Curriculum Vitae

Name
Yu-Ling SHIH

Current Position
Associate Research Fellow
Institute of Biological Chemistry, Academia Sinica

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Education & Professional Experiences

INSTITUTION	POSITION/ DEGREE	DURATION
Institute of Biological Chemistry, Academia Sinica, Taiwan	Associate Research Fellow	2014-
Institute of Biological Chemistry, Academia Sinica, Taiwan	Assistant Research Fellow	2006-2014
University of Connecticut Health Center, USA	Instructor	2004-2006
University of Connecticut Health Center, USA	Postdoc	1999-2003
University of Cambridge, UK	Ph.D.	1996-1999

Research Interests

As a microbiologist specializing in bacterial growth, division, and physiology, I integrate genetic, imaging, and biochemical approaches to unravel the fundamental processes that govern bacterial life. My work contributed to our understanding of spatial organization in cells by uncovering how Min proteins dynamically interact with membranes to drive pattern formation, coordinate broader physiological processes, and adaptively control division site placement. My current research focuses on two key areas: (1) the metabolic regulation of bacterial cell growth and division, and (2) the synthesis and remodeling of bacterial cell walls. These studies facilitate our understanding of core bacterial physiology and have significant implications for both basic science and medicine.

Selected Publications

Parada C, Yan CC, Hung CY, Tu IP, Hsu CP, **Shih YL**. (2025) Growth-dependent concentration gradient of the oscillating Min system in *Escherichia coli*. *Journal of Cell Biology* 224(2): e202406107.

Nguyen VHT, Chen X, Parada C, Luo AC, Shih O, Jeng US, Huang CY, **Shih YL**, Ma C. (2023). Structure of the heterotrimeric membrane protein complex FtsB-FtsL-FtsQ of the bacterial divisome. *Nature Communications* 14(1): 1903.

Hsieh PY, Meng FC, Guo CW, Hu KH, **Shih YL**, Cheng WC. (2021). Harnessing fluorescent moenomycin A antibiotics for bacterial cell wall imaging studies. *Chembiochem* 22(24): 3462-3468.

Shih YL, Huang LT, Tu YM, Lee BF, Bau YC, Hong CY, Lee HL, Shih YP, Hsu MF, Lu ZX, Chen JS, Chao L. (2019). Active transport of membrane components by self-organization of the Min proteins. *Biophysical Journal* 116(8): 1469-1482.

Lecture Title

Integrating Min Protein Oscillations into Bacterial Spatial Organization and Physiology

Abstract

Bacterial growth and division rely on cell's ability to measure its own geometry and organize its internal structure and function. In *Escherichia coli*, the Min system plays a key role in determining the cell division site by forming striking oscillatory patterns that help restrict division to the cell center. In the reconstitution system, the MinD and MinE proteins self-organize into the propagating waves that can impose steric pressure on the supported lipid bilayers, resulting in transport and directional accumulation of the component in the membrane. Reflecting in a living bacterium, the Min proteins not only regulate the placement of the division site but also the membrane protein topology that further influences physiological processes such as metabolism. We also revisited MinD oscillations in living bacteria to build a quantitative framework describing their behavior regarding how the intracellular MinD protein concentration gradients are coordinated with cell growth. The analysis revealed the length-dependent variation of the MinD concentration gradient, showing the gradient becomes progressively steeper as cells elongate. Interestingly, the oscillation period appears relatively constant across different cell lengths. Our reaction-diffusion modeling revealed that the variation in concentration gradients arises from coordinated changes in the reaction rates governing MinD and MinE recruitment to the membrane and the ATP-dependent recharging of MinD in the cytoplasm. The analyses highlighted the importance of dynamic concentration gradients in orchestrating bacterial spatial organization. Taken together, these studies transformed our understanding of bacterial spatial organization by showing how Min proteins interact with membranes to form self-organized patterns, regulate cellular physiology beyond division, and integrate their oscillation behaviors to the cellular context.