Course ID and Name: MBMG516 Cell Technologies and Applications

Course coordinator: Assoc. Prof. M.L. Saovaros Svasti, Ph.D.

Tel: 02-441-9003-7 ext. 1357

E-mail: saovaros.sva@mahidol.ac.th, stssv@yahoo.com

Instructors:

1. Prof. Duncan R. Smith, Ph.D.

2. Assoc. Prof. Chalermporn Ongvarrasopone, Ph.D.

3. Assoc. Prof. M.L. Saovaros Svasti, Ph.D.

4. Asst.Prof. Kusol Pootanakit, Ph.D.,

5. Asst.Prof. Alisa Tubsuwan., Ph.D.

6. Phatchariya Phannasil, Ph.D.

7. Arpaporn Sutipatanasomboon, Ph.D.

8. Wannapa Sornjai, Ph.D.

Supporting Staff:

1. Chanikarn Boonchuay

2. Naraporn Sirinonthanawech

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 call technologies and applications

2. Integrate and apply comprehensive knowledge in call 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 responsibilities for the work assignments	(1) Group/individual assignment	(1) Direct observation (2) Assessment of assigned work (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; semi-quantitative PCR; cell applications

Course schedule:

Date: Monday-Friday

Time: 09.00-16.00

Online, Onsite: Rooms C213, C405 and D401, Institute of Molecular Biosciences

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
Mon 24 Jan 2022	09.00-10.00	Orientation and over view of the class	1 hour	Lecture	Saovaros
	10.00-11.00	Comprehensive functional gene analysis	1 hour	Lecture (1)	Saovaros
	11.00-12.00	Biosafety	1 hour	Lecture (2)	Duncan
	13.00-16.00	Mammalian cell expression system I: mammalian cell culture	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Tue 25 Jan 2022	09.00-12.00	Mammalian cell expression system II: Transfection	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-14.00	Basic mammalian cell culture	1 hour	Lecture (3)	Phatchariya
	14.00-15.00	Mammalian cell expression system	1 hour	Lecture (4)	Phatchariya
	15.00-16.00	Genome editing	1 hour	Lecture (5)	Alisa
Wed 26 Jan 2022	09.00-10.00	RNA interference	1 hour	Lecture (6)	Chalermporn
	10.00-11.00	RNA extraction	1 hour	Lecture (7)	Chalermporn
	11.00-12.00	Real-Time PCR	1 hour	Lecture (8)	Kusol
	13.00-14.00	Mammalian cell expression system III:	1 hour	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
		Light microscope, Fluorescence microscope			
	14.00-16.00	PBL1	2 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Thu 27 Jan 2022	09.00-12.00	Mammalian cell expression system IV: Light microscope, Fluorescence microscope, flow cytometry	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	RNA extraction	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Fri 28 Jan 2022	09.00-12.00	cDNA synthesis, Semi-quantitative RT-PCR	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	Real-time PCR	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Mon 31 Jan 2022	09.00-12.00	Cell cycle analysis I: Seed cells	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	Wrap up	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Tue 1 Feb 2022	09.00-12.00	Cell cycle analysis II: Treatment	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-14.00	Flow cytometry	1 hour	Lecture (9)	Saovaros
	14.00-15.00	The cell cycle	1 hour	Lecture (10)	Duncan
	15.00-16.00	Cellular homeostasis	1 hour	Lecture (11)	Duncan
Wed 2 Feb 2022	09.00-12.00	Cell cycle analysis III: Collect cells (Day1)	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	PBL2	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Thu	09.00-12.00	Self-study	3 hours		

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
3 Feb 2022	13.00-16.00	Exam (Lecture 1, 2, 3, 4, 5, 6, 7, 8)	3 hours		Saovaros/ Arpaporn/ Phatchariya/Wannapa
Fri 4 Feb 2022	09.00-12.00	Cell cycle analysis IV: Collect cells (Day3)	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	Cell cycle analysis V: Flow cytometry	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Mon 7 Feb 2022	09.00-12.00	Cellular homeostasis I: Cytotoxicity	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-14.00	Cytotoxicity and cell proliferation	1 hour	Lecture (12)	Duncan
	14.00-16.00	Wrap up	2 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Tue 8 Feb 2022	09.00-12.00	Cellular homeostasis II: Cytotoxicity	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-15.00	Cell applications	2 hours	Lecture (13)	Saovaros
Wed 9 Feb 2022	09.00-12.00	Cellular homeostasis III: MTT assay	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
	13.00-16.00	MTT analysis and wrap up	3 hours	Lab	Saovaros/ Arpaporn/ Phatchariya/Wannapa
Thu 10 Feb 2022	09.00-10.00	Computational prediction of miRNAs and their targets	1 hour	Lecture (14)	Chalermporn
	10.00-12.00	Computer lab	2 hours	Lab	Chalermporn
	13.00-16.00	Self-study	3 hours		
Fri 11 Feb 2022	09.00-12.00	Student's presentations (PBL 3)	3 hours	Lab	All staffs
	13.00-16.00	Lab discussion	3 hours	Lab	All staffs

Date	Time	Topics/Details	Number of Hours	Class Activity/ Teaching Media	Lecturer
Mon 14 Feb 2022	09.00-12.00	Examination (Lecture 9, 10, 11, 12, 13, 14)	3 hours		Saovaros/ Arpaporn/ Phatchariya/Wannapa
Tue 15 Feb 2022	09.00-12.00	Examination (Lab)	3 hours		Saovaros/ Arpaporn/ Phatchariya/Wannapa

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

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

Lab Performance Evaluation Rubric				
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs to Improve (1)
		experiment to satisfy the lab objectives.	guidance about experiments to perform to satisfy the lab objectives.	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 =			

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. 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.

Lab notebook Evaluation Rubric				
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs to Improve (1)
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 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.

Lab notebook Evaluation Rubric				
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs to Improve (1)
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 attractive and effectively enhanced the presentation. Length of	Presenter generally maintained good eye contact with the audience and used body motion to support the presentation. Delivery was clear and smooth with good language skills. Visuals were appropriately used to enhance the	Presenter did not always maintain good eye contact with the audience and used body motion to support the presentation. Delivery had some broken sentences. Visuals were not well used to enhance the presentation. Length	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 used to enhance the presentation. Length of presentation was a few

Problem-based learning Presentation Rubric				
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs to Improve (1)
	presentation was within the assigned time limits.	presentation. Length of presentation was one minute over the assigned time limits.	of presentation was more than one minute over the assigned time limits.	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 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	Total points earned =			

Class participation, Group presentation, Group assignment Rubric				
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs to Improve (1)
(10 %)				

Date revised: 22 November 2021