

## 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>	医学合成生物学 Medical Synthetic Biology
2.	<b>授课院系 Originating Department</b>	医学院 School of Medicine
3.	<b>课程编号 Course Code</b>	MED233
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 Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	何涟, 医学院, <a href="mailto:hel3@sustech.edu.cn">hel3@sustech.edu.cn</a> Lian He, School of Medicine, hel3@sustech.edu.cn
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	48	0	0	0	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无/None				
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

医学合成生物学是合成生物学的一个分支领域，它将合成生物学的原理和技术应用于医学研究、医疗诊断和治疗方面。通过这门课程的学习，让学生可以掌握合成生物学的基本原理和技术，了解该门学科在医学、药物开发、生命科学等领域中的应用，为后续的深造学习和科学研究奠定基础。

Medical synthetic biology is a subfield of synthetic biology that applies the principles and techniques of synthetic biology to medical research, healthcare diagnostics, and treatment. Through this course, students can gain a solid understanding of the fundamental principles and techniques of synthetic biology and explore its applications in fields such as medicine, drug development, and life science research. This knowledge serves as a foundation for further advanced studies and scientific research.

#### 16. 预达学习成果 Learning Outcomes

通过本课程的学习，达到以下目标：

1. 让学生学习和了解合成生物学的基础知识及前沿领域进展；
2. 提高学生逻辑思维能力；
3. 训练提高学生文献阅读和演讲能力。

"Through this course, the following objectives are achieved:

1. Enable students to learn and comprehend the fundamental knowledge of synthetic biology and recent advancements in the field.
2. Enhance students' logical thinking abilities.
3. Train students to improve their skills in reading scientific literature and delivering presentations

#### 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.)**

课程主要包括合成生物学的基本内容，包括生物部件、生物装置和生物系统。还涉及多方面的医学应用示例：新药发现和开发、精准医学、疫苗研究、细胞治疗和基因编辑、疾病诊断以及人工细胞和组织工程等。

The course primarily covers the fundamentals of synthetic biology, including biologically based parts, devices, and systems. It also includes various medical application examples, such as drug discovery and development, precision medicine, vaccine research, cell therapy and gene editing, disease diagnosis, as well as artificial cell and tissue engineering.

Section	Topic	Hours
1	<b>1. 合成生物学简介 Introduction to Synthetic biology</b>	0-3
2	<b>2. DNA 合成及基因编辑 DNA Synthesis and Genome Engineering</b> 2.1 DNA 的读和写 Reading and writing DNA 2.2 下一代基因组设计技术 Next-generation of genome design technologies	3-6
3	<b>2. DNA 合成及基因编辑 DNA Synthesis and Genome Engineering</b> 2.3 定点基因组编辑 Site-directed genome modification 2.4 基因编辑与疾病治疗 Genetic Engineering and treatment of diseases	6-9
4	<b>3. 蛋白表达和活性调控中的元件和线路 Parts and Devices Supporting Control of Protein Expression and Activity</b> 3.1 剪接和可选择性剪接对基因设计的影响 Splicing and alternative splicing impact on gene design 3.2 基于 RNA 干扰的配体控制遗传开关设计 Design of ligand-controlled genetic switches based on RNA interference 3.3 RNA 开关与病毒感受器 RNA switches and virus biosensor	9-12
5	<b>文献汇报 1 Presentation 1</b>	12-15
6	<b>3. 蛋白表达和活性调控中的元件和线路 Parts and Devices Supporting Control of Protein Expression and Activity</b> 3.4 小分子调控的 RNA 开关 Small molecule-responsive RNA switches 3.5 基因表达调控 Programming gene expression	15-18
7	<b>4. 基因回路 Gene circuits</b> 4.1 调控回路的合成学方法 The synthetic approach for regulatory circuits 4.2 合成基因网络 Synthetic gene networks	18-21
8	<b>5. 无细胞系统 Cell-free system</b> 5.1 无细胞蛋白合成 Cell-free protein synthesis 5.2 无细胞生物传感器 Cell-free biosensing 5.3 无细胞药物高通量筛选 Cell-free high throughput drug screening 5.4 无细胞环境污染检测及医学诊断 Cell-free environmental pollutants detection and medical diagnosis	21-24
9	<b>6. 合成生物学中的人工细胞 Artificial Cells in Synthetic Biology</b> 6.1 合成生物学中的底盘细胞 “Chassis” in Synthetic biology 6.2 人工细胞的组装与构建 Design and build of artificial cells 6.3 人工细胞与药物递送 Use of artificial cells as drug carriers	24-27
10	<b>7. 细胞治疗及应用 Cell Therapy and Applications</b> 7.1 细胞治疗原理 Principles of cell therapy	27-30

	7.2 细胞治疗种类 Types of cell Therapy	
11	文献汇报 2 Presentation 2	30-33
12	8. 合成生物学中的精准医疗 Precision medicine in synthetic biology 8.1 精准药物治疗 Precision medicine therapy 8.2 诊断工具开发及应用 Development and application of diagnostic tools	33-36
13	9. 疫苗研究和新药研发 Vaccine Research and New Drug Development 9.1 疫苗种类 Types of vaccine 9.2 肿瘤疫苗 Tumor vaccine	36-39
14	10. 医学光遗传学 Medical Optogenetics 10.1 免疫调控 Immunomodulation 10.2 程序性细胞死亡 Programmed cell death 10.3 基因编辑和转录调控 Genome engineering and transcriptional regulation	39-42
15	11. 医学化学遗传学 Medical Chemogenetics 11.1 化学遗传学模块 Chemogenetic modulators 11.2 DREADD 系统 Designer receptors exclusively activated by designer drugs (DREADD) 11.3 PSEM 系统 Pharmacologically selective effector molecules (PSEMs) 11.4 药物调控的基因治疗 Drug-controlled gene therapies	42-45
16	课程汇报及总结 Discussion, Presentation and Review	45-48

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

<p>1. Lee, Sang Yup, Jens Nielsen, and Gregory Stephanopoulos. Synthetic biology: parts, devices and applications. John Wiley &amp; Sons, 2018.</p> <p>2. 合成生物学, 李春, 化学工业出版社, 2020</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		30		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final		60 口头报告		

**Presentation**

其它（可根据需要  
改写以上评估方  
式）

**Others (The  
above may be  
modified as  
necessary)**

	Oral presentation		

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**