

## 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.	<b>课程名称 Course Title</b>	生物物理学基本原理 Basic principles of biophysics
2.	<b>授课院系 Originating Department</b>	生物系
3.	<b>课程编号 Course Code</b>	BIO347
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业选修课 Major Elective Courses
6.	<b>授课学期 Semester</b>	秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>授课教师、所属学系、联系方式 Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	闫凯歌, 助理教授, 生物系, +86-15010947087 YAN Kaige, Assistant Professor, Department of Biology, +86-15010947087
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	待公布 To be announced
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	

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	44			4 学生口头汇报 Student presentation	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	BIO201 生物化学 I (生物大分子) BIO201 Biochemistry (Macromolecules)				
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.					

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

生物物理学基本原理的教学目标是，帮助学生定量地理解生命活动，并向其介绍如何应用前沿的生物物理研究手段去研究生物大分子的特性和功能，拓展学生的科学研究视野，增加他们对生命科学研究手段的认识，从而帮助其建立更加完善的知识体系和坚实的科研基础。

The teaching objectives of the Basic principles of biophysics course are to help students understand life activities quantitatively and to introduce them to how to apply cutting-edge biophysical research tools to study the properties and functions of biological macromolecules, to expand their scientific research horizons, to increase their knowledge of life science research tools, and thus to help them build a more complete knowledge system and a solid research foundation.

#### 16. 预达学习成果 Learning Outcomes

通过教师的讲授、课堂讨论和课外资料的研读，学生可以习得关于蛋白质、DNA、RNA 物理化学特性测量和空间结构测定的方法，掌握量化进行生命科学研究的思想方法，熟悉以光谱学、核磁共振、电子显微学等几种常用的生物物理研究手段。培养学生独立思考、批判性思考、团队合作及进行主题演讲的能力。

Through lectures, class discussions, and extra-curricular materials, students will acquire methods for measuring the physicochemical properties and spatial structure of proteins, DNA, and RNA, master the approach to do life science research quantitatively, and become familiar with several common biophysical research tools such as spectroscopy, nuclear magnetic resonance, and electron microscopy. Students will develop the ability to think independently, think critically, work in teams, and give presentations on certain topics.

#### 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 Section 1	第1讲：生物物理学发展简介 (2学时) Lecture 1: Introduction of the development of biophysics (2 h)
第二部分 Section 2	生物大分子物理和化学特性的测量 (10 学时) Measurement of physical and chemical properties of biological macromolecules a. 光吸收和发射的本质 Nature of light absorption and emission b. 比尔-朗伯特定律 Beer-Lambert law c. 圆二色谱的基本原理

	<p>CD spectroscopy principles</p> <p>d. 拉曼光谱的基本原理 Raman spectroscopy basics</p> <p>e. 核磁共振的基本原理 NMR basics</p>
<p><b>第三部分</b> <b>Section 3</b></p>	<p>生物大分子的折叠和结构预测 (10 学时) Folding and structure prediction of biological macromolecules (10 h)</p> <p>a. 蛋白质的折叠 Protein folding spontaneously</p> <p>b. 分子伴侣和蛋白质降解 Chaperonin and protein degradation</p> <p>c. 蛋白质的结构预测 Protein structure prediction</p> <p>d. RNA 的二级结构预测 RNA secondary structure prediction</p>
<p><b>第四部分</b> <b>Section 4</b></p>	<p>生物大分子空间结构的测定 (12 学时) Structural determination of biological macromolecules</p> <p>a. X射线衍射的基本原理 X-ray diffraction basics</p> <p>b. TEM 的基础知识 Basics of TEM</p> <p>c. 单颗粒重构原理 Principles of single particle reconstruction</p> <p>d. 冷冻电镜断层成像原理 Cryo-EM tomography basics</p>
<p><b>第五部分</b> <b>Section 5</b></p>	<p>单分子技术及其应用 (6 学时) Single molecule techniques and their applications</p> <p>a. 原子力显微镜技术 AFM technique</p> <p>b. 光镊技术 Optical tweezers</p> <p>c. 单分子光谱技术 Single molecule spectroscopy</p>
<p><b>第六部分</b> <b>Section 6</b></p>	<p>荧光漂白恢复技术在液-液相分离研究中的应用 (4 学时) Applications of fluorescence recovery after photobleaching (FRAP) technique in liquid-liquid phase separation studies</p> <p>a. 荧光漂白恢复技术的原理 Fluorescence recovery after photobleaching (FRAP)</p> <p>b. 液-液相分离 Liquid-liquid phase separation</p> <p>c. FRAP 在液-液相分离中的应用 FRAP applications in LLPS</p>
<p><b>第七部分</b> <b>Section 7</b></p>	<p>演讲展示 (4 学时) Presentation (4 h)</p> <p>演讲展示 I (2 学时) Presentation I (2 h)</p> <p>演讲展示 II (2 学时) Presentation II (2 h)</p>

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

教材: 《生物物理学导论》第一版, Rodney M. J. Cotterill (John Wiley & Sons Ltd., England, 2002)  
Textbook: *Biophysics: An Introduction* (1<sup>st</sup> Edition) by Rodney M. J. Cotterill (John Wiley & Sons Ltd., England, 2002)

### 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	1-16 周 Week 1-16	10%	缺席扣 3 分, 迟到扣 1 分 3 points are deducted for absenteeism; 1 point is deducted for late attendance	
课堂表现 Class Performance	1-16 周 Week 1-16	5%	严重影响课堂纪律扣 5 分 5 points are deducted for serious disruption of class discipline	表现优秀者可获得加分, 最多加 5 分 Bonus points for outstanding performance, up to 5 points
小测验 Quiz	4-16 周 Week 4-16	15%	作弊一次扣 15 分 15 points are deducted for cheating once	分两次, 每次 15 分; 两次分数取平均值 Two times, each time 15 points; the average of the two scores
课程项目 Projects	N/A	N/A	N/A	N/A
平时作业 Assignments	4-16 周 Week 4-16	30%		根据课程讲授进度, 安排两次作业, 每次给两周的时间完成, 每次作业分数占比 15%。1) 读一篇文章, 根据要求作图或者制作视频, 以文本形式展示中间过程步骤; 2) 完成一次从序列分析到结构预测的全部流程, 并以文本形式记录中间过程。 According to the lecture schedule, two assignments will be arranged, each given two weeks to complete, with 15% of the marks for each assignment. 1) read an article, make figures or a video according to the requirements, and show the intermediate steps in text form; 2) complete the whole process from sequence analysis to structure prediction once, and record the intermediate processes in text form.
期中考试 Mid-Term Test	N/A	N/A	N/A	
期末考试 Final Exam	N/A	N/A	N/A	
期末报告 Final Presentation	15-16 周 Week 15-16	40%		介绍一种生物物理实验方法的原理及应用, 要求用英语完成。报告内容: 40%; PPT 制作: 25%; PPT 讲述: 25%; 交流问答: 10%。如有严重抄袭行为, 此项即为不及格。

			Presentation of the principles and applications of a biophysical experimental method. It is required to be completed in English. Content:40%; style: 25%; oral presentation: 25%; Q&A: 10%. If there is serious plagiarism, this will be a failing grade.
其它（可根据需要改写以上评估方式） <b>Others (The above may be modified as necessary)</b>			

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本科教学指导委员会审议通过。  
 This Course has been approved by Undergraduate Teaching Steering Committee of School of Life Sciences

