

Distinguished Lecture Series in Physiology

Byung-Chang Suh, Ph.D.

Professor

Department of Brain Science

Daegu Gyeongbuk Institute of Science and Technology

“Dynamic Regulation of Voltage-Gated Ca²⁺ Channels by Membrane PIP2”

Voltage-gated calcium (CaV) channels serve as critical transducers that convert electrical signals into intracellular chemical signaling, governing diverse physiological processes. However, their activity is not autonomous; it relies heavily on the dynamic membrane environment, particularly phosphatidylinositol 4,5-bisphosphate (PIP2). In this seminar, I will present a comprehensive mechanistic framework describing the dual nature of PIP2 regulation: its constitutive requirement for maintaining channel stability and its hydrolysis-mediated depletion that leads to voltage-independent inhibition.

A key focus of the talk will be the structural interplay between membrane lipids and auxiliary CaV β subunits. We identified a multi-site binding model involving the S4II domain and the intracellular I-II loop of the $\alpha 1$ subunit. Our findings reveal that the subcellular localization of the β subunit acts as a determinant factor. Membrane-anchored β subunits (e.g., $\beta 2a$) structurally hinder PIP2 access to the I-II loop, reducing sensitivity to lipid depletion while facilitating voltage-dependent G $\beta\gamma$ inhibition. Conversely, cytosolic β subunits leave the I-II loop exposed, rendering the channel highly sensitive to PIP2 depletion. Furthermore, I will discuss the dynamic nature of these interactions, highlighting how specific isoforms reversibly associate with membrane phospholipids. Collectively, these studies propose a model where the CaV β subunit functions as a molecular switch, dictating the dominant signaling pathway, lipid metabolism versus G-protein modulation, to precisely control neuronal excitability.

Thursday, February 26, 2026
GBSF and Zoom

12 p.m.



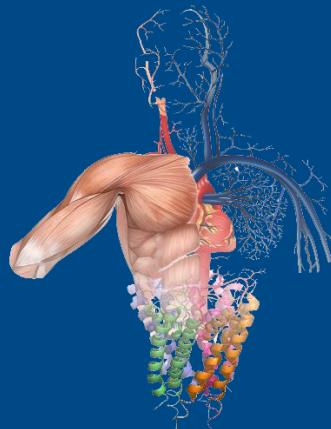
February
26



Byung-Chang Suh, Ph.D.

Professor

Department of Brain Science
Daegu Gyeongbuk Institute of
Science and Technology



Host: Jie Zheng

jzheng@health.ucdavis.edu