**生物化学（双语）课程教学大纲**

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| 课程基本信息（Course Information） | | | | | | | |
| 课程代码  （Course Code） | BI283 | | \*学时  （Credit Hours） | 64 | \*学分  （Credits） | | 4 |
| \*课程名称  (Course Name) | （中文）生物化学（双语） | | | | | | |
| （英文）Biochemistry (bilingual) | | | | | | |
| 课程性质  (Course Type) | 必修课  Required course | | | | | | |
| 授课对象  (Audience) | 生命科学技术学院本科生  Undergraduate Students of School of Life Sciences and Biotechnology | | | | | | |
| 授课语言  (Language of Instruction) | 中文  Chinese | | | | | | |
| \*开课院系  (School) | 生命科学技术学院  School of Life Sciences and Biotechnology | | | | | | |
| 先修课程  (Prerequisite) | 有机化学、普通生物学、微生物学  Organic Chemistry，General Biology, Microbiology | | | | | | |
| 授课教师  (Instructor) | 王灿华  Wang Canhua | | | 课程网址  (Course Webpage) | | 无  No | |
| \*课程简介(Description) | **课程目标：**  生物化学是生命科学领域重要的专业基础课。课程的主旨是使学生系统地掌握现代生物化学的理论知识和实验原理，培养学生从分子水平认识生命现象的能力。课程既注重讲授生物化学的基础知识，又注意增添当今生物化学研究的最新成果，力求教学内容达到基础性、前沿性和新颖性的统一。  **课程内容：**  共分19章，涵盖了结构生物化学和代谢生物化学两大部分。  **结构生物化学：**蛋白质及研究技术、核酸及研究技术、血红蛋白、酶概论及酶促动力学、酶促反应机制、酶活性调节机制、糖、脂质。  **代谢生物化学：**代谢总论、糖酵解和葡萄糖异生、柠檬酸循环、氧化磷酸化、卡尔文循环和戊糖磷酸途径、糖原代谢、脂肪酸合成与分解、脂质和胆固醇的合成、蛋白降解和氨基酸分解、氨基酸合成、核苷酸合成、代谢整合。 | | | | | | |
| \*课程简介(Description) | **Course Objectives:**  Biochemistry is an important basic course in the field of life science. It is a discipline that studies the chemical composition, chemical changes of living organisms and the regulation of chemical changes in life. The purpose of the course is to let students master systematically the theoretical knowledge and experimental principle of modern biochemistry, cultivate students' ability of understanding life phenomena from the molecular level. The course will teach not only pay attention to the basic knowledge of cell biology, but also the cutting-edge research of cell biology.  **Course Introduction:**  This course includes 23 chapters. It covers two sections: structure biochemistry and metabolism biochemistry.  **Structure Biochemistry**: Protein and Research Technology, Nucleic Acid and Research Technology, Hemoglobin, Concepts and Kinetics of Enzymes, Catalytic Strategies of Enzymes，Regulatory Strategies of Enzymes，Carbohydrates, Lipids and Cell Membranes.  **Metabolism Biochemistry**: Basic Concepts and Design of Metabolism, Glycolysis and Gluconeogenesis, The Citric Acid Cycle, Oxidative Phosphorylation, The Pentose Phosphate Pathway, Glycogen Metabolism, Fatty Acid Metabolism, The Biosynthesis of Lipids and Cholesterol, Protein Turnover and Amino Acid Catabolism, The Biosynthesis of Amino Acids, Nucleotide Biosynthesis, The Integration of Metabolism. | | | | | | |
| 课程教学大纲（course syllabus） | | | | | | | |
| \*学习目标(Learning Outcomes) | | 1．**结构生物化学**  *主要培养学生的基础知识、研究能力、科学素养。*   1. **生物化学是一门发展中的学科：**了解生物化学是生物多样性的基础；DNA阐明了组成和功能之间的相互关系；从化学概念解释生物分子的性质；基因组学和蛋白组学最新进展；认识到生物化学是生命科学必备的基础知识。(**A3, A5.4.1, B5, B6, C6**) 2. **蛋白质及研究技术：**重点掌握蛋白质组成；四个结构水平及相互关系；蛋白质纯化和分析的基本技术。一般掌握质谱在蛋白质组学研究的应用原理；核磁共振和X-衍射在蛋白结构解析的应用。(**A3,A5.4.1, A5.3, B8, B6, C3, C4**) 3. **核酸及研究技术：**重点掌握核酸组成及结构。核酸研究基本技术；DNA重组的基本方法。一般掌握基因组测序和分析；真核生物的基因操纵方法。(**A3,A5.4.1, A5.3, B8, B6, C4, C3**) 4. **酶：**酶的基本概念；重点掌握酶促动力学；酶反应机制；酶调节机制。(**A3, A5.4.1, B5, B6, C3**) 5. **糖与糖蛋白：**一般掌握单糖；复杂糖（寡糖和多糖）。(**A3, A5.4.1, B5, B6**) 6. **脂与生物膜：**一般掌握脂肪酸；三类膜脂质分子（磷脂、糖脂、和胆固醇）。(**A3, A5.4.1, B5, B6**)   **2. 代谢生物化学**  *主要培养学生的**基础知识、研究能力、科学素养。*   1. **代谢总论：**重点掌握代谢的基本概念；ATP；碳氧化供能；代谢过程反复使用的模式。(**A3, A5.4.1, B5, B6**) 2. **氧化磷酸化：**重点掌握电子传递链；氧化磷酸化及调控机制；线粒体内膜的穿梭系统。(**A3, A5.4.1, B3, B5, B6, B7**) 3. **糖代谢：**重点掌握糖酵解；葡萄糖异生途径；三羧酸循环；戊糖磷酸途径；糖原代谢。(**A3, A5.4.1, B5, B6, C2**) 4. **脂代谢：**重点掌握脂肪酸的分解代谢；脂肪酸的合成代谢。一般掌握甘油三酯合成；胆固醇合成途径。(**A3, A5.4.1, B5, B6, B2**) 5. **蛋白质代谢：**重点掌握蛋白质的降解途径；尿素循环；氨基酸碳骨架分解代谢。一般掌握氨基酸的生物合成；氨基酸是很多生物分子合成的前体。(**A3, A5.4.1, B5, B6, B7**) 6. **核苷酸代谢（机动，选上部分）：**一般掌握嘧啶核苷酸分解与合成途径；嘌呤核苷酸分解与合成途径；核苷酸合成的反馈调控。(**A3, A5.4.1, B5, B6**) 7. **代谢整合（机动，选上部分）：**重点掌握机体代谢由高度关联的代谢途径构成；各个器官有独特的代谢模式；饮食、运动和疾病影响代谢模式。(**A3, A5.4.1, B5, B6, C6**)   **1. Structure Biochemistry**  *Focus on basic knowledge, scientific literacy, and research ability.*   1. **Biochemistry: An Evolving Science:** Understanding of Biochemical Unity Underlies Biological Diversity；DNA Illustrates the Interplay Between Form and Function；Concepts From Chemistry Explain the Properties of Biological Molecules；The Genomic Recent Progress in Both Genomics and Proteomics Is transforming Biology and Medicine；Biochemistry Is Essential Knowledge for Biological Science. (**A3, A5.4.1, B5, B6, C6**) 2. **Protein and Research Technique:** Focus onProtein Composition and Structure. Exploring Proteins and Proteomes: the essential purification techniques. Understanding of Mass spectrometry; X-ray crystallography and NMR Spectroscopy. (**A3,A5.4.1, A5.3, B8, B6, C3, C4**) 3. **Nucleic acid and Research Technique:** Focus onthe composition and structure of nucleic acids**;** The Exploration of Genes Relies on Key Tools; Recombinant DNA Technology. Understanding of Complete Genomes Have Been Sequenced and Analyzed; Genes Manipulate of Eukaryotic. (**A3,A5.4.1, A5.3, B8, B6, C4, C3**) 4. **Enzymes:** Focus on Basic Concepts and Kinetics; Catalytic Strategies; Regulatory Strategies. (**A3, A5.4.1, B5, B6, C3**) 5. **Carbohydrates and Glycoproteins:** Understanding of Monosaccharides; Complex Carbohydrates (Oligosaccharides and polysaccharides); Glycoproteins; Lectins. (**A3, A5.4.1, B5, B6**) 6. **Lipids and Cell Membranes:** Understanding of Fatty Acids; Three Common Types of Membrane Lipids (Phospholipids, Glycolipids, Cholesterol). (**A3, A5.4.1, B5, B6**)   **2. Metabolism Biochemistry**  *Focus on basic knowledge, scientific literacy, and research ability.*   1. **Metabolism: Basic Concepts and Design:** Focus on Basic Concepts of Metabolism; ATP; The Oxidation of Carbon Fuels Is an important Source of Cellular Energy; Metabolic Pathways Contain Many Recurring Motifs. (**A3, A5.4.1, B5, B6**) 2. **Oxidative Phosphorylation:** Focus on Electron Transfer Chain; Oxidative Phosphorylation and Regulation Mechanism; Shuttle System Inner Mitochondrial Membrane. (**A3, A5.4.1, B3, B5, B6, B7**) 3. **Glycometabolism:** Focus on Glycolysis; Gluconeogenesis; The Citric Acid Cycle; Pentose Phosphate Pathway; Glycogen Metabolism. (**A3, A5.4.1, B5, B6, C2**) 4. **Lipid Metabolism:** Focus on Fatty Acid Catabolism; Fatty Acid Anabolism, Understanding of Synthesis Pathways of Triacylglycerols, Synthesis Pathways of Cholesterol. (**A3, A5.4.1, B5, B6, B2**) 5. **Protein Metabolism:** Focus on The Pathways of Proteins Degradation; Urea Cycle; The Catabolism of Carbon Atoms of Amino Acids. Understanding of the Biosynthesis of Amino Acid; Amino Acids Are Precursors of Many Biomolecules. (**A3, A5.4.1, B5, B6, B7**) 6. **Nucleotide Metabolism (optional part):** Understanding of Catabolism and Anabolism of Pyrimidine Nucleotide; Catabolism and Anabolism of Purine Nucleotide; Feedback Regulation of Nucleotide Synthesis. (**A3, A5.4.1, B5, B6**) 7. **The Integration of Metabolism (optional part):** Focus on Metabolism Consists of Highly Interconnected Pathways;Each Organ Has a Unique Metabolic Profile; Food Intake and Starvation Induce Metabolic Changes. (**A3, A5.4.1, B5, B6, C6**) | | | | | |
| \*教学内容、进度安排及要求  (Class Schedule  &Requirements) | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **教学内容** | **学时** | **教学方式** | **作业及要求** | **基本要求** | **考查方式** | | 1. 生物化学是一门发展中的学科 | 2 | 面授 | 习题 | 完成要求 | 作业 | | 1. 蛋白质及研究技术 | 10 | 面授 | 习题 | 完成要求 | 书面作业  PPT报告  期中考试 | | 1. 核酸及研究技术 | 7 | 面授 | 习题 | 完成要求 | 书面作业  PPT报告  期中考试 | | 1. 酶 | 9 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期中考试 | | 1. 糖与糖蛋白 | 2 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期中考试 | | 1. 脂与生物膜 | 2 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期中考试  期中考试 | | 1. 代谢总论 | 2 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期末考试 | | 1. 氧化磷酸化 | 4 | 面授 | 习题 | 完成要求 | 书面作业  PPT报告  期末考试 | | 1. 糖代谢 | 10 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期末考试 | | 1. 脂代谢 | 7 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期末考试 | | 1. 蛋白质代谢 | 5 | 面授 | 习题 | 完成要求 | 作业  PPT报告  期末考试 | | 1. 核苷酸代谢 (机动，选上部分) | 2 | 面授 | 习题 | 完成要求 | 期末考试 | | 1. 代谢整合 (机动，选上部分) | 2 | 面授 | 习题 | 完成要求 | 期末考试 |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Teaching contents** | **Credit Hours** | **Teaching Method** | **Assignments Requirements** | **Basic Requirements** | **Examination** | | 1. Biochemistry: An Evolving Science | 2 | Contact studies and visits | Homework | Fulfill learning outcomes | Homework | | 1. Protein and Research Technique | 10 | Contact studies | Homework | Fulfill learning outcomes | Written homework; Presentation;  Midterm Exam | | 1. Nucleic acid and Research Technique | 7 | Contact studies | Homework | Fulfill learning outcomes | Written homework; Presentation;  Midterm Exam | | 1. Enzymes | 9 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation;  Midterm Exam | | 1. Carbohydrates and Glycoproteins | 2 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation;  Midterm Exam | | 1. Lipids and Cell Membranes | 2 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation; Midterm Exam | | 1. Metabolism: Basic Concepts and Design | 2 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation;  Final Exam | | 1. Oxidative Phosphorylation | 4 | Contact studies | Homework | Fulfill learning outcomes | Written homework; Presentation;  Final Exam | | 1. Glycometabolism | 10 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation;  Final Exam | | 1. Lipid Metabolism | 7 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation;  Final Exam | | 1. Protein Metabolism | 5 | Contact studies | Homework | Fulfill learning outcomes | Homework; Presentation; | | 1. Nucleotide Metabolism   (optional part) | 2 | Contact studies | Homework | Fulfill learning outcomes | Final Exam | | 1. The Integration of Metabolism   (optional part) | 2 | Contact studies | Homework | Fulfill learning outcomes | Final Exam | | | | | | |
| \*考核方式  (Grading) | | 1. 小测验 10% 2. 课堂报告 10% 3. 课外作业 10% 4. 期中考试 35% 5. 期末考试 35%  |  | | --- | | 1. Quiz 10% | | 1. Presentation 10% | | 1. Homework 10% | | 1. Midterm Exam 35% | | 1. Final Exam 35% | | | | | | |
| \*教材或参考资料  (Textbooks & Other Materials) | | **教材Textbooks**  Jeremy Berg, John Tymoczko, Lubert Stryer. **Biochemistry, (Eighth Edition****).** W.H.Freeman and company, New York.2015.  **参考资料Other Materials**   1. David L. Nelson.W.H. Lehninger: **Principles of Biochemistry,** **(Seventh Edition).** Freeman and Company, 2017. 2. ***Nature; Science; Cell***. | | | | | |
| 其它  （More） | | 无  No | | | | | |
| 备注  （Notes） | | 无  No | | | | | |

备注说明：

1．带\*内容为必填项。

2．课程简介字数为300-500字；课程大纲以表述清楚教学安排为宜，字数不限。