

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	细胞生物学 Cell Biology				
2.	授课院系 Originating Department	生物系 Department of Biology				
3.	课程编号 Course Code	BIO206-15				
4.	课程学分 Credit Value	4				
5.	课程类别 Course Type	专业核心课(生物科学、生物技术、生物信息学) Major Core Courses (Biological Sciences, Biotechnology, Bioinformatics)				
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)	张严冬, 助理教授, 生物系 zhangyd@sustc.edu.cn ZHANG, Yandong, Assistant Professor, Department of Biology Peter Pimpl, 副教授, 生物系 pimpl@sustc.edu.cn Peter Pimpl, Associate Professor, Department of Biology				
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	56			8 Review and Mid-term Exam	64

<p>12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements</p>	<p>BIO102A 普通生物学 General Biology</p>
<p>13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite</p>	<p>本课程为生物系专业核心课，是 BIO208 细胞生物学实验、BIO302 现代生物技术、BIO304 系统生物学的先选课程；高级细胞生物学、干细胞与再生生物学、分子药理学、免疫学的先修课程；其它非生物学专业学生如果想学习有关细胞的功能调控，也可选修本课程。</p> <p>This course is a core course in biology, a prerequisite course in Cell Biology Laboratory, Modern Biotechnology, and Systems Biology; a pre-requisite course of Advanced Cell Biology, Stem Cell and Regenerative Biology, Molecular Pharmacology, Immunology; It should however also be suitable for non-specialists, i.e. for all those medical students to gain a certain amount of familiarity.</p>
<p>14. 其它要求修读本课程的学系 Cross-listing Dept.</p>	<p>无 None</p>

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

细胞生物学是生物化学，遗传学及分子生物学在细胞水平的整合，目的是：1. 了解细胞中几种重要大分子包括 DNA，RNA，蛋白质，脂类及它们所构成的功能复合物的结构，及其在生命活动中的重要功能；2. 细胞中各种亚细胞器的结构功能，认识它们在执行各项生命活动中的协调关系；3. 掌握细胞的各项有序生命活动，如物质运输，细胞周期，细胞通讯的基本原理；4. 了解细胞死亡，癌变的成因，治疗机制；5. 细胞骨架结构功能，细胞外基质与细胞之间的相互联系，细胞如何整合为组织；6. 了解干细胞及神经细胞等细胞生物学一些前沿领域。结合研究实例，掌握细胞生物学各个研究领域的重要发现。同时通过讲解目前一些常用的细胞生物学研究方法，让学生理解细胞生物学的研究内容、研究方法和研究思路。

Cell Biology is the integration of several basic subjects such as biochemistry, genetics and molecular biology on the level of cell. The aim is to: 1. Understand the basic structures and functions for biomolecules as well as their complexes including RNA/DNA, protein, lipid in cells. 2. Learn various cellular organelles and their structures as well as functions. 3. Learn the basic concepts in molecular transport, cell communication, cell cycle and cell growth. 4. Understand principles for cell death, cancer development as well as cancer treatment. 5. Learn the structure and function for cytoskeleton, understand how cells integrate into tissues and the composition and function of extracellular matrix. 6. Know some basic concepts for stem cell research and neurobiology. Finally, through the introduction of common experimental methods and classical experiments in Cell Biology, let the students understand the basic research methodology and rationales behind research designing.

16. **预达学习成果 Learning Outcomes**

学生会对细胞有一个系统的了解。这主要包括：细胞的结构和功能；细胞生物学的研究方法；膜生物化学及小分子运输；蛋白转运；细胞信号转导；细胞骨架；细胞黏附及胞外基质；细胞周期；细胞死亡和癌症生物学等。

Students will have a systematic understanding for cell, covering the following aspects: cell structure and function, methodology to study cell biology, membrane biochemistry and transport, protein sorting and trafficking, cell-cell communication/signalling, cytoskeleton, cell adhesion, cell cycle, cell death, cancer biology.

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.)

Week/Lecture No.	讲座题目 Lecture Topic	课本阅读 Chapter reading	学时 Hours	具体讲座内容 Lecture content
Week 1/ 1	细胞的概论 Introduction to the cell	Ch. 1 &2	2 学时 2 hours	<p>细胞生物学发展简史，细胞理论的提出</p> <p>细胞的共性，细胞多样性中基因进化原理</p> <p>原核细胞和真核细胞的对比</p> <p>细胞生物学中的常用模式生物及其应用</p> <p>A short history of cell biology and cell theory</p> <p>The common features of all cells and the variation of cell genomes</p> <p>Compare and contrast prokaryotic and eukaryotic cells</p> <p>Model systems in cell biology studies and their applications</p>
Week 1/ 2- Week 2/3	细胞生物学研究方法 Methods to study Cell Biology	Ch. 9	4 学时 4 hours	<p>显微镜的原理和应用（普通光学显微镜，相差显微镜，DIC 显微镜，荧光显微镜，激光共聚焦显微镜，电子显微镜，超分辨显微镜和冷冻电镜）</p> <p>Visualizing cells (bright field, dark field, phase contrast, differential interference, fluorescence, confocal microscopy, electron microscopy, nanoscopy and cyro-EM microscopy techniques and their applications)</p> <p>细胞的基本组成成分和分离分析方法（蛋白质，DNA 和 RNA 的分析及分离技术）</p> <p>The major components of cells (DNA, RNA and proteins). The isolation of proteins and common methods to analyze proteins (chromatography, centrifugation and SDS-PAGE, 2-D gel for proteome analysis). The isolation of DNA and RNA from cells, the application of Agarose gel electrophoresis, DNA cloning, PCR and RT-PCR, the use of DIG- and Biotin for nucleic acid labelling)</p> <p>细胞培养和分离的常用方法（从组织中分离细胞的常用方法，细胞的常用购买渠道和常用细胞的培养基成分，二维和三维细胞的培养体系原理和优缺点）</p> <p>How to obtain pure cell culture from tissues</p>

				<p>The basic components in cell medium</p> <p>Compare and contrast 2-D and 3-D cell culture systems.</p>
Week 2/4	<p>细胞膜结构 I</p> <p>Membrane Structure I</p>	Ch. 10	<p>2 学时</p> <p>2 hours</p>	<p>生物膜的概论</p> <p>生物膜的基本结构和功能</p> <p>生物膜脂类分子的研究方法</p> <p>生物膜中的脂双层中的主要构成成分，其结构和功能</p> <p>生物膜的组装</p> <p>Overview of membrane</p> <p>Common features of membrane and its functions</p> <p>Methods to study lipid molecules</p> <p>Major components of Lipid bilayer as well as their structures and functions.</p> <p>Membrane assembly</p>
Week 3/5	<p>细胞膜结构 II</p> <p>Membrane Structure II</p>	Ch. 10	<p>2 学时</p> <p>2 hours</p>	<p>生物膜中的蛋白质种类，结构，功能和分析方法，去污剂的性质，种类和其在膜生物学中的应用</p> <p>Categories of membrane proteins</p> <p>Methods to study membrane proteins</p> <p>The features of membrane proteins, their structures and functions</p> <p>Hydropathy plots to predict membrane protein structures.</p> <p>The use of detergents to study membrane proteins, micelle formation</p>
Week 3/6	<p>小分子运输 I</p> <p>Membrane transport I</p>	Ch. 11	<p>2 学时</p> <p>2 hours</p>	<p>膜的通透性和内外小分子浓度的差别</p> <p>简单渗透，主动运输和被动运输</p> <p>协助运输的两种蛋白：channel and transporter</p> <p>小分子物质运输的原理，水分子，离子通道（水通道和钾离子通道）</p> <p>Selective transportation of small molecules</p> <p>Simple diffusion , Active transport and passive transport</p>



				channels and transporters 离子通道 (aqueous channel, Potassium channel)
Week 4/7 Quiz 1 Homework 1	小分子运输 II Membrane transport II	Ch. 11	2 学时 2 hours	小分子运输通道 transporters (uniporter, symporter, anti-porter) ATP 泵 (钙离子泵, 钠钾泵) ABC transporter, 膜电势的产生原理 (membrane potential) 神经冲动的传导 (action potential and electron impulse transmission) 离子通道的干扰药物, 麻醉剂, 神经干扰药物等。 (drugs inhibiting ion channels)
Week 4/8	蛋白质转运 I protein sorting I	Ch. 12	2 学时 2 hours	细胞区室 (cell compartment) 核质物质运输 (nuclear and cytoplasmic transportation) 线粒体和叶绿体的蛋白转运 (protein transportation to mitochondria and chloroplast) 过氧化物酶体的蛋白转运 (transportation to peroxisomes) 内质网的物质转运 (transportation to endoplasmic reticulum) 脂分子的合成和运输 (bio-synthesis of lipid molecules and transportation)
Week 5/9	蛋白质转运 II Protein sorting II	Ch. 13	2 学时 2 hours	囊泡运输概论 (overview of vesicle trafficking) 囊泡运输的研究方法 (methods to study vesicle trafficking) 从内质网到高尔基体的蛋白转运 (transportation from ER to Golgi apparatus) 从高尔基体到内质网的蛋白转运 (transportation from Golgi apparatus to ER) 内吞 (endocytosis) 胞吐 (exocytosis)
Week 5/10	线粒体和叶绿体	Ch. 14	2 学时	线粒体的结构, 区室和功能



	Mitochondria and Chloroplast		2 hours	叶绿体的结构, 区室和功能 线粒体和叶绿体的遗传系统 化学渗透偶联—生物能的产生 Mitochondrion structure and its compartment Plastid and chloroplast structure/ function Genetic systems in mitochondria and chloroplasts Energy conversion---chemiosmosis coupling
Week 6/11	蛋白质功能调控 Protein functional regulation	Ch. 14	2 学时 2 hours	蛋白质的复杂性 蛋白活性的调控 蛋白稳态的调控 蛋白的泛素化和蛋白降解 蛋白的错误折叠和人类疾病 Protein complexity Control of protein activity Control of protein steady-state level Ubiquitination and protein degradation in the proteasome Protein misfolding and human diseases



<p>Week 6/12 Quiz 2 Homework 2</p>	<p>细胞通讯 I Cell communication/signaling I</p>	<p>Ch. 15</p>	<p>2 学时 2 hours</p>	<p>细胞通讯概论 细胞内的细胞转导 细胞表面受体介导的通讯 细胞信号转导的一般研究方法 细胞通讯动力学及正反馈和负反馈调控 Overview of cell signaling Intracellular signaling General principles of cell surface signaling Several methods to study cell signaling Positive and negative feedback in signaling and signaling kinetics</p>
<p>Week 7/13</p>	<p>细胞通讯 II Cell communication/signaling II</p>	<p>Ch. 15</p>	<p>2 学时 2 hours</p>	<p>G 蛋白耦联受体的发现和简史 G 蛋白耦联受体的概论 G 蛋白耦联受体的分离及代表途径的详解 Discovery of G-protein coupled receptor and short history Overview of GPCR signaling Category of GPCRs and typical examples with detailed introduction Desensitization of GPCR signaling</p>
<p>Week 7/14</p>	<p>细胞通讯 III Cell communication/signaling III</p>	<p>Ch. 15</p>	<p>2 学时 2 hours</p>	<p>酶连受体信号通路概论 酪氨酸激酶受体通路 酪氨酸相关激酶受体通路 丝氨酸、苏氨酸激酶受体通路 组氨酸激酶相关受体通路 Overview of enzyme - linked receptor signalling: receptor tyrosine kinase (RTK)</p>



				<p>Trypsine-kinase-associated receptors</p> <p>receptor Ser/Thr kinase</p> <p>Histidine-kinase-associated receptors</p>
Week 8/15	<p>复习 I</p> <p>Review session I</p>		<p>2 学时</p> <p>2 hours</p>	
Week 8/16	<p>期中考试</p> <p>Midterm Exam</p>		<p>2 学时</p> <p>2 hours</p>	
Week 9/17	<p>细胞骨架 I</p> <p>Cytoskeleton I</p>	Ch. 16	<p>2 学时</p> <p>2 hours</p>	<p>细胞骨架总论</p> <p>微丝和肌动蛋白结构</p> <p>肌动蛋白微丝的动态特征</p> <p>微丝组装的原理</p> <p>Overview of cytoskeleton</p> <p>Microfilament and actin structures</p> <p>Dynamics of actin filaments</p> <p>Mechanisms of actin filament assembly</p> <p>Organization of actin-based cellular structure</p>
Week 9/18	<p>细胞骨架 II</p> <p>Cytoskeleton II</p>	Ch. 16	<p>2 学时</p> <p>2 hours</p>	<p>肌球蛋白的分类, 结构和功能</p> <p>肌球蛋白在微丝的移动原理</p> <p>细胞的移动原理, 信号通路和细胞的趋化运动</p> <p>Myosins: actin-based motor proteins</p> <p>Myosin-powered movements</p> <p>Cell migration: mechanisms, signaling, and chemotaxis</p>
Week 10/19	<p>细胞骨架 III</p> <p>Cytoskeleton III</p>	Ch. 16	<p>2 学时</p> <p>2 hours</p>	<p>微管的结构和组装</p> <p>微管组装的动态原理</p> <p>微管组装的调控原理</p> <p>微管的两种马达蛋白结构和功能</p> <p>纤毛和鞭毛的结构及运动原理</p> <p>中间纤维</p>



				<p>Microtubule structure and organization</p> <p>Microtubule dynamics</p> <p>Regulation of microtubule assembly</p> <p>Kinesins and Dyneins: microtubule-based motor proteins</p> <p>Cilia and flagella</p> <p>Intermediate filaments</p>
Week 10/20	细胞周期 I Cell cycle I	Ch. 17	2 学时 2 hours	<p>细胞周期概论</p> <p>细胞周期的研究方法</p> <p>细胞周期的调控系统</p> <p>细胞周期中的 S 期</p> <p>Overview of the cell cycle</p> <p>Common methods to study cell cycle</p> <p>Introduction to the cell cycle control system</p> <p>S phase</p>
Week 11/21 Quiz 3 Homework 4	细胞周期 II Cell cycle II	Ch. 17	2 学时 2 hours	<p>细胞周期中的有丝分裂期</p> <p>细胞分裂</p> <p>细胞生长和细胞分裂的协调和失调</p> <p>Mitosis</p> <p>Cytokinesis</p> <p>Control of cell division and cell growth</p>
Week 11/22	细胞凋亡 Apoptosis	Ch. 18	2 学时 2 hours	<p>细胞死亡的种类和概述</p> <p>细胞凋亡的特征和分析方法</p> <p>细胞凋亡的发现和简史</p> <p>细胞凋亡的机理（外因凋亡和内因凋亡，凋亡的重要因子 CASPASE 及调控基因 Bcl-2 基因家族）</p> <p>细胞凋亡的失调和人类疾病的发生</p> <p>Overview of programmed cell death</p> <p>Methods in apoptosis identification</p> <p>Brief history of apoptosis</p>

				Mechanisms (Caspases, Bcl-2 family genes) Dysregulation of apoptosis and human diseases
Week 12/23	细胞自噬 Autophagy	Ch. 18	2 学时 2 hours	细胞自噬的秘密 细胞自噬系统的发现简史 细胞自噬的基本原理 细胞自噬的失调和人类疾病的关联 The mystery of autophagy Discovery of the autophagy machinery Basic components in autophagy and functions Autophagy in health and diseases
Week 12/24 Quiz 4 Homework4	复习 II Review Session II		2 学时 2 hours	
Week 13/25	细胞连接, 细胞黏附和胞外基质 I Cell Junctions, Cell adhesion, and ECM I	Ch. 19	2 学时 2 hours	细胞整合为组织的概述 细胞之间连接的种类 钙黏连蛋白和细胞与细胞连接 整合素及细胞与基质连接 Overview of cell-cell and cell-ECM junction and adhesion Cadherins and cell- cell adhesion Integrins in cell-ECM adhesion
Week 13/26	细胞连接, 细胞黏附和胞外基质 II Cell Junctions, Cell adhesion, and ECM II	Ch. 19	2 学时 2 hours	细胞致密连接的主要蛋白种类, 结构和功能 细胞孔道连接的主要蛋白种类, 结构和功能 细胞基膜的组成, 功能和分布 Occluding junctions Channel-forming Junctions Basal Lamina
Week 14/27	细胞连接, 细胞黏附和胞外基质 III	Ch. 19	2 学时	胞外基质的概论 胞外基质的组成成分及介绍 (蛋白聚糖, 糖蛋白, 胶



	Cell Junctions, Cell adhesion and ECM III		2 hours	原蛋白, 弹性蛋白, 黏连蛋白) 胞外基质的生物合成和讲解 Overview of ECM The making and composition of ECM GAGs Hyaluronan proteoglycans collagens elastin fibronectin The degradation of ECM
Week 14/28 Quiz 5 Homework 5	癌症 I Cancer I	Ch. 20	2 学时 2 hours	癌症的概论 癌症的特征 癌症产生的诱因 The nature of Cancer Properties of cancer Cause of cancer
Week 15/29	癌症 II Cancer II	Ch. 20	2 学时 2 hours	癌症重要基因 癌症发生的多步骤机理 癌症干细胞 癌症转移 癌症的传统治疗和最新治疗方法 Cancer critical genes Multi-step tumorigenesis Cancer stem cells Cancer metastasis Cancer treatment
Week 15/30	干细胞 Stem cell	Handouts	2 学时 2 hours	干细胞的特征的分类介绍 干细胞在多细胞生物发育中的功能

				<p>细胞的不对称分裂</p> <p>干细胞在多细胞生物中的分布及微环境对干性的维持</p> <p>Stem cell introduction</p> <p>Early metazoan development and embryonic stem cells</p> <p>Asymmetric cell division</p> <p>Stem cells and niches in multicellular organisms</p>
Week 16/31	神经细胞 Neurobiology	Handouts	2 学时 2 hours	<p>神经细胞的分类： 神经元和胶质细胞</p> <p>神经元的电信号通路</p> <p>胶质细胞的分类功能和分布</p> <p>血脑屏障</p> <p>神经髓鞘的结构功能</p> <p>神经突触</p> <p>Categories of nerve cells: neuron and glia</p> <p>Circuit of neuron impulse (motor neuron, interneuron, sensory neuron, etc)</p> <p>Category of glia cells , their structures, functions.</p> <p>Blood-brain barrier</p> <p>Neuron sheath structure and function</p> <p>Synapse</p>
Week 16/32	复习 Review session III		2 学时 2 hours	
Final weeks	Final Exam			

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

指定教材: Molecular Biology of the Cell, 5th edition, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Garland Science

参考教材: Molecular Cell Biology, 7th edition, Harvey Lodish, Chris Kaiser, Anthony Bretscher, Angelicka Amon, Arnold BERK, Monty Krieger, Hidde Ploeph, Matthew Scott. Macmillan

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		2.5		
课堂表现 Class Performance		2.5		
小测验 Quiz		10		
课程项目 Projects				
平时作业 Assignments		25		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		30		
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.