

Metabolic Engineering for Understanding and Harnessing Nature's Biosynthetic Potential

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Abstract: Nature produces many valuable compounds that can be used as alternative fuel or drug candidates. For example, plant natural products exhibit great pharmaceutical significance due to their structural complexity and chemical diversity. Sourcing compounds from their native producers is extensively used for valuable biochemical discovery and manufacturing. However, this approach may be crippled by cost and efficiency. Advances in metabolic engineering and synthetic biology have enabled efficient production of valuable microbial or plant natural products in heterologous hosts, mostly microorganisms. Moreover, recent progress in plant genomics lays the foundation for advancing our understanding of how nature achieves complex compound synthesis. Therefore, the combination of metabolic engineering, synthetic biology, and genomics provides a promising alternative approach for natural compound production and discovery. In this talk, I will discuss (1) the development of a systematic metabolic engineering approach in yeast for efficient bioethanol production and optimization, (2) complete biosynthesis of the opium poppy - derived medicinal alkaloid noscapine and related derivatives, and (3) the emerging opportunity of accelerating complex plant natural product discovery and engineering via the development of an integrated synthetic biology pipeline. These studies highlight the potential for integrated synthetic biology, metabolic engineering, and genomics approaches to advance plant natural product-based drug discovery and development.

Short Bio: Prof. Li received her B. S. degree in Chemical Biology from Tsinghua University in 2008, and her Ph.D. degree in Chemical and Biomolecular Engineering under the guidance of Prof. Huimin Zhao at the University of Illinois, Urbana-Champaign in 2014. Then she moved to Stanford University and worked with Prof. Christina D. Smolke as a postdoctoral scholar. Prof. Li will start as an Assistant Professor in the Robert Frederick Smith School of Chemical and Biomolecular Engineering at Cornell University in 2019, and has started her independent academic career as a Visiting Assistant Professor at Cornell from September 2018.

Li Lab's research goal is to develop metabolic engineering and synthetic biology platforms that enable the systematic discovery and production of plant natural products and their derivatives, ultimately transforming our ability to understand how nature achieves complex compound biosynthesis.