

**Division of Life Science  
The Hong Kong University of Science and Technology**

**LIFS 4800 Epigenetics and Chromosome Biology**

Spring semester, 2022-2023  
Credits: 3  
Class duration: 3 hours per week

**Instructor:** Toyotaka Ishibashi (course coordinator).

**Meeting Time and Venue:** Tuesdays and Thursdays 16:30-17:50, Rm 5583

**Course goals**

This course will cover recent advances in the fields of epigenetics and chromosome biology. The students will acquire basic knowledge in chromosome biology and epigenetics. The students will also practice how to critically review scientific publications. They will grow their team-working capability and refine their scientific communication and presentation skills.

**Intended Learning Outcomes**

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

1. Describe the basic concepts of chromosome structure and epigenetics.
2. Relate these concepts to relevant biological phenomena such as transcription and diseases.
3. Analyze related scientific articles published in international journals and assess their relevance.
4. Work as a team to gather relevant information and discuss related topics.
5. Communicate effectively to present the findings, both orally and in writing.

**Course description**

Epigenetics is defined as heritable changes in gene expression that is not coded in the DNA sequence. Epigenetic changes affect many cellular and developmental processes such as transcription and cell differentiation. Moreover, epigenetic changes are highly relevant for human health topics such as aging and X chromosome-linked diseases. This course will cover the principles and recent discoveries of chromosome biology and epigenetics. Several topics related to epigenetics including aging and human diseases will be discussed.

**Teaching approach**

The primary method of the course will be interactive lectures. In addition of the lectures, the students will be organized in small teams (about 2-3 students per team) to work together, analyze scientific papers and present them to the class.

They are expected to lead the discussions within the audience. in which peer participation and assessment will be expected.

### **Assessment scheme**

There will be two exams in open book format. The mid-term examination will cover material from Feb. 7<sup>th</sup> to Mar. 7<sup>th</sup> and will be held on Mar. 14<sup>th</sup> during the class. The final examination will cover material from Feb. 7<sup>th</sup> to May 10<sup>th</sup> and will be held on the spring exam time (TBD). Group projects are assigned to the class with a set of assignment questions that encourage students to understand the data and experimental methods. Group presentations will be held in Apr. 13<sup>th</sup>, 18<sup>th</sup> and 20<sup>th</sup>.

1. Mid-term examination 35%
2. Group presentations 20%
3. Group projects 10%
4. Final examination 35%

### **Course outline**

- Introduction, chromosome organization and function (Feb. 7<sup>th</sup>)
- Histone, nucleosome and chromatin (Feb. 9<sup>th</sup>)
- Histone post-translational modifications (PTMs) (Feb. 14<sup>th</sup>, 16<sup>th</sup>)
- Histone PTMs and Heterochromatin (Feb. 21<sup>st</sup>)
- Histone PTMs and Euchromatin (Feb. 23<sup>rd</sup>)
- DNA methylation, Methyl-CpG regulation and demethylation (Feb. 28<sup>th</sup>)
- Group project 1 (Mar. 2<sup>nd</sup>)
- Histone variants and epigenetics (Mar. 7<sup>th</sup>)
- Mid-term review (Mar. 9<sup>th</sup>)
- Mid-term exam (Mar. 14<sup>th</sup>)
- Group project 2 (Mar. 21<sup>st</sup>)
- Chromatin remodeler and histone chaperone (Mar. 23<sup>rd</sup>)
- Chromatin structure modifications and their mechanism of action (Mar. 28<sup>th</sup>)
- Genome imprinting (Mar. 30<sup>th</sup>)
- Epigenetics of X chromosome inactivation and dosage compensation (Apr. 4<sup>th</sup>)
- Student paper presentation (Apr. 13<sup>th</sup>, 18<sup>st</sup>, 20<sup>th</sup>)
- Epigenetics determinants of cancer (Apr. 25<sup>th</sup>, 27<sup>th</sup>)
- Epigenetics: environmental effects (May 2<sup>nd</sup>)
- Epigenetics: diet and aging (May 4<sup>th</sup>)
- Final exam review (May 9<sup>th</sup>)