

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	生物学原理 Principles of Biology
2.	授课院系 Originating Department	生命科学学院 School of Life Sciences
3.	课程编号 Course Code	BIO103
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	通识必修课程 General Education (GE) Required 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)	<p>课程负责人: 陈炜 (生命科学学院, 讲席教授, chenw@sustech.edu.cn)</p> <p>团队成员: 郭红卫(生命科学学院, 讲席教授, guohw@sustech.edu.cn) 廖茂富(生命科学学院, 讲席教授, liaomf@sustech.edu.cn) 王晓晨(生命科学学院, 讲席教授, wangxc7@sustech.edu.cn) 肖波(生命科学学院, 教授, xiaob@sustech.edu.cn) 赵燕 (生命科学学院, 副教授, zhaoyan@sustech.edu.cn) 王玲 (生命科学学院, 助理教授, wangl8@sustech.edu.cn) 宋毅 (生命科学学院, 助理教授, songy3@sustech.edu.cn)</p> <p>Course Coordinator: CHEN Wei (School of Life Sciences, Chair Professor, chenw@sustech.edu.cn)</p> <p>Group Member: GUO Hongwei(School of Life Sciences, Chair Professor, guohw@sustech.edu.cn) LIAO Maofu (School of Life Sciences, Chair Professor, liaomf@sustech.edu.cn) WANG Xiaochen (School of Life Sciences, Chair Professor, wangxc7@sustech.edu.cn) XIAO Bo(School of Life Sciences, Professor, xiaob@sustech.edu.cn) ZHAO Yan (School of Life Sciences, Associate Professor, zhaoyan@sustech.edu.cn) WANG Ling(School of Life Sciences, Assistant Professor, wangl8@sustech.edu.cn)</p>

	SONG Yi (School of Life Sciences,Assistant Professor,songy3@sustech.edu.cn)				
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	44			4(学生口头报告) (student presentation)	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 N/A				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	BIO104 普通生物学实验, BIO201 生物化学 I, BIO206-15 细胞生物学, BIO207-15 植物生理学, BIO320 分子生物学等 BIO104 General Biology Laboratory, BIO201 Biochemistry (Macromolecules), BIO206-15 Cell Biology, BIO207-15 Plant Physiology, BIO320 Molecular Biology and so on				
14. 其它要求修读本课程的学系 Cross-listing Dept.	生物医学工程系、医学院 Biomedical Engineering Department, Medical School				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程通过广泛的、多元化的入门级生命科学介绍, 让学生接触到可以作为终身学习基础的生命科学知识(包括生物大分子、遗传学、细胞生物学、植物生物学等相关领域)。同时, 生物学原理课程所介绍的内容还为更广泛的生命科学高级课程(包括生物化学, 遗传学, 细胞生物学, 分子生物学, 生理学等)的学习提供良好的准备。建议对生命科学有特别兴趣的学生选修。

This course allows the most diversified exposure to biology at the introductory level. It is designed to provide a knowledge base in life sciences that students can use as a foundation for life-long learning in the sciences. In addition, it is also designed to provide an excellent preparation for a wide range of advanced courses including biochemistry, genetics, cell biology, molecular biology, physiology, etc. As such, it is recommended for those students who have a particularly strong interest in studying biology-related majors.

16. 预达学习成果 Learning Outcomes

Students will be able to understand: 重点掌握的方面

- heredity and its molecular basis 遗传及其分子基础
- the correlation of biological structure, function and processes at all levels of biological organizations 在不同层面上理解结构-功能及生物学过程间的关系
- how energy, nutrients, metabolites and information are acquired and organized, and how they flow through biological systems 理解能量, 营养, 代谢及信息的获得和组织, 理解它们怎样贯穿在生物系统中。

- biotic interactions and the relationship of organisms to the physical environment 生物体与其它生物体及物理环境间的相互关系
- how mathematics, physics and chemistry are integrated into the study of biology 初步了解数学，物理和化学知识与生物学的整合
- Students will have skills to: 学生将掌握的技能
- construct reasonable hypotheses to explain biological phenomena and design 对生物学现象的解释，学会构建与之对应的合理的假说。
- clearly and accurately communicate biological concepts effectively in oral and written forms 能够清晰和准确的表述（口述及书面）生物学概念。

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.)

第一部分：（8 学时）（授课人：肖波，廖茂富等）

1. 生物化学

1.1 生命的化学

在不同层次认识生物学功能；生命的分子组成；化学键及理解重要的生命分子（ATP, 糖，脂）及细胞结构，如细胞膜。

1.2 蛋白质的基本结构及功能

以生命中重要蛋白质，如血红蛋白，抗体蛋白为例，介绍蛋白质的 1-3 级结构。

1.3 理解蛋白质机器的重要功能

膜转运；信号传导；蛋白质酶的催化作用；介导病毒蛋白感染宿主细胞的大至过程及相关的细胞器。

1.4 细胞代谢反应

以葡萄糖代谢为例介绍细胞的生化反应，代谢通路的基本概念和原理；细胞能量产生并介绍相关的细胞器。

第二部分：（16 学时）（授课人：陈炜，王玲，肖波）

2. 遗传学

2.1 经典遗传学：从亚里士多德到孟德尔

2.2 细胞遗传学：摩尔根学说

2.3 分子遗传学

2.3.1 DNA—遗传物质

2.3.2 复制

2.3.3 转录

2.3.4 翻译

2.3.5 基因调控

第三部分：（8 学时）（授课人：赵燕、王晓晨）

3. 细胞-生命体的基本单元

3.1 细胞的基本结构及活动

3.1.1 基本结构及共性：细胞膜，细胞质、细胞器等，概述

3.1.2 基本活动：物质合成、分选、运输（主要以蛋白质为例）

(1) 内质网-高尔基体: 分选

靶向位置：细胞膜（包括分泌蛋白）、细胞核、线粒体、溶酶体

细胞器跨膜转运：细胞核（核孔复合体）、线粒体（TOM-TIM 复合体）、内质网（转运体）

(2) 囊泡转运：内膜系统

(3) 细胞骨架

3.2 细胞的质量控制

3.2.1 蛋白质

(1) 正常蛋白（蛋白酶体系统）

(2) 未折叠蛋白（蛋白酶体系统）

(3) 蛋白质聚集体（自噬-溶酶体系统）

3.2.2 受损细胞器：以自噬清除损伤线粒体为例（线粒体自噬）

3.3 细胞调控

3.3.1 细胞增殖：细胞周期、细胞分裂

3.3.2 细胞死亡：主要以细胞凋亡为例

3.4 细胞生物学研究方法：工具及模式生物

3.4.1 工具 活细胞成像（眼见为实）：显微镜、报告系统

3.4.2 模式生物（单细胞和多细胞生物）：从现象到基因到功能

(1) 模式生物概述：酵母、果蝇、线虫、斑马鱼、小鼠、拟兰芥

(2) 遗传筛选及分析，举例：酵母-细胞自噬；线虫-细胞凋亡

学生口头答辩（4 学时）

第四部分 (12 学时) (授课人: 郭红卫, 宋毅)

4. 植物生物学

4.1 植物形态和结构

4.2 水分和养分吸收及运输

4.3 蒸腾作用

4.4 光合作用

4.5 植物生长调节及生活史

Part I (8h) (Instructor: XIAO Bo, LIAO Maofu)

1. Biochemistry

1.1 The Chemistry of Life

Understanding biological functions at different levels; atomic and molecular compositions of life; chemical bonds and forces; Understanding the high-energy molecule ATP, carbohydrates, lipids, cell membrane.

1.2 The Basic Structures of Protein

Understanding the primary, secondary, tertiary, and quaternary structures of proteins, e.g., hemoglobin and antibody.

1.3 Understanding Amazing Protein Machines

Protein machines in membrane transport, e.g., glucose transporter; signaling transduction protein, e.g., insulin; protein enzymes as catalysts of chemical reactions, e.g., triose phosphate isomerase.

1.4 Cellular Metabolism

Understanding the energetics of chemical reactions, basic concepts of metabolic pathways (catabolism and anabolism); Understanding how the critical metabolic pathway glycolysis works and how glycolysis is linked to mitochondrial metabolism to mass-produce ATP.

Part II (16h) (Instructor: CHEN Wei, WANG Ling, XIAO Bo)

2. Genetics

2.1 Classical Genetics: From Aristotle to Gregor Mendel

2.2 Cellular Genetics: Thomas Morgan

2.3 Molecular Genetics

2.3.1 It is DNA!

2.3.2 DNA replication

2.3.3 Transcription

2.3.4 Translation

2.3.5 Gene regulation

Part III (8h) (Instructor: WANG Xiaochen, ZHAO Yan)

3.The Fundamental Units of Life

3.1 The basic structures and activities of cells

3.1.1 Basic structures and features: the PM, cytoplasm, organelles, etc. Brief introduction

3.1.2 Basic activities: Synthesis, sorting and transportation (Proteins)

(1) ER-Golgi: sorting

Targets (signal peptides): PM (& secretory proteins), Nuclei, Mito, Lysosome

Cross membrane transport on organelles: nucleus, mitochondria, ER

(2) Vesicular transport (endomembrane system)

(3) Cytoseleton (transport vehicle)

3.2 Cellular quality control

3.2.1 Proteins:

(1) Normal (proteosome)

(2) Unfolded (proteosome)

(3) Protein aggregates (autophagy-lysosome)

3.2.2 Damaged Organelles:Mitophagy

3.3 Cell regulation

3.3.1 Proliferation: Cell cycle, Cell division

3.3.2 Cell death (apoptosis)

3.4 Study cell biology: tools and models

3.4.1 Tools, Living cell imaging (Seeing is Believing): microscopy and reporters

3.4.2 Model organism (single and multicellular): phenomena to gene to function

(1) Brief introduction: Yeast, fly, worm, zebrafish, mouse, Arabidopsis

(2) Genetic screen and analyses, examples: Yeast: autophagy; Worm: apoptosis

Part IV (12h) (Instructor: Guo Hongwei, SONG Yi)

4. Plant Biology

4.1 plant structure and anatomy

- 4.2 water and nutrient uptake and transport
- 4.3 transpiration
- 4.4 photosynthesis
- 4.5 plant growth regulation and life cycle

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

指定教材: Essential Biology with Physiology 4 ed. By Eric J. Simon, Jean L. Dickey and Jane B. Reece

参考书: Molecular Biology of the Cell, 6th Ed; Introduction to Genetic Analysis, 8th ed.

Required: Essential Biology with Physiology 4 ed. By Eric J. Simon, Jean L. Dickey and Jane B. Reece

Reference Book: Molecular Biology of the Cell, 6th Ed; Introduction to Genetic Analysis, 8th ed.

Molecular Biology of the Cell (7th), Bruce Alberts, W. W. Norton & Company

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				
课程项目 Projects				
平时作业 Assignments		20		
期中考试 Mid-Term Test				
期末考试 Final Exam		50		
期末报告 Final Presentation		20		
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

本课程经生命科学学院教学工作委员会审议通过
This course is approved by the Teaching Affairs Committee, School of Life Sciences.

