Maria de Sousa Summer Research Program

5ª Edição

O que é?

Estágios de verão de duas semanas, que incluem um prémio monetário (400 euros) para ajudar a suportar os custos de deslocação e alojamento. O programa é organizado pela associação ATG e visa honrar a emérita cientista Maria de Sousa. Os estudantes serão supervisionados por um membro ATG.

Quem se pode candidatar?

Estudantes de Licenciatura e Mestrado, inscritos numa instituição de ensino superior em Portugal.

Quando são as inscrições?

3 a 15 de julho de 2023

Como se poderá candidatar?

Candidatura deverá ser feita em inglês, através do seguinte formulário: https://forms.gle/6DuZw2gtD8LK7FNQ7.

Projetos disponíveis para 2023:

Projeto	**BioTribo - Designing biomaterials that can harvest electrical energy from the human body to tackle cardiovascular diseases**
Orientador	Andreia T. Pereira, PhD
Local	Advanced Graphene Biomaterials Group | i3S – Instituto de Investigação e Inovação em Saúde
Data	Setembro 15-30, 2023
Projeto	**How do epithelial cells regulate apical actomyosin contractility – a super-resolution approach**
Orientador	Mariana Osswald, PhD
Local	Epithelial Polarity and Cell Division | i3S – Instituto de Investigação e Inovação em Saúde
Data	Agosto e Setembro 2023, 2 semanas a definir com orientador

Com o apoio de: American Portuguese Biomedical Research Fund

Mais informação:

geral@atg.up.pt

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BioTribo – Designing biomaterials that can harvest electrical energy from the human body to tackle cardiovascular diseases

Cardiovascular diseases (CVD) are the leading cause of death and claim approximately 17.9 million lives annually. Cardiac electrical devices (CED) are essential in the treatment of CVD. The Internet of Medical Things (IoMT), that employs sensors to support continuous monitoring and more precise diagnosis of CVDs is the field's forthcoming technological advancement.

One thing that CEDs and IoMTs have in common is that both rely on batteries to power them. The conventional batteries have a lifetime of 3-8 years, requiring a surgical procedure to replace them. Moreover, the leakage of battery content damages the surrounding body tissues. Thus, there is a need for self-powered CED and sensors.

Triboelectric nanogenerators (TENG), reported for the 1st time in 2012, can convert mechanical energy into electricity, by the contact-separation or sliding between 2 materials. Recent studies revealed that TENG can also scavenge mechanical energy from body movement and cardiac/lung motions. However, most materials used as TENG are not biocompatible and are inefficient to supply CED.

The aim of BioTribo project is to explore biomaterials and different biomechanical sources in the development of self-powered and/or intelligent medical devices. During the Maria de Sousa Summer School, the student will have the chance to design a TENG using FDA-approved biomaterials. Additionally, a novel biomechanical source will be explored to produce electrical energy. The power required to supply CEDs and sensors will be compared with the obtained outputs. By engaging BioTribo, the student will also have the opportunity to acquire insights about the steps involved in all phases of biomaterials and medical device development, from bench to bedside.

How do epithelial cells regulate apical actomyosin contractility – a super-resolution approach

Epithelial tissues are of fundamental importance in biology and health. They function as essential barriers that compartmentalize multicellular organisms and selectively control the content of each compartment. Epithelial functions and shape depend on the organization of epithelial cells within them, which in turn is regulated by the asymmetric distribution of adhesion complexes and the actomyosin cytoskeleton along an apical-basal axis. In particular, at the apical surface of epithelial cells, adherens junctions and the actomyosin network integrate and propagate mechanical forces, which has been shown to be critical to shape epithelia during development.

Our recent work on epithelial architecture uncovered that proliferative epithelia have to balance mechanical forces at their apical surface in order to ensure tissue cohesion. By applying new optogenetic tools in Drosophila, we increased actomyosin contractility and directly observed that this causes tissue ruptures within minutes (Osswald et al., 2022). Furthermore, we observed that tissue ruptures originated predominantly through detachment of dividing and neighbor cells. These findings reveal that while contractile forces are important to shape epithelia, excessive contractility can be detrimental. Thus, epithelial cells have to keep actomyosin contractility in check to protect epithelial integrity. Furthermore, these findings also highlight that dividing cells are a weak spot particularly susceptible to mechanical challenges. So, how do epithelia balance apical contractility, in particular in the neighbourhood of dividing cells, to maintain cohesion and epithelial architecture?

This proposal will contribute to address this question by characterizing the apical actomyosin network of an adult Drosophila epithelium with unprecedented spatial detail using STED microscopy. This super-resolution approach will allow characterization of specific pools of actomyosin (apicomedial/junctional) within individual cells and their neighbors in the context of interphase, cell division and increased/decreased contractility. This will allow us to correlate the organization of apical the actomyosin with contractile behavior and provide further insight into how epithelia deal with dividing cells. Thus, the proposed work will contribute to understand how epithelial cells balance actomyosin forces at the apical surface to preserve the integrity and architecture of proliferative tissues.

Com o apoio de: AMERICAN PORTUGUESE BIOMEDICAL RESEARCH FUND

Mais informação:

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