

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	ABCT614
Subject Title	Advanced Chemical Biology
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Basic undergraduate training in organic chemistry, analytical chemistry, biochemistry or equivalent
Objectives	This course aims to train ABCT postgraduate students with advanced knowledge in chemical biology. Along the course, both the deep understanding of the basic chemical principles underlying biological processes and the cutting-edge chemical tools to deal with molecular mechanism in complex biology will be introduced. Moreover, the chemical biology methodologies including peptide ligation, bioorthogonal click chemistry, molecular probe design and labeling, biomedical imaging, as well as protein array, PCR, CRISPR-Cas9, genetic code expansion, and solid phase biomolecule synthesis will be discussed. The recent advancements in PROTACs and targeted protein degradation in drug discovery will be covered as well. Provided by such interdisciplinary subject education, this course will enhance the students's learning skills, and will be eventually beneficial to the biomedical research and industry in Hong Kong.
Intended Learning Outcomes (Note 1)	Upon completion of the subject, students will be able to: a) Deep understanding the concepts and rationales of the chemical biology topics, and nurturing the ability to tackle biological problems via chemical technologies. b) Grasping the modern and frontier knowledge and understanding the innovations of the new chemical approaches and biological techniques towards new generation of drug development, diseases therapy, imaging and diagnostics. c) Training students the interdisciplinary skills and broadening their critical thinking and problem-solving ability for future professional development in biotechnology and biomedical sciences.

Subject Synopsis/ Indicative Syllabus (Note 2)	1. Outline of Chemical Biology (3 hours) New concepts & principles of chemical biology, the necessity for biomedical development (Biomedical labelling, drug discovery, Therapeutic degradation, genetic editing, AI/machine learning, multi-modality imaging, theranostics etc) 2. Polypeptide & Protein Synthesis and Ligation (6 hours) Introduction of peptide reaction, Synthesis of peptide and proteins, Native Chemical Ligation, Protein bioconjugation & engineering 3. Carbohydrates Chemical Biology and Glycobiology (6 hours) Carbohydrate structure, function and synthesis, Chemical biology tools in carbohydrate biology, Carbohydrates engineering & bioproduction 4. Nucleic Acids Biology and New Technology (6 hours) Chemical biology of nucleic acids, Solid phase synthesis, Molecular recognition and manipulating, New technology in genetic Editing & therapeutics 5. Anticancer Therapeutics (6 hours) Cancer development, Therapeutic modalities, Targeted protein degradation 6. The Evolution of Click Chemistry: From Concept to Biomedical Applications (6 hours) Concept of biorthogonal chemistry, Click conjugation, Bio-labeling, Click release 7. Chemical Biology Development in Molecular Imaging and Therapeutics (6 hours) Concept of bio-imaging, Biophysics of fluorescence, Molecular probe development, Biomedical labeling, and theranostics
Teaching/Learning Methodology (Note 3)	Lectures: All the basic concepts and knowledge will be introduced and discussed through course interaction Written Assignment: To advance understanding the principles of chemical biology, and to enhance the critically thinking and problem-solving ability, students will be expected to read the research articles and learn how to write research proposals. Demonstrations: As an advanced subject offered to postgraduate students, real-world examples, animation and movie regarding the concept, new technique development, latest breakthrough in related chemical biology fields will be demonstrated.

Assessment Methods in Alignment with Intended Learning Outcomes (Note 4)	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			a	b	c			
	1. Examination	50	√	√	√			
	2. Written Assignment	50	√	√	√			
	Total	100 %						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The detailed mechanism explanation will be systematically discussed in the class. This can directly help the outcome of learning. One midterm exam will be arranged to help the student understand the concept. The proposal report can help to nurture the students’ critical thinking and problem-solving capability, and it can also build up transferable soft skill. These will greatly enhance the learning outcome.							
Student Study Effort Expected	Class contact:							
	▪ Lecture /demonstrations					39 Hrs.		
	Other student study effort:							
	▪ Self-learning					65 Hrs.		
	▪ Proposal Assignment Preparation					16 Hrs		
	Total student study effort					120 Hrs.		
Reading List and References	• <i>Chemical Biology and Drug Discovery</i>, Schmidt, Marco F. (author), Berlin: Springer, 2022 • <i>Handbook of Chemical Biology of Nucleic Acids</i>. 1st ed. 2023., Sugimoto, N., editor. Springer Nature Singapore, 2023 • <i>Imaging Tools for Chemical Biology</i>, Edited by Feng, Lei, and Tony D. James and published by The Royal Society of Chemistry in 2024, • <i>Advanced Chemical Biology Chemical Dissection and Reprogramming of Biological Systems</i>, Edited by Howard C. Hang, Matthew R. Pratt, and Jennifer A. Prescher, 2023 WILEY-VCH GmbH							

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon subject completion. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method is intended to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

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