

**Division of Life Science**  
**The Hong Kong University of Science & Technology**  
**LIFS 4540 Structure and Function of Proteins**  
(2021/2022 Spring Semester)

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**Date/Time:** Mondays, 10:30-11:50

Wednesdays, 10:30-11:50

**Venue:** Room 6591, Enterprise Center / Zoom

**Instructors:** Prof. Shangyu Dang, (x5944), Rm5507

**Course website:** CELT (<https://canvas.ust.hk>) for lecture slides and course materials.

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

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**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 most up-to-date methods (including X-ray crystallography and cryo-EM) utilized to characterize protein structures at atomic resolution.
3. Describe the history and scientific thinking behind the discoveries of biological principles and theories.
4. Utilize the strategies, ideas and methodologies used in current biological research.
5. Self-study biological topics related to proteins
6. Appreciate biological sciences and research

**Course Contents:**

- I. Chemical and physical characterization of proteins
- II. Secondary and tertiary structures of proteins
- III. Chemical modification of proteins
- IV. Post-translational modification of proteins
- V. Protein purification
- VI. Protein structure prediction
- VII. Protein structural determination (X-ray crystallography and cryo-EM)
- VIII. Tools to analyze protein sequence and structures
- IX. Structural and function of membrane proteins
- X. Protein and diseases

**Exams and Grading:**

Mid-term examination (20%), Final Examination (20%), Homework (30%), Presentation (30%)

## **Course Topics and Schedule:**

### **I. Chemical and physical characterization of proteins**

Properties of amino acids, peptides, and proteins (Textbook Chapter 1)

### **II. Secondary and tertiary structures of proteins**

Protein folding patterns (Textbook Chapter 5, 6.4)

Protein modules

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

### **III. Chemical modification of proteins**

Methods and applications

### **IV. Post-translational modification of proteins**

Structural and functional effects (Textbook Section 2.4)

Methods for detection of protein PTM

### **V. Protein purification**

Methods for protein expression and purification

Methods for characterization of protein

Methods for evaluation of protein behavior

### **VI. Protein structure prediction**

Secondary protein structure prediction

Tertiary Protein structure prediction

### **VII. Protein structural determination (X-ray crystallography and cryo-EM)**

X-ray crystallography (Textbook Chapter 10.1, 10.3)

Resolution revolution of cryo-EM (Textbook Chapter 10.5)

### **VIII. Tools to analyze protein sequence and structures**

Protein sequence analysis (Textbook Chapter 6.3)

Protein structural visualization and analysis (Textbook Chapter 6.6)

### **IX. Structural and function of membrane proteins**

Physiological functions of membrane proteins (Textbook Chapter 5)

Structural and mechanistic studies of membrane proteins

### **X. Protein and diseases**

Relationship of protein and diseases (Textbook Chapter 12)

Structural based drug development