

# JAMES RENNIE BEQUEST

## REPORT ON EXPEDITION / PROJECT / CONFERENCE

**Expedition/Project/  
Conference Title:** S3IC 2023 (Single-Molecule Sensors and nanoSystems International Conference)

**Travel Dates:** 21<sup>st</sup> November 2023 – 25<sup>th</sup> November 2023

**Location:** Barcelona, Spain

**Group member(s):** Diana Coroiu

**Aims:** Presenting a talk on my PhD project; Learn more about state-of-the-art sensing systems; Meet and network with scientists working in a similar field to mine

**Photography consent form attached:**  Yes  
(please refer to your award letter)  No

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### OUTCOME (a minimum of 500 words):

I recently had the privilege of attending the Single Molecule Sensors and nanoSystems International Conference, an event that aligns closely with the objectives of my PhD project on developing whole-cell biosensors, where I had the chance to present my results.

On the first day of the conference, I gave a 10-minute presentation titled “A motility-based bioelectrical interface for whole-cell biosensors”, focusing on my PhD work. My project aims to develop whole-cell biosensors with outputs that are easily detectable. Bacteria use their flagella for movement, and the rotational direction of the flagellar motors is controlled by the chemotactic pathway culminating with the phosphorylation or dephosphorylation of the cytoplasmic CheY protein. The level of phosphorylated CheY affects how much time the flagellar motors spend rotating clockwise. I have used a mutant form of CheY, known as CheY\*\*, which mimics its phosphorylated state, serving as a reporter. This reporter, synthesised under the control of an analyte-specific promoter, increases the proportion of time spent by the motor in clockwise rotation. We have the capability to electrically monitor alterations in the direction of flagellar motor rotation, making this approach a highly promising method for the detection analytes of interest *in situ*.

The response to my presentation was highly encouraging, notably when attendees took out their phones to record the spinning bacterial cells I showed. This interest led to numerous questions and discussions afterward, indicating the audience found my presentation engaging. However, since the conference participants were primarily from fields outside synthetic biology and bacterial motility, the questions I received didn't offer many new insights for my research. Despite this, the experience was valuable for practicing how to communicate complex topics to scientists from different areas and provided a fresh perspective on my presentation and project. Engaging with a diverse scientific audience allowed me to appreciate the broader context and potential impact of my work.

Although the conference primarily hosted physicists and engineers, presenting projects with a heavy emphasis on physics, I found the environment both challenging and enriching. The technical depth of these presentations provided me with a valuable learning experience,

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though a bit overwhelming at times. Nevertheless, the opportunity to engage with a diverse group of professionals led to meaningful conversations, connections, and friendships that continue to thrive post-conference.

An unexpected yet rewarding aspect of the conference was the chance to contribute my biology expertise during discussions, reflecting the interdisciplinary nature of the event. Additionally, I had the opportunity to attend multiple presentations on quantum biology, which gave me insight into this newly emerging field from both scientific and philosophical perspectives, especially during the panel debate on its significance and relevance in current research.

While the specific focus of many attendees differed significantly from my work, limiting the feedback that I received on my research, the conference was immensely beneficial. I gained not only a deeper understanding of adjacent fields but also invaluable advice on effective research presentation and storytelling. Meeting both eminent biophysicists and fellow PhD students expanded my network and provided a broader perspective on the scientific community.

In summary, the Single Molecule Sensors and Nanosystems conference was an enlightening experience that, despite its technical challenges and the diversity of research topics, offered substantial personal and professional growth opportunities. I am very grateful for the James Rennie Bequest travel scholarship that made travel to this conference possible.