

AI-Driven Strategies for Smart Culture Medium Optimization in Recombinant Protein Production

Background/Objective

- Recombinant protein production (RPP) is essential to biotechnology, where recombinant proteins are used as either end products or catalysts in the synthesis of chemicals, fuels, and materials.
- Among the major cost drivers, the culture medium plays a pivotal role in determining protein yield and quality.

Approach

- Provide a comprehensive perspective on the critical stages of smart culture medium optimization including planning, screening, modeling, optimization, and validation.
- Integrate AI/ML advances to guide medium optimization in RPP, shifting from trial-and-error approaches to rational, predictive strategies to accelerate medium formulation.

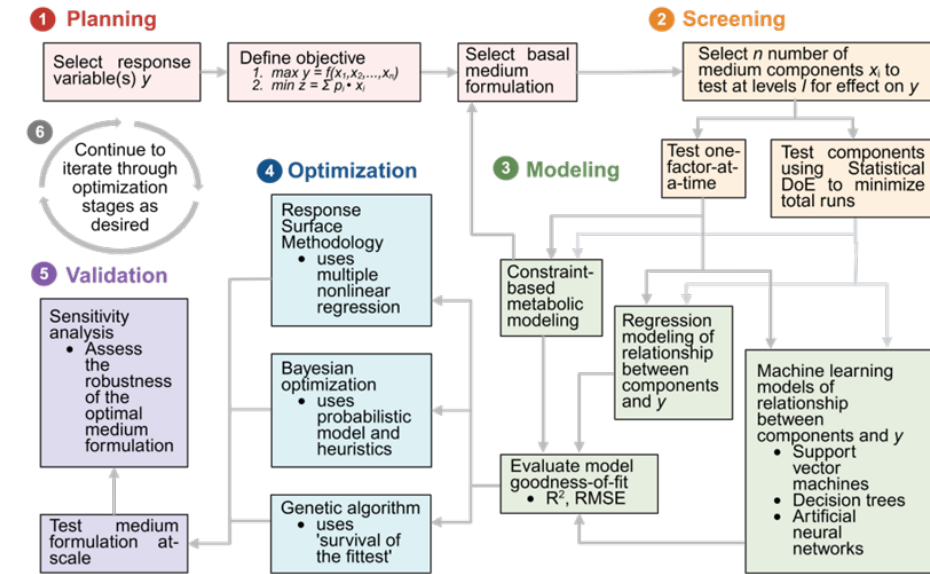
Results

- Defined the essential roles of medium components that influence recombinant protein production and quality.
- Highlighted the often-overlooked variability in medium components, such as trace metals, and their negative impact on RPP.
- Presented AI/ML-driven models for designing efficient and cost-effective culture media for RPP.
- Discussed the challenges in scaling medium optimization for RPP from lab to industry scales.

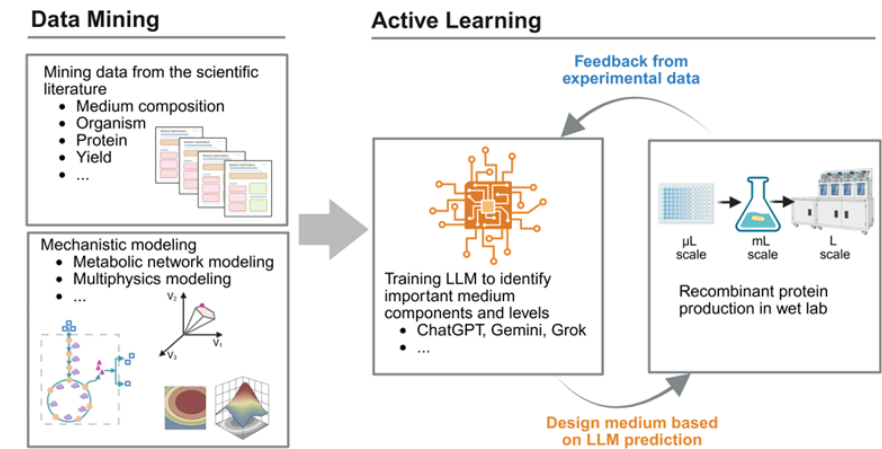
Significance/Impacts

- Provided a unified framework to advance smart medium design in RPP, enabling innovative biomanufacturing and biotechnology.

Khan, G., et al., Biotechnol Advances (2025) [10.1016/j.biotechadv.2025.108738](https://doi.org/10.1016/j.biotechadv.2025.108738)



Stages of medium optimization for recombinant protein production



Future of AI/ML in medium optimization