Curriculum Vitae

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Education & Professional Experiences

- Distinguished Research Fellow, IMB, Academia Sinica (2017- present)
- Adjunct Professor, Institute of Biochemistry and Molecular Biology, National Taiwan University (2004-2025)
- Deputy Director, IMB, Academia Sinica (2022-2023, 2015-2017, 2001-2002)
- Associate and Research Fellow, IMB, Academia Sinica (1992- 2017)
- Post-Doctoral Fellow, UCLA, USA (1988-1992)
- Ph. D. in Chemistry, University of Southern California, USA (1988)

Research Interests

We investigate the complex landscape of nucleic acid–processing proteins involved in RNA decay, DNA degradation, and nucleic acid modification by integrating biochemical assays with structural biology. Our primary objective is to elucidate the molecular mechanisms by which these enzymes, including helicases and nucleases, recognize, interact with, and process their substrates. Many of these proteins are implicated in human disease, and our work aims to bridge the gap between structural perturbations and disease pathogenesis. By defining how mutations alter enzyme function, we seek to establish a molecular basis for these conditions and to inform the development of preventive strategies and therapeutic interventions.

Selected Publications

Li, Y.C., Wang, C.-H., Patra, M., Chen, Y.-P., Yang, W.Z., and Yuan*, H. S. (2025) Structural insights into human PNPase in health and disease. ***Nucleic Acids Res.*** 53, gkaf119.

Cho, C.-C., Huang, H.-H., Jiang, B.-J., Yang, W.-Z., and Yuan*, H. S. (2025) Histone modification-driven structural remodeling unleashes DNMT3B in DNA methylation. ***Sci. Adv***. 11, eadu8116.

Patra, M., Jain, M., Li, Y.C., Chen, Y.-N. and Yuan*, H. S. (2026) Asymmetric dimeric Suv3 helicase drives processive RNA unwinding in mitochondrial RNA decay. ***Nat. Comm.*** (in press).

Lecture Title

The molecular machinery of mitochondrial RNA and DNA decay in health and disease
結構解析粒線體核糖核酸降解機制與疾病關係

Abstract

Mitochondrial DNA (mtDNA) and RNA (mtRNA) levels, along with their associated quality control mechanisms, are tightly coupled to mitochondrial function and homeostasis. Mitochondrial nucleic acid-processing enzymes, including nucleases and helicases, play pivotal roles in maintaining the integrity and quantity of the mitochondrial genome and transcriptome. Consequently, defects in mtDNA maintenance and mtRNA decay are closely associated with a wide range of pathologies, including aging and neurodegenerative diseases. Building on our longstanding interest in these proteins, we have extended our structural and biochemical investigations from bacterial and nematode systems to mammalian enzymes. Our analysis of the mitochondrial degradosome, a complex composed of an exoribonuclease and a helicase, have elucidated the molecular mechanisms underlying mtRNA turnover and demonstrated how disease-associated mutations impair enzymatic function, leading to diverse pathological phenotypes. In parallel, our work on a mitochondrial endonuclease has revealed its role in mtDNA processing and the maintenance of mitochondrial genome integrity. Furthermore, we have identified small natural compounds that directly bind to this endonuclease and modulate its activity, highlighting their potential as therapeutic agents for diseases associated with dysregulated enzyme function. Collectively, our findings provide a detailed molecular framework for understanding nucleic acid-manipulating enzymes and establish a foundation for targeting these pathways in therapeutic development.