

极端环境生命过程（OCE411）课程大纲

2018 秋季学期——2021 春季学期.....	2
2021 秋季学期起	8

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	极端环境生命过程 Life in Extreme Environments
2.	授课院系 Originating Department	海洋科学与工程系 Department of Ocean Science and Engineering
3.	课程编号 Course Code	OCE411
4.	课程学分 Credit Value	2
5.	课程类别 Course Type	专业选修课 Elective Course
6.	授课学期 Semester	秋季学期 (Fall)
7.	授课语言 Teaching Language	双语授课 (Bilingual teaching)
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)	张传伦 海洋科学与工程系 创园 9 栋 601 0755-88018785 Prof. Chuanlun Zhang Department of Ocean Sciences and Engineering Wisdom Valley-6-301 0755-88018785
9.	实验员/助教、所属学系、联系方式 (请列出本课所有教辅人员) Tutor/TA(s), Contact (Please list all)	范陆 前沿与交叉技术科学研究院 慧园 6 栋 303 0755-88018796 Dr. Lu Fan Academy for Advanced Interdisciplinary Studies - Ocean-X Wisdom Valley-6-303 0755-88018796
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 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	32	0	0	0	32

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	OCE302 海洋生态系统导论 Introduction to Marine Ecosystem				
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14.	其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15.	教学目标 Course Objectives
	<p>微生物在地球环境中无处不在，在维持地球生态功能稳定方面发挥着重要作用。然而，只有一小部分微生物种群被人类所认识。这节课将会介绍各种已被人类发现的生活在极端环境下的独特生命形式，并对其意义进行讨论。</p> <p>Microorganisms are ubiquitous and play important roles in maintaining the ecological functions of our planet. Yet, only a small fraction of the microbial populations has been identified. This course will introduce students all sorts of extreme environments where unique life forms have been unexpectedly found. The implications of such novel organisms will also be discussed.</p>
16.	预达学习成果 Learning Outcomes
	<p>能力方面：具有自主学习的能力和终身学习的意识；具有获取有关专业信息的能力，掌握中外文资料查询、文献检索及运用现代信息技术获取和表达信息的基本方法；具有不断学习和适应社会发展的能力。</p> <p>知识方面：系统掌握极端环境生命的基本理论、基本知识和基本技能，了解海洋科学的知识体系和发展趋势；了解极端环境生命的前沿发展现状和趋势。掌握一门外国语及基本的信息技术；具备一定的人文和社会科学知识。</p> <p>The students will gain the ability of self-motivated study for their life-time; they will be able to obtain international scientific experience, writing papers using modern information technology, and have the potential of continuous study and adaptation to the development of the society.</p> <p>They will master basic theories and skills of Life in Extreme Environments, understand the science at the geological and biological frontiers, and trends in different marine ecosystems. They will develop skills in English as a foreign language, gain basic information and technology, and obtain certain background in humanities and social sciences.</p>

17. 课程内容及教学日历（语言与授课语言一致，例：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. In consistency with instructional language. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

1. 前言（2学时）

Introduction (2 hours)

极端环境生命的存在形式、研究意义、研究历史、发展趋势及和国内外研究现状

Occurrence of life in extreme environments, significance of research, history and trend of development, international and domestic status of research.

2. 极端环境基础（2学时）

Fundamentals of Extreme Environments (2 hours)

极端环境定义、位置分布、类型、物理化学特征、形成、演化、生命存在的可能性

Definition of extremely environment, global distribution and classification, chemical and physical feature, formation and evolution, the possibilities for life.

3. 热泉生命（2学时）

Life in Hot Springs (2 hours)

热泉定义、类型及特征、嗜热微生物、代谢功能、适应机制、生态意义、开发潜力

Definition of hot spring, the variety and diversity of hot springs, thermophiles, metabolic function, adaptive mechanism, ecological significance and economic potential.

4. 大洋中脊生命（2学时）

Life at Mid-Ocean Ridges (2 hours)

大洋中脊概述、海底热液喷口、生态系统、适应机制、生态意义、经济意义

Overview of Mid-Ocean Ridges, hydrothermal vents, ecosystem, adaptive mechanism, ecological significance and economic potential.

5. 寒冷深海生命（天然气水合物）（2学时）

Life in the Cold Deep Ocean (Gas Hydrate Communities) (2 hours)

深海概况、天然气水合物、水化学、甲烷厌氧氧化古菌、代谢功能、适应机制、生物标志化合物、开发潜力

Overview of deep ocean, gas hydrate, hydrochemistry, anaerobic methanotrophic archaea,

metabolic function, adaptive mechanism, ecological significance and economic potential of gas hydrate communities.

6. 碱性湖生命 (2 学时)

Life in Soda Lake (2 hours)

碱性湖定义、水化学、嗜盐微生物代谢功能、适应机制、开发潜力

Overview of soda lake, hydrochemistry, metabolic function, adaptive mechanism, ecological significance and economic potential of halophilic microorganisms.

7. 嗜酸生命 (酸性矿物排水) (2 学时)

Life in Acid (Acid Mine Drainage) (2 hours)

酸性环境特征与分布、嗜酸微生物代谢功能、适应机制、开发潜力

Characteristic and distribution of sour environment, metabolic function, adaptive mechanism, ecological significance and economic potential of acidophilic microorganisms.

8. 矿物和微生物 (2 学时)

Minerals and Microbes (2 hours)

生物矿物与非生物矿物、微生物矿化意义与机制、趋磁细菌、

Biotic mineral and abiotic mineral, mechanism of biomineralization, magnetotactic bacteria

9. 极地海洋生命 (2 学时)

Life in Polar Oceans (2 hours)

极地海洋概况、嗜冷微生物、生理生态、潜在价值

Overview of polar ocean, definition of psychrophile, physiology and ecology, economic potential

10. 嗜盐生命 (2 学时)

Life in Salts (2 hours)

嗜盐微生物定义、分布、分离培养、系统发育

Definition of halophilic microorganism, distribution, isolation and cultivation, phylogeny

11. 在三重极端条件下生长的微生物 (2 学时)

Grow Microbes Under Triple Extreme Conditions (2 hours)

嗜极微生物、研究历史、特征、生态、应用潜力

Extremophiles, history of research, characteristics, ecology, economic potential

12. “地狱”生命（深地底）（2学时）

Life in “Hell” (Deep Subsurface) (2 hours)

深部地层概况、研究方法、深部生物圈、共生作用、产甲烷菌和硫酸盐还原菌

Overview of deep subsurface, research technique, deep biosphere, mutualism of methanogenic archaea and sulfate reduction bacteria

13. 了解碳的年龄（2学时）

Knowing the Age of Carbon (2 hours)

同位素定年概况，放射性碳同位素定年、应用及存在问题

Overview of isotopic dating, radiocarbon dating, applications and questions

14. “天堂”生命（外星生命的可能性）（2学时）

Life in “Heaven” (Possibility of Extraterrestrial Life) (2 hours)

地外行星分类、类地行星环境、生命所需条件、可能的存在形式

Classification of planet, terrestrial planets, essential conditions for life, possibility of life forms

15. 有机溶剂生命（微生物在酿酒过程中的作用）（2学时）

Life in Organic Solvents (2 hours)

有机溶剂对微生物的影响、微生物发酵、代谢产物

Consequences of organic solvents to microbe, microbial fermentation, metabolite

16. 学生报告（2学时）

Student Presentations (2 hours)

关于极端环境生命种类、研究方法、特点、差异、新陈代谢、应用等进行选择性介绍

Introduction of extremely environmental life, classification, research methods, characteristic, difference, metabolism or applications.

18.	教材及其它参考资料 Textbook and Supplementary Readings
	Extremophiles: Where It All Began. Authors: Horikoshi, Koki. 2016. ISBN 978-4-431-55408-0

教学评估 ASSESSMENT					
19.	评估形式 Type of Assessment	评估所需时间 Duration	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
	出勤 Attendance		0		
	课堂表现 Week Performance		0		
	小测验 Quiz		0		
	课程项目 Projects		0		
	平时作业 Assignments		30		
	期中考试 Mid-Term Test		25		
	期末考试 Final Exam		30		
	期末报告 Final Presentation		15		
	其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)				

课程审批 REVIEW AND APPROVAL	
20.	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
	海洋科学与工程系本科教学委员会 Department of Ocean Science and Engineering Undergraduate Committee

课程详述

COURSE SPECIFICATION

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6.	授课学期 Semester	秋季学期 (Fall)
7.	授课语言 Teaching Language	双语授课 (Bilingual teaching)
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)	范陆 海洋科学与工程系 工学院南楼 402 0755-88011400 Prof. Lu Fan Department of Ocean Sciences and Engineering College of Engineering South Tower 402 0755-88011400
9.	实验员/助教、所属学系、 联系方式 (请列出本课所 有教辅人员) Tutor/TA(s), Contact (Please list all)	
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 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	32	0	0	0	32

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

教学大纲及教学日历 SYLLABUS

15.	教学目标 Course Objectives
	<p>微生物在地球环境中无处不在，在维持地球生态功能稳定方面发挥着重要作用。然而，只有一小部分微生物种群被人类所认识。这节课将会介绍各种已被人类发现的生活在极端环境下的独特生命形式，并对其意义进行讨论。</p> <p>Microorganisms are ubiquitous and play important roles in maintaining the ecological functions of our planet. Yet, only a small fraction of the microbial populations has been identified. This course will introduce students all sorts of extreme environments where unique life forms have been unexpectedly found. The implications of such novel organisms will also be discussed.</p>
16.	预达学习成果 Learning Outcomes
	<p>能力方面：具有自主学习的能力和终身学习的意识；具有获取有关专业信息的能力，掌握中外文资料查询、文献检索及运用现代信息技术获取和表达信息的基本方法；具有不断学习和适应社会发展的能力。</p> <p>知识方面：系统掌握极端环境生命的基本理论、基本知识和基本技能，了解海洋科学的知识体系和发展趋势；了解极端环境生命的前沿发展现状和趋势。掌握一门外国语及基本的信息技术；具备一定的人文和社会科学知识。</p> <p>The students will gain the ability of self-motivated study for their life-time; they will be able to obtain international scientific experience, writing papers using modern information technology, and have the potential of continuous study and adaptation to the development of the society.</p> <p>They will master basic theories and skills of Life in Extreme Environments, understand the science at the geological and biological frontiers, and trends in different marine ecosystems. They will develop skills in English as a foreign language, gain basic information and technology, and obtain certain background in humanities and social sciences.</p>

17. 课程内容及教学日历（语言与授课语言一致，例：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. In consistency with instructional language. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

1. 前言（2学时）

a) Introduction (2 hours)

b) 极端环境生命的存在形式、研究意义、研究历史、发展趋势及和国内外研究现状

c) Occurrence of life in extreme environments, significance of research, history and trend of development, international and domestic status of research.

2. 极端环境基础（2学时）

a) Fundamentals of Extreme Environments (2 hours)

b) 极端环境定义、位置分布、类型、物理化学特征、形成、演化、生命存在的可能性

c) Definition of extremely environment, global distribution and classification, chemical and physical feature, formation and evolution, the possibilities for life.

3. 热泉生命（2学时）

a) Life in Hot Springs (2 hours)

b) 热泉定义、类型及特征、嗜热微生物、代谢功能、适应机制、生态意义、开发潜力

c) Definition of hot spring, the variety and diversity of hot springs, thermophiles, metabolic function, adaptive mechanism, ecological significance and economic potential.

4. 大洋中脊生命（2学时）

a) Life at Mid-Ocean Ridges (2 hours)

b) 大洋中脊概述、海底热液喷口、生态系统、适应机制、生态意义、经济意义

c) Overview of Mid-Ocean Ridges, hydrothermal vents, ecosystem, adaptive mechanism, ecological significance and economic potential.

5. 寒冷深海生命（天然气水合物）（2学时）

a) Life in the Cold Deep Ocean (Gas Hydrate Communities) (2 hours)

b) 深海概况、天然气水合物、水化学、甲烷厌氧氧化古菌、代谢功能、适应机制、生物

标志化合物、开发潜力

- c) Overview of deep ocean, gas hydrate, hydrochemistry, anaerobic methanotrophic archaea, metabolic function, adaptive mechanism, ecological significance and economic potential of gas hydrate communities.

6. 碱性湖生命 (2 学时)

- a) Life in Soda Lake (2 hours)
- b) 碱性湖定义、水化学、嗜盐微生物代谢功能、适应机制、开发潜力
- c) Overview of soda lake, hydrochemistry, metabolic function, adaptive mechanism, ecological significance and economic potential of halophilic microorganisms.

7. 嗜酸生命 (酸性矿物排水) (2 学时)

- a) Life in Acid (Acid Mine Drainage) (2 hours)
- b) 酸性环境特征与分布、嗜酸微生物代谢功能、适应机制、开发潜力
- c) Characteristic and distribution of sour environment, metabolic function, adaptive mechanism, ecological significance and economic potential of acidophilic microorganisms.

8. 矿物和微生物 (2 学时)

- a) Minerals and Microbes (2 hours)
- b) 生物矿物与非生物矿物、微生物矿化意义与机制、趋磁细菌、
- c) Biotic mineral and abiotic mineral, mechanism of biomineralization, magnetotactic bacteria

9. 极地海洋生命 (2 学时)

- a) Life in Polar Oceans (2 hours)
- b) 极地海洋概况、嗜冷微生物、生理生态、潜在价值
- c) Overview of polar ocean, definition of psychrophile, physiology and ecology, economic potential

10. 嗜盐生命 (2 学时)

- a) Life in Salts (2 hours)
- b) 嗜盐微生物定义、分布、分离培养、系统发育

- c) Definition of halophilic microorganism, distribution, isolation and cultivation, phylogeny
11. 在三重极端条件下生长的微生物 (2 学时)
- a) Grow Microbes Under Triple Extreme Conditions (2 hours)
- b) 嗜极微生物、研究历史、特征、生态、应用潜力
- c) Extremophiles, history of research, characteristics, ecology, economic potential
12. 12.“地狱”生命 (深地底) (2 学时)
- a) Life in “Hell” (Deep Subsurface) (2 hours)
- b) 深部地层概况、研究方法、深部生物圈、共生作用、产甲烷菌和硫酸盐还原菌
- c) Overview of deep subsurface, research technique, deep biosphere, mutualism of methanogenic archaea and sulfate reduction bacteria
13. 了解碳的年龄 (2 学时)
- a) Knowing the Age of Carbon (2 hours)
- b) 同位素定年概况, 放射性碳同位素定年、应用及存在问题
- c) Overview of isotopic dating, radiocarbon dating, applications and questions
14. “天堂”生命 (外星生命的可能性) (2 学时)
- a) Life in “Heaven” (Possibility of Extraterrestrial Life) (2 hours)
- b) 地外行星分类、类地行星环境、生命所需条件、可能的存在形式
- c) Classification of planet, terrestrial planets, essential conditions for life, possibility of life forms
15. 有机溶剂生命 (微生物在酿酒过程中的作用) (2 学时)
- a) Life in Organic Solvents (2 hours)
- b) 有机溶剂对微生物的影响、微生物发酵、代谢产物
- c) Consequences of organic solvents to microbe, microbial fermentation, metabolite
16. 学生报告 (2 学时)
- a) Student Presentations (2 hours)

	<p>b) 关于极端环境生命种类、研究方法、特点、差异、新陈代谢、应用等进行选择性介绍</p> <p>c) Introduction of extremely environmental life, classification, research methods, characteristic, difference, metabolism or applications.</p>
18.	教材及其它参考资料 Textbook and Supplementary Readings
	Extremophiles: Where It All Began. Authors: Horikoshi, Koki. 2016. ISBN 978-4-431-55408-0

教学评估 ASSESSMENT					
19.	评估形式 Type of Assessment	评估所需时间 Duration	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
	出勤 Attendance		0		
	课堂表现 Week Performance		0		
	小测验 Quiz		0		
	课程项目 Projects		0		
	平时作业 Assignments		50		
	期中考试 Mid-Term Test		0		
	期末考试 Final Exam		50		
	期末报告 Final Presentation		0		
	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
	<input checked="" type="checkbox"/> A. 十三级等级制 Letter Grading <input type="checkbox"/> 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

海洋科学与工程系本科教学委员会

Department of Ocean Science and Engineering Undergraduate Committee