课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	**心血管疾病研究模型与药物研发前沿与技术 （ Cardiovascular Disease Animal Models and Cutting-Edge Drug Development Technologies）**
2.	**课程性质** **Compulsory/Elective**	研究生专业选修 (Elective)
3.	**开课单位** **Offering Dept.**	医学院
4.	**课程学分/学时** **Course Credit/Hours**	3/48
5.	**授课语言** **Teaching Language**	中英文双语
6.	**授课教师** **Instructor(s)**	王莹
7.	**开课学期** **Semester**	春
8.	**是否面向本科生开放** **Open to undergraduates or not**	否
9.	**先修要求** **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） 否

10. 教学目标
Course Objectives

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

- 掌握最新上市或处于临床试验阶段的各种类型心血管药物以及它们的药理作用；
- 了解心血管疾病治疗策略、递送技术和最新靶点研究进展，包括细胞治疗、ModRNA 技术以及人工外泌体治疗策略等；
- 掌握心血管药物研究领域的尖端技术，包括人工智能和体外临床试验等。

11. 教学方法
Teaching Methods

（如面向本科生开放，请注明区分内容。If the course is open to undergraduates, please indicate the difference.）

教学手段多样：采用多种教学手段，如 PPT 讲解、案例分析、课堂互动、显微操作上机示范以及 3D 打印实际操作等，使学生能够深入理解和掌握知识点。同时还可以通过在线课程、实验视频等方式，提供更加灵活和多样化的教学方式。

The teaching methods are diverse: it is necessary to use various teaching methods such as PPT lectures, case analysis, and classroom interaction to enable students to gain a deep understanding and mastery of the knowledge points. At the same time, more flexible and diverse teaching methods can be provided through online courses, experimental videos, and other means.

12. 教学内容
Course Contents
（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

Section 1 (3hr)	心血管药物研发史: Introduction of the course, scope & overview A. 课程概述 Contents of the course B. 心血管药物的历史概览 Overview of the History of Cardiovascular

	Drugs C. 心血管药物的研发流程 Cardiovascular Drug Discovery and Development Process D. 全球心血管药物研发现状 Current status of global cardiovascular development E. 心血管疾病治疗策略的演进 Evolution of Cardiovascular Disease Treatment Strategies
Section 2 (3hr)	心血管疾病与信号转导 Cardiovascular Disease and signalling transduction A. 心血管疾病与受体 Classification of ion channel receptors； B. 与受体相关的心血管药物：作用机制与药理作用 Structure and function of ion channel receptors； C. 靶向受体的最新心血管药物研究方向：Biased agonist and antagonist
Section 3 (3hr)	心血管疾病与肠道微生物 Cardiovascular Disease and Gut Microbiota A. 心肠相互作用（cardiogut interaction）； B. 代谢与代谢产物的影响. Influence of Metabolism and Metabolites； C. 微生物组与心脏功能 The Microbiome and Cardiac Function。
Section 4 (3hr)	肿瘤心脏病学 Cardio-Oncology A. 心脏疾病和癌症 Heart Disease and Cancer； B. 癌症患者心脏健康 Cardiac Health in Cancer Patients； C. 化疗药物和靶向治疗药物心脏毒性 Cardiotoxicity of Chemotherapy and Targeted Therapy Drugs。
Section 5 (3hr)	心血管病与表观遗传 Cardiovascular Disease and Epigenetics A. **表观遗传**学与心血管疾病的关系 The Relationship Between Epigenetics and Cardiovascular Disease B. 心血管三维基因组 Three-Dimensional Genome of the Heart C. 表观遗传学在心血管疾病预测和诊断中的应用 The Application of Epigenetics in Cardiovascular Disease Prediction and Diagnosis： D. 表观遗传学对心血管治疗的影响 The Impact of Epigenetics on Cardiovascular Disease Treatment：
Section 6 (3hr)	心血管药物研发常用动物模型：优势与缺陷 Commonly Used Animal Models in Cardiovascular Drug Development: Advantages and Limitations A. 小/大动物心脏病模型（LAD 结扎心肌梗死模型、心室肥厚模型等）Small/Large Animal Cardiac Disease Models (LAD Ligation Myocardial Infarction Model, Ventricular Hypertrophy Model, etc.) B. 动脉粥样硬化模型 Atherosclerosis Models C. 动脉瘤模型 Arterial Aneurysm Models
Section 7 (3hr)	心血管纳米医学与荧光共振能量转移成像技术 Cardiovascular Nanomedicine and Fluorescence Resonance Energy Transfer Imaging Technology A. 荧光共振能量转移成像介绍 Introduction to Fluorescence Resonance Energy Transfer Imaging。 B. 荧光共振能量转移成像在心血管研究中的应用：包括纳米尺度研

	究心血管系统生物分子的相互作用以及亚细胞定位的生物信号的区域化 Applications of Fluorescence Resonance Energy Transfer Imaging in Cardiovascular Research: Including Nano-Scale Study of Interactions of Cardiovascular System Biomolecules and Subcellular Localization of Regionalized Biological Signals。 C. 上机操作 Hands-on Operation。
Section 8 (3hr)	人工心脏与人工血管移植（ Artificial Heart and Artificial Blood Vessel Transplants）：3D print and beyond。 A. 机械心脏 vs 基因编辑后的人工心脏 Mechanical Heart vs. Gene-Edited Artificial Heart。 B. 合成 vs 自体人工血管. Synthetic vs. Autologous Artificial Blood Vessels。 C. 人工心脏与人工血管移植瓶颈与未来方向 Challenges and Future Directions in Artificial Heart and Artificial Blood Vessel Transplants。
Section 9 (3hr)	心血管药物研发中的中药现代化 Modernization of Traditional Chinese Medicine in Cardiovascular Drug Development A. 中药现代化药物疗效评估。现代医学研究方法用于评估中药在心血管疾病治疗中的疗效 Modernization of Traditional Chinese Medicine: Efficacy Assessment of Traditional Chinese Medicine in Cardiovascular Disease Treatment using Modern Medical Research Methods。 B. 中药的靶向治疗：中药与现代心血管药物相结合，实现靶向治疗 Targeted Therapy with Traditional Chinese Medicine: Combining Traditional Chinese Medicine with Modern Cardiovascular Drugs for Targeted Treatment。
Section 10 (3hr)	**心血管药物开发与人工智能 Cardiovascular Drug Development and Artificial Intelligence** A. 基于 AI 的心血管药物筛选和设计 AI-Based Cardiovascular Drug Screening and Design。 B. 基于 AI 的心血管疾病相关的生物标志物 AI-Based Biomarkers in Cardiovascular Disease。 C. AI 在个性化心血管医疗中的应用 AI Applications in Personalized Cardiovascular Healthcare。
Section 11 (3hr)	**心血管疾病与基因治疗** The Relationship between Inflammation and Signal Transduction A. CRISPR-CAS9 技术在心血管疾病中的应用与展望 Applications and Prospects of CRISPR-CAS9 Technology in Cardiovascular Diseases；

		B. CAT Cell Therapy 治疗心肌梗死的机制与临床实验进展 Mechanisms and Clinical Trial Progress of CAT Cell Therapy in Myocardial Infarction Treatment C. MicroRNA 与心血管疾病 Translation of MicroRNAs for CVD treatment。
	Section 12 (3hr)	**抗纤维化心血管药物研发** A. 心血管疾病与器官纤维 Cardiovascular Diseases and Organ Fibrosis； B. 器官纤维化信号通路与治疗靶点 Organ Fibrosis Signaling Pathways and Therapeutic Targets； C. 心血管抗纤维化药物临床实验进展 Clinical Advances in Cardiovascular Anti-Fibrotic Drug Development。
	Section 13 (3hr)	心血管系统靶向药物递送技术 A. AAV 治疗心脏病 （基础与临床）AAV-Based Therapy for Cardiovascular Diseases (Basic and Clinical); B. 以 ModRNA 为基础的心血管靶向递 ModRNA-Based Cardiovascular Targeted Delivery； C. 外泌体递送与心脏心血管疾病治疗 Exosome Delivery in the Treatment of Cardiovascular Diseases。
	Section 14 (4 hr)	心血管医药研发与诺贝尔奖 Cardiovascular Drug Development and Nobel Prize A. Andr é Fr éd éric Cournand、 Werner Forssmann 和 Dickinson W. Richards（Cardiac Catheterization and Chemical Investigation） B. Robert J. Lefkowitz 和 Brian K. Kobilka（ 2012 Nobel Prize in Chemistry Laureates for G-Protein-Coupled Receptors and Anti-Heart Failure Targets）
	Section 15 (3hr)	心血管药物研发热点展望 (Frontiers in the signalling transduction) A. 心脏再生 cardiac regeneration。 B. 射血分数保留型心衰与代谢重编程 （ Heart Failure with Preserved Ejection Fraction and Metabolic Reprogramming）。 C. 心脏衰老与表观遗传 （Cardiac Aging and Epigenetics）
	Section 16 (3hr)	学生文献汇报 Seminar A. SGLT2i 钠-葡糖转运蛋白 2 抑制剂的基础研究与临床研究进展 Basic Research and Clinical Advances of SGLT2i Sodium-Glucose Transporter 2 Inhibitors。

		B. sGC activator 的药理机制和临床应用 Pharmacological Mechanism and Clinical Applications of sGC Activators。 C. PDE 抑制剂治疗心衰的机制与临床应用 Mechanisms and Clinical Applications of PDE Inhibitors in Heart Failure Treatment。
3.	**课程考核** **Course Assessment**	
	（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。If the course is open to undergraduates, please indicate the difference.） 考查（**学期间每周考核和文献汇报**） 分数构成： 出勤 30%+小组讨论 10%+期末报告 60%	
14.	**教材及其它参考资料** **Textbook and Supplementary Readings**	
	《心血管药理学》 2021 年科学出版社出版；Cardiovascular Pharmacology Edited by Michael J. Antonaccio	