

INNOVATIVE BIOMANUFACTURING PLATFORM: CELL-FREE SYNTHETIC PATHWAY BIOTRANSFORMATION

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Cell-free synthetic pathway biotransformation (SyPaB) (1, 2) is the implementation of complicated reactions that microbes and chemical catalysts cannot through the in vitro assembly of numerous (stable) enzymes originated from different sources and/or (biomimetic) cofactors. SyPaB features numerous advantages: high product yield, fast reaction rate, easy access and control for open systems, tolerance of toxic compounds, broad reaction conditions, and so on.

In this talk, I will introduce the basic concept of SyPaB and present several applications: (i) the highest yield hydrogen production from sugars (i.e., an out-of-the-box solution to the hydrogen economy) (3, 4), (ii) enzymatic biotransformation of cellulose to high-value amylose (i.e., feeding the world by providing high quality (tailored) food), (iii) enzymatic fuel cells (i.e., high-energy density biobatteries) (5), (iv) highest-energy retaining production of jet fuel through a hybrid of SyPaB and catalysis (6), and (iv) artificial photosynthesis for CO₂ utilization (7). Also, I will talk about some of our efforts in developing basic building blocks (e.g., thermoenzymes), building modules (e.g., synthetic metabolons) (8), and redox enzyme engineering. SyPaB would become a high-yield and low-cost biomanufacturing platform and lead a paradigm shift, especially in white biotechnology and biorefineries.

References

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