

Course Syllabus
MBMB 502 Cell Biology
Academic year 2025

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| Course ID and Title | MBMB 502 Cell Biology |
| Course Coordinator | Asst. Prof. Phatchariya Phannasil, Ph.D. Institute of Molecular Biosciences, Mahidol University Tel: 66 (0) 2441-9003 – 7 Ext. 1312, 1357 Email: Phatchariya.pha@mahidol.ac.th |
| Instructors: | Assoc. Prof. Kanokporn Triwitayakorn, Ph.D. (KT) Assoc. Prof. Soraya Chaturongakul, Ph.D. (SC) Asst. Prof. Alita Kongchanagul, Ph.D. (AK) Asst. Prof. Alisa Tubsuwan, Ph.D. (AT) Asst. Prof. Narisorn Kitiyanant, Ph.D. (Nok) Asst. Prof. Natee Jearawiriyapaisarn, Ph.D. (NJ) Asst. Prof. Dr. Phatchariya Phannasil, Ph.D. (PP) Chutima Thepparit, Ph.D. (CT) Duangnapa Kovanich, Ph.D. (DK) Ittipat Meewan, Ph.D. (IM) Promsin Masrinoul, Ph.D. (PM) Siraprapa Boobphahom, Ph.D. (SB) |
| Credits: | 3 (2-2-5) |
| Curriculum: | Master of Science Program in Molecular and Integrative Biosciences Doctor of Philosophy Program in Molecular and Integrative Biosciences |
| Semester offering: | First semester |
| Pre-requisites: | None |

Course learning outcomes (CLOs):

By the end of the course, students should be able to:

- 1) **Demonstrate core principles and comprehensive knowledge of cell structures functions and cellular processes and apply them to molecular and integrative biosciences research**
- 2) **Apply both classical and applied techniques in cell biology, basic mammalian cell culture, and cellular and molecular approaches to solve scientific research questions**

3) Adhere to scientific integrity, responsibility, and biosafety practice in cell culture work

4) Demonstrate leadership, teamwork, interpersonal skills, and responsibilities for the assignments

Course description

Cell Structure and organelles; Cellular Compartments and intracellular Sorting; Membrane Transport; Cell Signaling and Transduction; Cell Cycle and division; Cellular Response to Stress; Cell Aging and senescence; Cell Death; Cell Adhesion, Cell Junction and Extracellular Matrix; Cell Specialization; Stem Cells and Tissue Renewal; Cell Immunity; Cell Metabolism; Plant Cell Biology; Cellular Network Analysis & Data Visualization; Basic Mammalian Cell Culture Techniques; Compound treatments & DNA Transfection; MTT Assay; Flow Cytometry; Immunofluorescence; Confocal Microscopy

Alignment of Teaching and Assessment Methods to Course Learning Outcomes:

| Course Learning Outcomes | Teaching Method | Assessment Method |
|---|--|---|
| 1. Demonstrate core principles and comprehensive knowledge of cell structures functions and cellular processes and apply them to molecular and integrative biosciences research | 1. Lecture 2. Class Discussion 3. PBL | 1. Q&A during lecture 2. Discussion/presentation performance 3. Assignment/ Quiz/Written Examination |
| 2. Apply both classical and applied techniques in cell biology, basic mammalian cell culture, and cellular and molecular approaches to solve scientific research questions | 1. Lab practice 2. Lab discussion 3. Hands-on practice 3. PBL | 1. Lab performance/ Direct observation 2. Lab report 3. Discussion performance |
| 3. Demonstrate scientific integrity, responsibility, and biosafety practice in cell culture work | 1. Lecture 2. Hands-on practice 3. Lab safety guidelines | 1. Assignment/Quiz/Written Examination 2. Lab report 3. Class attendance 4. Direct observation/Lab performance |
| 4. Demonstrate leadership, teamwork, interpersonal skills, | 1. Lecture 2. Class Discussion 3. Hands-on practice | 1. Q&A during lecture 2. Discussion/presentation performance |

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| and responsibilities for the assignments | 4. PBL | 3. Lab performance 4. Group Assignment |
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Course Schedule, learning activity, and assessment:

| | Activities | Topic | Assessment methods | Instructor | Time |
|---------------|---------------------------------------|-------------------------------|--|------------|-------------|
| Week 1 | | | | | |
| Day 1 | | | | | |
| | | Course Orientation | | PP | 8.30-9.00 |
| L01 | Interactive Lecture, Class discussion | Cell Structure & Organelles | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | SB | 9.00-11.00 |
| L02 | Interactive Lecture, Class discussion | Intracellular Protein Sorting | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | CT | 13.00-15.00 |
| Day 2 | Self-study | | | | |
| Day 3 | | | | | |
| L03 | Interactive Lecture, Class discussion | Membrane Transport | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | NJ | 9.00-11.00 |
| L04 | Interactive Lecture, Class discussion | Cell Signaling & Transduction | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | DK | 13.00-15.00 |
| Day 4 | Self-Study | | | | |
| Day 5 | | | | | |
| L05 | Interactive Lecture, | Cell Cycle & Division | 1. Q&A during lecture 2. Discussion performance | IM | 9.00-11.00 |

| | Activities | Topic | Assessment methods | Instructor | Time |
|---------------|---------------------------------------|---|---|------------|-------------|
| | Class discussion | | 3.Assignment/ Quiz/Written Examination | | |
| L06 | Interactive Lecture, Class discussion | Cellular Response to Stress | 1. Q&A during lecture 2. Discussion performance 3.Assignment/ Quiz/Written Examination | PM | 13.00-15.00 |
| Week 2 | | | | | |
| Day 1 | | | | | |
| L07 | Interactive Lecture, Class discussion | Cell Aging & Senescence | 1. Q&A during lecture 2. Discussion performance 3.Assignment/ Quiz/Written Examination | AK | 9.00-11.00 |
| L08 | Interactive Lecture, Class discussion | Cell Death | 1. Q&A during lecture 2. Discussion performance 3.Assignment/ Quiz/Written Examination | PM | 13.00-15.00 |
| Day 2 | Self-study | | | | |
| Day 3 | | | | | |
| L09 | Interactive Lecture, Class discussion | Cell Adhesion, Cell Junction & Extracellular Matrix | 1. Q&A during lecture 2. Discussion performance 3.Assignment/ Quiz/Written Examination | NoK | 9.00-11.00 |
| L10 | Interactive Lecture, Class discussion | Cell Specialization | 1. Q&A during lecture 2. Discussion performance 3.Assignment/ Quiz/Written Examination | NoK | 13.00-15.00 |

| | Activities | Topic | Assessment methods | Instructor | Time |
|---------------|---------------------------------------|---|--|------------|-------------|
| Day 4 | Self-study | | | | |
| Day 5 | | | | | |
| L11 | Interactive Lecture, Class discussion | Stem Cells and Tissue Renewal | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | AT | 9.00-11.00 |
| L12 | Interactive Lecture, Class discussion | Cell Immunity | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | AK | 13.00-15.00 |
| Week 3 | | | | | |
| Day 1 | | | | | |
| Lab | Hands-on practice | Basic Mammalian Cell Culture Techniques: Cell Plating | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, CT | 9.00-12.00 |
| L13 | Interactive Lecture, Class discussion | Cell Metabolism | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | PP | 13.00-15.00 |
| Day 2 | | | | | |
| Lab | Hands-on practice | Transfection | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ, IM | 9.00-12.00 |
| Self-study | | | | | |
| Day 3 | | | | | |

| | Activities | Topic | Assessment methods | Instructor | Time |
|---------------|--|--|--|------------|-------------|
| L14 | Interactive Lecture, Class discussion | Plant cell biology | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | KT | 9.00-11.00 |
| L15 | Interactive Lecture, Class discussion | Cellular Network Analysis & Data Visualization | 1. Q&A during lecture 2. Discussion performance 3. Assignment/ Quiz/Written Examination | DK | 13.00-15.00 |
| Day 4 | | | | | |
| Lab | Hands-on practice | Investigation of the fluorescent proteins and their localization: Confocal Microscope | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 9.00-12.00 |
| Lab | Hands-on practice | Flow cytometry, Harvest cells for RNA and protein extraction | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 13.00-16.00 |
| Day 5 | | | | | |
| Lab | Hands-on practice | RNA extraction | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ, PM | 9.00-12.00 |
| Lab | Hands-on practice | cDNA synthesis | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 13.00-16.00 |
| Week 4 | | | | | |

| | Activities | Topic | Assessment methods | Instructor | Time |
|-------|------------------------------|---|---|------------|-------------|
| Lab | Hands-on practice | Real-time PCR | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 9.00-12.00 |
| Lab | Hands-on practice | Protein extraction for Western blot analysis | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 13.00-16.00 |
| Lab | Hands-on practice | Western blot I: SDS-PAGE | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 9.00-12.00 |
| | | Western blot II: Membrane transfer and blocking | | PP, NJ | 13.00-16.00 |
| Day 3 | | | | | |
| Lab | Hands-on practice | Antibody incubation and Western blot analysis | 1. Lab report 2. Lab performance 3. Presentation and discussion | PP, NJ | 9.00-16.00 |
| Day 4 | Self-study | | | | |
| Day 5 | | | | | |
| | Presentation, discussion | PBL | Presentation and discussion | All staff | 9.00-12.00 |
| | Presentation, lab discussion | Presentation & Discussion, Reflection & After-action review | Presentation and discussion | All staff | 13.00-16.00 |

Note: The laboratory session will be organized as a project-based learning.

Assessment Criteria:

| Assessment Criteria | Description (in Details) | Scoring Rubric |
|----------------------------|------------------------------|-----------------------|
| 1 Class Attendance (10%) | Showing up in the class (5%) | ● Full attendance (4) |

| Assessment Criteria | Description (in Details) | Scoring Rubric |
|---------------------|---|--|
| | | <ul style="list-style-type: none"> ● ~ 80% attendance (3) ● ~ 60% attendance (2) ● < 50% attendance (1) |
| 2 | Assignment/Quiz/written examination (40%) Content accuracy (15%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Creativity (10%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Sequencing of information (2.5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Supporting evidence (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Grammar and originality (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | On-time submission (2.5%) | <ul style="list-style-type: none"> ● On-time (4) ● Late (2-3) ● Very late (1) |
| 3 | Presentation/discussion (20%) Organization (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |

| Assessment Criteria | Description (in Details) | Scoring Rubric |
|--------------------------------|---|--|
| | Content (10%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Subject knowledge/answering questions (10%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Presentation technique and use of visual aids (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Creative and high-order thinking skills (10%) | <ul style="list-style-type: none"> ● Highly expressed (4) ● Fairly expressed (2-3) ● Not shown (1) |
| | Professional and interpersonal skills (responsibility, teamwork, and leadership) (5%) | <ul style="list-style-type: none"> ● Active (4) ● Fairly active (2-3) ● Inactive (1) |
| | Time management (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| 4 Lab performance (20%) | Ability to follow procedure or to design a procedure for the experiment (10%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | Use of equipment (5%) | <ul style="list-style-type: none"> ● Excellent (4) ● Good (3) ● Fair (2) |

| Assessment Criteria | | Description (in Details) | Scoring Rubric |
|---------------------|------------------|--|--|
| | | | ● Need to be improved (1) |
| | | Working area and safety (5%) | ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| 5 | Lab report (10%) | Writing style: Organization and Sequencing of information (2%) | ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | | Lab report submission (1%) | ● On-time (4) ● Late (2-3) ● Very late (1) |
| | | Lab report content (5%) | ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (1) |
| | | Data analysis, interpretation of data, and conclusion (2%) | ● Excellent (4) ● Good (3) ● Fair (2) ● Need to be improved (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 | 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 |

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| 0-49 | F | Fail |
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Date of revision: 10 Feb 2025