Syllabus for Foundation of Marine Pharmacology

“海洋药物学基础”教学大纲

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Course code/课程代码:	3422314
Course title/课程名称:	Foundation of Marine Pharmacology/海洋药物学基础
Credits/学分:	2
Hours per week/周学时:	4
Target students/面向学生:	International students/留学生
Prerequisites/预修课程:	None/无

1. INTRODUCTION/课程介绍

The oceans account for 71% of earthly landmass and are rich in marine organisms. Secondary metabolites with novel structures and unique bioactivity from marine organisms are important resources for the discovery and development of novel drugs or drug lead compounds for the treatment of major diseases. Marine Pharmacology is a newly developed cross-discipline that utilizes modern chemical and biological techniques to discover and develop novel drugs from marine biology. Marine Pharmacology has become a new field of pharmaceutical sciences and new drugs' research and development (R&D) in the 21th century. This course will focus on the introduction of: (1) the basic concept and history of Marine Pharmacology, (2) the methods for the research and development of marine drugs, (3) the major marine organism resources for the discovery and development of marine drugs, (4) the important marine drugs used in clinic and representative drug lead compounds, (5) the development trends and challenges in the research of marine drugs, and (6) the literatures and databases in the research field of marine drugs.

占地球 71%的海洋蕴藏着丰富的生物资源，其大量结构新颖和活性独特的次生代谢产物成为人类研究开发治疗重大疾病创新药物或药物先导化合物的重要资源。海洋药物学是应用现代化学和生物技术从海洋生物中发现和开发新药物的新兴交叉学科，成为 21 世纪药学科学和新药研究开发的新领域。本课程主要介绍：(1)海洋药物学的基本概念和发展简史，(2)海洋药物研究与开发的方法，(3)海洋药物研究的主要海洋生物资源，(4)临床使用的重要海洋药物和代表性的药物先导化合物，(5)海洋药物研究的发展趋势和挑战，(6)海洋药物研究的文献和数据库。

2. GENERAL AIMS & SPECIFIC LEARNING OUTCOMES/学习目标及可测量结果

2.1. General Aims/学习目标

Marine Pharmacology is one of the courses for the major of marine drug research. After the completion of this course, students should know: (1) what is the Marine Pharmacology? (2) why and how do we discover and develop novel marine drugs? (3) what are the clinic-used marine drugs and their chemical characteristics, efficacies and mechanisms of action? and (4) what is most recent progresses and the latest challenges in the research of marine drugs? This course

will enable students to acquire basic knowledge of Marine Pharmacology, to understand the significance of the discovery of innovative marine drugs for the treatment and prevention of major diseases, and to improve their interests and capabilities in the research and development of marine drugs.

海洋药物学是海洋药物研究的专业课程之一。通过课程的学习，学生应该掌握什么是海洋药物学？为什么要研究海洋药物？如何发现和开发新的海洋药物？临床使用的重要海洋药物及其它们的结构特征、功效和作用机制，海洋药物研究的最新进展和挑战。本课程的学习将助学生熟悉海洋药物学的基础知识，理解创新海洋药物的发现对重大疾病防治的重要意义，并提高他们对海洋药物研究与开发的兴趣和能力。

2.2. Specific Learning Outcomes/可测量结果

- Knowledge of the history and main research contents of Marine Pharmacology.
  熟悉海洋药物学的发展简史及其主要研究内容。
- Familiarity with the experimental designs and methods for the discovery and development of new marine drugs.
  熟悉发现和开发新的海洋药物的实验设计和实验方法。
- Familiarity with the major marine organism resources used for the discovery and development of new marine drugs.
  熟悉用于海洋药物发现和开发的主要海洋生物资源。
- Understanding of the structure characteristics, efficacies and mechanisms of action of the important clinic-used marine drugs and some representative lead compounds of marine drugs.
  了解临床使用的重要海洋药物和一些代表性海洋药物先导化合物的结构特点、功效和作用机制。
- Knowledge of the current status and major achievements in the research field of marine drugs as well as the future direction and strategy for the discovery and development of new marine drugs.
  了解海洋药物研究的现状、主要成就及其未来新的海洋药物研发的方向和策略。
- Familiarity with the literatures and databases in the area of Marine Pharmacology and the ability to search the related literatures.
  熟悉海洋药物学的文献和数据库，并有查找相关文献的能力。

3. COURSE REQUIREMENTS/课程要求

3.1. Teaching Method/授课方式

This course will be instructed by a combination of interactive lectures, student discussion, class assignment and homework, laboratory visiting, and student course topic presentation. Instruction will focus on both basic course knowledge and new technologies, methods and achievements, in combination with case studies, all aiming at developing student interest in the course of study.

课程采用教师课堂讲授和提问、学生讨论、学生课堂和课外作业、实验室参观实践和学生专题报告等多种形式相结合。教师在讲授课程的基本知识的同时，重点介绍课程发展的新技术、新方法和新成果，并结合案例教学，培养学生对课程学习的兴趣.

3.2. Grading /考核

The grade of each student will be determined based on the following:

Attendance: totally 16 times (2■8), 16 points;

Class interaction: class discussion, question and answer sessions, 14 points;

Class assignment and homework: 20 points;

Course topic presentation: 15 points;

Final examination: 35 points.

采用过程化和多元化的课程考核和评价，注重学生学习过程和综合能力的考核。成绩(满分 100 分)构成包括：

- 到课率：16 次 (2■8)，每次 1 分，共 16 分；
- 课堂互动：课堂讨论、课堂回答问题和提出问题情况，14 分
- 课堂课外作业情况：20 分；
- 学生课程主题报告：15 分；
- 期末考试成绩：35 分。

4. COURSE ARRANGEMENTS/教学安排

Week	Outline		Content	Hours	Teaching method
Week 1	1	Introduction	General information about the course, including course objectives, requirements, arrangement, and assessment.	4.0	Teaching, discussion, class assignment
	2	Interaction with students	Students introduce themselves and their own research fields.		
	3	Class assignment	Ask students six questions in order to assess that how much knowledge of Marine Pharmacology the students had.		
	4	Overview of Marine Pharmacology	1. What is the Marine Pharmacology? 2. The development history of Marine Pharmacology. 3. The research contents of Marine Pharmacology. 4. Significance of the discovery and development of marine drugs.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第一周	1	课程简介	课程教学要求与目标，课程安排，课程考核和成绩评定方法等。	4.0	课堂讲授，课堂讨论， 课堂作业
	2	学生自我介绍	学生介绍自己基本情况和研究领域。		
	3	课堂作业	通过六个问题，了解学生对课程基础知识的掌握情况。		
	4	海洋药物学概论	1. 什么是海洋药物学？ 2. 海洋药物学的发展历史。 3. 海洋药物学的研究内容。 4. 海洋药物研究和开发的重要意义。		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 2	1	Methodology for the research of marine drugs	1. Summary of the concept and method for the discovery and development of marine drugs. 2. Brief introduction of basic research, preclinical study, and clinical trial of marine drugs.	4.0	Review, teaching, class assignment
	2	Methodology for the research of marine drugs	1. Bioactive study of marine drugs. 2. Method introduction of extract and isolation of marine natural products.		
	3	Class assignment	Assignment for the extract and isolation of marine natural products.		
	4	Laboratory visiting	Visit the laboratory of Marine Drugs and develop familiarity with the equipments used for the extract and isolation of marine natural products.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**

第二周	1	海洋药物的研究方法	1. 海洋药物研究开发的基本思路和方法概述。 2. 简要介绍海洋药物的基础研究、临床前研究和临床研究。	4.0	提问式复习，课堂讲授，课堂作业
	2	海洋药物的研究方法	1. 海洋药物的生物活性研究。 2. 海洋天然产物提取分离方法的介绍。		
	3	课堂作业	海洋天然产物提取分离的作业。		
	4	实验室参观实际	参观海洋药物实验室，熟悉海洋天然产物提取分离所用的仪器设备及其使用方法。		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 3	1	Methodology for the research of marine drugs	1. How to elucidate the structures of marine natural products? 2. Application of HRMS, IR, UV, optical rotation, ECD, X-ray diffraction, and chemical degradation on the structural determination of the marine natural products.	4.0	Teaching, discussion, class assignment, homework
	2	Methodology for the research of marine drugs	Application of NMR on the structural elucidation of the marine natural products.		
	3	Methodology for the research of marine drugs	Application of NMR on the structural elucidation of the marine natural products.		
	4	Class assignment	Determine the structures of marine natural products through a combination of various methods.		
	5	Homework	Start to prepare the course topic presentation.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第三周	1	海洋药物的研究方法	1. 如何鉴定海洋天然产物的化学结构？ 2. 高分辨质谱、红外光谱、紫外光谱、旋光光谱、ECD 谱、单晶 X 射线衍射和化学降解等在海洋天然产物结构鉴定方面的应用。	4.0	课堂讲授，课堂讨论， 课堂作业， 课外作业
	2	海洋药物的研究方法	核磁共振在海洋天然产物结构鉴定方面的应用。		
	3	海洋药物的研究方法	核磁共振在海洋天然产物结构鉴定方面的应用。		
	4	课堂作业	综合运用各种方法来鉴定海洋天然产物的化学结构。		
	5	课外作业	开始准备课程主题报告		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 4	1	Marine organism resources	1. Introduction of marine animal resources used for discovery and development of marine drugs, mainly including sponges, coelenterates, molluscs, bryozoans, urochordates, and echinoderms. 2. How to identify sponges? Sponge barcoding project, http://www.spongebarcoding.org	4.0	Review, teaching, class assignment, homework

			and Barcoding Sponges: An overview based on comprehensive sampling, PLoS One, 2012, 7(7): e39345。		
	2	Marine organism resources	Introduction of marine plant resources used for the discovery and development of marine drugs, including marine algae, mangrove flora and seagrass.		
	3	Class assignment	Read review articles about marine plant resources: (1) Natural products from true mangrove flora: source, chemistry and bioactivities, Natural Product Reports, 2008, 25: 955-981; (2) Natural products from semi-mangrove flora: source, chemistry and bioactivities, Natural Product Reports, 2009, 26: 281-298; (3) Secondary metabolites of seagrasses (Alismatales and Potamogetonales; Alismatidae): Chemical diversity, bioactivity, and ecological function, Phytochemistry, 2016, 124: 5-28.		
	4	Homework	Continue to read the review articles and students will be asked to discuss article content.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第 4 周	1	海洋生物资源	1. 海洋动物资源：主要介绍用于海洋药物研究和开发的海绵动物、腔肠动物、软体动物、苔藓动物、尾索动物和棘皮动物资源。 2. 海绵的鉴定：Sponge barcoding project, http://www.spongebarcoding.org and Barcoding Sponges: An Overview Based on Comprehensive Sampling, PLoS One, 2012, 7(7): e39345。	4.0	课程复习，课堂讲授，文献阅读，课外作业
	2	海洋生物资源	海洋植物资源：主要介绍用于海洋药物研究和开发的海洋植物资源，包括海藻、红树林和海草资源。		
	3	课堂作业	海洋植物资源的文献阅读：(1) Natural products from true mangrove flora: source, chemistry and bioactivities, Natural Product Reports, 2008, 25: 955-981; (2) Natural products from semi-mangrove flora: source, chemistry and bioactivities, Natural Product Reports, 2009, 26: 281-298; (3) Secondary metabolites of seagrasses (Alismatales and Potamogetonales; Alismatidae): Chemical diversity, bioactivity, and ecological function, Phytochemistry, 2016, 124: 5-28.		
	4	课外作业	继续阅读文献，下堂课学生讲解文献主要内容。		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 5	1	Student presentation	Students present the content of the review articles.	4.0	Review, student

	2	Marine organism resources	Introduction of marine actinomycete and fungus resources used for the discovery and development of marine drugs.		presentation, teaching
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第 5 周	1	学生讲解	学生讲解文献的主要内容。	4.0	课程复习，学生讲解阅读的文献， 课程讲授
	2	海洋生物资源	海洋微生物资源：重点介绍用于海洋药物研究和开发的海洋放线菌和真菌资源。		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 6	1	Clinic-used marine drugs	Introduction of clinic-used marine drugs, including their origin, structural characteristic, efficacy, mechanism of action, and history of discovery and development.	4.0	Review, teaching, homework
	2	Lead compounds of marine drugs	Introduction of important lead compounds of marine drugs, including their origin, structural characteristic, and bioactivity.		
		Marine Chinese Materia Medica	Introduction of commonly used Marine Chinese Materia Medica		
	3	Homework	Complete the course topic report and prepare presentation in the next week.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第 6 周	1	临床用海洋药物	介绍目前临床使用的海洋药物，包括来源、结构特点、功效、作用机制和研究开发的历史等。	4.0	复习， 课堂讲授， 课外作业
	2	海洋药物先导化合物	介绍重要的海洋药物先导化合物，包括来源、结构特点和生物活性等。		
	3	海洋中药	介绍我国常用的海洋中药。		
	4	课外作业	完成课程主题报告，准备下周的课堂报告。		
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 7	1	Course topic report by students	Students present their course topic reports (including question and answer from the teacher and other students). The grade of the presentation is given by both students (50%) and teacher (50%).	4.0	Presentation and discussion
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第 7 周	1	学生课程专题报告	学生逐一展示各自的专题报告，其他同学就报告内容进行提问和讨论，老师总结，学生和老师共同打分，各占 50%。	4.0	课堂交流讨论
Week	**Outline**		**Content**	**Hours**	**Teaching method**
Week 8	1	Literature and databases in the research field of marine drugs	Introduction of the major literature and databases in the research area of marine drugs.	4.0	Teaching, discussion
	1	Review and summary	Review the whole course and create summary.		
	2	Discussion	Class discussion to receive feedback and		

			suggestions for improvements from students.		
教学周	**教学单元**		**内容提要**	**学时数**	**授课方式**
第 8 周	1	海洋药物研究的文献和数据库	介绍与海洋药物研究和开发的主要文献和数据库	4.0	课堂讲授，课堂交流讨论
	2	课程回顾	对整个课程内容进行复习和总结。		
	3	课堂讨论	通过交流讨论，了解学生对本课程的建议。		

References/参考教材及相关资料

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3. 中华海洋本草，管华诗 王署光 主编，上海科技出版社，2009 年。
4. Blunt JW, Carroll AR, Copp BR, Davis RA, Keyzers RA, Prinsep MR. Marine natural products. *Natural Product Reports*, 2018, 35: 8–53.
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Website/课程教学网站

http://oc.zju.edu.cn/lxspy/hyywxjc