

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	细胞生物学实验/Cell Biology Laboratory
2.	授课院系 Originating Department	生物系/Department of Biology
3.	课程编号 Course Code	BIO208
4.	课程学分 Credit Value	2
5.	课程类别 Course Type	专业核心课（生物科学、生物技术专业） - Major Core Courses (Biological Sciences, Biotechnology) 专业选修课（生物信息专业） - Major Elective Courses (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)	赵颖岚 工程师 南方科技大学生物系 广东省深圳市西丽区南方科技大学第一教学楼 229 室 Tel (电话): (0755)8801-8749 Email: zhaoyl@sustc.edu.cn Dr. ZHAO Yinglan, Engineer, Department of Biology Teaching building 1, room 229 生悦 工程师 南方科技大学生物系 广东省深圳市西丽区南方科技大学荔园 1 栋 506 室 Tel (电话): (0755)8801-8750 Email: Shengy@sustc.edu.cn Dr. SHENG Yue, Engineer, Department of Biology Lychee Hills Building 1, room 506
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	宋亚坤 实验员 南方科技大学生物系 广东省深圳市西丽区南方科技大学荔园 1 栋 506 室 Tel (电话): (0755) 8801-0236 Email: Songyk@sustc.edu.cn Mrs. SONG Yakun, Laboratory Technician, Department of Biology

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10. **Maximum Enrolment (Optional)**
 选课人数限额(可不填)

11. Delivery Method 授课方式	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			64		64

12. **Pre-requisites or Other Academic Requirements**
 先修课程、其它学习要求
 要求先修 BIO102A 普通生物学实验；学习本实验课的同时学习 BIO206-15 细胞生物学理论课程。
 Pre-study General Biology Laboratory, and study the theory course Cell Biology with the experiment course at the same time.

13. **Courses for which this course is a pre-requisite**
 后续课程、其它学习规划

14. **Cross-listing Dept.**
 其它要求修读本课程的学系

教学大纲及教学日历 SYLLABUS

15. **Course Objectives**
 教学目标

细胞是生命的基本单元，解读细胞的活动规律是了解生命的基础。细胞生物学实验给本科生提供了一个初步了解如何解读细胞活动规律、了解前沿细胞生物学研究技术和先进仪器的学习和培训平台。本课程设置自成体系，分基础实验、综合实验和开放设计性实验 3 个层次；大多数实验采用活细胞材料，由学生自己动手取材、培养和实验，掌握基本技能和了解前沿细胞生物学研究技术和先进仪器，使学生能对细胞的生长、周期、凋亡等细胞活动规律获得直接、生动、全面的认识；着重培养学生规范化实验动手能力、养成良好的实验和观察习惯、发现问题和解决问题的能力、求实创新的科学探索精神，为后续的课程学习及生物科学研究打下坚实的基础。

Cell is the essential unit of life, and interpreting the activity of cells is the basis of understanding life. The cell biology experiment gives undergraduates an initial understanding of how to interpret the laws of cell activity, the study of cutting-edge cell biology, and the learning and training platform of advanced instruments. This course is set up in three levels: basic experiment, comprehensive experiment and open design experiment. Most experimental materials using living cells, training the operation of students, let the student understanding the advanced technology in cell biology, and make students have a comprehensive understanding to cell growth, cell cycle and cell apoptosis. This course focuses on cultivating students' manipulative ability of standardized experiment, to form a good habit of experiment and analysis problems, strives for realism the innovation spirit of scientific inquiry, for the follow-up courses and biological sciences research to lay a solid foundation.

16. **Learning Outcomes**
 预达学习成果

在学习的过程中，以期让学生能掌握基本技能和了解前沿细胞生物学研究技术和先进仪器，使学生能对细胞的生长、周

期、凋亡等细胞活动规律获得直接、生动、全面的认识；着重培养学生规范化实验动手能力、养成良好的实验和观察习惯、发现问题和解决问题的能力、求实创新的科学探索精神，为后续的课程学习及生物科学研究打下坚实的基础。

The chosen of this course is to let the students master the basic skills and knowledge of cell biology research methods and advanced equipment. To give a vivid and full understanding of the cell growth, cell cycle and cell apoptosis. This course is focuses on cultivating students' manipulative ability of standardized experiment, to form a good habit of experiment and observation, analysis the problem, strives for realism the innovation spirit of scientific inquiry, for the follow-up courses and biological sciences research to lay a solid foundation.

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.)

一、细胞生物学实验简介（4 学时）

Lab 1. Introduction to Cell Biology Laboratory (4 credit hours)

介绍实验室规则、安全、课程设置及实验安排；实验记录本及实验报告要求；实验课考核及评分标准。

Introduce Cell Biology Laboratory safety, course requirement (notebook and report), course schedule and evaluation.

二、细胞形态观察及细胞计数（4 学时）

Lab 2. Observe Morphological Characteristic and Determining the density of cell cultures(4 credit hours)

介绍倒置显微镜的原理及使用，了解原代细胞及传代培养细胞形态观察方法；学会用倒置显微镜观察培养细胞的形态及学会判断细胞状态；熟悉贴壁细胞的消化过程及细胞计数。

To learn the structure of invert-phase microscope and how to use it correctly. To study how to observe the morphology of culture cells and judge cell condition. Learn how to determine cell number of adherent cells.

三、细胞培养（6 学时）

Lab 3. Cell culture(6 credit hours)

掌握贴壁细胞传代的培养方法，练习在细胞培养室内进行无菌操作。观察传代细胞贴壁、生长和繁殖过程中细胞形态的变化。课堂实验 5 学时，第二天观察 1 学时。

Introduction of aseptic technique in cell culture room and master the technique of adherent cells passage. Observe the morphology change of cell during spread and growth. 5 class hours for the classroom teaching and 1 class hour for the results observed in the next day.

四、细胞转染（6 学时）

Lab 4. Cell transfection (6 credit hours)

掌握细胞转染的原理和方法（如磷酸钙介导，脂质体介导等），了解细胞转染用途和影响转染效率的因素，熟悉质粒载体的基本结构及其作用，了解荧光蛋白在生物学领域的应用，学习荧光显微镜的工作原理。课堂实验 5 学时，第二天观察 1 学时。

To study the principle of cell transfection, such as Calcium phosphate mediated or lipofection transfection. To know the purpose of cell transfection and the effects that would influence transfection efficiency. To let the students get a understanding about the basic structure and function of plasmids and fluorescent proteins. To study the principle of fluorescent microscope. 5 class hours for the classroom teaching and 1 class hour for the results observed in the next day.

五、红细胞膜渗透性（4 学时）

Lab 5. Determination of red blood cell membrane permeability (4 credit hours)

了解溶血现象及发生机制；了解红细胞膜的渗透性及各种物质进入细胞的速度；理解物质分子质量、脂溶性，电解质和非电解质对细胞膜渗透性的影响。

Understanding the mechanism of hemolysis. To study the permeability of red cell membrane and the velocity of various substances entering cells. Analysis the result and study the influence of material molecular mass, fat solubility, electrolyte and non-electrolyte on membrane permeability.

六、U-937 细胞的染色体观察（5 学时）

Lab 6. Chromosome Observation (5 credit hours)

掌握体外培养细胞的染色体制备技术（中期阻断法及低渗处理法）；掌握人类体细胞染色体组型分析的方法；了解肿瘤细胞染色体的特点。

Master how to prepare chromosomes from cells in vitro by the method of metaphase blocking and low osmotic treatment. To study the karyotype analysis of human somatic cells and the characteristic of tumour cell chromosomes.

七、细胞分化（6 学时）

Lab 7. Cell differentiation (6 credit hours)

细胞分化是个体发育中重要事件，是指同一起来源的细胞逐渐产生出形态结构、功能特征差异细胞类群的过程。细胞分化模型是体外研究个体发育及疾病发生的重要手段，本实验利用 U-937 细胞在体外的诱导分化，让学生观察到分化前后细胞形态的变化。课堂实验 4 学时，第二天观察 2 学时。

Cell differentiation is an important issue in development, it means cells that come from one original become differences in morphology and function. The model of differentiation is useful for studying development and disease progression in vitro. In this experiment, U-937 cells are used as a model to study the morphology change after differentiation inducing. 4 class hours for the classroom teaching and 2 class hours for the results observed in the next day.

八、细胞增殖与细胞周期（4 学时）

Lab 8. Cell proliferation and cell cycle (4 credit hours)

细胞分化程度会对细胞增殖能力产生影响，因此我们利用 U-937 细胞分化模型，研究分化对细胞周期的影响。介绍细胞增殖与细胞周期的检测方法，了解细胞周期在疾病发生中的作用，学习流式细胞仪的原理以及其在细胞周期检测中的应用。

The degree of cell differentiation would influence the ability of cell proliferation; we use the model of U-937 to study this effect. Introduction of the method to detect cell proliferation and cell cycle, and study the change of cell cycle in disease. Introduction the principle of flow cytometry, to study the application of flow cytometry in cell cycle detection.

九、细胞吞噬（5 学时）

Lab 9. Phagocytosis (5 credit hours)

诱导激活分化后的 U-937 细胞具有吞噬细胞功能，能在体外吞噬微生物（细菌、酵母等）或磁珠颗粒。本实验采用遗传学实验中表达超折叠绿色荧光蛋白（super folded-GFP）的大肠杆菌作为吞噬对象。利用荧光显微镜、流式细胞仪分析 U-937 细胞对该种细菌的吞噬作用。

The induced U-937 cells have the function of phagocytosis after activation. Those cells can swallow microbe (bacteria or yeast) or magnetic beads. E.coli that express super folded-GFP which was constructed in genetic laboratory class is

used as subject for phagocytosis. Analysis the phagocytosis of U-937 with the method of fluorescent microscope and flow cytometry.

十、细胞凋亡检测（4 学时）

Lab 10. Analysis of cell apoptosis (4 credit hours)

熟悉凋亡细胞的形态学特征，学会鉴别凋亡细胞、坏死细胞及正常细胞的方法；了解体外诱导细胞凋亡的方法；掌握利用流式细胞仪区分凋亡与坏死细胞。

Study how to distinguish apoptosis, necrosis and normal cells and the morphology characteristic of apoptosis cells. To know the method of inducing cell apoptosis. Detect the apoptosis by FCM.

十一、细胞中总蛋白的提取（4 学时）

Lab 11. Cyto/nuclear and protein fraction (4 credit hours)

本实验为实验十二的前期准备，了解提取组织及细胞中蛋白的基本方法。利用化学试剂（RIPA）裂解细胞，提取哺乳动物细胞中总蛋白。学习 BCA 法定量蛋白的原理，并用 BCA 法对蛋白进行定量。

This experiment is a preparation for lab 12, to know the basic method of protein extraction from tissue and cells. Lysis the cells with reagent-based method (RIPA), and extract total protein from mammalian cells. To study the principle of BCA method, and quantify total protein with BCA method.

十二、Western blot I（4 学时）

Lab 12. Western blot I (4 credit hours)

利用免疫印迹技术检测凋亡相关蛋白的表达情况。了解抗体的结构，及免疫印迹技术的基本步骤。以实验 12 所获得的细胞总蛋白为实验材料，通过 SDS-PAGE 按分子量大小分离不同蛋白，并将蛋白转印到 PVDF 膜上，以封闭液或脱脂奶粉封闭过夜。封闭后的膜经 TBST 洗涤后于层析柜中保存一周备用。

To detect the expression of apoptosis associated protein with immuno-blotting technique. To know the structure of antibody and the basic process of immuno-blotting technique. Separate the distinct protein as molecular weight with SDS-PAGE, blotting the proteins to PVDF membrane, then blocking it overnight. Store the TBST washed membrane in tomographic ark for 1 week.

十三、Western blot II（4 学时）

了解抗原抗体结合的特异性及化学发光法显色的原理。将封闭后的膜孵育一抗、洗涤、孵育二抗、洗涤，显色后观察凋亡相关蛋白的表达变化。

Lab 13. Western blot II (4 credit hours)

To know the specificity binding of antigen and antibody, to study the principle of enhanced chemiluminescent (ECL) method. Primary antibody incubation, washing, secondary antibody incubation, washing then detecting for the expression change of apoptosis associated protein with ECL.

十四、实验回顾与总结（4 学时）

Lab 14. Review (4 credit hours)

学生根据课程内容对实验原理、步骤、实验结果进行回顾，并对本实验相关内容进展扩展，以演讲形式讲解。

The students will summary the lab course by themselves and expand the mind. They will do the presentation with PPT.

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

细胞生物学实验技术, 吕冬霞, 科学出版社, 2012

细胞生物学实验技术, 第二版, 章静波等, 化学工业出版社, 2011

Culture of Animal Cells, 6th. R.Ian Freshney, Wiley-backwell, 2010

Cell Culture Basic handbook, Invitrogen.

Phorbol Myristate Acetate Inhibits Okadaic Acid-Induced Apoptosis and Downregulation of X-Linked Inhibitor of Apoptosis in U937 Cells. TK Kwon, Biochemistry and Biophysical Research Communications 287, 135-141, 2001

A phagocytosis assay for oxidized low-density lipoprotein versus immunoglobulin G-coated microbeads in human U937 macrophages. DT Vance, J Dufresne, et al. Analytical Biochemistry 500, 24-34, 2016

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



南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

