Escherichia coli cell factory for producing an enantioselective enzyme used in the synthesis of industrial building blocks

Beatrice Serati[1], Mirko Frigerio Verga[1], Daniela Bucchieri[1], Immacolata Serra[1], Valeria Mapelli[1], Paola Branduardi[1]
E-mail: b.serati@campus.unimib.it
[1] Univerisity of Milano-Bicocca, Italy

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Abstract:
Chiral molecules are pivotal building blocks in pharmaceutical, agrochemical, and fine chemical industries due to their prevalence in bioactive molecules and complex organic compounds.
Conventional chemical methods for their synthesis often involve multi-step processes that require harsh reaction conditions and frequently result in poor-to-moderate yields and limited selectivity. In contrast, enzymatic synthesis has emerged as an environmentally friendly alternative, offering reduced process complexity, higher selectivity, and milder reaction conditions.
The goal of this project was to produce an enantioselective enzyme enabling a more efficient and sustainable process to overcome the chemical methods limitation.

Bacteria, such as *Escherichia coli*, are highly effective at producing large amounts of proteins, making them ideal for industrial applications. Secretion is a desirable property in recombinant protein production, due to the more straightforward subsequent downstream processing. Yeasts, like *Saccharomyces cerevisiae,* offer advantages such as post-transcriptional modifications and protein secretion capabilities. For small proteins that do not require complex modifications, bacteria's production capacity could still be the preferred option, despite secretion in *E. coli* has historically been a challenge. Nevertheless, in recent years, advanced toolkits have been developed to tune the secretion of heterologous proteins in *E. coli*, without relying on cell lysis.
This work focuses on adapting and optimizing the secretion of a specific enzyme in *E. coli*, enabling efficient extracellular production and paving the way for more sustainable and cost-effective industrial processes.