MU3

Course Specification

Section 1 General Information

1. Course Code and Title

In Thai เอ็กซ์ทราเซลลูลาร์ เวสิเคิลในโรคของมนุษย์: จากพยาธิกำเนิดสู่การวินิจฉัยและการบำบัดขั้นสูง

In English Extracellular Vesicles in Human Diseases: From Pathogenesis to Advanced Diagnostics and Therapeutics

2. Number of Credits 2 (2–0–4)

(Theory .....30 .... hrs. Practice ...0..... hrs. Self-Study ...60... hrs.)

3. Curriculum and Course Type

3.1 Program Master of Science Program in Molecular and Integrative Biosciences (International Program) (Multidisciplinary Program)

Doctor of Philosophy Program in Molecular and Integrative Biosciences (International Program) (Multidisciplinary Program)

3.2 Course Type Specific Course ☐ Compulsory Course ☑ Elective Course

4. Course Coordinator and Instructor

4.1 Course Responsible Instructor Kunwadee Phongpao, Ph.D.

4.2 Instructors Kunwadee Phongpao, Ph.D.

5. Semester/Class Level

5.1 Semester 2

5.2 Number of Students Allowed : Approximately 10 Students

6. Prerequisites

None

7. Co-requisites

None

8. Date of Preparation/Latest Revision of the Course Specifications

12 May, 2026

Section 2 Course Goals and Course Description

1.Course Goals

The primary objective of this course is to provide students with a comprehensive understanding of Extracellular Vesicles (EVs) as pivotal mediators in health and disease. Students will master the fundamental principles of EV biology, including biogenesis and functions. The course focuses on isolation techniques and standardized characterization criteria according to international guidelines (MISEV). A significant portion of the course is dedicated to the clinical relevance of EVs, specifically their role in triggering thrombosis in Beta-thalassemia, providing a deep dive into hematological complications, including neurological and neurodegenerative disorders, cardiovascular diseases, and other systemic conditions. Furthermore, the course aims to equip students with the ability to critically evaluate EVs as "liquid biopsies" for diagnostic biomarkers. By the end of the course, learners will be able to integrate this knowledge to design innovative applications for EVs in various biomedical fields, including targeted drug discovery and delivery, and advanced diagnostics, bridging the gap between basic research and clinical implementation.

2.Course Description

ศึกษากลไกการกำเนิด องค์ประกอบระดับโมเลกุล และหน้าที่ทางชีวภาพของถุงนอกเซลล์ มาตรฐานสากลในการแยกและการจำแนกคุณลักษณะของถุงนอกเซลล์ บทบาทของถุงนอกเซลล์ต่อพยาธิกำเนิดของโรค ภาวะลิ่มเลือดอุดตันในโรคบีตา-ทาลัสซีเมียและโรคระบบอื่น ตัวบ่งชี้ทางชีวภาพสำหรับการตรวจชิ้นเนื้อของเหลวและการวินิจฉัยแม่นยำ การประยุกต์ถุงนอกเซลล์ในการวินิจฉัยขั้นสูง การค้นพบยาและการนำส่งยาแบบจำเพาะ แนวโน้มการใช้ประโยชน์ทางชีวการแพทย์และการบำบัดขั้นสูง

Exploration of biogenesis, molecular composition, and biological functions of extracellular vesicles; international standards for extracellular vesicle isolation and characterization; roles of extracellular vesicles in disease pathogenesis, thrombosis in beta-thalassemia and other systemic diseases; extracellular vesicles as biomarkers for liquid biopsy and precision diagnostics; applications of extracellular vesicles in advanced diagnostics, targeted drug discovery and delivery, biomedical translation and advanced therapeutics.

Section 3 Course Objectives, Course-level Learning Outcomes and Course Implementation

1. **Course Objectives**

The primary goal of this course is to provide students with a foundational yet advanced understanding of extracellular vesicles (EVs) and their emerging role in modern medicine. The course is designed to transition from the fundamental biology of EV biogenesis and molecular composition to the theoretical evaluation of isolation and characterization strategies, emphasizing adherence to international reporting standards.

Instruction integrates theoretical lectures with paper-based discussions, allowing students to critically examine the pathological involvement of EVs in hematological and other systemic diseases. Furthermore, the course explores the translational potential of EVs as non-invasive diagnostic biomarkers and their development as drug discovery and therapeutic delivery vehicles. Ultimately, the course aims to prepare students to integrate EV research into clinical and industrial frameworks with a realistic understanding of current technological limitations and regulatory requirements in the field of advanced medicinal products.

2. Course-level Learning Outcomes: CLOs

On completion of the course, the students will be able to

CLO1: Explain the biogenesis, molecular composition, and biological functions of extracellular vesicles in human biological systems.

CLO2: Evaluate and justify extracellular vesicle isolation and characterization methods according to international standards and specific research or clinical contexts.

CLO3: Analyze the roles of extracellular vesicles in disease pathogenesis, including thrombosis in beta-thalassemia and other systemic diseases, with awareness of scientific integrity in data interpretation.

CLO4 : Appraise the feasibility and limitations of extracellular vesicles as diagnostic biomarkers, therapeutic platforms, and advanced therapy products based on current evidence and ethical considerations.

3. How to organize learning experiences to develop the knowledge or skills stated in number 2 and how to measure the learning outcomes

CLOs	Teaching and learning experience management			Learning outcomes measurements		
	Lecture	Disussion	PBL	Class attendance	Class Discussion	Assignment/Discussion/Presentation
CLO1	X	X	X	X	X	X
CLO2	X	X	X	X	X	X
CLO3	X	X	X	X	X	X
CLO4	X	X	X	X	X	X

Section 4 Lesson Plan and Evaluation

1. Lesson Plan

Teaching Period	Topics/Details	Number of hours		Methods: Teaching	Lecturer
		Theory	Practice		
1	**Orientation and overview of the** class	0.5	0	1. Introduction	Kunwadee Phongpao, Ph.D.
2	EV types and Bio-genesis	2.5	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
3	EV function in physiology and pathology	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
4	Standardization: Isolation, Charac-terization & MISEV Guidelines	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
5	EVs in hematological diseases	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
6	EVs in several diseases	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.

Teaching Period	Topics/Details	Number of hours		Methods: Teaching	Lecturer
		Theory	Practice		
7	Advanced diagnos-tics: EVs as biomarkers	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
8	Therapeutics: EVs as drug delivery & ATMPs	3	0	1. Interactive lecture 2. Class Discussion	Kunwadee Phongpao, Ph.D.
9	Advanced discus-sion: integrating knowledge	3		1. Active learning 2. Class Discussion	Kunwadee Phongpao, Ph.D.
10	Paper-based. Discussion	3		1.Active learning 2. Class Discussion	Kunwadee Phongpao, Ph.D.
11	Final Presentation: Experimental Design Challenge	3		1.Active learning 2. Class Discussion	Kunwadee Phongpao, Ph.D.
	Total hours of the entire semester	30			

2. Plan for Assessment of Expected Course-Level Learning Outcomes (CLOs)

2.1 Measurement and Evaluation of Learning Achievement

A. Formative Assessment

There will be a Q&A during the lecture and laboratory session to check students' understanding and give them a chance to discuss with the staff. Students will be evaluated based on their total participation, engagement, discussion, and presentation performance in the whole course.

B. Summative Assessment

(1) Tool and weight for measurement and evaluation

Learning Outcomes	Evaluation Method*		Weight (Percentage)
	Presentation/Discussion /PBL	Class participation	
1. Explain the biological mechanisms of EV biogenesis and functions.	-	10	**10**
3. Analyze the correlation between EV profiles and the pathogenesis of diseases	-	10	**10**
4. Apply EVs for advanced diagnostics, and Advanced Therapy Medicinal Products (ATMPs).	-	10	**10**

Learning Outcomes	Evaluation Method*		Weight (Percentage)
	Presenta-tion/Discussion /PBL	Class participation	
5. Demonstrate leadership and responsibility, as well as the ability to criti-cally integrate theoretical concepts into practical and evidence-based applications in PBL, discussion and presenta-tions	60		**60**
รวม	**60**	**40**	**100**

(2) Grading Rules

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
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

(3) Measurement and Evaluation

Students' achievements will be graded based on their participation and assessment methods throughout the entire course.

Assessment Criteria		Description (In Details)	Scoring Rubric
1	Class participation (40%)	Class attendance (20%)	• Full attendance (4) • ~ 80% attendance (3) • ~ 60% attendance (2) • < 50% attendance (1)
		Class discussion (20%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
2	Presentation/discussion/PBL (60%)	Organization (10%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
		Content (10%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)

Assessment Criteria	Description (In Details)	Scoring Rubric
	Subject knowledge/answering questions (10%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
	Creative and high-order thinking skills (10%)	• Highly expressed (4) • Fairly expressed (2-3) • Not shown (1)
	Professional and interpersonal skills (responsibility, teamwork, and leadership) (10%)	• Active (4) • Fairly active (2-3) • Inactive (1)
	Presentation technique and use of visual aids (5%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)
	Time management (5%)	• Excellent (4) • Good (3) • Fair (2) • Need to be improved (1)

2.2 Re-examination (if the course allows any.)

Students failing to achieve a passing grade may make a request to redo the presentation of experimental design by contacting the course coordinator, and then the Administrative Program Committee will make a decision based on the student's overall performance and behavior. Granted, retakes are capped at the passing grade level, and these revised grades are final and non-appealable. Students scoring below a “B” in any required course or below a “C” in any elective course must retake those courses until they can meet the passing criteria. For required courses, students must retake the same course, whereas for elective cours-

es, they can choose either to retake the same one or another equivalent course with equal credits. However, the grade received after repeating the courses is capped at a “B”.

3. Students’ Appeal

The course syllabus, detailing assessment and grading criteria, is distributed online before the commencement of each course. After the assigned tasks are evaluated, the scores, along with some advice/feedback, are communicated to individual students by instructors through email or Google Classroom. Course coordinators will announce the final grades. Before submitting the final grades to the FGS online system, there is a chance for students to appeal if they disagree with the results. Appeals regarding assessments or grades are addressed to the respective instructor or course coordinator via direct contact, email, telephone, or even through the Institute’s Appeal Committee. The procedure for students’ appeals is outlined in the student handbook (distributed during orientation day). Additionally, students can get access to information regarding Mahidol University's appeal process on the FGS website.

Section 5 Teaching Resources

1. Required Texts

1) The lecturer on each topic will provide handouts/Lecture notes

2. Suggested Materials

1) Provided by the lecture on each topic

3. Other Resources (if any)

Corse orientation

Section 6 Evaluation and Improvement of Course Implementation

1. Analysis and Evaluation of Course Implementation

A. Data for Analysis

- A course evaluation form will be given to students at the end of the course. The questionnaire will be designed to address whether the expected learning outcomes of the course meet student expectations.

- An after-action review (AAR) will be conducted at the end of the course to gather relevant opinions about the course.

B. Course Effectiveness Evaluation

- The questionnaire will be designed to ask how each teaching method in each topic helps students achieve the aim of the course.

- At the end of the course, lecturers will discuss the overall course performance.

2. Revision Process and Improvement Plan for Course Effectiveness

At the beginning of the academic year, the program committee will have a meeting about each course. All the feedback from the evaluation will be discussed, and the course amendment will be proposed to the program committee as well. The course coordinator will also hold an annual staff meeting before the start of the academic year.

3. The self-assessment report of the course

The overall feedback from students and lecturers will be summarized and circulated among lecturers

Appendix

1. Relations between the course and the program

Table 1 Relations between the course and the PLOs

Extracellular Vesicles in Human Diseases: From Pathogenesis to Advanced Diagnostics and Therapeutics	Program-Level Learning Outcomes (PLOs)			
	PLO1	PLO2	PLO3	PLO4
	R	R	R	R

Table 2 Relation between CLOs and PLOs

Extracellular Vesicles in Human Diseases: From Pathogenesis to Advanced Diagnostics and Therapeutics	Program-Level Learning Outcomes (PLOs)			
	PLO1	PLO2	PLO3	PLO4
CLO1 Explain the biological mechanisms of EV biogenesis and functions.	R			
CLO2 Evaluate and justify the choice of EV isolation and characterization methodologies based on specific research or clinical contexts.	R		R	
CLO3 Analyze the correlation between EVs and the	R	R		R

Extracellular Vesicles in Human Diseases: From Pathogenesis to Advanced Diagnostics and Therapeutics	Program-Level Learning Outcomes (PLOs)			
	PLO1	PLO2	PLO3	PLO4
pathogenesis of diseases.				
CLO4 Appraise the feasibility of EVs as diagnostic biomarkers and therapeutic platforms by synthesizing information from current literature, including their translation into Advanced Therapy Medicinal Products (ATMPs).	R	R		R

2. Rubric scoring*

Class Attendance (10%) – Showing up in the class

Criteria	Score	Description
Full attendance	4	Attends 100% of scheduled classes
~ 80% attendance	3	Attends approximately 80% of classes
~ 60% attendance	2	Attends approximately 60% of classes
< 50% attendance	1	Attends less than 50% of classes

Class Discussion (10%) – discussion in the class

Criteria	Score	Description
Excellent	4	Consistently leads or contributes to discussions with high-level critical thinking. Offers insightful connections between theory and practice. Actively listens and builds upon others' ideas.
Good	3	Frequently participates on topic. Provides clear arguments or examples supported by course materials. Responds appropriately to questions from the instructor or peers.

Criteria	Score	Description
Fair	2	Participates occasionally or only when prompted. Contributions are mostly descriptive rather than analytical. May sometimes be hesitant to engage in deeper academic debate.
Need to be improved	1	Rarely speaks or offers no input during discussions. Present in class but remains passive (a "silent listener"). Contributions may be irrelevant to the topic at hand.

Presentation / Discussion (50%)

Criteria	Weight	Score	Description
Organization	10%	4	The presentation is well-structured, with a clear introduction, body, and conclusion; the ideas flow logically.
		3	Mostly well-organized, with only small issues in flow or clarity
		2	Somewhat disorganized; hard to follow at times.
		1	Poorly organized; confusing and hard to understand.
Content	10%	4	Accurate and detailed cell biology content; includes relevant concepts like cell structure, functions, and processes.
		3	Mostly accurate with minor gaps or missing details.
		2	Basic coverage but lacks depth or contains some inaccuracies.
		1	Inaccurate or insufficient content.
Subject Knowledge / Answering Questions	10%	4	Demonstrates strong understanding of cell biology; confidently answers questions with scientific explanations.
		3	Good understanding; answers most questions adequately.
		2	Limited understanding; struggles with some questions.
		1	Poor understanding; unable to answer questions appropriately.
Presentation Technique & Use of Visual Aids	5%	4	Effectively uses clear visuals such as diagrams and process illustrations to support the presentation. Maintains eye contact, speaks clearly and confidently, and engages the audience with well-delivered content and appropriate use of pointers.
		3	Mostly good eye contact, clear speech, adequate visuals, some use of pointers, moderate engagement.
		2	Maintains limited eye contact, speech lacks clarity or consistency, visuals are used but not effectively, tools are used awkwardly, and

Criteria	Weight	Score	Description
			audience engagement is minimal.
		1	No eye contact, unclear speech, poor or no visuals, no use of tools, presentation is hard to follow.
Creative and Higher-Order Thinking Skills	10%	4	Demonstrates strong creativity and critical thinking; shows originality and deep analysis of cell biology concepts.
		3	Shows some creativity and good problem-solving skills; applies higher-order thinking fairly well.
		2	Displays limited creativity and reasoning; higher-order thinking skills are weak or inconsistently applied.
		1	Lacks creativity and higher-order thinking; responses are basic and repetitive.
Professional and Interpersonal Skills (Responsibility, Teamwork, Leadership)	10%	4	Actively participates, takes responsibility, and demonstrates strong teamwork and leadership skills.
		3	Participates regularly, usually responsible, works well with others, shows some leadership qualities.
		2	Participates occasionally, responsibility is inconsistent, and limited teamwork and leadership are demonstrated.
		1	Rarely participates, avoids responsibility, has poor teamwork, and no leadership.
Time Management	5%	4	Presentation fits the time limit well without rushing or exceeding.
		3	Slightly over or under time (± 3 min).
		2	Noticeably short or long presentation (± 5 min).
		1	Poor time management, disrupting flow (± 10 min).

3. Relations between the course and Sustainable Development Goals (SDGs)

☐ SDG1 No poverty

☐ SDG2 Zero Hunger

☐ SDG3 Good Health and Well–being

☑ SDG4 Quality Education

☐ SDG5 Gender Equality

☐ SDG6 Clean Water and Sanitation

☐ SDG7 Affordable and Clean Energy

☐ SDG8 Decent Work and Economic Growth

☐ SDG9 Industry, Innovation and Infrastructure

☐ SDG10 Reduced Inequalities

☐ SGD11 Sustainable Cities and Communities

☐ SDG12 Responsible Consumption and Production

☐ SDG13 Climate Action

☐ SDG14 Life Below Water

☐ SDG15 Life on Land

☐ SDG16 Peace, Justice and Strong Institutions

☐ SDG17 Partnerships for the goals