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**	医学生物信息学 Medical bioinformatics
2.	**授课院系 Originating Department**	医学院 School of Medicine
3.	**课程编号 Course Code**	MED232
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业选修课 Major Elective Courses
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）**	徐鹰 医学院 xuy9@sustech.edu.cn Ying Xu, School of Medicine, xuy9@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）**	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorial	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	无	无	无	48

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无/NA
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	无/NA
14.	其它要求修读本课程的学系 Cross-listing Dept.	无/NA

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程的教学目标旨在帮助学生获得计算生物学领域所需的知识和实际技能。学生将深入理解生物信息学及系统生物学的核心概念，包括生物序列分析、基因预测、蛋白质结构和功能预测、RNA 结构与功能预测、生物网络构建及分析、生存压力与生物演化、代谢重编程、及在生物医学方面的应用。他们将学会使用生物信息学及系统生物学工具来分析生物数据，解锁生物学中的重要问题。通过实际操作，他们将掌握生物信息学及系统生物学项目的技能。此外，学生将能够将所学知识和技能应用于解决实际的生物医学问题，理解生物信息学及系统生物学在生物医学学领域的重要性，以及学会有效地与同行合作和沟通。最重要的是，他们将培养批判性思维和问题解决技能，以及了解伦理和社会责任，使他们成为准备好解决当今复杂生物学问题的专业人士。

The teaching objective of this course is to help students acquire the knowledge and practical skills required in the field of computational biology. Students will gain a deep understanding of the core concepts of bioinformatics and systems biology, including biological sequence analysis, gene prediction, protein structure and function prediction, RNA structure and function prediction, biological network construction and analysis, survival pressure and biological evolution, metabolic reprogramming, and applications in biomedical fields. They will learn to use bioinformatics and systems biology tools to analyze biological data and unlock important issues in biology. Through practical operations, they will master the skills of bioinformatics and systems biology projects. In addition, students will be able to apply their knowledge and skills to solve practical biomedical problems, understand the importance of bioinformatics and systems biology in the field of biomedical science, and learn to effectively collaborate and communicate with peers. Most importantly, they will cultivate critical thinking and problem-solving skills, as well as an understanding of ethics and social responsibility, making them professionals prepared to solve today's complex biological problems.

16. 预达学习成果 Learning Outcomes

通过参加本课程，学生将实现多个学习成果。他们将深入研究生物信息学及系统生物核心概念，涵盖生物序列分析、基因预测、蛋白质结构预测和功能预测、RNA 结构与功能预测、生物网络构建及分析、生存压力与生物演化、代谢重编程、及在生物医学方面的应用，同时培养数据分析技能，能够熟练使用生物信息学和系统生物学工具进行实际操作。学生将通过实验和项目获得关键的生物信息学技能，培养跨学科合作的能力，以有效解决生物学问题。此外，他们将发展批判性思维和问题解决技能，关注伦理和社会责任，为应对生物信息学领域的职业或研究挑战做好准备。这门课程旨在全面培养学生的技能，使他们具备成功解决现代生物学和计算生物学领域复杂问题的综合能力。

By participating in this course, students will achieve multiple learning outcomes. They will delve into the core concepts of bioinformatics and systems biology, covering biological sequence analysis, gene prediction, protein structure and function prediction, RNA structure and function prediction, biological network construction and analysis, survival pressure and biological evolution, metabolic reprogramming, and applications in biomedical fields. At the same time, they will cultivate data analysis skills and be proficient in using bioinformatics and systems biology tools for practical operations. Students will acquire key bioinformatics skills through experiments and projects, cultivate the ability to collaborate across disciplines, and effectively solve biological problems. In addition, they will develop critical thinking and problem-solving skills, focus on ethics and social responsibility, and prepare for professional or research challenges in the field of bioinformatics. This course aims to comprehensively cultivate students' skills and equip them with the comprehensive ability to successfully solve complex problems in the fields of modern biology and computational 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.)

病理条件与生理条件下的生物学有质的不同，因为两者的基本化学微环境不同，导致细胞内的代谢方式不同；另外，疾病生物学的本质是：持续的压力应激生物学，包括：1、胞内外pH不同、重要电解质浓度不同、细胞膜电势不同；2、细胞持续在压力下生存；3、调控方式以表观调控、基因突变为主；4、普遍使用改变的代谢方式，称为代谢重编程；5、导致组学数据的解释会有不同。

There is a qualitative difference in biology between pathological and physiological conditions, as the basic chemical microenvironment of the two is different, leading to different metabolic modes within cells; In addition, the essence of disease biology is: the biology of sustained stress, including: 1. different intracellular and extracellular pH, different concentrations of important electrolytes, and different cell membrane potentials; 2. Cells continue to survive under pressure; 3. The main regulatory methods are epigenetic regulation and gene mutation; 4. The commonly used metabolic changes are called metabolic reprogramming; 5. The interpretation of omics data may vary.

Section	Topic	Hours
1	Course overview	2
2	Bio-sequence comparison I	2
3	Bio-sequence comparison II	2
4	Computational gene finding I	2
5	Computational gene finding II	2
6	Prediction of transcription regulatory binding sites I	2
7	Prediction of transcription regulatory binding sites II	2
8	Protein structure prediction I	2
9	Protein structure prediction II	2
10	Functional prediction of proteins	2
11	Comparative genome analysis I	2
12	Comparative genome analysis II	2
13	Non-coding RNA structures and gene finding I	2
14	Non-coding RNA structures and gene finding II	2
15	Gene co-expression network analysis	2
16	Metabolic network analysis I,II	2
17	Chemical Equilibrium Analysis: Oxidation-Reduction and pH	2
18	Chronic human diseases I: Cancer	2
19	Chronic human diseases II: AD	2
20	Chronic human diseases III: Diabetes	2
21	Stressors and stress response via genomic mutations, epigenetic regulation I	2

22	Stressors and stress response via genomic mutations, epigenetic regulation II	2
23	Metabolic reprogramming, I	2
24	Metabolic reprogramming II	2

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

待定

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%	10%	无
课堂表现 Class Performance	无	10%	10%	无
小测验 Quiz	无	无	无	无
课程项目 Projects	无	80%	80%	无
平时作业 Assignments	无	无	无	无
期中考试 Mid-Term Test	无	无	无	无
期末考试 Final Exam	无	无	无	无
期末报告	无	无	无	无

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