

Biotechnology and Its Business Opportunities

Fall 2023/24

Course Information

Course number: CENG1600

Credit hours: 2 hours 40 mins per week/13 weeks

Meeting times: Wed. 03:00PM - 04:20PM; Fri. 03:00PM - 04:20PM

Classroom location: LTB

Instructor Information

Prof. Yong Lai

Office location: CYT2006A

Office hours: Fri. 5:00-6:00 PM

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Teaching Assistants:

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and additional UG TAs (TBD)

Course Description

This course provides an introductory overview of biotechnology, covering both technical and business aspects, for our first-year undergraduate students who have recently transitioned from high school to the university. It surveys the current landscape of medical biotechnology, discusses the significant milestones in this field, describes underlying scientific concepts, and emphasizes how innovations impact human health and the economy. Case studies are used to illustrate the opportunities and limitations in current and future biotechnology development. In addition, guest lectures on course-related topics will be delivered by experts from the biotech industry and investment sector.

The course is divided into three main parts. Part I talks about the roots of biotechnology. The technological development of some classical biotechnology products is highlighted, in the context of the opportunities captured by the companies that are considered biotechnology giants nowadays in US. Part II presents the growth of supporting technologies and the emergence of new start-up companies. Part III discusses the key elements for building biotechnology companies and biotechnology clusters, with emphasis on the increasingly significant role of universities in technology transfer, and provides a glimpse of the biotechnology picture in China and the nearby regions.

We look forward to meeting you this semester!

Intended Learning Outcomes (ILOs)

By the end of this course, students will be able to...

1. explain the basic technical concepts, scientific and engineering principles in medical biotechnology.
2. describe the opportunities and challenges facing the biotech industry.

3. analyze the potential and impact of modern biotechnology on human health and economy.
4. identify the key components contributing to biotechnology of commercial interest - research topics in biotechnology and its current development - communicate technical ideas more effectively.
5. develop the ability to work in a team with complementary strengths.

Course materials

The following e-books can be accessed via the library by HKUST students:

-[Introduction to Biotechnology and Genetic Engineering](#) by A.J. Nair, Infinity Science Press, c 2008
[Comments from instructor: This text gives a broad overview of biotechnology and the content is written for novice.]

-[Biotechnology and Biopharmaceuticals: Transforming Proteins and Genes into Drugs](#) by Rodney J.Y. Ho, Milo Gibaldi, Wiley-Liss, c2013

[Comments from instructor: This text provides more in-depth knowledge about many topics of medical biotechnology that we are covering in this course].

-[The Biotech Age: the business of biotech and how to profit from it](#), by Richard W. Oliver, McGraw-Hill, c2003

Assessments

Summative assessments are used to facilitate your understanding of biotechnology and its real-world applications. We use quizzes, group projects, and final examinations outlined below to assess your learning against the ILOs.

	Time	Notes	Percent of final grade	Purpose
Quizzes¹	Sep 22 and Oct 18	All will be graded but only the best one will be counted towards final grade	15%	Assesses ILO 1
Class project	Week 5-9	Midterm project plan ²	10%	Assesses ILO 1-5
	Week 5-14	Final project poster	10%	
	Nov 29	Poster presentation	15%	
Final exam	TBD		45%	Assesses ILO 1-3
Class participation			5%	

¹Quizzes: 20 min (closed-book).

²Midterm project plan: 6-page PPT slides

Course Expectations and Policies

- Attendance

Students are expected to attend each class in person.

- Class participation

Be open to learning from each other; Respect your classmates who hold different opinions and beliefs. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

- Late assignments

All course assignments must be submitted no later than the due date unless a new due date is established by the instructor. Late assignments will be deducted (5% of the grade).

- Academic integrity and honesty

<https://registry.hkust.edu.hk/resource-library/academic-integrity>

Possible sanctions include receiving a failing grade on the assignment or quiz.

- We encourage students to use generative AI.

Course outline

	Time	Topics	Notes
Week 1	Sep 01	Course introduction	
Week 2	Sep 06	Basics of Bioengineering I: DNA, RNA, and proteins	
	Sep 08	Basics of Bioengineering II: genetic information flow	
Week 3	Sep 13	Innovation in biotechnology and medicine	
	Sep 15	Recombinant DNA-The story of Genentech	
Week 4	Sep 20	Artificial control over biological systems	
	Sep 22	Immunotherapy of cancer I: Antibody engineering	Quiz 1
Week 5	Sep 27	Library workshop* : How to find and evaluate biotech-related business information? (Ms. Eunice WONG, HKUST library)	Library E-Learning Classroom B
	Sep 29		
Week 6	Oct 04		
	Oct 06	Parts for synthetic genetic circuits	
Week 7	Oct 11	Rational design of genetic parts, devices, and circuits	
	Oct 13	Invited guest speaker (Prof. Fei Sun, CBE, HKUST): TBD	
Week 8	Oct 18	Immunotherapy of cancer II: Engineering immune cells	Quiz 2
	Oct 20	Invited guest speaker (Prof. Yugang Guo, co-founder of Leman Biotech & Zhejiang U): AI-enabled metabolic cancer immunotherapy	
Week 9	Oct 25	Vaccine development: mRNA vaccine	
	Oct 27	DNA read and write	Midterm submission
Week 10	Nov 01	Genome editing I	
	Nov 03	Invited guest speaker (Dr. Xiaolu Huang, CEO of XtalPi investment): AI-driven biotechnology	
Week 11	Nov 08	Genome editing II	
	Nov 10	Invited guest speaker (Dr. Xiao Shen, founder and CEO of Canton Biologics): TBD	
Week 12	Nov 15	Biotech business (Moderna/Synlogic/Senti Biosciences)	
	Nov 17	Invited guest speaker (Dr. Mingyu Xue, VP of Matrix Partners China): Biotech investment	
Week 13	Nov 22	Funding sources of biotech	
	Nov 24	Invited guest speaker (co-founder of Delonix Bioworks Ltd): TBD	
Week 14	Nov 29 and 30	Poster presentation	Library LG4 Multi-function room

*Library workshop: please scan your HKUST card (twice) to take attendance.

Important Dates

- Team Forming of class project (5 people per group) – Sep 30, 2023
- Library Workshop – Sep 27, Sep 29, or Oct 4, 2023 (***no class on these three dates***)
- Midterm Project Plan Due Date – Oct 27, 2023