

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 <b>Course Title</b>	生物化学 I (生物大分子) <b>Biochemistry I (Macromolecules)</b>				
2.	授课院系 <b>Originating Department</b>	生物系 Department of Biology				
3.	课程编号 <b>Course Code</b>	BIO201				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业基础课(生物科学、生物技术、生物信息学) Major Foundational Courses (Biological Sciences, Biotechnology, Bioinformatics)				
6.	授课学期 <b>Semester</b>	春季 Spring / 秋季 Fall				
7.	授课语言 <b>Teaching Language</b>	英文 English / 中英双语 English & Chinese				
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	生物系: 魏志毅, 余聪, 杜嘉木 Zhiyi, Wei, Department of Biology, <a href="mailto:wei.zy@sustc.edu.cn">wei.zy@sustc.edu.cn</a> Cong, Yu, Department of Biology, <a href="mailto:yu.c@sustc.edu.cn">yu.c@sustc.edu.cn</a> Jiamu Du, Department of Biology, <a href="mailto:dujm@sustech.edu.cn">dujm@sustech.edu.cn</a>				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	待公布 To be announced				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>					
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数 <b>Credit Hours</b>	40	6 (including presentation)		2 (期中考试/mid-term exam)	48

12. 先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b>	生物学原理 BIO103, Principles of Biology ; 化学原理 CH101A, General Chemistry A
13. 后续课程、其它学习规划 <b>Courses for which this course is a pre-requisite</b>	生物化学 II (新陈代谢) BIO202, Biochemistry II (Metabolism)
14. 其它要求修读本课程的学系 <b>Cross-listing Dept.</b>	医学院 Medical School

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

生物化学 I (大分子) 是的一门生物学基础课程。本课程的目标是为生物学各专业的学生传授生物化学的基本知识和实验方法。通过课程的学习, 让学生能够理解并掌握生物化学的研究对象、研究方法和研究思路, 并最终学会应用这些知识和技巧来解决生物学中的研究问题。

Biochemistry I (Macro-Biomolecules) is a basis course in biology. Our aim is to teach the basic knowledge and techniques of biochemistry. With this course, we present the biochemical structures, methods, and theories, and teach students to apply the biochemical knowledge and skills to solve problems in biological research.

#### 16. 预达学习成果 Learning Outcomes

通过本课程的学习, 学生可以

- 1、掌握生物化学中各个反应的基本原理;
- 2、了解生化分子的结构与功能之间的关系;
- 3、了解常用的生化技术和方法, 并进行生物化学实验设计;
- 4、分析和解决复杂的生物化学问题。

At the end of the course, students should be able to

1. Demonstrate the basic principal governing the biochemical reactions;
2. Identify the structures of biomolecules and their relationship with functions;
3. Apply common biochemical techniques and skills to design experiments;
4. Analyse and solve complex biochemical problems.

#### 17. 课程内容及教学日历 (如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人)

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

1. Introduction (6 hours)

1) Brief introduction of biochemistry. (2 hours)

Basis concepts and history of biochemistry

2) Weak interaction in aqueous system. (2 hours)

Noncovalent interactions

Role of water in biological processes

Interactions between macromolecules in solution

3) Bioenergetics, basic understanding of thermodynamics in biological systems. (2 hours)

The laws of thermodynamics

Enthalpy, entropy and free energy

Chemical equilibrium and free energy sources in biological systems

2. Nucleic Acids (7 hours)

1) Nucleotides, polynucleotide, and discovery of DNA as genetic material. (2 hours)

Structure and chemical properties of the nucleotides

Primary structure of nucleic acids

2) Double helical structure. (2 hours)

The structural properties of the double helix

Semiconservative nature of DNA replication

Alternative nucleic acid structures (A, B, Z-forms)

3) Structure and function of DNA/RNA (1 hour)

DNA supercoiling

RNA structures

Student Presentation I: Discovery of DNA double helical structure (2 hours)

3. Proteins (15 hours)

1) Amino acids. (1 hour)

Structure of the alpha-amino acids

Properties of the amino acid side chains

2) Peptide and secondary structure. (2 hours)

Polyampholytes

The structure and stability of peptide bond

Helices and sheets (Ramachandran plots)

3) Tertiary structure. (3 hours)

Fibrous proteins (Keratin, Fibroin,, and Collagen)

Globular proteins and their classifications

Factors determining secondary and tertiary structure

Protein folding

Dynamics of globular protein structures

4) Quaternary structure. (1 hour)

Protein assembly

Protein-protein interactions

5) Protein function and evolution. (4 hours)

Structures of Hemoglobins and myoglobins

Cooperative binding

Allosteric effectors of Hemoglobin

Protein evolution of globins

Hemoglobin variants and diseases

Immunoglobulins and binding vasatility

Mid-term Exam (2 hours)

6) Contractile proteins and molecular motors. (2 hours)

Actin and myosin

The structure of muscle

The mechanism of contraction

Microtubule and intracellular transport



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#### 4. Enzymes (9 hours)

##### 1) Enzymatic reactions. (2 hours)

Chemical reaction rates and the effects of catalysts

General principles of enzymatic reactions

Examples (Lysozyme and Serine proteases)

##### 2) Enzyme kinetics. (2 hours)

Michaelis-Menten kinetics

The significance of  $K_M$ ,  $k_{cat}$ , and  $k_{cat}/K_M$

Enzyme inhibition and the changes of  $K_M$  and  $k_{cat}$ ,

##### 3) Enzyme regulation. (3 hours)

Cofactors and coenzymes

Classification of enzymes

The regulation of enzyme activity

Allosteric enzymes

Covalent modifications

Student Presentation II: Enzyme structure and function (2 hours)

#### 5. Carbohydrates (4 hours)

##### 1) Monosaccharides and disaccharides (2 hours)

Aldoses and ketoses

Stereoisomers of monosaccharides

Disaccharide structures

Stability and formation of the glycosidic bond

##### 2) Polysaccharides and glycoproteins (2 hours)

Storage and structural polysaccharides

Glycoproteins

Oligosaccharides in different biological structures



6. Lipids and membrane (5 hours)

1) Structures of lipids and membrane (2 hours)

Fatty acids, fats, and other derivatives

The major types of lipid constituents of biological membranes

The structure and properties of membranes

2) Membrane proteins and cellular transport (3 hours)

Structures of membrane proteins

The fluid mosaic model of membrane structure

Transport across membrane

Ion channels and action potentials

Tutorial/Review 2 hours

18. 教材及其它参考资料 Textbook and Supplementary Readings

教材/Textbook

Biochemistry, 4th edition, CK Mathews, KE Holde, etc.

参考书/Reference book

Biochemistry, 7th edition, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer;

Lehninger Principles of Biochemistry, 5th edition, Dave Nelson, Mike Cox

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Class Performance				
小测验 Quiz		10	作弊 0 分 Cheating, 0 credits	
课程项目 Projects		10		
平时作业 Assignments		10	抄袭 0 分 Plagiarism, 0 credits	
期中考试 Mid-Term Test		30	作弊 0 分 Cheating, 0 credits	

期末考试 <b>Final Exam</b>	30	作弊 0 分 Cheating, 0 credits	
期末报告 <b>Final Presentation</b>			
其它（可根据需要 改写以上评估方式） <b>Others (The above may be modified as necessary)</b>			

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**  
 B. 二级记分制（通过/不通过） **Pass/Fail Grading**

**课程审批 REVIEW AND APPROVAL**

21. 本课程设置已经过以下责任人/委员会审议通过  
**This Course has been approved by the following person or committee of authority**

本课程经生物系本科教学指导委员会审议通过。  
 This Course has been approved by Undergraduate Teaching Steering Committee of Department of Biology.

