香港城市大學
City University of Hong Kong

SYL

Course Syllabus

offered by Department of Chemistry
with effect from Semester B 2018/19

This form is for the completion by the *Course Leader*. The information provided on this form is the official record of the course. It will be used for the City University's database, various City University publications (including websites) and documentation for students and others as required.

Please refer to the Explanatory Notes on the various items of information required.

Prepared / Last Updated by:

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Part I Course Overview

Course Title:	Biological Techniques and Instrumentation
Course Code:	BCH4064
Course Duration:	1 semester
Credit Units:	4 credits
Level:	B4
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	BCH2003 Biochemistry
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	BCH4025 Immunology and Biological Techniques BMS4101 Analytical Biochemistry

Part II Course Details

1. Abstract

(A 150-word description about the course)

The purpose of this course is to explain to the students the following sentence:

"Progress in science depends on new techniques, new discoveries, and new ideas, probably in that order."

Sydney Brenner, 2002 Nobel Prize Winner in Physiology/Medicine

This course is about the interplay between techniques, discoveries and ideas in the progress of science. Through taking part in this course, the students will:

- Acquire knowledge on the history of development and the working principles of a selection of modern biological techniques.
- Examine how advances in biological sciences have ALWAYS been made possible by technical breakthroughs.
- Critically evaluate the roles of creativity and innovation in the invention of biological techniques.
- Develop the abilities to critically evaluate newly invented biological techniques they encounter in the literature and to apply these new techniques in realistic research situations.
- Develop the skills in original thinking, teamwork and presentation.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe the working principles and history of development of three groups of modern biological techniques (see below) introduced throughout the course.			✓	
2.	Identify the applications and limitations of each of the taught biological technique.			✓	
3.	Analysing the key elements contributing to the invention of new biological techniques.		✓		✓
4.	Critically evaluate the "Methods and Materials" section of the original papers published in broad-audience, high-impact cell biology journals such as Nature Cell Biology and Journal of Cell Biology.		✓	✓	
5.	Create original research proposals, using combinations of biological techniques taught during the course, when given a realistic biological project.				✓
		100%			

** If weighting is assigned to CILOs, they should add up to 100%.*

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lectures and in-class discussions	Students will learn in lectures and in-class discussions by examining three large groups of biological techniques. For each group of techniques, students will be introduced the biological problems involved, how scientists developed new techniques to tackle the problems, and how these new techniques led to new discoveries in biology (which invaluably led to new problems that required new techniques).	✓	✓				
In-class debate	Students will be asked to focus on one technique and, through in-class debate, examine the key factors that contribute to its development.			✓			
Oral presentations	Students will be asked to examine papers chosen (by course leader) from the current issues of Nature Cell Biology, Journal of Cell Biology, or other journals of similar calibre. They will be asked to illustrate, in oral presentations, how different techniques taught in the course are used in combination to address specific biological questions.				✓		
Group activities	Students will be asked to divide in groups and each group given (by course leader) a biological question. They will develop original research proposals, based on biological techniques learned in CILO1, to tackle the scientific questions.					✓	

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 45%							
Tutorial Assignment	✓	✓			✓	35%	
Web-based Discussion / Oral Presentation / Debate			✓	✓		10%	
Examination: 55% (duration: 3 hours)	✓	✓	✓	✓		55%	
** The weightings should add up to 100%.*						100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for BCH courses:

"A minimum of 40% in both coursework and examination components."

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Tutorial Assignment	CAPACITY for PROBLEM-SOLVING by utilizing the concepts and techniques taught in lectures in real-life research questions	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Web-based Discussion / Oral Presentation / Debate	ABILITY to IDENTIFY biological questions that CAN or CANNOT be solved by the biological techniques and instruments introduced in this course. ABILITY to EXPLAIN the methodology and procedure published in research papers in this field.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	ABILITY to APPLY the biological techniques and instruments introduced in this course to tackle real-life research problems and to ADAPT and COMBINE these techniques for original scientific questions	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

This course will focus on three groups of biological techniques:

- Visualization of gene expression
  - Microscopy
- Manipulation of gene expression
  - Introduction of foreign DNA into cells
  - RNA interference
- Detection of gene expression
  - Detection of protein expression
  - Proteomics

This course will also include the following skills:

- Presentation skills
- Technology transfer
- Entrepreneurship in science
- Open source learning in science

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	
2.	
3.	
…	

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	**Next generation sequencing technologies and challenges in sequence assembly** El-Metwally, Sara author. Ouda, Osama M. author.; Helmy, Mohamed author. New York, New York : Springer, 2014 Available online at Run Run Shaw Library
2.	Kwok, C. K., Tang, Y., Assmann, S. M. & Bevilacqua, P. C. **The RNA structurome: transcriptome-wide structure probing with next-generation sequencing.** Trends Biochem. Sci. 40, 221-232 (2015).
3.	Kwok, C. K. **Dawn of the in vivo RNA structurome and interactome**. Biochem. Soc. Trans. 44, 1395-1410 (2016).
4.	**Targeted genome editing using site-specific nucleases : ZFNs, TALENs, and the CRISPR/Cas9 system** Yamamoto, Takashi. Yamamoto, Takashi Editor Tokyo, Japan : Springer, 2015 Available online at Run Run Shaw Library

5.	**Introduction to fluorescence** Jameson, David M. author. Boca Raton : CRC Press, Taylor & Francis Group, 2014 Available at Run Run Shaw Library Circulation Collection (QP519.9.F56 J36 2014)
6.	**Essentials of single-cell analysis : concepts, applications and future prospects** Tseng, Fan-Gang. Tseng, Fan-Gang editor.; Santra, Tuhin Subhra editor. 1st ed. 2016. Berlin, Germany ; Heidelberg, Germany : Springer, 2016 Available online at Run Run Shaw Library
7.	**Modern proteomics -- sample preparation, analysis and practical applications** Carrasco Marqués, Martín editor.; Mirzaei, Hamid editor. Cham, Switzerland : Springer, 2016 Available online at Run Run Shaw Library

Annex
(for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	**Please indicate which CILO(s) is/are related to this PILO, if any** ***(can be more than one CILOs in each PILO)***
PILO 1: Demonstrate the capacity for self-directed learning	
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	
PILO 3: Demonstrate critical thinking skills	
PILO 4: Interpret information and numerical data	
PILO 5: Produce structured, well-organised and fluent text	
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task