

Syllabus

1. Course Title, Style and Credit:

Molecular and Cellular Physiology I,

(X) Lecture, () Discussions () Practice

1 credit

2. Appropriate grade level and Eligible Departments:

D1, 2, 3, 4, 5

(X) Department of Physiological Sciences, School of Life Science

3. Lectures

Yoshihiro Kubo (ykubo@nips.ac.jp , Tel: 0564-55-7831, Myodaiji Rm364)

Masaki Fukata (mfukata@nips.ac.jp , Tel: 0564-59-5873, Yamate)

Mikio Furuse (furuse@nips.ac.jp , Tel: 0564-59-5277, Yamate)

4. Time

(oral): AM 10:00-12:00 on Friday, (April 19, 26, May 10, 17, 24, 31, June 14, 21, 28th in 2019)

5. Place

*Myodaiji Area : 1st Floor in Myodaiji building of NIPS. (April 19, 26, May 10th)

*Yamate Area : Seminar room B, 9th Floor of the Yamate 3rd Building

(May 17, 24, 31, June 14, 21, 28th)

*Lectures will be delivered by a remote lecture system.

6. Prerequisites and Styles

This course begins with basic introduction of molecular and cellular physiology, and there is no lecture course especially requested to have been finished in advance. The entire course will be presented in English.

7. Contents

Ion channels, receptors and cell-adhesion molecules in neurons and epithelial cells will be introduced from the point of view of their structure, function, regulation and analytical methods.

In the 1st, 2nd and 3rd lectures of this lecture course, we will introduce cutting-edge

methodologies to elucidate the structure-function relationship of ion channels and receptors, including subunit counting by single molecule imaging, FRET analysis and structure analysis including dynamic aspects.

In the 4th, 5th and 6th lectures, we will focus on “Synapse” where neurons communicate each other. The mechanisms of synaptogenesis, synaptic transmission and synaptic plasticity will be introduced.

In the 7th, 8th and 9th lectures, we will introduce basic knowledge about the molecular basis of cytoskeleton, cell adhesion and cell polarity, all of which regulate the functions and behavior of various types of cells.

8. Course objectives

- (1) To understand the detail and the significance of the various cutting-edge approaches to the dynamic structure-function relationship.
- (2) To understand the molecular basis of synaptic transmission and synaptic plasticity
- (3) To understand the molecular basis of cytoskeleton, cell adhesion and cell polarity in terms of physiological functions of epithelial cells as well as neurons.

9. Schedule

(1) April 19th, 2019

“Cutting-edge approaches to the structure-function of ion channels and receptors 1”

-- Subunit counting by single molecule live imaging --

Yoshihiro Kubo (Div. Biophysics and Neurobiology)

(Myodaiji area: NIPS 1F, Lecture room)

(2) April 26th, 2019

“Cutting-edge approaches to the structure-function of ion channels and receptors 2”

-- FRET analysis of the structural rearrangements of membrane proteins --

Michihiro Tateyama (Div. Biophysics and Neurobiology)

(Myodaiji area: NIPS 1F, Lecture room)

(3) May 10th, 2019

“Cutting-edge approaches to the structure-function of ion channels and receptors 3”

-- Structure analysis -- from snapshot to movies --

Takushi Shimomura (Div. Biophysics and Neurobiology)

(Myodaiji area: NIPS 1F, Lecture room)

(4) May 17th, 2019

“Synapse biology and Synaptic disorders”

Masaki Fukata (Div. Membrane Physiology)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

(5) May 24th, 2019

“Structural biology of synaptic proteins”

Norihiko Yokoi (Div. Membrane Physiology)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

(6) May 31th, 2019

“Synaptic transmission and Synaptic plasticity”

Yuko Fukata (Div. Membrane Physiology)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

(7) June 14th, 2019

“Cytoskeleton and regulation of cellular functions”

Tetsuhisa Otani (Div. Cell Structure)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

(8) June 21th, 2019

“Molecular mechanism of cell adhesion”

Mikio Furuse (Div. Cell Structure)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

(9) June 28th, 2019

“Cell polarity”

Yasushi Izumi (Div. Cell Structure)

(Yamate area: Seminar room B, 9th Floor of the Yamate 3rd Building)

10. Lecture materials and readings

(1) Ion channels of excitable membranes 3rd Edition (by Hille B), Sinauer, 2001

(2) Mark F.Bear et al, “Neuroscience: Exploring the Brain, Fourth edition”

: Lippincott Williams & Wilkins Inc.

(3) Bruce Alberts et al, 「Molecular Biology of the Cell Sixth edition」: Garland Science

11. Grades

*Themes based on the above course objectives will be presented by lecturers. Students will select one of themes and are requested to submit an essay report by the deadline.

*The grades will be determined by the quality of the report.

*Students must attend at least half of the lectures to get credit.

12. Notes

Nothing particular