**Course Syllabus**

**MBMB 501 Molecular Biology**

Academic year 2025

**Course ID and Title** MBMB 501 Molecular Biology

**Course coordinator** Prof. Panadda Boonserm, Ph.D.
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**Instructors:** Prof. Chalermporn Ongvarrasopone, Ph.D.
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Assoc. Prof. Chalongrat Noree, Ph.D.
Assoc. Prof. Sarin Chimnaronk, Ph.D.
Assoc. Prof. Soraya Chaturongakul, Ph.D.
Asst. Prof. Alisa Tubsuwan, Ph.D.
Asst. Prof. Kusol Pootanakit, Ph.D.
Asst. Prof. Natee Jearawiriyapaisarn, Ph.D.
Asst. Prof. Phatchariya Phannasil, Ph.D.
Asst. Prof. Poochit Nonejuie, Ph.D.
Chutima Thepparit, Ph.D.
Duangnapa Kovanich, Ph.D.
Ekkaphot Khongkla, Ph.D.
Ittipat Meewan, Ph.D.
Kittiphong Paiboonsukwong, M.D., Ph.D.
Siraprapa Boobphahom, Ph.D.

**Credits:** 2 (1-2-3)

**Curriculum:** Master of Science Program in Molecular and Integrative Biosciences (required course)

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Doctor of Philosophy Program in Molecular and Integrative Biosciences (required course)

**Semester offering:** First semester

**Pre-requisites:** None

**Course learning outcomes (CLOs):**

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

1. Describe the comprehensive knowledge of molecular biology
2. Apply comprehensive molecular biology knowledge to answer scientific research questions
3. Develop practical research skills by conducting molecular biology experiments, analyzing and presenting lab findings using relevant information and communication tools
4. Demonstrate scientific integrity, safety practice, teamwork, interpersonal skills, and responsibilities for the work assignments

**Course description**

Overview of Central Dogma; DNA and RNA Structure and Function; Protein Structure and Function; DNA Replication; Transcription; Protein Translation; Gene Expression and Regulation in Prokaryotes; Gene Expression and Regulation in Eukaryotes; Molecular Basis of Mutation; Recombinant DNA Technology; Nucleic Acid-Based Technologies; Protein-Based Technologies; DNA and RNA Extraction; DNA Cloning; PCR and Agarose Gel Electrophoresis; Protein Extraction and SDS-PAGE

กระบวนการหลักในการควบคุมการทำงานของสิ่งมีชีวิต โครงสร้างและหน้าที่ของดีเอ็นเอและอาร์เอ็นเอ โครงสร้างและหน้าที่ของโปรตีน การจำลองตัวของดีเอ็นเอ การถอดรหัสพันธุกรรม การแปลรหัสพันธุกรรม การควบคุมการแสดงออกของยีนในโปรคารีโอต การควบคุมการแสดงออกของยีนในยูคารีโอต พื้นฐานระดับโมเลกุลของการกลายพันธุ์ เทคโนโลยีดีเอ็นเอรีคอมบิแนนท์ เทคโนโลยีด้านกรดนิวคลีอิก เทคโนโลยีด้านโปรตีน การสกัดดีเอ็นเอและอาร์เอ็นเอ การโคลนดีเอ็นเอ ปฏิกิริยาลูกโซ่โพลีเมอเรสและอะกาโรสเจลอิเล็กโทรโฟรีซิส การสกัดโปรตีนและเอสดีเอสเพจ

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**Alignment of Teaching and Assessment Methods to Course Learning Outcomes:**

| PLO (M.Sc./Ph.D.) | Course learning outcome (CLO) | Teaching method | Assessment method |
|---|---|---|---|
| PLO1 | 1. Describe the comprehensive knowledge of molecular biology | (1) In-class lecture and discussion<br>(2) Active learning<br>(3) Assignment | (1) Class participation<br>(2) Assessment of assigned work<br>(3) Quizzes |
| PLO1 | 2. Apply comprehensive molecular biology knowledge to answer scientific research questions | (1) In-class discussion<br>(2) Active learning<br>(3) Assignment<br>(4) Problem-based learning | (1) Class participation<br>(2) Assessment of assigned work<br>(2) Problem-based learning presentation |
| PLO2 | 3. Develop practical research skills by conducting molecular biology experiments, analyzing and presenting lab findings using relevant information and communication tools | (1) Hands-on practice/VDO lab demonstration<br>(2) Experimental data presentation and discussion | (1) Lab performance<br>(2) Reports<br>(3) Lab notebooks<br>(4) Short presentation |

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| | | | |
|---|---|---|---|
| PLO3 and PLO4 | 4. Demonstrate scientific integrity, safety practice, teamwork, interpersonal skills, and responsibilities for the work assignments | (1) Lab safety guidelines<br>(2) Group/individual assignment<br>(3) Group presentation | (1) Direct observation<br>(2) Lab performance<br>(3) Assessment of responsibility for assigned work<br>(4) Class attendance<br>(5) Group presentation |

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**Course schedule:**

Date: Monday-Friday

Time: 09.00 AM-4.00 PM

Rooms C405 (On-site lecture) and D401 (On-site lab), Institute of Molecular Biosciences or Webex/Zoom meetings for Online activities

| Topic/Details | Time | Class Activity | Lecturer |
|---|---|---|---|
| **xxx 202x** | | | |
| Course Orientation | 9.00-9.10 AM | Introduction | Panadda |
| Overview: Central Dogma (Flow of Genetic Information) | 9.10 – 11:30 AM | Lecture | Siraprapa |
| DNA/RNA Structure & Function | 1.30-4.00 PM | Lecture | Sarin |
| **xxx 202x** | | | |
| Self-study | | | |
| **xxx 202x** | | | |
| Protein Structure & Function | 9.00 – 11:30 AM | Lecture | Ittipat (Siraprapa) |
| DNA Replication | 1.30-4.00 PM | Lecture | Poochit |
| **xxx 202x** | | | |
| Self-study | | | |
| **xxx 202x** | | | |
| mRNA Transcription | 9.00 – 11:30 AM | Lecture | Natee |
| Protein Translation | 1.30-4.00 PM | Lecture | Ekkaphot |
| **xxx 202x** | | | |
| Gene Expression and Regulation (Prokaryotes) | 9.00 – 11:30 AM | Lecture | Soraya |
| Gene Expression and Regulation (Eukaryotes) | 1.30-4.00 PM | Lecture | Chutima |
| **xxx 202x** | | | |
| Self-study | | | |

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| Topic/Details | Time | Class Activity | Lecturer |
|---|---|---|---|
| **xxx 202x** | | | |
| Molecular Basis of Mutation | 9.00 – 11:30 AM | Lecture | Chalongrat |
| Recombinant DNA Technology | 1.30-4.00 PM | Lecture | Chalermporn |
| **xxx 202x** | | | |
| Self-study | | | |
| **xxx 202x** | | | |
| Nucleic Acid-based Technologies | 9.00 – 11:30 AM | Lecture | Kittiphong |
| Protein-based Technologies | 1.30-4.00 PM | Lecture | Duangnapa |
| **xxx 202x** | | | |
| DNA/RNA Extraction | 9.00 – 11:30 AM | Lab | Chalermporn, Chutima, Alisa, Phatchariya |
| | 1.30-4.00 PM | Lab | |
| **xxx 202x** | | | |
| DNA Cloning | 9.00 – 11:30 AM | Lab | Chalermporn, Poochit, Ittipat |
| | 1.30-4.00 PM | Lab | |
| **xxx 202x** | | | |
| PCR and Agarose Gel Electrophoresis | 9.00 – 11:30 AM | Lab | Kusol, Alisa, Chutima |
| | 1.30-4.00 PM | Lab | |
| **xxx 202x** | | | |
| Protein Extraction and SDS-PAGE | 9.00 – 11:30 AM | Lab | Panadda, Duangnapa |
| | 1.30-4.00 PM | Lab | |
| **xxx 202x** | | | |
| Problem-based learning presentation | 10.00 AM-12.00 PM | Group presentation | All teaching staff |
| Reflection and After-Action Review (AAR) | 1.30-2.00 PM | AAR | Panadda |

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**Assessment Criteria:**

| Assessment Criteria | Assessment Method | Scoring Rubric |
|---|---|---|
| Assignment 40% | (1) Quizzes/exercises<br>(2) Assignment | (1) Comprehension |
| Problem-based learning presentation<br>20% | (1) Problem-based presentation | (1) Ability to apply knowledge to solve research problems<br>(2) Ability to answer questions |
| Laboratory performance/ Laboratory report/ Lab notebook<br>30% | (1) Direct observation<br>(2) Practical examination/Quizzes<br>(3) In-class/on-line discussion<br>(4) Short presentation<br>(1) Reports<br>(2) Lab notebooks | (1) Ability to follow procedure or to design a procedure for an experiment<br>(2) Use of equipment<br>(3) Working area and safety<br>(4) Report writing<br>(5) Report submission time<br>(6) Presentation of data<br>(7) Data analysis and conclusion<br>(8) Lab notebook |
| Class participation, Group presentation, Group assignment<br>10% | (1) Direct observation<br>(2) Short presentation | (1) Class participation<br>(2) Group work<br>(3) Assigned work submission time |

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| Assessment Criteria | Assessment Method | Scoring Rubric |
|---|---|---|
| | | (4) Group presentation |

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 |

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| Assignment Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Need to Improve (1)** |
| **1. Organization (15 %)** | The writing demonstrated strong logic and thinking skills. Unity effectively brought readers to a conclusion and stimulated thought on the topic. | The writing was rationally arranged, with transitions between ideas and paragraphs to ensure consistency. | The writing was clear and ordered. Some points were misplaced beyond the topic. Transitions appeared but were not used throughout the essay. | The writing lacked logical organization. Although coherent, the ideas lacked unity. There were some serious errors. |
| **2. Level of content (15 %)** | The content demonstrated a synthesis of concepts, in-depth analysis, and creative thought and supported the subject. | The content demonstrated creative thinking and strong evidence-based concepts. | The content reflected some innovative thinking and reasoning on certain ideas. | While there was some thought and reasoning, most of the concepts were undeveloped and unoriginal. |
| **3. Grammar and format (8 %)** | The essay was free from spelling, punctuation, and grammatical problems. Met all formal and assignment criteria. | The essay had few spelling, punctuation, and grammatical errors. Met format and assignment requirements | The essay had some spelling, punctuation, and grammatical errors. Some errors in format appeared. | Errors in spelling, punctuation, and grammar made reading difficult. Failed to follow format and assignment requirements |
| **4. Report Submission time (2 %)** | The assignment was sent on time. | The assignment was sent one day late. | The assignment was sent two days late. | The assignment was sent more than two days late. |
| **Total (40 %)** | **Total points earned =** | | | |

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| Problem-based learning Presentation Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Needs to Improve (1)** |
| **1. Scientific background (4%)** | The main ideas were presented in depth and detail, and all key elements were included. The experimental design answered all questions, and the poster contained accurate information. | The main ideas were presented with appropriate depth and details. Most key elements were included. Experimental design answered almost all questions. The poster contained a few mistakes. | The main ideas were presented but not completely or with superficial details. Some key elements were missing. The experimental design answered some questions. The poster contained some mistakes. | The main ideas were not presented, and there were no details. Most key elements were missing. The experimental design could not directly answer questions. The poster contained many mistakes. |
| **2. Innovative and creative ideas (4%)** | The presenter extended a novel or unique idea/ product to create a new knowledge by integrating alternative, or diverse perspectives. The presenter transformed ideas or solutions into entirely new forms. | The presenter recognized and incorporated some alternative or diverse perspectives. The presenter experimented with creating a novel or unique idea /product and made some efforts to synthesize new ideas or solutions. | The presenter incorporated a few alternative perspectives. The presenter experimented with creating a novel or unique idea /product and made little effort to synthesize new ideas or solutions. | The presenter used only a single approach to solve the problem. The presenter reformulated a collection of already available ideas. |
| **3. Presentation skills (4%)** | Delivery was clear and smooth, with good language skills. The visuals were attractive and effectively enhanced the presentation. The | Delivery was clear and smooth, with good language skills. Visuals were appropriately used to enhance the presentation. The | The delivery had some broken sentences. Visuals were not well used to enhance the presentation, and it was more than one | The delivery had many broken sentences and was not clear. Visuals were not used to enhance the presentation. The length of the presentation was a few |

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| Problem-based learning Presentation Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Needs to Improve (1)** |
| | length of the presentation was within the assigned time limits. | length of the presentation was one minute over the assigned time limit. | minute over the assigned time limit. | minutes over the assigned time limits. |
| **4.Debate and argument skills (4%)** | The presenter debated and responded to questions confidently and completely. | The presenter debated and responded to most questions but needed some clarification. | The presenter debated and responded to some questions but always needed some clarification. | The presenter could not debate and respond to most questions. |
| **Total (20 %)** | **Total points earned =** | | | |

| Lab Performance Evaluation Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Need to Improve (1)** |
| **1. Ability to Follow Procedure or to Design a Procedure for Experiment (10 %)** | Actively followed the instructions in the procedure without assistance. Showed ability to perform additional experiments or tests beyond what was required in the procedure. | Followed the instructions in the procedure with little or no assistance. If the procedure was not provided, the student was able to determine an appropriate experiment to satisfy the lab objectives. | Had difficulty with some of the instructions in the procedure and needed clarification from the instructor or lab partner. If the procedure was not provided, the student needed some guidance about experiments to perform to satisfy the lab objectives. | Had difficulty reading the procedure and following the directions. Several mistakes were made during the experiment. If the procedure was not provided, student was incapable of designing a set of experiments to satisfy the given lab objectives. |

| | | | | |
|---|---|---|---|---|
| **2. Use of Equipment (5 %)** | Showed proper techniques for handling tools and lab equipment without error. | Showed proper techniques for handling tools and lab equipment with a few minor errors. | Showed adequate care for handling tools and lab equipment with some minor errors. | Showed improper techniques for handling some major errors. |
| **3. Working Area and Safety (5 %)** | The experiment was carried out with full attention to relevant safety procedures & directions. No incident occurred. Outstanding job on cleaning up the working area, tools, and equipment. Lab tools were organized and stored with care. | The experiment was generally carried out with attention to relevant safety procedures & directions. No incident occurred. Good job on cleaning up the working area, tools, and equipment. Lab tools were properly stored. | The experiment was carried out with some attention to relevant safety procedures & directions. A few incidents occurred. Had to be reminded to clean up area and equipment. Sometimes showed disorganized storage of lab tools. | Safety procedures were ignored. Did not follow directions. Several incidents occurred. Did not clean up area and equipment after work. Showed disorganized storage of lab tools. |
| **Total (20 %)** | **Total points earned =** | | | |

| **Lab Report/ Lab notebook Evaluation Rubric** | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Need to Improve (1)** |
| **1. Writing Style (2%)** | The report was neat and well organized, with minimum spelling errors. | The report was neat and appropriately organized, with a few spelling errors. | The report was somewhat neat and organized, with some spelling errors. | The report was disorganized, with many spelling errors. |
| **2. Report Submission time (1%)** | The report was sent on time. | The report was sent one day late. | The report was sent two days late. | The report was sent more than two days late. |

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| Lab Report/ Lab notebook Evaluation Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Need to Improve (1)** |
| **3. Presentation Of Data (2%)** | Experimental data was clearly presented with tables, diagrams, pictures, or graphs that effectively present the experimental data. Results were shown in clear detail, and graphical data were labeled accurately. | Experimental data was presented in an appropriate format with only a few minor errors or omissions. Showed clear detail of results and graphical data were labelled accurately. | Experimental data was presented in an appropriate format, but some significant errors were noticed. Some tables and graphical data could be better organized, and some units, labels, and titles were missing. | Experimental data was poorly presented. Graphs or tables were poorly constructed and had several errors. Data was missing or incorrect. Some units, labels, and titles were not included. |
| **4. Data Analysis and Conclusion (2%)** | Reasonable scientific explanations for the results were discussed and logically analyzed. The conclusion was well-written and provided a complete answer to the question or hypothesis. It described what was learned, possible sources of error, and good suggestions for improving the experiment and application. | Scientific explanations for the results were given. The conclusion was appropriately written with a possible answer to the question or hypothesis. Provided description of what was learned, possible sources of error, and suggestions for improving the experiment and application. | Scientific explanations for the results were given, but they were neither complete nor accurate. The conclusion was written with an inaccurate answer to the question or hypothesis. A description of what was learned, possible sources of error, and suggestions for improving the experiment and application were missing. | The scientific explanation for the results was neither complete nor accurate. The conclusion was poorly written and inaccurate, answering the question or hypothesis incorrectly. A description of what was learned, possible sources of error, and suggestions for improving the experiment and application were missing. |

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| Lab Report/ Lab notebook Evaluation Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Need to Improve (1)** |
| **5. Lab notebook (3%)** | The lab notebook was completed, including procedures for each experiment, calculation, results, and conclusion. | The lab notebook was sufficiently complete, with only minor omissions. | The lab notebook had partial information with major omissions. | The lab notebook was incomplete and difficult to understand. |
| **Total (10 %)** | **Total points earned =** | | | |

| Class participation, Group presentation, Group assignment Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Needs to Improve (1)** |
| **1. Class participation (2 %)** | Used time well in class and focused attention on the lecture and experiments. Actively participated in the group and in classroom discussions. | Used time pretty well. Stayed focused on the lecture and experiments most of the time. Usually provided useful ideas when participating in the group and in classroom discussion. | Focused on the class but did not appear very interested. Sometimes provided useful ideas when participating in the group and in classroom discussion. | Participation was minimal. Rarely provided useful ideas when participating in the group and in classroom discussions. |
| **2. Group work (2%)** | Shared a lot of work with others. Gave ideas and helped others to complete the assigned work. | Shared equal work as others. Gave ideas and completed the assigned work in the group. | Did almost as much work as others. Sometime gave ideas and asked for help from others. | Did less work than others. Did not give ideas or ask for help from others. |
| **3.Assigned work submission time (2%)** | Completed assigned work on time. | Completed assigned work one day late. | Needed some reminding; work was late but no more than two days. | Needed much reminding; work was late more than two days. |

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| Class participation, Group presentation, Group assignment Rubric | | | | |
|---|---|---|---|---|
| **Criteria** | **Excellent (4)** | **Good (3)** | **Satisfactory (2)** | **Needs to Improve (1)** |
| **4.Group presentation (2%)** | The presentation was well organized, and easy to follow. All of the group members contributed equally to the presentation. | The presentation had good organization. Everyone gave some presentation but someone gave more contribution than others. | The presentation could be better organized. Certain people did not do as much work as others. | The presentation lacked organization. A few people or only one person worked on the presentation. |
| **Total (10 %)** | **Total points earned =** | | | |

**Revised Date:** XXX