

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 Neurobiology				
2.	授课院系 Originating Department	生物系 Department of Biology				
3.	课程编号 Course Code	BIO310				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业选修课（生物科学、生物技术、生物信息学专业） Major Elective Courses (Biological Sciences, Biotechnology, Bioinformatics Majors)				
6.	授课学期 Semester	春季 Spring / 秋季 Fall				
7.	授课语言 Teaching Language	英文 English				
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)	姬生健，生物系 JI Shengjian, Biology Department jisj@sustech.edu.cn, 88018498 程龙珍，生物系 CHENG Longzhen, Biology Department chenglz@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)	50				
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	40			8（神经生物学最新文献阅读、讲解和讨论 Neuroscience article reading, presentation and discussion）	48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	生物化学 I (BIO201) Biochemistry(Macromolecules)
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	None 无
14. 其它要求修读本课程的学系 Cross-listing Dept.	None 无

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

神经生物学是为中高年级的本科生和一年级的研究生开设的生物学课程。本课程的总体目标是帮助学生了解控制神经系统结构、组织、发育、功能和疾病的基本原理。

Neurobiology is an advanced biology course designed for junior/senior undergraduate students and first-year graduate students. The overall goal of this course is to provide students a starting point to understand the fundamental principles governing the structure, organization, development, function and diseases of nervous system.

16. 预达学习成果 Learning Outcomes

理解和掌握现代神经生物学的基本知识、研究方法和思维方法。

Learn the basic principles, methods and ideas for modern neuroscience.

提高学生在神经科学领域的报告和交流能力。

Improve the skills for scientific presentation and communication in neuroscience.

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.)

Part 1, Introduction & Structure and Organization of Nervous System (2 h)

Outline: model organisms in neuroscience; cellular components of nervous system; neurons; glia; organization of nervous system; survey of human neuroanatomy.

Part 2, Nervous System Development and Diseases (10 h)

Section 2.1. Early nervous system development

Outline: formation of nervous system; neural stem cells; neural crest; segmentation and *Hox* genes; molecular basis of neural induction; major inductive signaling pathways in vertebrate embryos (RA, FGF, BMP, Wnt; Shh); neurogenesis; molecular and genetic disruptions of early neural development; neural migration.

Section 2.2. Construction of neural circuits

Outline: cell polarity; axon growth and guidance; actin and tubulin; signals for axon guidance; chemoattraction and chemorepulsion; synapse formation; neurotrophic interactions; synaptic refinement; neurotrophins.

Section 2.3. Modification of neural circuits as a result of experience

Outline: critical period; critical periods in visual system development; critical period for language.

Section 2.4. Repair and regeneration in nervous system

Outline: three types of neural repair; peripheral nerve regeneration; restoration of damaged central nerve cells; adult neurogenesis (non-mammalian and mammalian).

Part 3, Neural Signaling (14 h)

Section 3.1. Electrical signals of nerve cells

Outline: resting membrane potential; action potential; passive and active current flow in axons; how neuronal electrical signals arise; electrochemical equilibrium; Nernst equation; Goldman equation; long-distance signaling by means of action potentials.

Section 3.2. Ion channels and transporters

Outline: patch clamping; ion channels; structure of K⁺ channels; active transporters; Na⁺/K⁺ pump.

Section 3.3. Synaptic transmission

Outline: electrical synapses; chemical synapses; chemical neurotransmission; criteria that define a neurotransmitter; two types of neurotransmitter; molecular mechanisms of synaptic vesicle cycling; neurotransmitter receptors; end plate current; end plate potential; reversal potentials; postsynaptic current and potential; excitatory and inhibitory postsynaptic potentials; summation of synaptic potentials.

Section 3.4. Neurotransmitters and their receptors

Outline: categories of neurotransmitters; acetylcholine and its receptors; glutamate and its receptors (eps. AMPA receptors); GABA and glycine; biogenic amines (dopamine, histamine, serotonin); peptide neurotransmitters (substance P, opioid peptides).

Section 3.5. Molecular signaling within neurons

Outline: chemical signaling and different forms; three classes of signaling molecules; receptor types; channel-linked receptors; enzyme-linked receptors; G-protein-coupled receptors; G-proteins and their molecular targets; second messengers (Ca^{2+} , cyclic nucleotides, diacylglycerol and IP_3); protein kinases and phosphatases; CREB; c-fos.

Section 3.6. Synaptic plasticity

Outline: short-term synaptic plasticity; long-term synaptic plasticity; synaptic facilitation; synaptic depression; synaptic potentiation and augmentation; synaptic plasticity in *Aplysia*; synaptic mechanisms in *Aplysia*; long-term potentiation (LTP); long-term depression (LTD); mechanisms underlying LTP and LTD.

Part 4, Sensory System (10 h)

Section 4.1. Somatic sensory system

Outline: sensation and sensory processing; sensory transduction; somatic sensory afferents; two-point discrimination; mechanoreceptors for proprioception; central pathways conveying tactile information from the body---the dorsal column-medial lemniscal system; central pathways conveying proprioceptive information from the face; primary somatic sensory cortex; plasticity in the adult cerebral cortex.

Section 4.2. Pain

Outline: nociceptors; neuronal basis of pain; first and second pain; nociceptive axon subtypes; central pain pathways; nociceptive and mechanosensory pathways; sensitization; the placebo effect.

Section 4.3. Vision: the eye

Outline: retina; retinal circuitry; structure of retina; rods and cones; retinal pigment epithelium; phototransduction; retinoid cycle; light adaptation; functional specialization of rod and cone systems; differences in transduction mechanisms of rod and cone; anatomical distribution of rods and cones; cones and color vision; abnormalities of color vision; genetics of the cone pigments.

Section 4.4. The chemical senses

Subsection 4.4.1. Olfactory system

Outline: organization of the olfactory system; olfactory perception in humans; olfactory epithelium and olfactory receptor neurons; odor transduction; odorant receptor proteins; odorant receptor genes; physiological mechanisms of odor transduction; the olfactory bulb; cortical processing of olfactory information.

Subsection 4.4.2. Taste system

Outline: organization of the taste system; taste perception in humans; taste papillae and taste buds; tastants; peripheral innervation of the tongue; taste categories; taste receptor proteins and transduction.

Part 5, Brain Imaging Techniques and Complex Brain Functions (4 h)

Section 5.1. Brain imaging techniques

Outline: CT; MRI; functional brain imaging; PET; SPECT; fMRI.

Section 5.2. Association cortex and cognition

Outline: association cortex and cognition; cortical structure; unique features of the association cortices; contralateral neglect syndrome; cognition study in monkeys; temporal association cortex mediates recognition; frontal association cortex mediates planning and decision making.

Section 5.3. Sleep and wakefulness

Outline: some facts about sleep; why do humans sleep? circadian cycle of sleep and wakefulness; stages of sleep; neural circuits governing sleep; sleep disorders.

Part 6, Neuroscience journal club (8 h)

Outline: 1~2 students will be assigned with a most recent or classic scientific article in neuroscience. They will read carefully and then present this paper to the class.

教材 Textbooks:

Neuroscience, 5th ed., Dale Purves et al., Sinauer Associates

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		10		
小测验 Quiz				
课程项目 Projects		30		Neuroscience article reading, presentation and discussion
平时作业 Assignments				
期中考试 Mid-Term Test		20		
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.