

Course Syllabus
MBNS 751 Research Methods in Cellular and Molecular Neuroscience
Academic Year 2/2025

Course ID and Name: MBNS 751 Research Methods in Cellular and Molecular Neuroscience

Course Coordinator: Assoc. Prof. Sujira Mukda

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Instructors:

1. Assoc. Prof. Dr. Sujira Mukda
2. Asst Prof. Dr. Jiraporn Panmanee
3. Asst. Prof. Dr. Narisorn Kitiyanant
4. Asst. Prof. Dr. Alisa Tubsuwan
5. Asst Prof. Dr. Natee Jearawiriyapaisarn
6. Asst Prof. Dr. Phatchariya Phannasil
7. Dr. Siraprapa Boobphahom
8. Dr. Nopphon Petchyam

Supporting Staff:

1. Ms. Somsong Phengsukdaeng

Credits: 2 (1-2-3)

Curriculum: Doctor of Philosophy Program in Neuroscience (elective course)

Semester offering: Second semester

Pre-requisites: None

Course learning outcomes (CLOs):

Upon completion of this course, students are able to:

1. Demonstrate knowledge of ethical standards and regulations in neuroscience research.
(Aligned with PLO1(P))
2. Apply advanced knowledge of cellular and molecular neuroscience to design experiments that reflect current trends in the field. (Aligned with PLO2(P))
3. Critically evaluate scientific literature within the field of cellular and molecular neuroscience, assessing experimental methodologies and data interpretation. (Aligned with PLO3(P))
4. Work effectively as part of a team, demonstrating leadership and collaborative skills in group projects. (Aligned with PLO4(P))
5. Evaluate and interpret experimental results using appropriate statistical methods and communicate findings clearly. (Aligned with PLO5(P))

Alignment of teaching and assessment methods to course learning outcome:

Course learning outcome	Teaching method	Assessment method
1. Demonstrate knowledge of ethical standards and regulations in neuroscience research.	1. Lecture 2. In-class discussion 3. Assignments/ Exercises	1. Assessments/ exercises 2. In-class discussion
2. Apply advanced knowledge of cellular and molecular neuroscience to design experiments that reflect current trends in the field.	1. Lecture 2. In-class discussion 3. Assignments/ Exercises 4. Hands-on practice	1. In-class discussion 2. Assessments/ exercises 3. Oral presentation 4. Laboratory performance
3. Critically evaluate scientific literature within the field of cellular and molecular neuroscience, assessing experimental methodologies and data interpretation.	1. Lecture 2. In-class discussion 3. Hands-on practice	1. Assessment / exercises 2. Laboratory performance 3. In-class discussion 4. Oral presentation
4. Work effectively as part of a team, demonstrating leadership and collaborative skills in group projects	1. In-class discussion 2. Assignments/ Exercises 3. Hands-on practice	1. Assessment / exercises 2. Laboratory performance 3. In-class discussion
5. Evaluate and interpret experimental results using appropriate statistical methods and communicate findings clearly.	1. In-class discussion 2. Assignments/ Exercises 3. Hands-on practice	1. In-class discussion 2. Assessments/ exercises 3. Oral presentation 4. Laboratory performance

Course description:

The in-depth knowledge of the research design and methods used in the cellular and molecular neuroscience research; the experimental design, data analyses and interpretations; presentations of the research results; techniques to analyze the anatomical and chemical changes of the cells, proteins, or genes in the nervous system

ความรู้เชิงลึกของการออกแบบการวิจัยและวิธีการที่ใช้ในการวิจัยทางประสาทวิทยาศาสตร์ระดับเซลล์และโมเลกุล การออกแบบการทดลอง การวิเคราะห์ข้อมูล และแปลผล การนำเสนอผลงานวิจัย เทคนิคในการวิเคราะห์การเปลี่ยนแปลงทางกายวิภาคและเคมีของเซลล์โปรตีนหรือยีนในระบบประสาท

Course schedule:

Date: Monday-Friday

Time: 09:00-16:00

Venue: Lecture: A409⁽¹⁾, A107⁽²⁾, A207-01⁽³⁾ Institute of Molecular Biosciences.

Lab: TBA

Schedule

MBNS 751 Research Methods in Cellular and Molecular Neuroscience

Lecture: 17 April 2026 – 30 April 2026 & 22 May 2026

Course Coordinator: Assoc. Prof. Sujira Mukda

Tel: 02-441-9003-7 ext. 1206, 1437

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	Date	Time	Topic	Lecturer
	17 April 2026	10.00-10.30	L0: Course orientation	Sujira ⁽¹⁾
1	20 April 2026	09.00-11.00	L1: Viral vectors and their applications	Narisorn ⁽²⁾
2		13.00-15.00	L2: Downstream processing and virion analytics	Narisorn ⁽²⁾
3	21 April 2026	09.00-12.00	<i>Lab:</i> Viral vector I	Narisorn/ Jiraporn
4		13.00-16.00	<i>Lab:</i> Viral vector II	Narisorn/ Jiraporn
5	22 April 2026	09.00-12.00	<i>Lab:</i> Viral vector III	Narisorn/ Jiraporn
6		13.00-16.00	<i>Lab:</i> Viral vector IV	Narisorn/ Jiraporn
7	23 April 2026	10.00-12.00	L3: Genetic modification, Genome editing, and CRISPR	Alisa ⁽¹⁾
8		13.00-16.00	<i>Lab:</i> Genome editing	Alisa
9	24 April 2026	09.00-12.00	L4: Next-generation sequencing technologies and their applications in neuroscience	Natee ⁽³⁾
10		13.00-16.00	L5: Transcriptomics in neuroscience research	Natee ⁽³⁾
11	27 April 2026	13.00-15.00	L6: Enzyme kinetics and their applications	Nopphon ⁽³⁾
12	28 April 2026	10.00-12.00	L7: Fluorescence-based techniques for cellular molecular analysis	Siraprapa ⁽³⁾
13		13.00-15.00	L8: Flow cytometry in neuroscience research	Narisorn ⁽³⁾
14	29 April 2026	10.00-12.00	L9: Metabolomics in neuroscience research	Phatchariya ⁽³⁾
15		13.00-15.00	<i>Lab:</i> Metabolomics	Phatchariya
16		15.00-16.00	<i>Lab:</i> Next-generation sequencing	Natee
17	30 April 2026	10.00-12.00	L10: Proteomics in neuroscience research	Jiraporn ⁽³⁾
18		13.00-15.00	L11: Discussion: Current research in cellular and molecular neuroscience	Sujira ⁽³⁾
	22 May 2026	13.00-16.00	Student Presentation (will be joined with MBNS 752 Research Methodology in Cognitive Neuroscience, MBNS 658 Animal Experimentation in Neuroscience, and MBNS 659 Microtechniques in Neuroscience Research courses)	Teaching Staff ⁽²⁾

Assessment Criteria:

Assessment Criteria	Assessment Method	Scoring Rubric
Assignments / Quiz (50%)	1. Report 2. Quiz	1. Comprehension
Laboratory performance (20%)	1. Direct observation 2. Practical examination 3. In-class discussion	1. Ability to follow procedure or to design a procedure for experiment 2. Use of equipment 3. Working area and safety 4. Group work
Problem-based learning presentation (20%)	1. Presentation 2. In-class discussion	1. Ability to apply knowledge to solve research problems 2. Ability to answer questions
Class attendant (10%)	1. Number of classes signed in 1. Direct observation	1. Class participation

Student's achievement will be graded using symbols: A, B+, B, C+, C, D+, D and F based on the criteria as follows:

Percentage	Grade	Description
85-100	A	Excellent
80-84	B+	Very good
70-79	B	Good
60-69	C+	Fairly good
50-59	C	Fair
45-49	D+	Poor
40-44	D	Very poor
< 40	F	Fall

Rubric for Evaluating Lab Performance

Course: MBNS 75.1 Research Methods in Cellular and Molecular Neuroscience

Student Name: Date of Evaluation:

Criteria	PLOs & CLOs Alignment		Poor (1)	Needs Improvement (2)	Satisfactory (3)	Good (4)	Excellent (5)	Level of Achievement*
	CLOs	PLOs						
1. Ethical Standards and Research Integrity	CLO1	PLO1	<input type="checkbox"/> Shows disregard for ethical guidelines and regulations.	<input type="checkbox"/> Frequently neglects ethical standards and requires reminders.	<input type="checkbox"/> Demonstrates basic understanding of ethics but occasionally overlooks guidelines.	<input type="checkbox"/> Generally demonstrates ethical behavior with minor lapses.	<input type="checkbox"/> Consistently demonstrates outstanding ethical behavior and fully adheres to all research regulations.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
2. Experimental Design and Application of Knowledge	CLO2	PLO2 PLO3	<input type="checkbox"/> Unable to design appropriate experiments; lacks application of knowledge.	<input type="checkbox"/> Struggles to design coherent experiments; limited understanding of trends.	<input type="checkbox"/> Designs basic experiments but lacks innovation or current relevance.	<input type="checkbox"/> Designs solid experiments with good alignment to current research trends.	<input type="checkbox"/> Designs innovative, detailed experiments aligned with the latest neuroscience trends.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
3. Critical Evaluation of Literature and Methodologies	CLO3	PLO2 PLO3	<input type="checkbox"/> Unable to critically evaluate or understand methodologies.	<input type="checkbox"/> Limited ability to evaluate literature critically; frequent errors.	<input type="checkbox"/> Basic analysis with some understanding of methodologies.	<input type="checkbox"/> Good analysis with occasional minor gaps in assessment.	<input type="checkbox"/> Critically analyzes literature and methodologies with deep insight and accuracy.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
4. Teamwork, Leadership, and Collaboration	CLO5	PLO5	<input type="checkbox"/> Fails to collaborate; negatively impacts team performance.	<input type="checkbox"/> Rarely contributes to team efforts; struggles to collaborate.	<input type="checkbox"/> Participates in team activities but shows limited leadership or collaboration.	<input type="checkbox"/> Frequently contributes to team efforts and shows emerging leadership skills.	<input type="checkbox"/> Demonstrates exceptional leadership, fosters team spirit, and resolves conflicts effectively.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
5. Data Analysis, Statistical Application, and Communication	CLO5	PLO5	<input type="checkbox"/> Poor analysis and ineffective communication of findings.	<input type="checkbox"/> Frequent errors in analysis; communication lacks clarity.	<input type="checkbox"/> Basic data analysis with occasional misuse of statistical methods; communication is understandable.	<input type="checkbox"/> Correctly applies statistical methods and communicates findings with minor flaws.	<input type="checkbox"/> Accurately analyzes data using advanced statistical methods and presents findings clearly and professionally.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
Total Score								

* Note: A score in the "Satisfactory" range indicates that the student has achieved at least a **Practiced (P)** level of competency for this course. Students must achieve at least a **P (Practiced)** level in each of the Course Learning Outcomes (CLOs).

* Guideline for Scoring: 1 = I (Introduced); 2 = R (Reinforced); 3 & 4 = P (Practiced); 5 = M (Mastery)

Score Interpretation:

- Outstanding (22% - 25%)
- Good (18% - 21%)
- Satisfactory (14% - 17%)
- Needs Improvement (11% - 13%)
- Poor (5% - 9%)

Comments:

Evaluator:

Rubric for Evaluating Problem-Based Learning (PBL) Presentation

Course: MBNS 75.1 Research Methods in Cellular and Molecular Neuroscience

Student Name: Date of Evaluation:

Criteria	PLOs & CLOs Alignment		Poor (1)	Needs Improvement (2)	Satisfactory (3)	Good (4)	Excellent (5)	Level of Achievement*
	CLOs	PLOs						
1. Research Problem Design and Consideration of Ethical Implications (Implied)	CLO1	PLO1	<input type="checkbox"/> Research question/method reflects disregard for basic ethical principles.	<input type="checkbox"/> Design may involve questionable ethical practices or shows lack of awareness.	<input type="checkbox"/> Shows basic awareness of appropriateness in research design, but overlooks some ethical concerns.	<input type="checkbox"/> Research design avoids obvious ethical concerns; minor aspects could be more carefully considered.	<input type="checkbox"/> Research question and approach clearly reflect careful ethical consideration (e.g., minimize risk, respect data sensitivity) even if not stated explicitly.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
2. Application of Neuroscience Knowledge	CLO2	PLO2 PLO3	<input type="checkbox"/> Fails to apply relevant neuroscience concepts to the problem.	<input type="checkbox"/> Inconsistent or weak application of neuroscience knowledge.	<input type="checkbox"/> Applies basic neuroscience knowledge; lacks depth or minor conceptual errors.	<input type="checkbox"/> Applies appropriate neuroscience knowledge with minor inaccuracies during presentation.	<input type="checkbox"/> Applies advanced, current neuroscience knowledge thoroughly and accurately to solve the problem, demonstrating deep understanding during presentation.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
3. Critical Analysis and Data Interpretation	CLO3	PLO2 PLO3	<input type="checkbox"/> No critical evaluation; lacks use of evidence.	<input type="checkbox"/> Weak analysis or superficial interpretation of data.	<input type="checkbox"/> Basic problem analysis with moderate interpretation of data.	<input type="checkbox"/> Good problem analysis and data interpretation with minor gaps.	<input type="checkbox"/> Demonstrates critical, insightful problem analysis supported by strong evidence, and expertly interprets relevant data.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
4. Structure and Clarity of Presentation	CLO5	PLO5	<input type="checkbox"/> Disorganized, uncoordinated effort; ineffective presentation.	<input type="checkbox"/> Presentation is disorganized, unclear in several parts.	<input type="checkbox"/> Presentation is understandable but lacks strong structure or clarity.	<input type="checkbox"/> Presentation is clear and mostly logical with minor organizational flaws.	<input type="checkbox"/> Presentation is exceptionally clear, logical, well-structured, and engaging; key points are emphasized effectively.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
5. Use of Visual Aids, Data Presentation, and Communication Skills	CLO5	PLO5	<input type="checkbox"/> Inaccurate or missing data analysis; poor communication of solutions.	<input type="checkbox"/> Poor visual aids or unclear data presentation; communication often unclear.	<input type="checkbox"/> Basic use of visual aids and data; communication is understandable but not polished.	<input type="checkbox"/> Visual aids and data presentation are appropriate with minor issues; communication mostly clear.	<input type="checkbox"/> Visual aids are professional, enhance understanding; data is presented clearly; excellent verbal communication skills.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
6. Response to Questions (Q&A Session)	CLO3 CLO5	PLO2 PLO5	<input type="checkbox"/> Unable to respond appropriately; lacks understanding or avoids questions.	<input type="checkbox"/> Struggles to respond clearly or accurately to several questions.	<input type="checkbox"/> Responds adequately but may lack depth or clarity in explanations.	<input type="checkbox"/> Responds well to most questions; minor inaccuracies or hesitations.	<input type="checkbox"/> Responds accurately, confidently, and insightfully to all questions; demonstrates deep understanding and ability to engage in academic discussion.	<input type="checkbox"/> I <input type="checkbox"/> R <input type="checkbox"/> P <input type="checkbox"/> M
Total Score (30)								

* Note: A score in the "Satisfactory" range indicates that the student has achieved at least a **Practiced (P)** level of competency for this course. Students must achieve at least a **P (Practiced)** level in each of the Course Learning Outcomes (CLOs).

* Guideline for Scoring: 1 = I (Introduced); 2 = R (Reinforced); 3 & 4 = P (Practiced); 5 = M (Mastery)