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COMPUTATIONAL CHEMISTRY

BI-WEEKLY SEMINAR SERIES

TOPIC: Optimal microdomain crosstalk between endoplasmic reticulum and mitochondria for Ca^{2+} signaling

SPEAKER: Jianwei Shuai, Department of Physics, Xiamen University

TIME: 13:30-14:30, 30 September 2014

VENUE: Room 152, Geography Building, 3663 Zhongshan Road North, Shanghai (中山北路校区, 地理楼 152 室)

ABSTRACT OF THE TALK

The calcium ion (Ca^{2+}) is a ubiquitous intracellular signal controlling diverse cellular functions. It has been widely accepted that the inositol 1,4,5-trisphosphate receptors (IP3R) function as Ca^{2+} release channels on the endoplasmic reticulum (ER) membrane. Since the 1990s, the manner in which mitochondrial Ca^{2+} uptake through mitochondrial Ca^{2+} uniporter (MCU) shapes intracellular Ca^{2+} signaling has attracted much attention. The key questions presently debated are: to what extent mitochondria acquire Ca^{2+} ; what impact mitochondria have on cytosolic Ca^{2+} signals; and what dimensions the ER/mitochondria Ca^{2+} microdomain might have. To address these questions, we constructed a Ca^{2+} signaling model to consider the Ca^{2+} crosstalk within microdomains between IP3Rs and MCU. Our model predicts that there is a critical IP3R-MCU distance at which 50% of the ER-released Ca^{2+} is taken up by mitochondria and that mitochondria modulate Ca^{2+} signals differently when outside of this critical distance. The model demonstrates the existence of an optimal IP3R-MCU distance (30-85 nm) for effective Ca^{2+} transfer and the successful generation of Ca^{2+} -signals in healthy cells. This study highlights the importance of the IP3R-MCU distance on Ca^{2+} signaling dynamics.

BIOGRAPHY

Jianwei Shuai, professor in the Department of Physics, Xiamen University. He received the B.E., M.E., and Ph.D. degrees in Physics from Xiamen University, Xiamen, China in 1989, 1992, and 1995, respectively. From 1995 to 2007, he worked in Xiamen University, City University of Hong Kong, University of Electro-Communications in Tokyo, Case Western Reserve University in Ohio, Ohio University, and University of California, Irvine, as research associate and assistant project scientist, respectively. He obtained China National Funds for Distinguished Young Scientists in 2011. His research interests are in the areas of biophysical simulation, including calcium signal, neural networks, protein dynamics, immune dynamics and cellular signal network.