

2026 Akita University Faculty of Medicine Syllabus

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| Category | : 基礎医学アドバンストコース |
| Course Title | : Cell Physiology - Cardiovascular Electrophysiology |
| Eligible Students | : grade 2 Elective Course |
| Code | : 71564005 |
| Schedule | : week 31 ~ week 31 |
| Credits | : 1 |

1. Lead Instructor

Takafumi Miki (Professor, Department of Cell Physiology, 6069, Office Hour: By appointment)

2. Instructors

Takafumi Miki (Professor, Department of Cell Physiology, 6069, Office Hour: By appointment)

Hirokazu Sakamoto (Associate Professor, Graduate School of Medicine, Nagoya University)

3. Course Description Outline(Course Objectives)

Summary: Conduct virtual experiments on cardiomyocyte excitability and contraction using virtual cells reproduced on a computer. The responses of cardiomyocytes to various stimuli are observed and the mechanisms are discussed. Furthermore, the experimental results are summarized and presented. Finally, a lecture on the latest research in cell biology is given.

Aim: The aim is to deepen understanding of the excitability and contractility of cardiomyocytes through virtual experiments in virtual cells, in order to master the pathology of each disease and practice medical treatment, which is necessary in clinical practice. Students are divided into small groups to carry out experiments and considerations, and deepen discussions through dialogue with the teaching staff. Through this process, problem-solving and communication skills are nurtured. Presentation skills are also developed through experience in communicating the results obtained in an easy-to-understand manner to others. Furthermore, by coming into contact with the latest research and experiencing the continually advancing state of medical science, students develop a research mindset that leads to lifelong learning.

(1-1 ~ 1-2, 2-1 ~ 2-8, 3-1 ~ 3-4, 5-1 ~ 5-5, 6-1 ~ 6-2)

4. Textbook/Reference Books

「標準生理学」医学書院

「心筋細胞イオンチャネル」倉智嘉久著 文光堂

「心筋細胞の電気生理学」山下武志著 メディカルサイエンスインターナショナル

5. Assessment

Attendance, reports, presentations

6. Out of Class Study/Message

- The lecture and exercises will be conducted in accordance with the materials distributed on the day.
- The software will be installed on a PC (Windows) on the first day, so bring your own PC. If you do not have a PC, please contact the teacher in charge in advance. Note: the software can only be installed on a Windows PC. Mac PC is not available.
- The schedule is subject to change slightly depending on the schedule of the teacher in charge.

Number of students to be accepted: About 20

| Topics and Contents of class, Course Objectives | | | | | | |
|---|---------------|--------|----------------|--|---------------|------------------------------|
| | Class Date | Period | Class Format | Topics and Contents of class, Course Objectives | Instructors | Class Room |
| 1 | 11 / 30 (Mon) | 1-2 | Lecture | Theme: Introduction to virtual cells The simulation of life phenomena is outlined, and how to perform experiments using cardiac virtual cells and how to prepare reports. 生命現象のシミュレーションについて概説し、心臓バーチャル細胞を用いた実験の方法、レポートの作成方法について解説する。 | Takafumi Miki | 基礎棟 1 階 第一会議室、大学院 共用室 |
| 2 | 11 / 30 (Mon) | 3-4 | Exercise | Theme: Action potentials of cardiomyocytes Using virtual cells, observe the action potentials of ventricular myocytes and sinus node cells and measure the parameters of the action potential. Basic properties of cardiomyocytes, such as the total or nothing law and the refractory period, are confirmed in virtual cells. バーチャル細胞を用いて、心室筋細胞や洞結節細胞の活動電位を観察し、活動電位のパラメータを測定する。全か無かの法則や不応期など、心筋細胞の基本的な性質を仮想細胞で確認する。 | Takafumi Miki | 基礎棟 1 階 第一会議室、大学院 共用室 |
| 3 | 11 / 30 (Mon) | 5-10 | Exercise | Theme: Response of myocardial excitability to changes in extracellular fluid Observe the changes in cardiomyocyte excitability when the extracellular fluid ion concentration (Na, K, Ca) is changed, and discuss the obtained changes. 細胞外液のイオン濃度 (Na, K, Ca) を変化させた際の心筋細胞の興奮性の変化を観察し、得られた変化について考察する。 | Takafumi Miki | 基礎棟 1 階 第一会議室、大学院 共用室 |
| 4 | 12 / 1 (Tue) | 1-6 | Exercise | Theme: Role of various ionic currents in action potentials Response of myocardial excitability to changes in the amplitudes of various ionic currents are observed. 種々のイオン電流の振幅を変化させ、それによって引き起こされる心筋興奮性の変化を観察し、考察を行う。 | Takafumi Miki | 基礎棟 1 階 第一会議室、第 2 実 習室 |
| 5 | 12 / 1 (Tue) | 7-10 | Exercise | Theme: Effects of bioactive substances on myocardial excitability Observe and discuss changes in myocardial excitability when noradrenaline and acetylcholine are administered. ノルアドレナリン及びアセチルコリンを投与した際の心筋興奮性の変化を観察し、考察を行う | Takafumi Miki | 基礎棟 1 階 第一会議室、第 2 実 習室 |
| 6 | 12 / 2 (Wed) | 1-10 | Group learning | Theme: Preparation for presentation Summarize and discuss simulation results. Prepare a presentation. シミュレーション結果をまとめ、考察を行う。プレゼンテーションを作成する。 | Takafumi Miki | 基礎棟 1 階 第一会議室、第 2 実 習室 |
| 7 | 12 / 3 (Thu) | 1-4 | Discussion | Theme: Presentation Presentations and discussions in groups. | Takafumi Miki | 基礎棟 1 階 第一会議室、大学院 共用室 |

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| 8 | 12 / 3 (Thu) | 5-10 | Self learning | Theme: Preparation of reports Reporting by group. レポートを作成する。 | Takafumi Miki | 基礎棟 1 階 第一会議 室、大学院 共用室 |
| 9 | 12 / 4 (Fri) | 1-4 | Lecture | Theme: Introduction to the latest research Presents the latest research in the field of cell physiology. 細胞生理学分野の最新研究を紹介。 | Takafumi Miki Hirokazu Sakamoto | 基礎棟 1 階 第一会議室 |
| 10 | 12 / 4 (Fri) | 5-10 | Lecture | Theme: Introduction to the latest research Presents the latest research in the field of Neurophysiology. 神経生理学分野の最新研究を紹介。 | Takafumi Miki Hirokazu Sakamoto | 基礎棟 1 階 第一会議室 |