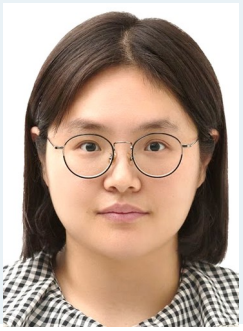
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RESEARCH & COLLABORATION PROFILE

KEY WORDS: Extremophile Biotechnology | Enzyme Discovery and Engineering | Structural Biology
Non-model Yeast Metabolic Engineering | Lignocellulosic Biomass Conversion

Research Snapshot. Dr. Areum Lee's earlier research focused on discovering and biochemically characterizing enzymes from thermophilic microorganisms and exploring their biotechnological applications. She also investigated lignocellulosic biomass utilization through enzyme discovery and application, as well as metabolic engineering of thermoacidophilic archaea. Her current research has expanded to metabolic engineering of non-model yeasts for the production of value-added compounds, including the construction of meroterpenoid biosynthetic pathways. She also studies the structural and functional properties of biosynthetic enzymes, particularly type III polyketide synthases, and uses structural insights to guide enzyme engineering and pathway development.

RESEARCH EXPERTISE

- **Extremophile microbiology and biotechnology:** Study thermophilic microorganisms, including thermoacidophilic archaea, and engineer archaeal hosts for the utilization of lignocellulosic biomass.
- **Enzyme discovery and engineering:** Discover and characterize enzymes from thermophilic microorganisms, investigate their structural and functional properties, and apply structure-guided engineering to biosynthetic enzymes, including type III polyketide synthases.
- **Sustainable bioconversion: Develop** enzyme-based and microbial approaches to convert lignocellulosic biomass and other substrates into useful products.
- **Metabolic and synthetic biology:** Engineer non-model yeasts and microbial pathways for compound production, including the construction of meroterpenoid biosynthetic pathways and the development of type III PKS-associated pathways.

CURRENT RESEARCH DIRECTIONS

- **Meroterpenoid biosynthesis in non-model yeast:** Developing a non-model yeast platform and constructing a biosynthetic pathway for meroterpenoid production.
- **Structure-guided engineering of type III polyketide synthases:** Investigating the structure–function relationships of type III polyketide synthases and exploring structure-guided approaches to tune their product profiles.
- **Engineering *Sulfolobus acidocaldarius* for lignocellulose utilization:** Engineered S. acidocaldarius to utilize hemicellulose and pursuing further engineering to enable utilization of crystalline cellulose.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: Microbial metabolic engineering | Enzyme discovery and engineering | Structural biology | Biomass conversion | Extremophile biotechnology

- **1. Metabolic engineering of non-model yeasts:** Build and optimize biosynthetic pathways in non-model yeast hosts for the production of meroterpenoids and other value-added compounds.
- **2. Structure-guided enzyme engineering:** Integrate structural biology, enzymology, and protein engineering to understand and modify the activity or product profiles of biosynthetic enzymes, including type III polyketide synthases
- **3. Lignocellulosic biomass conversion:** Combine enzyme discovery and microbial engineering to expand biomass utilization by thermoacidophilic archaea, including ongoing efforts toward crystalline-cellulose utilization.
- **4. Extremophile enzyme discovery and characterization:** Collaborative screening and characterization of enzymes from thermophilic microorganisms, followed by evaluation of their potential in high-temperature bioprocesses.

SELECTED RECENT PUBLICATIONS

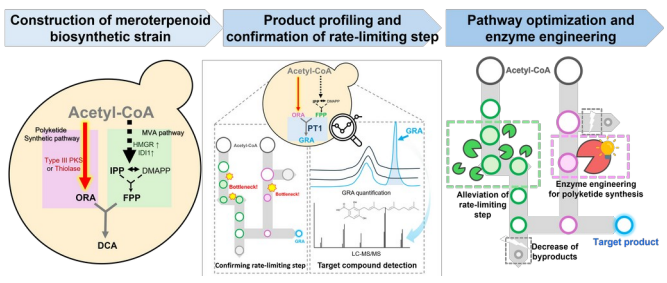
- International Journal of Biological Macromolecules 2025, 306, 141431 — "AmyA contributes to the glycogen synthesis in *Sulfolobus acidocaldarius*."
- Journal of Microbiology and Biotechnology 2022, 32(5), 663–671 — "Engineering of *Sulfolobus acidocaldarius* for Hemicellulosic Biomass Utilization."

CONTACT

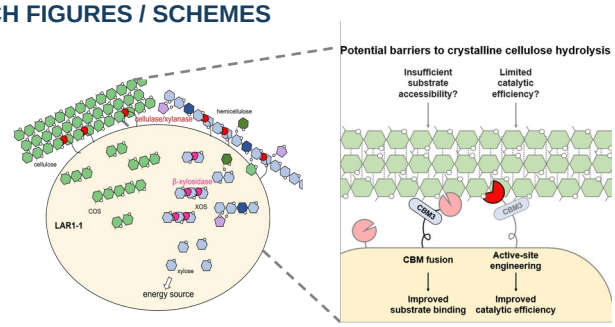
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REPRESENTATIVE RESEARCH FIGURES / SCHEMES



Metabolic engineering of Yeast for meroterpenoid production



Engineering archaea for lignocellulosic biomass utilization