Course Syllabus

MBMG516 Cell Technologies and Applications

Academic year 2024

Course ID and Name: MBMG516 Cell Technologies and Applications

Course coordinator: Assoc. Prof. Sarin Chimnaronk, Ph.D.

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Instructors:

1. Assoc. Prof. Sarin Chimnaronk, Ph.D.
2. Asst. Prof. Alisa Tubsuwan., Ph.D.
3. Asst. Prof. Narisorn Kitiyanant, D.V.M., Ph.D.
4. Asst. Prof. Natee Jearawiriyapaisarn, Ph.D.
5. Asst. Prof. Phatchariya Phannasil, Ph.D.
6. Benjaporn Kiatpakdee, DVM, PhD.
7. Chutima Thepparit, Ph.D.
8. Ittipat Meewan, Ph.D.
9. Promsin Masrinoul, Ph.D.
10. Wannapa Sornjai, Ph.D.

Supporting Staff:

1. Potchaman Sittipaisankul
2. Naraporn Sirinonthanawech
3. Theptharin Charuraksa

Credits: 3 (1-6-5)

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: Second semester

Pre-requisites: None

Course learning outcomes (CLOs):

Upon completion of this course, students are able to:

1. Acquire new knowledge and innovation in cell technologies and applications
2. Integrate and apply comprehensive knowledge in cell technologies to solve scientific research questions
3. Analyze and present lab data by using appropriate information and communication technologies
4. Demonstrate scientific integrity, responsibility, and safety practice
5. Demonstrate teamwork, interpersonal skills and responsibilities for the work assignments

Alignment of teaching and assessment methods to course learning outcome:

Course learning outcome	Teaching method	Assessment method
1. Acquire new knowledge and innovation in call technologies and applications	(1) Lecture (2) Class discussion	(1) Written examination (2) In-class discussion
2. Integrate and apply comprehensive knowledge in call technologies to solve scientific research questions	(1) Class discussion (2) Hands-on practice (3) Problem-based learning	(1) Direct observation (2) Lab performance (3) In-class discussion
3. Analyze and present lab data by using appropriate information and communication technologies	(1) Experimental data presentation and discussion	(1) Lab notebooks (2) Short presentation (3) In-class discussion
4. Demonstrate scientific integrity, responsibility, and safety practice	(1) Assignment (2) Lab safety guidelines	(1) Assessment of assigned work (2) Direct observation (3) Class attendance
5. Demonstrate teamwork, interpersonal skills, and	(1) Group/individual assignment	(1) Direct observation (2) Assessment of assigned work

responsibilities for the work assignments		(3) Assessment of responsibility for assigned work.

Course Description:

Basic mammalian cell culture technique; biosafety; mammalian cell expression system; RNAi; genome editing; immunofluorescence; flow cytometry; cell cycle; cellular homeostasis; cytotoxicity; MTT assay; real-time PCR; cell applications

Course schedule:

Date: Monday-Friday

Time: 09.00 a.m.-16.00 p.m.

Online, Onsite: Rooms D408 cell culture room, A409 Lecture room and C410-C411, Institute of Molecular Biosciences

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
Mon 6 Jan 2025	08.00-09.00	Orientation and overview of the class	1 hour	Lecture	Sarin
	09.00-10.00	Biosafety in cell culture work	1 hour	Lecture (1)	Chutima
	10.00-12.00	Mammalian cell culture and its application	2 hours	Lecture (2)	Phatchariya
	13.00-16.00	Mammalian cell expression system I: Cell seeding for siRNA transfection	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Tue 7 Jan 2025	09.00-12.00	Mammalian cell expression system II: Chemical-based transfection	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-14.00	Understanding Gene Functions and Their	1 hour	Lecture (3)	Promsin

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
		Applications in Cell Technology			
	14.00-16.00	Expression system in mammalian cell and transfection method	2 hours	Lecture (4)	Phatchariya
Wed 8 Jan 2025	09.00-10.00	RNA extraction and purification	1 hour	Lecture (5)	Sarin
	10.00-11.00	RNA interference	1 hour	Lecture (6)	Sarin
	11.00-12.00	In silico method for siRNA design	1 hour	Lab	Ittipat/ Phatchariya
	13.00-14.00	In silico drug discovery and drug target identification	1 hour	Lecture (7)	Ittipat
	14.00-16.00	PBL1: Molecular modeling for cancer drug design	2 hours	Lab	Phatchariya/ Ittipat/ Chutima/Promsin
Thu 9 Jan 2025	09.00-12.00	Mammalian cell expression system IV: Investigation of target protein expression level	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Mammalian cell expression system V: RNA extraction	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Fri 10 Jan 2025	09.00-12.00	Mammalian cell expression system VI: cDNA synthesis	2 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
	13.00-14.00	Principle of Real-time PCR and its applications	1 hour	Lecture (8)	Chutima
	14.00-16.00	Mammalian cell expression system VII: Real-time PCR	2 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Mon 13 Jan 2025	09.00-11.00	Flow cytometry and its applications	2 hours	Lecture (9)	Natee
	11.00-12.00	Phases of the cell cycle and research implications	1 hour	Lecture (10)	Ittipat
	13.00-16.00	Cell cycle analysis I: Cell quantification and drug treatment	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Tue 14 Jan 2025	09.00-12.00	Wrap up: Gene expression in mammalian cell	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Cell cycle analysis II: Cell harvest and fixation (Day 1)	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Wed 15 Jan 2025	09.00-12.00	PBL2: Cancer drug candidate identification	3 hours	Lab	Phatchariya/ Ittipat/ Chutima/Promsin
	13.00-16.00	Self-study	3 hours		
Thu 16 Jan 2025	09.00-12.00	Cell cycle analysis III: Cell harvest and staining (Day3)	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Cell cycle analysis IV: Investigation of cell cycle inhibitors using Flow cytometry	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Fri 17 Jan 2025	09.00-12.00	Exam (Lectures 1, 2, 3, 4, 5, 6, 7, 8)	3 hours		Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Self-study	3 hours		

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
Mon 20 Jan 2025	09.00-12.00	Cell Cytotoxicity I: Cell seeding for MTT assay	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-15.00	Cytotoxicity and evaluation methods	2 hours	Lecture (11)	Ittipat
	15.00-16.00	Type of cell deaths and mechanisms	1 hour	Lecture (12)	Promsin
Tue 21 Jan 2025	09.00-12.00	Cell Cytotoxicity II: Comparison of anti-cancer drugs' effect	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Wrap up: Cell cycle analysis	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Wed 22 Jan 2025	09.00-12.00	Cell Cytotoxicity III: Cell viability assessment using MTT assay	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
	13.00-16.00	Cell Cytotoxicity IV: Cytotoxicity concentrations evaluation	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Thu 23 Jan 2025	09.00-11.00	Applications of Viral vector in mammalian cell	2 hours	Lecture (13)	Narisorn
	13.00-15.00	Genome editing technologies	2 hours	Lecture (14)	Alisa
Fri 24 Jan 2025	09.00-12.00	PBL 3: Data visualization and cancer drug activity evaluation	3 hours	Lab	Phatchariya/ Ittipat/ Chutima/Promsin
	13.00-16.00	Wrap up: MTT assay and lab discussion in Cell Technologies and Applications	3 hours	Lab	Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
Mon 27 Jan 2025	09.00-12.00	Examination (Lectures 9, 10, 11, 12, 13, 14)	3 hours		Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin
Tue 28 Jan 2025	09.00-12.00	Examination (Lab)	3 hours		Phatchariya/Wannapa/ Benjaporn/ Ittipat/ Chutima/Promsin

Assessment Criteria:

Assessment Criteria	Assessment Method	Scoring Rubric
Laboratory performance 25%	(1) Direct observation (2) In-class discussion (3) Short presentation	(1) Ability to follow procedure or to design a procedure for experiment (2) Use of equipment (3) Working area and safety
Lab notebook 15%	(1) Lab notebooks	(1) Writing style (2) Lab notebook sending (3) Lab notebook content (4) Presentation of data (5) Data analysis and conclusion
Quizzes and exercises 30%	(1) Written examination	(1) Comprehension
Problem-based learning presentation 20%	(1) Presentation	(1) Presentation (2) Ability to apply knowledge to solve research problems (3) Ability to answer questions

Assessment Criteria	Assessment Method	Scoring Rubric
Class participation, Group presentation, Group assignment 10%	(1) Direct observation (2) Short presentation	(1) Class participation (2) Group work (3) Group presentation

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 (15 %)	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 (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 with some major errors.

3. Working Area and Safety (5 %)	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 (25 %)	**Total points earned =**			

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 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.

Lab notebook Evaluation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
2. Lab notebook Sending (3 %)	Lab notebook was sent on time.	Lab notebook was sent one day late.	Lab notebook was sent two days late.	Lab notebook was sent more than two days late.
3. Lab notebook content (3 %)	Lab notebook was complete including procedure for each experiment, calculation, results, discussion 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.
4. Presentation Of Data (3 %)	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.
5. Data Analysis and Conclusion (3 %)	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	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	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	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

Lab notebook Evaluation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
	improving the experiment and application.	experiment and application.	improving the experiment and application were missing.	experiment and application were missing.
Total (15 %)	**Total points earned =**			

Problem-based learning Presentation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
1. Presentation Organization (5 %)	Information was presented in a logical sequence. Flow of experiments was in order and well planned.	Information was presented in a logical sequence. Most of experiments were in order.	Information was loosely organized. Some experiments were not in order or linked.	Information lacked connection and not clear. Most experiments were not in order or linked.
2. Presentation scientific content (8 %)	Main ideas were presented with depth and details. All key elements were included. Experimental design answered all questions. Presentation contained accurate information.	Main ideas were presented with appropriate depth and details. Most key elements were included. Experimental design answered almost all questions. Presentation contained a few mistakes.	Main ideas were presented but not complete or with superficial details. Some key elements were missing. Experimental design answered some questions. Presentation contained some mistakes.	Main ideas were not presented and lacked of details. Most key elements were missing. Experimental design could not directly answer questions. Presentation contained many mistakes.
3. Over all presentation (2 %)	Presenter maintained good eye contact with the audience and appropriately used body motion. Delivery was clear and smooth with good language skills. Visuals were	Presenter generally maintained good eye contact with the audience and used body motion to support the presentation. Delivery was clear and smooth	Presenter did not always maintain good eye contact with the audience and used body motion to support the presentation. Delivery had some broken	Presenter did not maintain good eye contact with the audience and lacked body motion. Delivery had many broken sentences and was not clear. Visuals were not

Problem-based learning Presentation Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
	attractive and effectively enhanced the presentation. Length of presentation was within the assigned time limits.	with good language skills. Visuals were appropriately used to enhance the presentation. Length of presentation was one minute over the assigned time limits.	sentences. Visuals were not well used to enhance the presentation. Length of presentation was more than one minute over the assigned time limits.	used to enhance the presentation. Length of presentation was a few minutes over the assigned time limits.
4. Response to questions (5 %)	Presenter answered questions confidently and completely.	Presenter answered most questions but needed some clarification.	Presenter answered some questions but always needed some clarification.	Presenter could not understand or answer most questions.
Total (20 %)	**Total points earned =**			

Class participation, Group presentation, Group assignment Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
1. Class participation (5 %)	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 (3 %)	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. Group presentation (2 %)	The presentation was well organized, and easy to follow. All of the group members	The presentation had good organization. Everyone gave some presentation but	The presentation could be better organized. Certain	The presentation lacked organization. A few people or only one

Class participation, Group presentation, Group assignment Rubric				
Criteria	**Excellent (4)**	**Good (3)**	**Satisfactory (2)**	**Needs to Improve (1)**
	contributed equally to the presentation.	someone gave more contributions than others.	people did not do as much work as others.	person worked on the presentation.
Total (10 %)	**Total points earned =**			

Date revised: 12 November, 2024