Role of Calcium Signaling Between Mitochondria and Sarcoplasmic Reticulum in the Heart

Summary

In heart muscle cells, calcium regulates cells' contraction and mitochondria energy production needed to perform mechanical work and maintain ion balance. The primary calcium source in adult mammalian cells is the sarcoplasmic reticulum (SR). Recently, it has been shown that SR and mitochondria are physically linked and regulate mitochondrial respiration. The precise interaction between them is essential for maintaining energy balance in the heart, yet many aspects of this regulatory pathway are still poorly understood. This project aims to unravel mechanistic aspects of SR-mitochondria interaction in heart muscle cells.

Research field:	Chemistry and biotechnology
Supervisors:	Prof. Dr. Marko Vendelin Dr. Martin Laasmaa
Availability:	This position is available.
Offered by:	School of Science Department of Cybernetics
Application deadline:	Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

Description

In heart muscle cells, calcium regulates cells' contraction and mitochondria energy production needed to perform mechanical work and maintain ion balance. The primary calcium source in adult mammalian cells is the sarcoplasmic reticulum (SR). Recently, it has been shown that SR and mitochondria are physically linked and regulate mitochondrial respiration. The precise interaction between them is essential for maintaining energy balance in the heart, yet many aspects of this regulatory pathway are still poorly understood.

This project aims to unravel mechanistic aspects of SR-mitochondria interaction in heart muscle cells. For that, multiple experimental methods will be used that would allow us to pinpoint the structural and functional aspects of the SR-mitochondria interaction. Primary rat cardiomyocytes are expected to be used in the study.

Responsibilities and (foreseen) tasks

- Participation in introducing of single molecule localization microscopy at the Institute
- Isolation of rat cardiomyocytes using protocols established in the lab
- Imaging live and fixed cells using single molecule localization(dSTORM), confocal, and widefield microscopy
- Functional studies of mitochondria in cardiomyocytes using microscopy and other relevant techniques
- Data analysis
- Writing academic papers
- Presenting the results in international meetings
- Supervision of junior students
- Participation in the teaching of the courses given by the laboratory

Applicants should fulfil the following requirements:

- a master’s degree in relevant field
- a clear interest in the topic of the position
- excellent command of English
- strong writing skills (English) that are compatible with doctoral-level requirements
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- Light microscopy, confocal fluorescence microscopy, super-resolution microscopy
- Working knowledge of SQL
- Working knowledge of statistics and statistical software
- Working with cells

We offer:

- Fully funded 4-year PhD position in one of the largest universities in Estonia
- The chance to do high-level interdisciplinary research in a supporting environment
- Great opportunities for self-development
- Opportunities for conference visits, research stays and networking with globally leading research centers in the field

About the department

The Laboratory of Systems Biology is a part of the Department of Cybernetics, School of Science, Tallinn University of Technology.

The main aim of the laboratory is to study regulation of intracellular processes and understand functional influences of intracellular interactions.

We use interdisciplinary approaches to tackle questions in cardiac physiology. For that, we have formed a team of researchers with backgrounds in biophysics, biology, and applied mathematics/physics. As a result, we are able to approach scientific questions on different scales, from organ to molecular level, using combinations of different experimental and theoretical techniques. When needed, we find new ways to characterize the data, develop new mathematical models, build new hardware and program it to carry out novel experimental protocols.

Additional information

For further information, please contact Prof Marko Vendelin <markov@sysbio.ioc.ee> or Dr Martin Laasmaa <martin@sysbio.ioc.ee> or visit https://sysbio.ioc.ee.

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