

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 Course Title	生物化学 II (新陈代谢) Biochemistry II (Metabolism)				
2.	授课院系 Originating Department	生物系 Department of Biology				
3.	课程编号 Course Code	BIO202				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业基础课 Major Foundational Courses				
6.	授课学期 Semester	春季 Spring / 秋季 Fall				
7.	授课语言 Teaching Language	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) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	生物系 Department of Biology 肖国芝, 教授, , 第一科研楼 341 室 xiaogz@sustc.edu.cn 王冠宇, 副教授, 第一科研楼 207 室 wanggy@sustc.edu.cn 饶枫, 副教授, 第一教学楼 415 室 raof@sustc.edu.cn XIAO Guozhi, Professor, Rm.341, No.1 Research Bldg. WANG Guanyu, Associate Professor, Rm.207, No.1 Research Bldg. RAO Feng, Associate Professor, Rm.416, No.1 Teachin Bldgg.				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced				
10.	选课人数限额(可不填) Maximum Enrolment (Optional)					
11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	40			8 (presentation)	48

<p>12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements</p>	<p>BIO201 生物化学 I Biochemistry (Metabolism)</p>
<p>13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite</p>	<p>本课程为生物科学、生物信息学和生物技术专业基础课，是绝大部分应用到新陈代谢的先修课程；非生物系学生如果对生物化学和新陈代谢有兴趣，也可选修本课程。 This course should be taken by everyone contemplating doing Biological Sciences, Bioinformatics or Biotechnology in the following years and it is a prerequisite for courses that have metabolism as an important component. It should however also be suitable for non-specialists, i.e. for all those students who are interested in Biochemistry and Metabolism.</p>
<p>14. 其它要求修读本课程的学系 Cross-listing Dept.</p>	

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

本课程旨在确保南科大生物系学生掌握生命的基本过程—新陈代谢，亦即生物体从环境摄取营养物转变为自身物质和能量，同时将自身原有组成转变为废物排出到环境中的不断更新的过程。同时，通过讲解目前用于生物化学领域的研究方法，结合研究热点，对教材内容进行深入讲解。通过本课程的学习，学生可以掌握合成代谢和分解代谢的基本原理，较为详细地理解物质和能量在生物体内转化的过程和功用，以及该领域的主要研究方法和思路。希望通过对生物化学 II 的学习，学生们能更深入地了解生物化学 I 中大分子为何如此构造，实现从分子动力学原理到系统功能的跨越。这样在以后的研究和工作中，学生们可以采用生物化学的研究思路发现和解决问题，并且能够更进一步拓展到其他实际应用中去。

The purpose of this course is to ensure that the students can master the basic process of life-metabolism which means that organism uptake nutrition as its material and energy, while their original composition secretion is discharged to the environment. Moreover, I will elucidate the content of the textbook in detail through explaining the current research methods used in biochemistry and combined with research hotspots. Through this course, students can master the basic principle of anabolism and catabolism and understanding the process of the material and energy conversion and functions in living organisms, as well as the main areas of research methods and ideas. It is hoped that through the study of biochemistry II, students will be able to know more about how the macromolecules are constructed in biochemistry I so as to achieve the leap from the molecular dynamics principle to the system function. Thus, in the future research and work process, students can use biochemical research ideas to find and solve problems, and can expand to other practical applications.

16. **预达学习成果 Learning Outcomes**

通过本课程的学习，学生们将掌握生命的基本过程—新陈代谢。掌握合成代谢和分解代谢的基本原理；生化反应能量转换，自由能的计算；掌握糖代谢（包括糖酵解、糖异生、柠檬酸循环、氧化磷酸化、戊糖磷酸化途径），脂代谢等重要新陈代谢过程；掌握能量代谢在器官间及细胞内的协调；各器官的能量供求及相互关系。

Through studying this course, students will master the basic process of life – metabolism, and master the basic principle of anabolic metabolism and catabolism; the biochemical reaction energy conversion, the calculation of free energy, the glycometabolism (including glycolysis, gluconeogenesis, citric acid cycle, oxidative phosphorylation, pentose phosphate pathway), lipid metabolism, and other important metabolic processes, and grasp the coordination of energy metabolism in the organs and cells, energy supply and demand of each organ and their interrelation.

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.)

第 12 章 代谢的化学逻辑

学时：2 小时

Chapter 12 Chemical Logic of Metabolism

Hours: (2h)

1 代谢路线图概览

1 Metabolic Road Map

2 生化反应类型

2 Biochemical Reaction Types

3 生物热力学概述

3 Some Bioenergetic Considerations

4 代谢调控机理

4 Metabolic Control Mechanisms

5 代谢的实验分析

5 Experimental Analysis of Metabolism

第 13 章 糖代谢

学时：5 小时

Chapter 13 Carbohydrate Metabolism

Hours: (5h)

1 糖酵解概览

1 Glycolysis: An Overview

2 糖酵解反应过程

2 Reactions of Glycolysis

3 丙酮酸的代谢命运

Metabolic Fates of Pyruvate

4 能量及电子平衡

4 Energy and Electron Balance Sheets

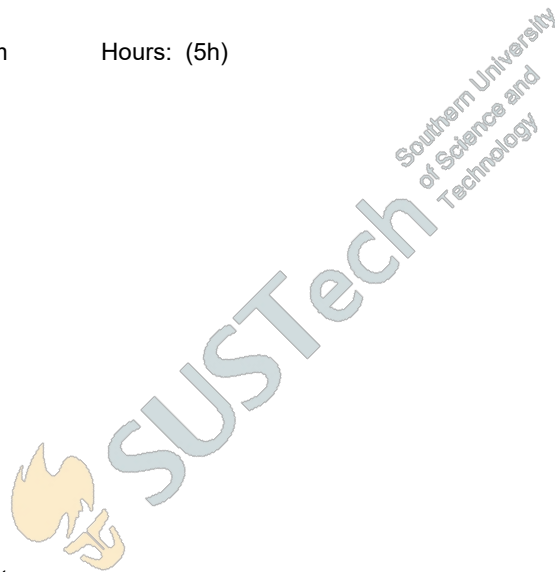
5 糖异生

5 Gluconeogenesis

6 糖代谢通路的进化

Evolution of Carbohydrate Metabolic Pathways

7 糖酵解及糖异生的协同调节



Coordinated Regulation of Glycolysis and Gluconeogenesis

8 糖原在肌肉和肝脏中的代谢

8 Glycogen Metabolism in Muscle and Liver

9 戊糖磷酸化途径

9 The Pentose Phosphate Pathway

第 14 章 柠檬酸循环及乙醛酸循环

学时: 5 小时

第 14 章 Citric Acid Cycle and Glyoxylate Cycle

Hours: (5h)

1 丙酮酸氧化及柠檬酸循环总览

1 Overview of Pyruvate Oxidation and the Citric Acid Cycle

2 丙酮酸氧化: 碳进入柠檬酸循环的主要入口

2 Pyruvate Oxidation: A Major Entry Route for Carbon into the Citric Acid Cycle

3 丙酮酸氧化及柠檬酸循环的辅酶

3 Coenzymes Involved in Pyruvate Oxidation and the Citric Acid Cycle

4 丙酮酸脱氢酶复合物的行动

4 Action of the Pyruvate Dehydrogenase Complex

5 柠檬酸循环

5 The Citric Acid Cycle

6 柠檬酸循环的化学计量学及热力学

Stoichiometry and Energetics of the Citric Acid Cycle

7 丙酮酸脱氢酶及柠檬酸循环的调节

7 Regulation of Pyruvate Dehydrogenase and the Citric Acid Cycle

8 乙醛酸循环

8 Glyoxylate Cycle

第 15 章 电子运输, 氧化磷酸化, 及氧代谢

学时: 5 小时 Hours: (5h)

Chapter 15 Electron Transport, Oxidative Phosphorylation, and Oxygen Metabolism

1 线粒体

1 The Mitochondrion

2 氧化及能量生成

2 Oxidations and Energy Generation

3 电子运输

3 Electron Transport

4 氧化磷酸化

4 Oxidative Phosphorylation

5 线粒体运输系统

5 Mitochondrial Transport Systems

6 氧化代谢的能量生成

6 Energy Yields from Oxidative Metabolism

7 线粒体基因组及疾病

7 The Mitochondrial Genome and Disease

8 线粒体的进化

8 Mitochondria and Evolution

9 氧气作为其它代谢反应的底物

9 Oxygen as a Substrate for Other Metabolic Reactions

第 16 章 光合作用

学时：4 小时

Chapter 16 Photosynthesis

Hours: (4h)

1 光合作用的基本过程

1 The Basic Processes of Photosynthesis

2 叶绿体

2 The Chloroplast

3 光反应

3 The Light Reactions

4 暗反应：开尔文循环

4 The Dark Reactions: The Calvin Cycle

5 光合作用二系统中光反应及暗反应的总结

5 A Summary of the Light and Dark Reactions in Two-System Photosynthesis

第 17 章 脂代谢 I: 脂肪酸, 甘油三酯, 及脂蛋白 学时: 4 小时 Hours: (4h)

Chapter 17 Lipid Metabolism I: Fatty Acids, Triacylglycerols, and Lipoproteins

1 脂肪及胆固醇的利用及传输

1 Utilization and Transport of Fat and Cholesterol

2 脂肪酸氧化

2 Fatty Acid Oxidation

3 脂肪酸生物合成

3 Fatty Acid Biosynthesis

4 甘油三酯的生物合成

4 Biosynthesis of Triacylglycerols

5 肥胖症的生化启发

5 Biochemical Insights into Obesity

第 18 章 能量代谢在脊椎动物器官间细胞内的协调 学时: 4 小时 Hours: (4h)

Chapter 18 Interorgan and Intracellular Coordination of Energy Metabolism in Vertebrates

1 脊椎动物能量代谢重要器官的相互依存

1 Interdependence of the Major Organs in Vertebrate Fuel Metabolism

2 能量代谢的激素调节

2 Hormonal Regulation of Fuel Metabolism

3 饥饿及糖尿病

3 Starvation, Diabetes

第 19 章 脂代谢 II

学时: 4 小时

Chapter 19 Lipid Metabolism II

Hours: (4h)

1 甘油的代谢

1 Metabolism of Glycerophospholipids

2 鞘脂的代谢

2 Metabolism of Sphingolipids

3 类固醇的代谢

3 Steroid Metabolism

4 其它异戊二烯化合物

4 Other Isoprenoid Compounds

第 20 章 含氮化合物的代谢 I

学时: 5 小时

Chapter 20 Metabolism of Nitrogenous Compounds I: Hours: (5h)

1 生物合成, 利用, 及周转的原理

1 Principles of Biosynthesis, Utilization, and Turnover

2 无机氮的利用: 氮循环

2 Utilization of Inorganic Nitrogen: The Nitrogen Cycle

3 氨的利用: 有机氮的生物合成

3 Utilization of Ammonia: Biogenesis of Organic Nitrogen

4 氨基酸的合成及降解

4 Amino Acid Synthesis and Degradation

5 蛋白质的周转

5 Protein Turnover

6 氨基酸降解及含氮终端产物的代谢

6 Amino Acid Degradation and Metabolism of Nitrogenous End Products

7 氮代谢的辅酶

7 Coenzymes Involved in Nitrogen Metabolism

第 21 章 含氮化合物的代谢 II

学时: 5 小时

Chapter 21 Metabolism of Nitrogenous Compounds II Hours: (5h)

1 氨基酸降解的路径

1 Pathways of Amino Acid Degradation

2 氨基酸作为生物合成先导

2 Amino Acids as Biosynthetic Precursors

3 卟啉及铁的代谢

3 Porphyrin and Heme Metabolism

4 氨基酸及它们的代谢物作为神经递质及生物调节物

4 Amino Acids and Their Metabolites as Neurotransmitters and Biological Regulators

5 氨基酸的生物合成

5 Amino Acid Biosynthesis

第 22 章 核苷酸的代谢

学时：5 小时

Chapter 22 Nucleotide Metabolism

Hours: (5h)

1 核苷酸的代谢的途径

1 Outlines of Pathways in Nucleotide Metabolism

2 嘌呤核苷酸的从头生物合成

2 De Novo Biosynthesis of Purine Nucleotides

3 嘌呤降解及嘌呤的临床紊乱

3 Purine Degradation and Clinical Disorders of Purine Metabolism

4. 嘧啶的核苷酸代谢

4 Pyrimidine Nucleotide Metabolism

5 依赖谷氨酰胺的氨基转移酶

5 Glutamine-Dependent Amidotransferases

6 DNA 的生物合成和代谢

6 Deoxyribonucleotide Biosynthesis and Metabolism

7 胸苷酸合酶：化疗的目标酶

7 Thymidylate Synthase: A Target Enzyme for Chemotherapy

8 病毒引起的核苷酸代谢的改变

8 Virus-Directed Alterations of Nucleotide Metabolism

9 其它类核苷酸的生物医学重要性

9 Biological and Medical Importance of Other Nucleotide Analogs

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

指定教材: Biochemistry, 第四版, CK Mathews, KE Holde 等

推荐参考资料: Lehninger Principles of Biochemistry, 第五版, Dave Nelson, Mike Cox

Required text: Biochemistry, 4th edition, CK Mathews, KE Holde et al.

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

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	正常时间	10	正常处罚	
课堂表现 Class Performance				
小测验 Quiz	正常时间	15	正常处罚	
课程项目 Projects	正常时间	15	正常处罚	
平时作业 Assignments				
期中考试 Mid-Term Test	正常时间	30	正常处罚	
期末考试 Final Exam	正常时间	30	正常处罚	
期末报告 Final Presentation				
其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)				

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.