

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	神经生物学综合实验和科研实践 Integrated Laboratory Research Training--Neuroscience
2. 授课院系 Originating Department	生命科学学院神经生物学系 Department of Neuroscience, School of Life Sciences
3. 课程编号 Course Code	BIO485
4. 课程学分 Credit Value	6
5. 课程类别 Course Type	专业选修课 Major Elective Courses
6. 授课学期 Semester	秋季 Fall 春季 Spring 夏季 Summer
7. 授课语言 Teaching Language	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: 姬生健, 副教授, jisj@sustech.edu.cn</p> <p>团队成员: 张明杰, 讲席教授, zhangmj@sustech.edu.cn 王晓晨, 讲席教授, wangxc7@sustech.edu.cn 侯圣陶, 教授, houst@sustech.edu.cn 肖波, 教授, xiaob@sustech.edu.cn 刘东, 副教授, liud@sustech.edu.cn 宋昆, 副教授, songk@sustech.edu.cn 魏志毅, 副教授, weizy@sustech.edu.cn 姬生健, 副教授, jisj@sustech.edu.cn 饶枫, 副教授, raof@sustech.edu.cn 赵燕, 副教授, zhaoyan@sustech.edu.cn 程龙珍, 助理教授, chenglz@sustech.edu.cn 陈小菁, 助理教授, chenxj@sustech.edu.cn</p> <p>Course Coordinator: JI Shengjian, Associate Professor, jisj@sustech.edu.cn</p> <p>Group Members: ZHANG Mingjie, Chair Professor, zhangmj@sustech.edu.cn WANG Xiaochen, Chair Professor, wangxc7@sustech.edu.cn</p>

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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)

每学年开设 1-2 个教学班级，每班级限额 5 人。
 1-2 classes per school year with a maximum of 5 students per class.

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
		192		192

学时数
Credit Hours

12. 先修课程、其它学习要求
Pre-requisites or Other Academic Requirements

生物学原理，普通生物学实验
 Principles of Biology, General Biology Laboratory

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

None

14. 其它要求修读本课程的学系
Cross-listing Dept.

None

教学大纲及教学日历 SYLLABUS

15. 教学目标 **Course Objectives**

本课程是生命科学学院为刚进入生命科学学院相关专业的大二（或大三）年级本科生开设的六学分、三学期制的专业限选课。课程的教学目标是让学生熟悉现代神经生物学的基本理论和实验方法，特别是让学生了解神经生物学系的各个主要研究方向及其所用的主要和关键实验技术和研究方法，包括组织学、细胞生物学、分子生物学、行为学、神经电生理、神经环路以及脑疾病动物模型的构建和解析。通过本课程的学习，学生将在熟悉神经生物学主要研究方法和技术、神经生物学系各个研究方向的基础上进一步确定自己的研究兴趣所在，将在接下里的大三和大学四年在相关实验室进行更为深入的科研创新研究。

Integrated Laboratory Research Training--Neuroscience is a specialized elective course offered by the School of Life Sciences for sophomore (or junior) undergraduate students majoring in life sciences, with six credits and a three-semester system. The teaching objective of this course is to familiarize students with the fundamental theories and experimental methods of modern neuroscience, especially to enable them to understand the main research directions of the neuroscience department and the major and key experimental techniques and research methods used in these directions, including histology, cell biology, molecular biology, behavioral study, neuroelectrophysiology, neural circuits, and the construction and analysis of animal models of brain diseases. Through the study of this course, students will further determine their research interests based on their familiarity with the main research methods and techniques of

neuroscience and the various research directions of the neuroscience department, and will conduct more in-depth scientific research and innovation in related laboratories in their junior and senior years.

16. 预达学习成果 Learning Outcomes

1. 系统学习和掌握每个部分的神经生物学实验科学原理和标准的实验操作步骤。
 2. 学习利用神经元或胶质细胞原代培养以及体外动物组织开展神经生物学研究的基本原理和方式。
 3. 观摩和学习利用实验动物模型开展相关表型和体内机制分析。
1. Master the scientific principles of neurobiological experiments and the standard operating procedures for each section.
 2. Learn the basic principles and methods of conducting neurobiological research using primary cultures of neurons or glial cells and in vitro animal tissue.
 3. Watch and learn using experimental animal models to conduct relevant phenotype and in vivo mechanism analysis.

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：神经系统的组织学研究

1. 学习实验动物（小鼠、大鼠、斑马鱼等）的基本知识，学习转基因和基因敲除等实验动物模型构建的原理；
2. 在研究生、科研助理或博士后的指导下，学习实验动物胚胎或成体脑组织的固定与包埋，包括心脏灌流、脑组织提取、OCT包埋等；
3. 学习和练习实验动物大脑组织的冰冻切片和/或石蜡切片的制备；
4. 学习和练习利用不同抗体对脑切片进行免疫荧光染色和成像，以及高尔基染色技术；
5. 学习和练习利用 mRNA 探针进行原位杂交实验分析相关基因 mRNA 的表达。

Part 1: Histological Study of the Nervous System

1. Learn the basic knowledge of experimental animals (mice, rats, zebrafish, etc.), and the principles of constructing experimental animal models such as transgenic and gene knockout models;
2. Under the direction of graduate students, RAs and postdocs, learn fixation and embedding of embryonic or adult brain tissue of experimental animals, including cardiac perfusion, brain tissue extraction, OCT embedding, etc.;
3. Learn and practice preparation of frozen and/or paraffin sections of experimental animal brain tissue;
4. Learn and practice immunofluorescence staining and imaging of brain sections using different antibodies, as well as Golgi staining techniques;
5. Learn and practice analysis of the expression of related gene mRNA in brain sections using mRNA probes for in situ hybridization experiments.

第二部分：神经系统的细胞生物学和分子生物学研究

1. 学习和练习分离原代神经元和/或胶质细胞进行体外培养；
2. 学习和练习各种敲低或过表达质粒载体的构建；
3. 学习和观摩宫内电转、脑定位注射、胚胎注射等实验动物手术和操作；
4. 学习和练习神经发育和功能相关基因的克隆、表达、纯化、理化性质鉴定、相互作用分析及相分离现象分析；
5. 学习和练习神经递质分泌检测的生物化学技术。

Part 2: Cellular and Molecular Biology Study of the Nervous System

1. Learn and practice isolation and in vitro culture of primary neurons and/or glial cells;
2. Learn and practice construction of various plasmid vectors for knockdown or overexpression;
3. Watch and learn animal surgery and manipulation, such as in utero electroporation, brain localization injection, and embryo injection;
4. Learn and practice cloning, expression, purification, physicochemical property identification, interaction analysis, and phase separation analysis of genes related to neural development and function;
5. Learn and practice biochemical techniques for detecting neurotransmitter secretion.

第三部分：神经行为学、神经电生理、神经环路和脑疾病动物模型的学习和研究

1. 在研究生、科研助理或博士后等指导下，学习和观摩实验动物的各种行为学测试和分析，包括学习和记忆、运动、认知、视觉、焦虑、疼痛等；
2. 学习和练习各种神经电生理记录方法的原理、技术和分析；
3. 学习和观摩相关神经环路（空间记忆、痛、痒、温度控制和感知等）的研究方法，包括环路示踪、神经元精确失活等；
4. 学习脑疾病动物模型构建的神经生物学基础理论和方法，观摩研究生、科研助理或博士后等进行相关实验操作，模型包括老年痴呆、自闭症、帕金森病、脑缺血再灌注、青光眼、多动症、神经元轴突（外周神经，视神经等）损伤和再生、神经自噬、铁死亡、凋亡等，模式动物包括小鼠、大鼠、斑马鱼等

Part 3: Neurobehavioral, Neuroelectrophysiological, Neural Circuit, Animal Models of Brain Diseases

1. Under the direction of graduate students, RAs and postdocs, watch and learn various behavioral tests and analyses of experimental animals, including learning and memory, movement, cognition, vision, anxiety, pain, etc.;
2. Learn and practice principles, techniques, and analysis of various neuroelectrophysiological recording methods;
3. Watch and learn methods for related neural circuits (spatial memory, pain, itch, temperature control and perception, etc.), including circuit tracing, precise inactivation of neurons, etc.
4. Learn neurobiological basis and methods for constructing animal models of brain diseases, and watch experimental operations conducted by graduate students, RAs and postdocs. The models include Alzheimer's disease, autism, Parkinson's disease, cerebral ischemia-reperfusion, glaucoma, ADHD, axonal injury and regeneration (peripheral nerves, optic nerves, etc.), neuroautophagy, ferroptosis, apoptosis, etc. The model

animals include mice, rats, zebrafish, etc.;

以上三个部分的修读顺序可根据实际情况调整。学生修读内容须覆盖三个部分，但是因为每个部分的内容都很多且课时有限，因此在鼓励学生修读尽可能多的研究内容的前提下，本课程不要求学生修读每个部分里面的所有内容。

The order of studying the above three parts can be adjusted according to the actual situation. Students are required to cover all three parts, but due to the large amount of content in each part and the limited class hours, this course does not require students to study all the content in each part. However, students are encouraged to study as much research content as possible.

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

实验技术和原理选取自常用实验技术手册和科学文献。

Experimental techniques and principles are selected from commonly used experimental technique manuals and scientific literature.

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		30		春季/秋季学期，4 学时/周 夏季学期（6 周），8 学时/天 实验室会议：2 次/月 Spring/Fall semester, 4 hours/week Summer semester (6 weeks), 8 hours/day Lab meetings: 2 times/month
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		30		完成所有部分的学习后，以小组为单位进行项目答辩 After completing all modules, conduct project defence in groups
其它（可根据需要 改写以上评估方 式） Others (The above may be modified as necessary)		40		每个部分独立撰写实验报告和做口头报告 Experimental report and oral presentation for each independent module.

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.