



**BioSim Talk #11**  
**13th February 2026 (Friday)**  
**4.30 – 6.00 pm**  
Institute for Protein Research  
University of Osaka (Suita Campus)  
2nd Conference room (large)

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Specially-appointed associate  
professor, The University of Osaka,  
WPI-PRIMe

### **Multi-scale Modeling of the Heart, from Molecular Mechanisms to Organ Function**

The Heart is an organ whose primary function is to act as a pump that generates the driving force required for blood circulation, propelling blood through the vascular system throughout the body. This driving force is determined by the sum of the contractile forces generated by individual cardiomyocytes that constitute the myocardial wall. To understand how hundreds of millions of cardiomyocytes forming the ventricular wall are able to contract synchronously and generate sufficient force to eject blood from the ventricle, it is essential to consider not only the function of each individual cell but also the interactions among them. However, living systems are highly complex, involving numerous biochemical interactions among molecules, physical phenomena such as electrical activity and force generation, and even structural and morphological changes. Moreover, the biological functions we seek to understand represent dynamic systems in which all parameters continuously change over time. One of the most effective approaches to elucidating the mechanisms underlying such complex physiological phenomena is bio-simulation.

In this presentation, I will outline how the behavior of cardiomyocytes has been mathematically described based on experimental data, leading to the development of comprehensive ventricular cardiomyocyte models. I will then introduce an approach to understanding the dynamism of cardiac function using multiscale bio-simulation frameworks.

Link for online participation via Zoom:

Meeting ID: 834 0498 4146

Passcode: 228063

*Please inform us if you will be participating online or  
joining our Slack channel*

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