

LIFS3110 Biotechnological Applications of Recombinant DNA Techniques

Course Outline for Fall 2020 – 2021

Teaching Team

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Course Description

Credit Points: 3

Pre-requisite: LIFS 2040 AND LIFS 2210

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

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

Intended Learning Outcomes (ILOs)

Upon successful completion of this course, students should be able to:

1. Acquire a sound knowledge of recombinant DNA methodology, gene structure and expression.
2. Understand how to 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. Exhibit accuracy and independence in recording and reporting results.

Learning Activities

1. **Learning environment:** Zoom meetings will be organized regularly by the instructors, during which students can learn individually and also interact with the instructor or other students to better understand the concepts and skills. The recordings of Zoom meetings will be provided afterwards so students can review again at you own pace.
2. **Tutorial:** Theoretical concepts related to the experiments will be reviewed in detail. Analysis and interpretation of experimental results will also be explained.
3. **Pre-lab talk:** Contents will focus on basic theoretical and practical issues pertaining to the experiment.
4. **Practical demonstration:** Specific techniques in each laboratory exercise will be demonstrated by the instructor in real-time or through pre-recorded close-up videos. Students are expected to learn a core set of techniques in the fields of Biotechnology and Molecular Biology.
5. **In-class discussion:** In some exercises, the instructor will show experimental results for data analysis and raise questions for discussion. Students are expected to think critically and express your view actively, so the instructor can better explain the concepts based on your understanding.

Assessment Scheme

1. Every student will need to submit the worksheets on Exercise 2 to 7. Questions in the worksheets cover underlying principles of experiments, data reporting, data interpretation and statistical analysis.
2. Every student will be assessed individually in the final examination. Knowledge on concepts and principles of recombinant DNA technology, and the ability to analyze laboratory data will be evaluated.

Method of assessment	Percentage	ILOs* to be assessed
Worksheets	36% (6% per worksheet)	(1), (3) and (5)
Final examination	64%	(1), (2), (3), (4) and (5)

***Listed on Page iii**

Evaluation on Worksheets:

Each student is required to submit SIX worksheets covering Exercise 2 to 7. Experimental results will be provided in CANVAS Assignments for your data analysis.

Each worksheet should include your Name, Student Number, Date, Course Code and the Number of Exercise (e.g. Exercise 2), as well as the Answer of ALL questions. Clearly indicate the question number (e.g. 1a, 2c) that you are answering WITHOUT COPYING the questions themselves.

Completed worksheets should be submitted to the corresponding CANVAS Assignment for Turnitin check within 1 week after the related laboratory exercise. Therefore, the submission will be due on next Tuesday at 6pm, unless otherwise specified.

Students should note that all submissions MUST BE your own work writing in YOUR OWN WORDS. Academic integrity and honesty are key values at HKUST, therefore, any CHEATING (e.g. making up data) or PLAGIARISM (e.g. copying from others/ course notes/ books/ internet, failing to provide citations for any facts or ideas not originated from yourself) may be subjected to ZERO MARKS, "FAIL" in the course and/or other disciplinary actions. (For details, please visit <http://ugadmin.ust.hk/ug-guide/integrity/dishonesty.html>; <https://libguides.ust.hk/referencing/plagiarism>)

General Safety Precautions and Procedures

Although face-to-face classes will not be offered due to the COVID-19 outbreak, it is important to understand that working in a laboratory may expose one to potentially dangerous tools and hazardous reagents. Therefore, we need to exercise discipline and caution in order to ensure that experiments are conducted under the best and safest conditions. Below show some basic laboratory rules for your reference:

1. Wear lab coats AT ALL TIMES in the laboratory and wear gloves when handling the following: bacterial cultures, hazardous chemicals or reagents, nucleic acids and proteins.
2. Read and understand the laboratory manual BEFORE coming to the laboratory. Do not perform any unauthorized experiments or improvise any procedure.
3. Do not operate any equipment until properly instructed. Seek advice if you are unsure about any procedures or the operation/handling of equipment/tools.
4. Report to the instructor IMMEDIATELY for any accidents, such as cuts, burns, and spillage of culture or toxic reagents.
5. Clean the laboratory bench with 70% ethanol BEFORE and AFTER the experiment. Do not put any unnecessary personal items on the bench.
6. Do not eat, drink or put anything in your mouth while in the laboratory.
7. Clearly label all laboratory samples with your group number and sample name BEFORE submission.
8. Handle Bunsen burners carefully and make sure the gas is turned off when not in use.
9. Wash your own apparatus and dispose any wastes of in designated locations (e.g. throw tubes of bacterial culture in Biohazardous Waste bag). Do not take any equipment, consumables and reagents away from the laboratory.
10. Wash your hands thoroughly before leaving the laboratory.