

**The Chinese University of Hong Kong
Faculty of Science
Science Academy for Young Talent**

Course Schedule

CUSA3000 Chemistry and Biochemistry for Extended Science Research Projects
化學及生物化學：科學研究延伸課程

Introduction:

The course aims at helping students to learn the major concepts and methods of chemistry and biochemistry. Topics include simple organic chemistry, principles of molecular biology, scientific methods and skills for research. Students will gain hands-on experience of using modern technology such as infrared spectroscopy and polymerase chain reaction (PCR) for running research projects.

本課程旨在幫助學生學習化學與生物化學的概念和方法。主題包括簡單有機化學，分子生物學原理和科學探究的方法與技巧。學生將親身體驗如何應用現代科技諸如紅外光譜與聚合酶鏈反應（Polymearse Chain Reaction）技術在科學探究項目之應用。

Medium of Instruction: Cantonese supplemented with English

Organising Unit:

Department of Chemistry, Faculty of Science, CUHK
School of Life Sciences, Faculty of Science, CUHK

Teacher:

Dr. CHEUNG Yu San
Department of Chemistry, Faculty of Science, CUHK
Tel: 3943-6265, Email: yscheung@cuhk.edu.hk

Professor KONG Siu Kai
School of Life Sciences, Faculty of Science, CUHK
Tel: 3943-6799, Email: skkong@cuhk.edu.hk

Dr. MAK Kin Wah Kendrew
Department of Chemistry, Faculty of Science, CUHK
Tel: 3943-8136, Email: kendrewmak@cuhk.edu.hk

Dr. WONG Fai George
Department of Chemistry, Faculty of Science, CUHK
Tel: 3943-8135, Email: george911@cuhk.edu.hk

Course Content:

1) Basic Techniques

Lab Safety
Use of pipettes and Small Lab Instruments
Preparation of Buffer Solutions
pH Determination and Titration
Aseptic Techniques
Instrumental analysis (GC, HPLC)

2) Basic Organic Chemistry

Basic Organic Chemistry
Fundamental of instrumental analysis (quantitative and qualitative analysis)
Spectroscopic identification of organic compounds (IR, MS, NMR)
Organic synthesis (Synthesis and isolation, purification and spectroscopic analysis)

3) Microbiology

Virus and Bacteria
Bacterial Growth and Antibiotics
Aseptic Techniques for Bacterial Culture
Bacterial Plasmid (including promoter, terminator, RBS)
Bacterial Transformation
Expression Green Fluorescent Protein (GFP) from Jellyfish in *E. coli*

4) Molecular Biology and Biochemistry

Gene and DNA Structure
Protein Structure
Central Dogma: DNA - RNA - Protein
DNA, RNA and Protein Isolation
Restriction Enzymes, Ligase
DNA Cutting by Restriction Enzymes
Molecular Cloning to Make Recombinant Proteins
DNA Electrophoresis and DNA Fingerprinting
Polymerase Chain Reaction for DNA Isolation and Amplification (including RT-PCR)
DNA Sequencing by Sanger Method
Antibody and Antigen Reaction
Protein Separation by Acrylamide Gel
Western Blot Analysis

5) Project Management

Project and Scientific Project
Scientific Method for Research Type Project
Information Searching
How to Design an Experiment (dependent & independent parameters, control?)
How to carry out a scientific investigation
Basic training for analytical techniques
Simple statistics
How to Present your Work

Course Schedule:

29 October 2016 (Saturday)	<u>Chemistry Lecture 1 (AM session):</u> Basic organic chemistry (I)
12 November 2016 (Saturday)	<u>Chemistry Lecture 2 (AM session):</u> Basic organic chemistry (II)
19 November 2016 (Saturday)	<u>Chemistry Lecture 3 (AM session):</u> Chemistry of biological molecules (I) and How to carry out a scientific investigation (I) <u>Chemistry Lecture 4 (PM session):</u> Chemistry of biological molecules (II) and How to carry out a scientific investigation (II)
2 December 2016 (Friday)	<u>Biochemistry Lecture 1 (AM session):</u> Microbiology for Biotechnology
9 December 2016 (Friday)	<u>Biochemistry Lecture 2 (AM session):</u> Basic Biochemistry Part I (DNA, RNA and Protein)
16 December 2016 (Friday)	<u>Biochemistry Lecture 3 (AM session):</u> Basic Biochemistry Part II (Flow of Genetic information from DNA to RNA to Protein)
19 December 2016 (Monday)	<u>Biochemistry Lecture 4 & Laboratory 1 (AM session):</u> Aseptic Techniques and Bacterial Culture <u>Biochemistry Lecture 5 & Laboratory 2 (PM session):</u> DNA (Plasmid) Isolation, DNA Measurement and Bacterial Transformation
20 December 2016 (Tuesday)	<u>Biochemistry Lecture 6 & Laboratory 3 (AM session):</u> DNA Digestion by Endonuclease and Polymerase Chain Reaction (PCR) <u>Biochemistry Lecture 7 & Laboratory 4 (PM session):</u> DNA Electrophoresis for DNA Digestion by Endonuclease & PCR, and DNA Fingerprinting
21 December 2016 (Wednesday)	<u>Biochemistry Lecture 8 & Laboratory 5 (AM session):</u> Protein Purification and Polyacrylamide Gel Preparation <u>Biochemistry Lecture 9 & Laboratory 6 (PM session):</u> SDS-Polyacrylamide Gel Electrophoresis, Western Blot Analysis-Part I
22 December 2016 (Thursday)	<u>Biochemistry Lecture 10 & Laboratory 7 (AM session):</u> Western Blot Analysis-Part II and Antibody & Antigen Reaction <u>Biochemistry Lecture 11 & Laboratory 8 (PM session):</u> Immunoassays, ELISA, Results from Microbiology and General Discussion
7 January 2017 (Saturday)	<u>Chemistry Lecture 5 (AM session):</u> Spectroscopic identification of organic compounds (I) (UV-Vis, IR, MS)

21 January 2017 (Saturday)	<u>Chemistry Lecture 6 (AM session):</u> Spectroscopic identification of organic compound (II) (NMR)
4 February 2017 (Saturday)	<u>Chemistry Lecture 7 (AM session):</u> Laboratory safety <u>Chemistry Lecture 8 (PM session):</u> Fundamental of instrumental analysis (quantitative and qualitative analysis)
8 April 2017 (Saturday)	<u>Chemistry Laboratory 1 (AM session):</u> Basic training for analytical techniques <u>Chemistry Laboratory 2 (PM session):</u> Instrumental analysis (GC, HPLC)
13 May 2017 (Saturday)	<u>Chemistry Laboratory 3 (AM session):</u> Organic synthesis (Part I) – Synthesis and isolation <u>Chemistry Laboratory 4 (PM session):</u> Organic synthesis (Part II) – Purification and spectroscopic analysis

Duration	23 sessions (total 69 contact hours)
Date	29 October, 12, 19 November and 2, 9, 16, 19 – 22 December 2016 7, 21 January, 4 February, 8 April and 13 May 2017
Time	AM session: 8:00 am – 11:00 am / 10:30 am – 1:30 pm/ 11:00 am – 2:00 pm PM session: 2:30 pm – 5:30 pm/ 4:00 pm – 7:00 pm
Venue	The Chinese University of Hong Kong & Pui Ching Middle School (Macau)
Enrollment	10-15
Expected applicants	S4-S5 who are interested in chemistry, biology and biochemistry
Tuition Fee	HKD 15,000 (including materials for experiments)
Credit	4.5 Academy Units Certificates or letters of completion will be awarded to students upon completion.