

## 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>	基因组学 Genomics
2.	<b>授课院系 Originating Department</b>	生物系 Department of Biology
3.	<b>课程编号 Course Code</b>	BIO350
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>	春季 Spring
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 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation &amp; Contact (For team teaching, please list all instructors)</b>	郑梅珍、生物系、电话 15800474108 Meizhen Zheng, Department of Biology, Phone: 15800474108
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 determined
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	无 None

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
	48				48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	BIO103 生物学原理和 BIO301 遗传学 Principles of Biology and Genetics				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	<p>基因组学是一门具有很强的理论性和实用性的交叉学科，对深化与开拓生命科学新的研究方向具有重大的意义。基因组学将引领 21 世纪现代生命科学。从源头上揭示生命的奥秘，必须从结构基因组学和功能基因组入手。本课程为生物系专业选修课，具备基础的生化知识、遗传学知识的学生均可选修本课程。</p> <p>Genomics is an interdisciplinary subject with strong theoretical and practicality, which is of critical meaning to deepen and open up new research directions in life sciences. Genomics would lead the development of modern life sciences in the 21<sup>st</sup> century. To uncover the mysteries of life from the origin, we must start with structural genomics and functional genomics. This course is a Major Elective Course in biology, and it is suitable for the students who have basic knowledge of biochemistry or genetics.</p>				
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

基因组学从结构基因组学和功能基因组入手，从源头上揭示生命的奥秘。该课程的教学目标：1. 了解基因组学的发展历史；2. 了解全基因组测序的策略、路线和方法；3. 熟悉基因组的结构及基因功能元件，以及功能元件的鉴定技术；4. 熟悉基因组的表观遗传与基因调控；5. 熟悉转录组及检测技术；6. 了解基因组学与转录组学的关系。通过结合研究实例，讲解基因组学的研究思路、原理、技术与方法，深入理解基因组学领域的最新进展及其对生命科学各领域的影响，进而从本质上理解生命的起源、变异与进化。

Genomics starts with structural genomics and functional genomics to uncover the mysteries of life from the origin. The aim is: (1) To understand the development history of genomics; (2) To understand the strategy, route, and method of whole genome sequencing; (3) To understand the structure of the genome, the functional elements and the identification techniques; (4) To understand the epigenetics and gene regulation; (5) To understand the transcriptome and associated techniques; (6) To understand the relationship between Genomics and transcriptomics. By using examples to explain research ideas, principles, techniques and methods of genomics, finally, in-depth understanding and familiarity with the latest developments in the field of genomics and their impact on various fields of life sciences. Furthermore, to understand the origin, mutation and evolution of life fundamentally.

#### 16. 预达学习成果 Learning Outcomes

学生会对基因组学有一个系统的了解。这主要包括：基因组的结构和功能；基因组学的研究方法；研究基因组结构与功能的技术手段与方法等。基因组学对理解当代生命科学中诸多极具突破性的技术革新和方法革新的理论基础有重要的指导性意义。

Students will have a systematic understanding of genomics. This mainly includes: the structure and function of the genome; the research methods of genomics; the technical strategies and methods to study the structure and function of the genome, etc. This would have important guiding significance for understanding the theoretical basis of many breakthrough technological innovations in contemporary life sciences.

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.)**

Lecture No.	讲座题目 Lecture Topic	学时 Hours	具体讲座内容 Lecture content
1	基因组学总体介绍 Introduction of Genomics	2 学时 2 hours	基因组学的概念 (The concept of Genomics) 基因组学的发展史 (The history of genomics)
2	人类基因组计划 Introduction of the Human Genome Project (HGP)	2 学时 2 hours	什么是人类基因组计划 What is the Human Genome Project (HGP) 人类基因组计划的研究历史 (The research history of HGP) 人类基因组计划的研究领域 (The research field of HGP)
3 Homework 1	二代基因组测序技术 Second-generation sequencing techniques	2 学时 2 hours	二代测序技术的种类 二代测序技术的原理 二代测序技术的应用 The type of second-generation sequencing methods The principle of second-generation sequencing methods The application of second-generation sequencing methods
4	三代基因组测序技术 Third-generation sequencing techniques	2 学时 2 hours	Nanopore PacBio Linked Read Sequencing – 10X Genomics Chromium Technology
5	基因组结构 The structure of genome	2 学时 2 hours	基因组的结构与大小 原核生物的基因组结构 真核生物的基因组结构 The structure and size of genome The genome structure of prokaryote The genome structure of eukaryote

6	基因组功能元件  The functional element of genome	2 学时  2 hours	基因组功能元件的定义  基因组功能元件的分类  The definition of genome functional elements  The classification of functional elements
7	基因组功能元件注释的进展阶段-1  The stage of the functional element annotation for genome	2 学时  2 hours	DNA 元件百科全书阶段 1 (Encode 1)  DNA 元件百科全书阶段 2 (Encode 2)
8	基因组功能元件注释的进展阶段-2  The stage of the functional element annotation for genome	2 学时  2 hours	DNA 元件百科全书阶段 3 (Encode 3)  DNA 元件百科全书阶段 4 (Encode 4)
9	染色质状态注释  The annotation of chromatin states	2 学时  2 hours	核小体 (Nucleosome)  常染色质 (Euchromatin)  异染色质(Heterochromatin)  染色质状态(Chromatin states)
10	染色质状态检测技术  The detecting techniques for chromatin states		DNase-seq  ATAC-seq
11 Homework 2	增强子、启动子、绝缘子注释与检测技术  The annotation and detection method for enhancer, promoter, and insulator	2 学时  2 hours	增强子 (Enhancer)  启动子 (Promoter)  绝缘子 (Insulator)  全基因组功能性调控元件的鉴定 (Genome-wide identification of regulatory elements)  ChIP-seq  STARR-seq
12	基因组远程交互  The long-range interactions of 3D Genome	2 学时  2 hours	三维基因组学概念介绍(The concept of 3D Genome)  三维基因组学发展历史 (The history of 3D Genome)
13	基因组交互技术	2 学时	3C

	The interaction techniques for 3D Genome	2 hours	4C Hi-C
14 Homework 3	特异因子介导的基因组远程交互技术  The interaction techniques for the specific factor mediated long-range interaction for 3D Genome	2 学时 2 hours	ChIA-PET  Long-read ChIA-PET
15	新一代基因组远程交互技术  The new generation of 3D Genome technology	2 学时 2 hours	SPRITE  ChIA-Drop
16	基因组表观遗传介绍-1  The introduction of Genomics & epigenetics	2 学时 2 hours	表观遗传的定义 (The definition of epigenetics )  DNA 甲基化及其检测技术 (DNA methylation and its detection techniques)
17	基因组表观遗传介绍-2  The introduction of Genomics & epigenetics	2 学时 2 hours	染色质结构与表观标记  Chromatin structure and histone marks
18	转录组  Transcriptome	2 学时 2 hours	转录组定义(The definition of transcriptome)  转录组对象(The object of transcriptome)  转录组优势(The advantage of transcriptome)
19 Homework 4	转录组相关技术  The techniques of transcriptome	2 学时 2 hours	基因芯片 (Microarray)  mRNA 测序 (mRNA sequencing)  Total RNA 测序 (Total RNA sequencing)
20	单细胞转录组  Single-cell transcriptome	2 学时 2 hours	单细胞转录组定义  单细胞转录组对象  单细胞转录组优势  The definition of single-cell transcriptome  The object of single-cell transcriptome

			The advantage of single-cell transcriptome
21	单细胞转录组相关技术  The techniques of single-cell transcriptome	2 学时  2 hours	10x genomics  SMART-seq2
22  Homework 5	基因组与转录组  Genome and transcriptome	2 学时  2 hours	基因组到转录组  基因组编码区序列变异影响转录组的表达谱  基因组非编码区序列变异影响转录组的表达谱  From genome to transcriptome  Sequence variations in coding region affect gene expression  Sequence variations in non-coding region affect gene expression
23	基因组学与肿瘤研究  Genomics and Cancer research	2 学时  2 hours	肿瘤的基因组图谱分析  The genomic landscape of cancer
24	综述基因组学的发展与应用  Write a review about the application and development of Genomics	2 学时  2 hours	

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

<p>参考教材：</p> <p>高等教育出版社出版的《基因组学》第3版或者第4版，杨金水编著。</p> <p>Introduction to Genomics (Second Edition) Author: Arthur M. Lesk 2012。</p> <p>基因组学概论（第二版）[美] A.M.莱斯克 著，薛庆中，胡松年 等译。</p>
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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		20		
平时作业 Assignments		30		
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		30		综述基因组学的应用与发展趋势 Write a review about the application and development of Genomics
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.