Course Syllabus
MBMG 512 DNA Engineering
Academic year 2021 (September 6 to 20, 2021)

Course ID and Name: MBMG 512 DNA Engineering

Course coordinator: Assoc. Prof. Chalermporn Ongvarrasopone, Ph.D.
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Instructors:

1. Assoc. Prof. Apinunt Udomkit, Ph.D.
2. Assoc. Prof. Chalermporn Ongvarrasopone, Ph.D.
3. Assoc. Prof. Kanokporn Triwitayakorn, Ph.D.
4. Assoc. Prof. Surapon Piboonpocanun, Ph.D.
5. Asst. Prof. Kusol Pootanakit, Ph.D.
6. Chalongrat Noree, Ph.D.
7. Poochit Nonejuie, Ph.D.

Lab supporting Staff:

1. Chanikarn Boonchuay
2. Chaweewan Chimwai
3. Somsri Sakdee
4. Thaneeya Nantapojd

Credits: 2(1-2-3)

Curriculum: Master of Science Program in Molecular Genetics and Genetic Engineering (required course)

Doctor of Philosophy Program in Molecular Genetics and Genetic Engineering (required course for students from B.Sc.)

Semester offering: First semester

Pre-requisites: None

Course learning outcomes:

At the end of the course, students are able to:

1. Integrate comprehensive knowledge in DNA cloning technology to solve scientific research questions.
2. Conduct experiments related to DNA cloning technology.
3. Analyze and present laboratory data in a scientific manner.
4. Demonstrate scientific integrity, responsibility, and safety practice.
5. Demonstrate critical thinking, teamwork, interpersonal skills and responsibilities for the work assignments.

Alignment of teaching and assessment methods to course learning outcomes:

Course learning outcomes	Teaching methods	Assessment methods
1. Integrate comprehensive knowledge in DNA cloning technology to solve scientific research questions.	(1) On-line lecture (2) On-line discussion	(1) Written examination (2) On-line discussion (3) Quizzes (4) Assignment in google classroom
2. Conduct experiments related to DNA cloning technology	(1) Hands-on practice (2) Class / on-line discussion (3) VDO demonstration	(1) Direct observation (2) Lab performance test (If possible)
3. Analyze and present laboratory data in a scientific manner.	(1) Experimental data presentation and discussion either in-class or on-line	(1) Reports (2) Lab notebooks (3) On-line short presentation (4) On-line discussion
4. Demonstrate scientific integrity, responsibility, and safety practice.	(1) Assignment in google classroom (2) Lab safety guidelines	(1) Assessment of assigned work (2) Direct observation (3) On-line attendance
5. Demonstrate critical thinking, teamwork, interpersonal skills and responsibilities for the work assignments.	(1) Group/individual assignment in google classroom	(1) Direct observation (2) Assessment of assigned work (3) Assessment of responsibility for assigned work

Course description:

Basic techniques in genetic engineering; DNA cloning, vectors, restriction enzymes, extraction of DNA from agarose gel, quantitation of DNA, ligation, competent cell preparation, transformation, plasmid DNA purification and screening of the recombinant clones. Principle of instrumentations such as Pipetting techniques, agarose gel electrophoresis, centrifuges, absorption and fluorescence spectroscopy, pH meter, and biological buffer systems. Computational analysis in various aspects such as *In-silico* plasmid construction; restriction enzyme mapping, sequence manipulation, plasmid map construction and *In-silico* DNA concentration estimation by Image analysis. Laboratory safety handling.

Course schedule:

Date: Monday-Friday
Time: 09.00-16.30
Rooms C405 / on-line (Lecture) and D401 (Lab), Institute of Molecular Biosciences, Mahidol University.

Date/time	Topics/Details	Number of Hours	Class Activity/Teaching Media	Lecturers
Sept. 6 9.00-10.00	Orientation /Laboratory safety handling	1	On-line lecture	Chalermporn
10.00-12.00	Recombinant DNA technology overview	2	On-line lecture	Chalermporn
13.00-15.00	Reagent preparation	2	On-line demonstration	Chalermporn
Sept. 7 9.00-11.00	Vectors and restriction enzymes	2	On-line lecture	Surapon
11.00-12.00	pH meter	1	On-line lecture	Surapon
13.30-15.00	Agarose gel electrophoresis / Set up	1.30	On-line lecture / demonstration	Kanokporn, Chalermporn
Sept. 8 9.00-11.00	Spectrophotometry	1-1(2)	On-line lecture / Lab demonstration	Chalongrat
13.00-15.00	Pipetting techniques	2	On-line lecture / demonstration	Chalongrat,
Sept. 9 9.00-12.00	DNA concentration quantitation Restriction enzyme analysis and running agarose gel electrophoresis	3	On-line demonstration / discussion	Chalermporn,
13.30-15.30	*In-silico* plasmid construction	1-2 (2)	On-line lecture-lab	Poochit
Sept. 10 13.00-15.00	Running agarose gel electrophoresis, Cut gel	2	On-line demonstration / discussion	Chalermporn,
Sept. 13 9.00-12.00	DNA purification by gel extraction method	3	On-line demonstration / discussion	Chalermporn,
13.00-15.00	*In-silico* DNA concentration estimation: Image analysis	1-2	On-line lecture-lab	Poochit
Sept. 14 9.00-10.00	DNA ligation	1	On-line lecture	Surapon

Date/time	Topics/Details	Number of Hours	Class Activity/Teaching Media	Lecturers
10.00-12.00	Set up DNA ligation	2	On-line demonstration / discussion	Surapon, Chalermporn, Poochit
13.00-15.00	Class discussion	2	On-line discussion	Surapon, Chalermporn, Poochit
Sept. 15 9.00-10.00	Bacterial transformation lecture (1): Principles and concepts	1	On-line lecture	Poochit
10.00-11.00	Bacterial transformation lecture (2): Transformation efficiency	1	On-line lecture	Poochit
13.00-15.00	Centrifuges	2	On-line lecture-demonstration	Apinunt
Sept. 16 9.00-12.00	Bacterial inoculation Bacteria competent cell preparation Bacterial transformation Calculate transformation efficiency	3	On-line demonstration	Poochit, Chalermporn, Surapon
13.00-16.00	Class discussion on transformation effeciency	3	On-line discussion	Poochit, Chalermporn, Surapon
Sept. 17 9.00-10.30	Plasmid DNA extraction Plasmid DNA digestion and agarose gel electrophoresis	1 h 30 min	On-line demonstration / discussion	Kusol, Apinunt
10.30-12.00	Class discussion (conclude)	1 h 30 min	On-line discussion	Kusol, Apinunt Poochit, Chalermporn, Surapon
Sept. 20 9.30-12.00	Examination	1h 30 min	On-line examination	Chalermporn
November	Lab DNA cloning	1 week	Lab practice	Chalermporn, Poochit, Surapon, Kusol, Apinunt

Assessment Criteria:

Assessment Criteria	Assessment Method	Scoring Rubric
Class discussion on Laboratory demonstration 20%	(1) Direct observation (2) On-line discussion and on-line short presentation	(1) Ability to follow procedure or to design a procedure for experiment (2) Assignment
Laboratory performance (Optional 10 %)	(1) Direct observation (2) Practical examination (3) On-line discussion and on-line short presentation	(1) Ability to follow procedure or to design a procedure for experiment (2) Use of equipment (3) Working area and safety
Laboratory report/ Lab notebook 25%	Electronic reports and lab notebooks	(1) Writing style (2) Report sending (3) Presentation of data (4) Data analysis and conclusion (5) Lab notebook (6) Understanding of experimental objective and analysis of results
On-line examination 30%	(1) Written examination	(1) Comprehension
Class participation, Group presentation, Group assignment 15%	(1) Direct observation (2) Short presentation (3) On-line discussion and on-line short presentation	(1) Class participation (2) Group work (3) Assigned work sending (4) Group presentation (5) Understanding of experimental objective and analysis of results

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
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

Lab Performance Evaluation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
1. Ability to Follow Procedure or to Design a Procedure for Experiment	Actively followed the instructions in the procedure with no 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	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 with some major errors.
3. Working Area and Safety	Lab was carried out with full attention to relevant safety procedures & directions. No incident occurred. Outstanding job cleaning up working area, tools and equipment. Lab tools were organized and stored with care.	Lab was generally carried out with attention to relevant safety procedures & directions. No incident occurred. Good job on cleaning up working area, tools and equipment. Lab tools were properly stored.	Lab 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 working. Showed disorganized storage of lab tools.
Total	**Total points earned =**			

Lab Report/ Lab notebook Evaluation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
1. Writing Style (3 %)	Report was neat and well organized with minimum spelling error.	Report was neat and appropriately organized with a few spelling errors.	Report was somewhat neat and organized with some spelling errors.	Report was disorganized with many spelling errors.
2. Report Sending (1%)	Report was sent on time.	Report was sent one day late.	Report was sent two days late.	Report was sent more than two days late.
3. Presentation Of Data (4%)	Experimental data was clearly presented with tables, diagrams, pictures or graphs that effectively present the experimental data. Showed clear detail of results 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 labeled accurately.	Experimental data was presented in an appropriate format but some significant errors were noticed. Some tables, graphical data could be better organized. Some units, labels, and titles were missing.	Experimental data was poorly presented. Graphs or tables were poorly constructed with 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. Conclusion was well written with a complete answer to the question or hypothesis. Provided description of what was learned, possible sources of error, good suggestions for improving the experiment and application.	Scientific explanations for the results were given. Conclusion was appropriately written with a possible answer to the question or hypothesis. Provided description of what was learned, possible sources of error, suggestions for improving the experiment and application.	Scientific explanations for the results were given but not complete or accurate. Conclusion was written with inaccurate answer to the question or hypothesis. Description of what was learned, possible sources of error, suggestions for improving the experiment and application were missing.	Scientific explanations for the results were given but not complete or accurate. Conclusion was poorly written with inaccurate answer to the question or hypothesis. Description of what was learned, possible sources of error, suggestions for improving the experiment and application were missing.
5. Lab notebook (15 %)	Lab notebook was complete including procedure for each experiment, calculation, results and conclusion.	Lab notebook was sufficiently complete with only minor omissions.	Lab notebook had partial information with major omissions.	Lab notebook was incomplete and difficult to understand.
Total (25 %)	**Total points earned =**			

Class participation, Group presentation, Group assignment Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
1. Class participation (3 %)	Used time well in class and focused attention on the lecture and experiments. Actively participated in the group and in classroom discussion.	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 discussion.
2. Group work (5 %)	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 sending (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.
4.Group presentation (5 %)	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 contributions 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 (15 %)	**Total points earned =**			

Date revised: August 2nd , 2021