

Division of Life Science
The Hong Kong University of Science & Technology
LIFS 4540 Structure and Function of Proteins
(2017/2018 Spring Semester)

Date/Time: Mondays 16:30-17:50 and Fridays 12:00-13:20

Venue: Room G009A

Instructors: Prof. Chun LIANG (**Course Coordinator**), 2358-7296, Rm 5524; bccliang@ust.hk
Prof. Mingjie ZHANG, 2358-8709, Rm 5532; mzhang@ust.hk

Textbook/Reference: T.E. Creighton “*Protein: Structure and Molecular Properties*” 2nd Ed.
W.H. Freeman and Company; plus reading materials in handouts

Course Objectives (Intended Learning Outcome):

After completion of the course, students are expected to be able to

1. Comprehend the knowledge, theories and principles of protein structure, functions, regulation and biological processes;
2. Describe the history and scientific thinking behind the discoveries of biological principles and theories.
3. Utilize the strategies, ideas and methodologies used in current biological research.
4. Self-study biological topics related to proteins
5. Appreciate biological sciences and research

Course Contents:

First half (Prof. C. Liang)

Biogenesis of proteins and protein engineering

Approaches for studying protein functions, interactions and regulation in budding yeast

Literature search and protein and DNA sequence analysis

Activities and regulation of protein enzymes

Biochemical methods for studying protein-protein and protein-DNA interactions

Proteolysis and cellular regulation

Second half (Prof. M. Zhang)

Chemical and physical characterization of proteins

Chemical modification of proteins

Post-translational modification of proteins

Forces that determine protein structures

Secondary and tertiary structures of proteins

Course Topics and Schedule:

Second Half (Prof. C. Liang) 02 Feb.- 19 Mar. (12 lectures to cover 19 topics in 6 areas)

I. Biogenesis of Proteins and Protein Engineering

1. General Introduction, Gene Structure and DNA Replication (Textbook section 2.1)

2. Transcription, Splicing and Translation (Textbook section 2.1)
3. Protein Engineering: Cloning, Expression and Mutagenesis of Genes (Textbook section 2.3)

II. Approaches to Study Protein Functions and Regulation in Budding Yeast

4. Introduction to Budding Yeast
5. Gene Disruption and Tetrad Analysis
6. Random Mutagenesis and Making Yeast Mutants
7. Characterization of Proteins in the Cell Cycle
8. DNA and Chromatin Association of Proteins
9. Identification and Characterization of Interacting Proteins by Using Interaction Screens
10. Phenotypic Screens: Finding Genes Involved in Particular Cellular Functions or Pathways
11. Using Budding Yeast to Study Proteins of Other Eukaryotes and Two-hybrid System to Study Protein-Protein Interactions

III. Literature Search and Protein and DNA Sequence Analysis

12. Web-based Literature Search, Sequence Retrieval and Sequence Analysis

IV. Activities and Regulation of Protein Enzymes

13. Functions and Regulation of Enzymes (Textbook section 9.4)
14. Regulation of the Activities of Enzymes and Other Proteins by Phosphorylation and Dephosphorylation

V. Protein-Protein and Protein-DNA Interactions

15. Biochemical Methods to Study Protein-Protein Interactions
16. Biochemical Methods to Study Protein-DNA Interactions
17. Case study: Protein-Protein and Protein-DNA Interactions in the Initiation of DNA Replication in Budding Yeast

VI. Protein-Protein and Protein-DNA Interactions

18. Mechanism of Protein Degradation and Proteolysis Pathways (Textbook sections 10.2-10.3)
19. Case study: Proteolysis in Cell Cycle Control

Midterm Exam on 23 March 2018, or to be arranged

(Covers the lectures by Prof. C. Liang; counts as 50% of the course together with homework)

Second Half (Prof. M. Zhang) 26 Mar.– 11 May (12 lectures to cover 7 topics in 5 areas)

I. Chemical and physical characterization of proteins

- Properties of amino acids, peptides, and proteins (Textbook Chapter 1)
- Working with proteins----- purification and characterization of proteins

II. Chemical modification of proteins

Methods and applications

III. Post-translational modification of proteins

Structural and functional effects (Textbook Section 2.4)

IV. Forces that determine protein structures

How to keep a protein folded properly (Textbook Chapter 4)

V. Secondary and tertiary structures of proteins

Protein folding patterns (Textbook Chapter 5, 6.4)

Protein modules

Final Exam: covers the lectures by Prof. C. Liang; counts as 50% of the course]