

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	模式生物和发育生物学 Model organisms and developmental biology				
2.	授课院系 Originating Department	生物系 Department of Biology				
3.	课程编号 Course Code	BIO305				
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)				
6.	授课学期 Semester	春季 Spring				
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)	刘东/生物系, Dong Liu/Biology, liud@sustc.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)	不超过 40 人, not more than 40 persons				
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	48				48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	BIO103 生物学原理 Principles of Biology
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 None
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

模式生物是指那些能够揭示生命科学基本规律的物种。它们的生命周期较短，子代数量大，遗传研究工具齐全。现在绝大多数的生命科学研究是在模式生物中展开的。本课程讲授那些应用广泛的模式动物及其在发育生物学，即精子和卵子发生，受精，胚胎，个体，衰老（再生）死亡过程，研究中的作用。发育生物学是胚胎、解剖学与遗传学，细胞生物学和分子生物学相结合的产物。通过本课程学习学生们将在了解经典模式动物的基础上，整体理解发育、衰老/死亡，再生及演化的规律。

This is an introduction course to reveal the biological characteristics of model animals such as mouse, chick, zebrafish, Drosophila, C. elegans, and Sea urchin, and the great achievements using them to study developmental process, i.e., the generation of sperm and egg, fertilization, embryogenesis, growth, aging, and regeneration. The mechanisms of molecular gene regulation underlying the development and interpretation of developmental evolution will also be discussed.

16. **预达学习成果 Learning Outcomes**

希望同学们通过本门课的学习，了解经典模式生物的特性，学会根据不同的科学问题来选择合适的模式生物；掌握经典模式生物的发育过程，从整体（空间和时间）上理解发育的一般规律；培养独立思考的能力，对生命现象提出自己的想法；无障碍阅读与发育相关的文献。

Students are expected to learn common and featured biological characteristics of model animals (C. elegans, Drosophila, Xenopus, Zebrafish, Chick, Mouse), to select a proper model organism(s) in a specific project, and to apply general rules of development/embryogenesis to their own research and/or literature study. They should be able to read most research and review papers related to developmental 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.)

1. 课程总介绍 General Introduction (学时 Hours: 四小时 4h)

- 1). 课程及学科介绍 Introduction of developmental biology
- 2). 研究历史 (核移植, 转基因, 极地动物) 及演化意义 The developmental biology study history (nuclear transplant, transgenesis, adaptation of extreme weather, etc.) and developmental evolution

2. 早期发育 Early development (学时 Hours: 二十小时 20h)

- 1). 早期发育-1 (连体胚胎之谜) Early embryogenesis-1 (the mystery of conjoined twin)
- 2). 早期发育-2 (形态素及其作用机制, 半个世纪寻找诱导因子的努力及结果, 体轴的建立) Early embryogenesis-2 (morphogen, transduction of morphogen, establishing A-P and D-V axes of body, search for the inducers)
- 3). 神经发育-1 (神经诱导, 神经管 D-V 轴建立, 后脑分化-结节化) Neural development-1 (neural induction, D-V patterning in the neural tube, segmentation of the hindbrain)
- 4). 神经发育-2 (轴突导向的调节, 神经嵴和前基板外胚层构成了第四个胚层, 内耳的发育) Neural development-2 (Axon guidance, the 4th germ layer: the neural crest and pre-placodal ectoderm, the development of inner ear)
- 5). 中内胚层 (体节形成的机制, 心脏发育与再生) Mesoderm and endoderm (Development of somite, heart development and regeneration)
- 6). 中内胚层 (心血管发育, 其他内脏器官发育) Mesoderm and endoderm (Cardiovascular development, development of other internal organs)
- 7). 左右不对称发育 Left-right asymmetry

3. 模式动物 Model animals (学时 Hours: 五小时 5h)

- 1). 秀丽隐杆线虫 (历史, 研究优势, 诺奖级工作) Worm (History of *C.elegans*, research advantages of the worm, achievements of worm research)
- 2). 果蝇 (简介, 与脊椎动物的巨大差异和研究优势, 对分子遗传学和发育遗传学的贡献) Fly (Brief history, comparison with vertebrates, research advantages, contribution to molecular and developmental genetics)
- 3). 斑马鱼 (斑马鱼研究起源, 优势和劣势, 对发育生物学的贡献) Zebrafish (History of research, similarity and difference with frog models, contribution to developmental biology, recent exciting and convincing progress)

4. 肢体发育及再生 Limb development and regeneration biology (学时 Hours: 八小时 8h)

- 1). 肢体发育 (肢芽诱导、形成, 三个轴向的确定与发育/分化, 重要调节信号参与) Limb development process (Limb bud formation, establishing P-D, A-P and D-V axes of a limb and the underlying regulatory mechanisms, signaling molecules critical for the proper limb development)
- 2). 两栖类肢体再生研究 (再生现象, 研究方法的演进, 重要概念更新) Limb regeneration (Phenomenon of limb regeneration, novel research tools, conceptual changes)
- 3). 模式系统研究再生 (研究再生的经典与现代体统或动物, 调节再生的规律或基本原则, 细胞死亡与再生) Regeneration in model systems (Classical model animals and systems for regeneration study, general rules of regeneration, cell death and regeneration)
- 4). 再生与干细胞 (胚胎干细胞或全能细胞可以直接用于再生医学吗? 模式动物的研究结果可以直接用于再生医学研究)

吗?) Regeneration and stem cells (ES or iPS cells and regenerative medicine, can the research outcome in model systems be applied directly to regenerative medicine?)

5. 性别发育 Sex development (学时 Hours: 四小时 4h)

1). 性别决定 (性染色体及性别决定基因, 寻找人的 SRY 基因, 性别决定的两个层次) Sex determination (Sex chromosome, sex determination pathway/mechanism, search for sex determining gene in humans, primary and secondary sex determination)

2). 生殖与体细性别 (生殖细胞的性别是‘环境’决定的, 生殖细胞通过特殊途径决定体细胞性别) Germline and somatic sex development (Germ cell sex is regulated by somatic aspects, germ cell also determines somatic sex)

6. 基因组编辑 Genome editing (学时 Hours: 二小时 2h)

1). 发展历史 History

2). 应用 Application

3). 重编程 Re-programming

7. 细胞死亡语法与、再生 Development, regeneration and aging/death (学时 Hours: 二小时 2h)

1) 发育与再生中哪些时候需要细胞死亡? When does cell death occur in animal development/regeneration?

2) 有哪些死亡方式? What are the major types of cell death?

3) 细胞死亡与疾病 Cell death and diseases

8. 发育演化论 Developmental evolution (学时 Hours: 三小时 3h)

1) 动物发育图示及调控的保守性 Developmental patterning and its regulation at gene level are fairly conserved in evolution

2) 智人演化上成功的合理性 Why did Homo sapiens so succeed in evolution?

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

No textbooks! These are the reference books (注意: 没有指定课本! 以下三本参考书可根据自己的阅读习惯选择):

Developmental Biology, 11th edition, Gilbert and Barresi, 2016

Essential Developmental Biology, 3rd edition, JMW Slack, 2013

Principles of Developmental Biology, 5th edition, Wolpert, Tickle and Arias, 2015

最近发表于发育领域期刊上的文章 (国内或国外的研究人员, 或南科大教授实验室) 均会推荐给学生阅读 For the supplementary reading, recently published top journal papers by others either abroad or domestic, and by PIs of SUSTech will be recommended.

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
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出勤 Attendance	5		
课堂表现 Class Performance	5		
小测验 Quiz	30		
课程项目 Projects			
平时作业 Assignments			
期中考试 Mid-Term Test			
期末考试 Final Exam	50		
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)	Group presentation or short essay (10)		

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.