OCES 4202 Marine Biotechnology (3 credits)

Course Instructor

Prof. Qinglu Zeng

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Office hours: Office hours are not fixed, and students are encouraged to contact the instructor by email/phone or ask questions after the lectures.

Class Time

Tuesday and Thursday, 1:30 pm – 2:50 pm

Classroom 5508 (lift 25/26)

Course Description

Ocean is the largest ecosystem on the planet and it contains more than 80% of current living organisms. Having a high biodiversity, the marine ecosystem is considered as a huge reservoir of various active compounds. Biotechnology is a powerful tool to utilize the valuable resources provided by marine organisms. This course introduces the current development and future directions of marine biotechnology. Students will learn the diversity of marine organisms, their bioactive compounds and production methods.

Textbooks: Springer Handbook of Marine Biotechnology

https://link.springer.com/book/10.1007/978-3-642-53971-8

Course Intended Learning Outcomes

1. Understand the basic concepts and principles of biotechnology
2. Describe the biodiversity of marine organisms and their ecological functions
3. Evaluate the production process of bioactive compounds
4. Recognize the importance of marine biotechnology to sustain our society
5. Propose new methods for the utilization of novel marine compounds

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments

Assessment Task	Contribution to Overall Course grade (%)	Due Date
Mid-term examination	30%	March 11 2025*
Project report	20%	April 8 2025*
Presentation	20%	May 8 2025*
Final examination	30%	To be announced

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Mid-term examination	ILO1, ILO2, ILO3	This task assesses students' ability to understand the basic concepts (ILO 1), describe the functions of marine organisms (ILO 2), and evaluate the various biotechnology processes (ILO 3).
Project report	ILO2	This task assesses students' ability to use bioinformatics tools to describe the genetic diversity and functions of marine organisms (ILO 2).
Presentation	ILO4, ILO5	This task assesses students' ability to recognize the importance of marine biotechnology (ILO4) and propose new methods to use novel marine compounds (ILO5).
Final examination	ILO1, ILO2, ILO3	This task assesses students' ability to understand the basic concepts (ILO 1), describe the functions of marine organisms (ILO 2), and evaluate the various biotechnology processes (ILO 3).

Grading Rubrics

Mid-term and final examinations:

In each exam, there are five assay questions, with 20 points for each question (100 points in total). The mid-term exam will cover lectures from "Introduction to marine biotechnology" to "Transgenic technology in marine organisms II". The final exam will cover lectures from "Marine metagenomics I" to "Coral engineering" and the guest lecture will not be covered.

Project report:

1. Totally 100 points for this report.

2. Read the UniProtKB webpage about the growth hormone (somatotropin protein) of Atlantic salmon https://www.uniprot.org/uniprot/P10814

3. From this webpage, find out and write down the sequences of growth hormone protein and its cDNA (5 points for each sequence, 10 points in total).

4. Use BLAST to get more growth hormone protein and cDNA sequences. You can either use protein sequences to do BLAST or use cDNA sequences, but you need to make sure that you get both protein and cDNA sequences from the same fish species (you should check that the cDNA sequence can be translated into the protein sequence).

5. Make a sequence alignment of the cDNA sequences (10 points), build a phylogenetic tree from this sequence alignment (10 points), and use bootstrap to test your tree (10 points).

6. Make a sequence alignment of the protein sequences (10 points), build a phylogenetic tree from this sequence alignment (10 points), and use bootstrap to test your tree (10 points). In your report, you should show the sequence alignment, the tree, and the bootstrap values.

7. Write down the methods you used in this report (20 points).

8. Compare the cDNA and protein trees, and discuss how and why they are different (10 points).

9. The soft copy of your report is due on **April 8 2025** before the class. Your report should be in the form of one PDF/word file.

Presentation:

1. Each student chooses one topic to do the presentation herself/himself.

2. Presentations should be case studies related to marine biotechnology.

3. The time for individual presentation is 20 min (15 min for presentation + 5 min for questions).

4. The project counts for 20% of the total course grade.

5. Grading will be given according to the case study, slide design, presentation skill, and ability to answer questions.

6. Please send Prof. Zeng (zeng@ust.hk) your presentation topic by **April 24 2025**.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates an exceptional understanding of the subject matter, showcasing advanced problem-solving skills and significant creativity in thought.

		Exhibits a high level of scholarship and collaboration, consistently exceeding core requirements to achieve and surpass learning objectives.
B	Good Performance	Displays a strong knowledge and understanding of the main subject matter, with competence in problem-solving and the ability to analyze and evaluate complex issues. Shows a high level of motivation to learn and effectively collaborates with peers, consistently meeting the course requirements.
C	Satisfactory Performance	Demonstrates a solid understanding of core subject matter, with adequate competence in addressing familiar problems and some ability for analysis and critical thinking. Shows consistent effort and engagement in achieving defined learning goals, meeting the basic expectations of the course.
D	Marginal Pass	Exhibits a basic understanding of core subject matter, with the potential to develop essential professional skills. Demonstrates the ability to make fundamental judgments but often struggles with more complex concepts. Benefits from the course experience and shows some potential for growth in the discipline.
F	Fail	Demonstrates a lack of understanding of the subject matter and insufficient problem-solving skills. Shows minimal ability to think critically or analytically and exhibits little effort toward achieving learning goals. Fails to meet the basic requirements for professional practice or development in the discipline.

Course AI Policy

The use of Generative AI is permitted and requested to assist students with brainstorming, drafting, and writing their papers.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include total marks and marks for individual questions. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Course calendar

Date	Topic
February 4	Introduction to marine biotechnology
February 6	Marine microorganisms
February 11	Marine viruses
February 13	Seaweeds in Hong Kong
February 18	Bioprocess engineering
February 20	Novel bioreactors for culturing marine organisms
February 25	Marine enzymes – production and applications
February 27	Microfluidic systems for marine biotechnology
March 4	Transgenic technology in marine organisms I
March 6	Transgenic technology in marine organisms II
March 11	**Midterm exam**
March 13	Bioinformatics I
March 18	Bioinformatics II
March 20	Bioinformatics III
March 25	Marine metagenomics I
March 27	**Bioinformatics tutorial**
April 1	Midterm Break
April 3	Midterm Break
April 8	Marine metagenomics II
April 10	Marine proteomics
April 15	Monitoring marine microbial communities
April 17	Environmental DNA to monitor disease outbreaks
April 22	Biofuels from algae
April 24	Coral engineering
April 29	Guest lecture
May 1	Labor Day
May 6	Project presentation
May 8	Project presentation