香港城市大學
City University of Hong Kong

SYL

Course Syllabus

offered by Department of Chemistry
with effect from Semester A 2020/21

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:	Systems Biology
Course Code:	CHEM4063
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)*	CHEM3017/BCH3017 Molecular Biology
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	BCH4063 Systems Biology
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims to introduce the emerging area of systems biology, a "whole-istic approach to understanding biology" (Chong and Ray (2002), Science 296: 1634). In this course, biology as taught in our programme will "re-narrated" from the perspective of systems, i.e., an examination of the structure and dynamics of cellular and organismal function as a complex single system, rather than the characteristics of isolated parts of a cell or organism.

Through taking part in this course, the students will:

- Acquire knowledge on the history of development and the working principles of systems biology.
- Identify the properties of life that arise at the systems level only, as the behaviour of the system as a whole cannot be explained by its constituents alone.
- Examine biological techniques that enable the analysis of biological systems.
- Develop the mathematical skills in quantitative biological modelling.
- Develop the ability of conducting in silico biological experiments by using data and information available in publicly available databases.

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 the high throughput biological technologies (see course keywords below).			✓	
2.	Identify the key features of "omics", including genomics, transcriptomics, proteomics and interactomics.			✓	
3.	Apply basic mathematical skills in analysing and modelling biological networks.			✓	
4.	Name commonly used databases for bioinformatics. Perform in silico experiments to test biological hypotheses by using these databases.			✓	✓
5.	Critically evaluate the "Methods and Materials" section of the original papers published in broad-audience, high-impact systems biology journals such as Molecular Biosystems.		✓	✓	
6.	Create original research proposals, using combinations of biological techniques taught during the course, when given a realistic systems biology project.		✓		✓
** If weighting is assigned to CILOs, they should add up to 100%.*		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	6	
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).	✓						
Lectures	Students will be taught in lectures the various "omics" and the characteristics of these datasets.		✓					
Lectures	Students will be taught in lectures the various mathematical skills for analysing biological networks.			✓				
Computer labs and tutorials	Every student will be given a gene in the beginning of the course. Throughout the course, he/she will be shown, in computer labs and tutorials, how to extract from publicly available databases information on this gene such as its evolutionary conservation, expression profiles, pathway, post-translational modifications, and interactions.				✓			
Journal club-style presentation	Journal club-style presentation of recent papers on systems biology by students.					✓		
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	6		
Continuous Assessment: 50%								
Tutorial Assignment	✓	✓	✓	✓		✓	42%	
Web-based Discussion / Oral Presentation / Debate				✓	✓		8%	
Examination: 50% (duration: 3 hours)								
** The weightings should add up to 100%.*							100%	

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

"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 systems biology. 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 principles of systems biology to tackle real-life research problems and to ADAPT the methodology of systems biology 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.)

- Historical perspective: From Molecular Biology to Functional Genomics
- Genome annotation: methods and challenges
- Introduction to genomic-scale sequence comparisons
- ORFeome cloning and other resources
- Scaling up through miniaturization and automation
- Second generation sequencing technologies
- Archon X prize for genomics. Approaches used by each contestant will be examined.
- Chip-based technologies
- Mass spectrometry-based proteomics
- Technologies for studying the protein interactome
- High throughput microscopy
- Model organisms for systems biology
- High throughput screening and chemical genetics
- Database resources in systems biology
- Biostatistics for genomic-scale technologies

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.	"Wetware: A Computer in Every Living Cell" by Dennis Bray. Published by Yale University Press (May 26, 2009). ISBN-10: 0300141734. ISBN-13: 978-0300141733
2.	Special issue on Systems biology, Science, March 1, 2002 issue
3.	Ideker T. "Systems biology 101: What you need to know." Nature Biotechnology 22, 473–475 (1 April 2004)
4.	Lazebnik Y. (2002) "Can a biologist fix a radio? -- Or, what I learned while studying apoptosis." Cancer Cell. 2(3): 179-82

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	CILO6

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