes	Teaching Method	Assessment Method
1. Discuss the fundamental	1. Case studies and problem-	1. Discussion performance
concepts of thalassemia, covering	based project	2. Assignment
the topic from its molecular	2. Discussion	
biology to clinical manifestations,	3. Assignment	
diagnosis, and treatments		
2. Conduct laboratory diagnosis	1. Hands-on lab practice	1. Laboratory performance
of thalassemia		2. Lab report
3. Demonstrate scientific integrity,	1. Lab safety orientation	1. Discussion performance
responsibility, and safety	2. Discussion	2. Laboratory performance
practices	3. Lab report	3. Report and assignment
	4. Assignment	submission
		4. Assignment
		5. Plagiarism detection
4. Demonstrate critical thinking,	1. Case studies and problem-	1. Discussion performance
teamwork, and interpersonal	based project	2. Laboratory performance
skills	2. Discussion	3. Performance in group activities
	3. Group activities	
5. Effectively communicate	1. Discussion	1. Discussion performance
laboratory findings through	2. Presentation	2. Presentation performance
discussions and presentations		

Course description:

Erythropoiesis; Hemoglobin Synthesis and Regulation; Pathophysiology and Clinical Manifestations of Thalassemia; Molecular Biology of Thalassemia and Abnormal Hemoglobin; Genotype-phenotype Interaction; Iron Overload; Conventional Managements; Novel Therapies; Laboratory Diagnosis; Prevention and Control

กระบวนการสร้างเม็ดเลือดแดง การสังเคราะห์ฮีโมโกลบินและการควบคุม พยาธิสรีรวิทยาและอาการทางคลินิกของโรคธาลัสซีเมีย อณูชีววิทยาของโรคธาลัสซีเมียและฮีโมโกลบินผิดปกติ ปฏิสัมพันธ์ระหว่างพันธุกรรมและลักษณะปรากฏ ภาวะเหล็กเกิน เวชปฏิบัติ ทั่วไป การรักษาแนวทางใหม่ การตรวจวินิจฉัยทางห้องปฏิบัติการ การป้องกันและควบคุม

Course Schedule (Tentative):

(Classroom XXX and Lab Classroom XXX)

				Instructors
	Activities	Description	Time	and
				Assistants
Day 1				
1	Lecture/Discussion:	The concepts and molecular	9.00 - 10.30	PP
	Erythropoiesis	mechanisms of erythropoiesis will be		
		introduced and discussed.		
2	Lecture/Discussion:	The concepts, molecular mechanisms,	10.30 - 12.00	NJ
	Hemoglobin synthesis	and regulation of hemoglobin		
	and regulation	synthesis will be introduced and		
		discussed.		
Day 2				
1	Lecture/Discussion:	Pathophysiology and clinical	9.00 - 10.30	KP
	Pathophysiology and	manifestations of thalassemia will be		
	clinical manifestations	introduced and discussed.		
	of thalassemia			
2	Lecture/Discussion:	Types and molecular biology of	10.30 - 12.00	SS
	Molecular biology of	thalassemia and abnormal hemoglobin		
	thalassemia and	will be introduced and discussed.		
	abnormal hemoglobin			
Day 3	Day 3			

1	Lecture/Discussion:	Genotype-phenotype interaction of	9.00 - 10.30	TM
	Genotype-phenotype	thalassemia will be introduced and		
	interaction	discussed.		
2	Lecture/Discussion:	Iron overload and its implications in	10.30 - 12.00	ВК
	Iron overload	thalassemia will be introduced and		
		discussed.		
Day 4	1			
1	Lecture/Discussion:	Conventional managements for	9.00 - 10.30	KP
	Conventional	thalassemia, including supportive and		
	managements	curative treatments, will be introduced		
		and discussed.		
2	Lecture/Discussion:	Novel therapies for thalassemia,	10.30 - 12.00	NJ
	Novel therapies	including small molecule-based		
		approaches and gene therapies, will		
		be introduced and discussed.		
Day 5)			
1	Lecture/Discussion:	Laboratory diagnosis of thalassemia,	9.00 - 10.30	TM
	Laboratory diagnosis	including screening tests, hemoglobin		
		typing, and DNA analysis will be		
		introduced and discussed.		
2	Lecture/Discussion:	Prevention and control for thalassemia	10.30 - 12.00	KP
	Prevention and	will be introduced and discussed.		
	control			
Day 6	5: Laboratory for Thalasse	emia diagnosis		
1	Lab: Screening tests:	- Lab safety training	9.00 - 12.00	All Staff
	Osmotic fragility (OF)	- To perform screening tests (OF and		
	test, and	DCIP) for thalassemia diagnosis.		
	dichlorophenol			
	indophenol			
	precipitation (DCIP)			
	test			
2	Lab: Screening tests:	- To perform screening tests (CBC and	13.00 - 16.00	All Staff
	Complete blood	blood smear) for thalassemia		
		diagnosis.		

Day 7: Laboratory for Thalassemia diagnosis 1		count (CBC), and			
1 Lab: Hemoglobin (Hb) Typing Property		blood smear			
Typing performance liquid chromatography (HPLC) and Capillary Electrophoresis (CE) for thalassemia diagnosis. 2 Lab: Hb Typing (continued) 3 Lab: DNA extraction - To extract DNA from blood samples (unknown). Day 8: Laboratory for Thalassemia diagnosis 1 Lab: DNA analysis for α-thalassemia. 1 Lab: DNA analysis for α-thalassemia. 2 Lab: DNA analysis for α-thalassemia. 2 Lab: DNA analysis for α-thalassemia (continued) 3 Lab: DNA analysis for α-thalassemia. 4 Lab: DNA analysis for α-thalassemia. 5 Lab: DNA analysis for α-thalassemia (continued) 5 Lab: DNA analysis for β-thalassemia (continued) 6 Lab: DNA analysis for β-thalassemia (abgnosis) 1 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued) 3 Lab: DNA analysis for β-thalassemia (continued) 4 Lab: DNA analysis for β-thalassemia (continued) 5 Lab: DNA analysis for β-thalassemia (continued) 6 Lab: DNA analysis for β-thalassemia (continued) 7 Do or everse dot-blot hybridization (and possible problem) 1 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued) 3 Lab: DNA analysis for β-thalassemia (continued) 4 Lab: DNA analysis for β-thalassemia (continued) 7 Do or everse dot-blot hybridization (and possible problem) 8 DNA analysis for β-thalassemia (abgnosis) 1 Problem-based - To identify high-risk couples having a 9.00 – 12.00 All Staff	Day 7	: Laboratory for Thalasse	mia diagnosis		
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C(E) for thalassemia diagnosis. 13.00 - 14.30 All Staff (continued) 2 Lab: Hb Typing - To interpret Hb typing results. 13.00 - 14.30 All Staff (continued) 3 Lab: DNA extraction - To extract DNA from blood samples (unknown). 14.30 - 16.00 All Staff (unknown). All Staff (unknown). 2 Lab: DNA analysis for - To do gap-PCR and real-time PCR for 9.00 - 12.00 All Staff (diagnosis of \mathbb{\alpha}-thalassemia: Gap-PCR and real-time PCR 2 Lab: DNA analysis for - To analyze PCR products by agarose 13.00 - 14.30 All Staff (continued) - To interpret results from real-time PCR - To interpret results from real-time PCR - To amplify \mathbb{\beta}-globin gene by PCR for All Staff - To amplify \mathbb{\beta}-globin gene by PCR for - To do reverse dot-blot hybridization - To do reverse dot-blot hybridization - To do reverse dot-blot hybridization - To dot re		Typing	performance liquid chromatography		
2 Lab: Hb Typing (continued) 3 Lab: DNA extraction - To extract DNA from blood samples (unknown). Day 8: Laboratory for Thalassemia diagnosis 1 Lab: DNA analysis for Other and the period of the			(HPLC) and Capillary Electrophoresis		
Continued Co			(CE) for thalassemia diagnosis.		
Lab: DNA extraction - To extract DNA from blood samples (unknown).	2	Lab: Hb Typing	- To interpret Hb typing results.	13.00 - 14.30	All Staff
Day 8: Laboratory for Thalassemia diagnosis - To do gap-PCR and real-time PCR for 9.00 - 12.00 All Staff		(continued)			
Day 8: Laboratory for Thalassemia diagnosis 1 Lab: DNA analysis for α-thalassemia: Gap-PCR and real-time PCR for diagnosis of α-thalassemia. 2 Lab: DNA analysis for α-thalassemia gel electrophoresis and interpret (continued) 3 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) Day 9: Laboratory for Thalassemia (RDB). (continued) 2 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) Day 9: Laboratory for Thalassemia (RDB). (continued) 2 Lab: DNA analysis for β-thalassemia (RDB). (continued) 2 Lab: DNA analysis for β-thalassemia (continued) (continued) 2 Lab: DNA analysis for β-thalassemia (continued) 1 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued) (continued) - To do reverse dot-blot hybridization (continued) (continued) - To interpret RDB results. Day 10: Laboratory for Thalassemia diagnosis 1 Problem-based - To identify high-risk couples having a 9.00 – 12.00 All Staff	3	Lab: DNA extraction	- To extract DNA from blood samples	14.30 - 16.00	All Staff
1 Lab: DNA analysis for α-thalassemia: Gap-PCR and real-time PCR for diagnosis of α-thalassemia. 2 Lab: DNA analysis for α-thalassemia (continued) 3 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) Day 9: Laboratory for Thalassemia (RDB) Day 10: Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (RDB) Day 10: Laboratory for Thalassemia (continued) - To do reverse dot-blot hybridization (RDB) Day 10: Laboratory for Thalassemia diagnosis - To do reverse dot-blot hybridization (continued) - To interpret RDB results. All Staff			(unknown).		
α-thalassemia: Gap-PCR and real-time PCR diagnosis of α-thalassemia. 2 Lab: DNA analysis for α-thalassemia (continued) - To analyze PCR products by agarose gel electrophoresis and interpret results. 13.00 – 14.30 All Staff 3 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) - To amplify β-globin gene by PCR for hybridization (RDB) 14.30 – 16.00 All Staff Day 9: Laboratory for Thalassemia diagnosis - To do reverse dot-blot hybridization (RDB). 9.00 – 12.00 All Staff 2 Lab: DNA analysis for β-thalassemia (continued) - To do reverse dot-blot hybridization (RDB). 13.00 – 16.00 All Staff 2 Lab: DNA analysis for β-thalassemia (continued) - To do reverse dot-blot hybridization (continued). 13.00 – 16.00 All Staff 3 Lab: DNA analysis for β-thalassemia (continued) - To interpret RDB results. 13.00 – 16.00 All Staff 4 Lab: DNA analysis for β-thalassemia (continued) - To interpret RDB results. 13.00 – 16.00 All Staff 5 Lab: DNA analysis for β-thalassemia (continued) - To interpret RDB results. 13.00 – 16.00 All Staff 6 Lab: DNA analysis for β-thalassemia (continued) - To interpret RDB results. 13.00 – 16.00 All Staff	Day 8	3: Laboratory for Thalasse	mia diagnosis		
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2 Lab: DNA analysis for α-thalassemia (continued) 3 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) Day 9: Laboratory for Thalassemia (RDB). 2 Lab: DNA analysis for β-thalassemia (continued) 1 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued)		lpha-thalassemia: Gap-	diagnosis of $lpha$ -thalassemia.		
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- To interpret results from real-time PCR. 3 Lab: DNA analysis for β-thalassemia: Reverse dot-blot hybridization (RDB) Day 9: Laboratory for Thalassemia diagnosis 1 Lab: DNA analysis for β-thalassemia (RDB). (continued) 2 Lab: DNA analysis for β-thalassemia (continued) (continued) 2 Lab: DNA analysis for β-thalassemia (continued). (continued) 2 Lab: DNA analysis for β-thalassemia (continued). (continued) - To do reverse dot-blot hybridization 13.00 – 16.00 All Staff β-thalassemia (continued). (continued) - To interpret RDB results. Day 10: Laboratory for Thalassemia diagnosis 1 Problem-based - To identify high-risk couples having a 9.00 – 12.00 All Staff		lpha-thalassemia	gel electrophoresis and interpret		
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1 Lab: DNA analysis for β-thalassemia (RDB). 2 Lab: DNA analysis for β-thalassemia (continued) 2 Lab: DNA analysis for β-thalassemia (continued). (continued) 1 (continued) 2 (continued) 1 (continued) 2 (continued) 1 (continued) 2 (continued) 2 (continued) 2 (continued) 3 (continued) 4 (conti		hybridization (RDB)			
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2 Lab: DNA analysis for Ghalassemia (continued). Continued) -To interpret RDB results. Day 10: Laboratory for Thalassemia diagnosis 1 Problem-based - To identify high-risk couples having a 9.00 – 12.00 All Staff		eta-thalassemia	(RDB).		
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Day 10: Laboratory for Thalassemia diagnosis 1 Problem-based - To identify high-risk couples having a 9.00 - 12.00 All Staff		$oldsymbol{eta}$ -thalassemia	(continued).		
1 Problem-based - To identify high-risk couples having a 9.00 - 12.00 All Staff		(continued)	-To interpret RDB results.		
	Day 1	0: Laboratory for Thalass	emia diagnosis		
learning: Family study child with severe thalassemia.	1	Problem-based	- To identify high-risk couples having a	9.00 – 12.00	All Staff
		learning: Family study	child with severe thalassemia.		

2	Presentation,	- To present results achieved in the	13.00 - 16.00	All Staff
	discussion, reflection,	class.		
	and after-action	- To discuss the techniques used to		
	review	diagnose thalassemia.		
		- 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.		

Assessment Criteria:

Assessment method		Performance criteria	Scoring rubric
1	Class attendance & participation	Attendance and	Punctually (4)
	(10%)	punctuality (5%)	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 (20%)	Punctual assignment	On-time (4)
		submission (1%)	1 day late (3)
			2 days late (2)
			3 days late (1)
			4 days late or later (0)
		Creativity (3%)	Excellent (4)
			Above average (3)
			Average (2)
			Needs improvement (1)

		- Organization (2%)	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 (2%)	Excellent (4)
			Above average (3)
			Average (2)
			Needs improvement (1)
		Grammar and originality	Excellent (4)
		(2%)	Above average (3)
			Average (2)
			Needs improvement (1)
3	Discussion (20%)	Participation and	Active (4)
		performance (5%)	Fairly active (2-3)
			Inactive (1)
		Professional and	Excellent (4)
		interpersonal skills	Above average (3)
		(responsibility, teamwork,	Average (2)
		and leadership) (5%)	Needs improvement (1)
		Creative and high-order	Excellent (4)
		thinking skills (10%)	Above average (3)
			Average (2)
			Needs improvement (1)
4	Lab performance (20%)	Safety practice (5%)	Excellent (4)
			Above average (3)
			Average (2)
			Needs improvement (1)
		Lab skills (5%)	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 (20%)	Punctual submission (2%)	On-time (4)
			1 day late (3)
			2 days late (2)
			3 days late (1)
			4 days late or later (0)
		Report organization: intro,	Excellent (4)
		methods, results,	Above average (3)
		discussion and conclusion	Average (2)
		(5%)	Needs improvement (1)
		Data presentation, analysis	Excellent (4)
		and interpretation (10%)	Above average (3)
			Average (2)
			Needs improvement (1)
		Grammar and originality	Excellent (4)
		(3%)	Above average (3)
			Average (2)
			Needs improvement (1)
6	Presentation (10%)	Organization (1%)	Excellent (4)
			Above average (3)
			Average (2)
			Needs improvement (1)
		Content (3%)	Excellent (4)
			Above average (3)
			Average (2)
			Needs improvement (1)

	Subject	Excellent (4)
	knowledge/Answering	Above average (3)
	questions (5%)	Average (2)
		Needs improvement (1)
	Presentation style (1%)	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	А	Excellent
75-79	B+	Very Good
70-74	В	Good
65-69	C+	Fairly Good
60-64	С	Fair
55-59	D+	Poor
50-54	D	Very Poor
0-49	F	Fail

Date of Revision: XXX 20XX