Division of Life Science
The Hong Kong University of Science and Technology

LIFS 3110 Biotechnological Applications of Recombinant DNA Techniques

Fall semester, 2016-2017
Credits: 2
Time: Tuesday, 14:00 – 17:50, Room 4160, Lift 33

Instructor: Bobby Yim (E-mail: bobby@ust.hk)

Course goals

The course LIFS 3110 Biotechnological Applications of Recombinant DNA Techniques comprises altogether eight laboratory exercises. The goals of these exercises are three-fold: 1) to enhance students' comprehension of what they have learnt in lectures; 2) to provide hands-on experience in the fields of Biotechnology and Molecular Biology; and 3) to prepare students for advanced laboratory studies.

Intended Learning Outcomes

On successful completion of this course, students are expected to be able to:

1. Acquire a sound knowledge of recombinant DNA methodology, gene structure and expression.
2. Perform practical skills relating to molecular biology and bacterial culturing to yield recombinant DNA / protein.
3. Demonstrate analytical awareness via interpretation of experimental results.
4. Plan and execute recombinant DNA techniques in order to determine and interpret genetic modifications.
5. Work and coordinate effectively in a group to accomplish laboratory based tasks.
6. Exhibit accuracy and independence in recording and reporting results.

Course description

Students will be given exposure to the following areas of molecular biology and recombinant DNA technology:

- Microbial culture and aseptic techniques
- Analysis of plasmid DNA by agarose gel electrophoresis
- Restriction endonuclease digestion
- Amplification of DNA by polymerase chain reaction
- DNA recovery from agarose gel
- Plasmid construction by Gibson Assembly
- Transformation of *E. coli*
- Plasmid DNA isolation
- Site-directed mutagenesis
- Quantitative analysis of recombinant proteins

Learning activity

1. Learning environment: A group of two or three students will collaborate to perform the experiments during the semester. Workbench, routinely used labwares and instruments would be assigned to and managed by each group of students.
2. Pre-lab talk: Contents would focus on basic theoretical and practical issues pertaining to the experiment.
3. Pre-lab demonstration: Specific techniques will be demonstrated by the instructor prior to each laboratory exercise; real time close-up video shot will be shown live. Right after demonstration, students will perform the same techniques by themselves. Students are expected to learn a core set of techniques that will be repeatedly used throughout the semester.
4. On-bench supervision: Teaching staff, who is a technician or postgraduate student, will serve as a bench supervisor to take care of several groups of students. Bench supervisor will provide assistance and instructions to students during the experiment.
5. Exit discussions: In some exercises, on completion of the experimental work, all students would be expected to present their results to the instructor. Additional discussions on data analysis and interpretation may be conducted on a large group-basis.

Method of assessment

1. Every student is required to submit 8 worksheets. Questions in the worksheets cover underlying principles of experiments, data reporting, data interpretation and statistical analysis.
2. In each laboratory exercise, practical performance, discipline and safety awareness of students will be assessed by the bench supervisor.
3. Every student will be assessed individually in the final examination, which includes written questions and practical tasks. Knowledge on concepts and principles of recombinant DNA technology, and the ability to analyze laboratory data will be evaluated in the written part. Competence on experimental techniques acquired in this course will be evaluated in the practical part.

Assessment scheme

Method of assessment	Percentage	Learning outcomes to be assessed
Worksheet	24% (3% per week)	(1), (3) and (6)
Laboratory performance	12% (1.5% per week)	(1), (2), (4) and (5)
Final examination (Written and practical)	64%	(1), (2), (3), (4) and (6)

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Schedule of Laboratory Activities

Fall Semester 2016-17 (Tuesday, 14:00 – 17:50, Room 4160, Lift 33)

	Activities	**Date**
Check-in		6 September
Exercise 1	Aseptic and microbial techniques	13 September
Exercise 2	Analysis of plasmid DNA by restriction digestion and agarose gel electrophoresis	20 September
Exercise 3	Amplification of DNA by polymerase chain reaction	27 September
Exercise 4	Plasmid construction by Gibson Assembly	4 October
Exercise 5	Transformation of *Escherichia coli* by plasmid DNA	11 October
Exercise 6	Plasmid mini-prep and restriction analysis	18 October
Exercise 7	QuikChange site-directed mutagenesis	25 October
Exercise 8	Quantitative analysis of recombinant green fluorescent proteins	1 November
	Final Examination	**29 November**