

## *IBEC-SJD INTERNATIONAL PhD PROGRAMME*

### **Position**

1. Project Title/ Job Position title:

**4DmyoSync: 4D Microfluidic Myocardium Platform for Protocolized CPVT Drug Testing and Rhythm Synchronization**

2. Research project/ Research Group description:

Children and adolescents with Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT) face life-threatening arrhythmias triggered by emotional or physical stress. For those unresponsive to current therapies, the outcome can be devastating, with sudden cardiac death as a tragic reality. Pharmaceutical companies have shown limited interest in developing targeted treatments, leaving public research as the only hope. The "4DmyoSync" project seeks to change this narrative.

CPVT is a rare genetic condition (1 in 10,000) caused by mutations in calcium-handling proteins like RYR2. Current treatments such as beta-blockers and defibrillators are ineffective for severe cases, underscoring the urgent need for a personalized platform to study mutation-specific drug responses and develop targeted therapies.

"4DmyoSync" combines 4D microfluidic technology, an engineered sinoatrial node (SAN), biosensors, and machine learning (ML). The project progresses through three parallel tasks:

- Dynamic ECM scaffolds guiding cardiomyocyte alignment and supporting neural co-culture.
- Real-time biosensors to monitor electrophysiological activity and actuators simulating stress states like adrenergic surges.
- Finalizing SAN-electrode synchronization, replicating CPVT episodes, and using ML for biomarker discovery.

The platform will enable standardized drug testing for both established (e.g., beta-blockers) and experimental therapies, providing mutation-specific precision in dynamic cardiac environments.

Collaborating with IBEC, Hospital Sant Joan de Déu, and the assistance of UB, "4DmyoSync" will transform CPVT research, offering hope to affected children and advancing personalized medicine.

#### **Research Group description:**

The [Biomaterials for Regenerative Therapies Group](#) specializes in designing and fabricating bioactive scaffolds to guide tissue regeneration. Their expertise spans ECM engineering, bioinks, and microfluidic cardiac models tailored for drug testing. Collaborating closely with the Electronics and [Biomedical Engineering Department](#) of the University of Barcelona, they

integrate advanced electrophysiological assessments to enhance the efficiency and precision of their platforms.

The [Pediatric Arrhythmias, Inherited Cardiac Diseases, and Sudden Death Team](#) focuses on CPVT, hypertrophic cardiomyopathy, and sudden cardiac death, developing innovative tools for pediatric arrhythmia treatment.

### 3. Job position description:

We are seeking a highly motivated PhD candidate in Biomedical Engineering, Bioengineering, Biological Systems Engineering, Electronics Engineering, or related fields to join the 4DmyoSync project—a cutting-edge initiative to develop a 4D microfluidic myocardial platform for personalized drug testing and rhythm synchronization in pediatric patients with Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT). This transformative platform integrates biosensors, machine learning (ML), and an engineered sinoatrial node (SAN), setting a new standard for mutation-specific drug testing and precision medicine.

The candidate will focus on integrating biosensors and actuators to monitor and control the platform's electrophysiological activity. Responsibilities include:

- Developing real-time biosensors for action potentials, calcium dynamics, and arrhythmia detection.
- Designing actuators to simulate physiological and stress-induced conditions like adrenergic surges.
- Establishing workflows for continuous, precise monitoring of cardiac activity.

Additionally, the candidate will contribute to finalizing SAN-myocardium-electrode synchronization and validating the platform by replicating CPVT episodes:

- Assisting in SAN integration as a pacemaker for synchronized signal propagation.
- Validating drug responses under mutation-specific, physiologically relevant conditions.
- Collaborating with ML experts to analyze experimental data and uncover biomarkers.

You will work within a multidisciplinary team combining engineering, biology, and clinical expertise: the Biomaterials for Regenerative Therapies Group at IBEC, the SIC-BIO Group at UB, and Dr. Georgia Sarquella Brugada's team at Hospital Sant Joan de Déu.

If you have expertise in biosensors, bioelectronics, or cardiac electrophysiology, and are passionate about interdisciplinary collaboration, join us in this unique opportunity to revolutionize drug testing and advance pediatric cardiology.

## Group Leaders at IBEC

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