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Evolutionary Genetics and Genomics

Construction of Multifunctional Bacterial Hosts for Biomining and Bioproduction of the Secondary Metabolite

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Interdisciplinary Research Building
跨領域科技研究大樓1樓演講廳
Host: Dr. Wen-Hsiung Li 李文雄特聘研究員

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Abstract

Heavy metals pollution in various environments has been a persistent and severe threat to the human and animal health. Hence, it is an urgent demand to pursue an efficient and environmentally compatible method to remove or detoxify heavy metals in an economical and natural way. Biomining is an inventive and optimistic technology which is applicable for the retrieval and reduction of heavy metals in water and polluted lands. Apparently, biological method is one of the potential solutions for heavy metal remediation since it provides a complete clean-up of heavy-metal contaminants without creating any secondary pollution. Therefore, the objective of this study is to demonstrate the feasibility of genetically engineered *Bacillus subtilis* to enhance the effectiveness of heavy-metal biosorption via overexpression of metal binding protein (Metallothionein) and membrane-associated mercuric-ion transport protein (MerP). In this study, we employed "Cellulosome", a multiple-protein complex thus enables the synergistic function of the metal binding proteins.

Production of high-value carotenoids is an attractive alternative for the extraction from plant materials and to chemical synthesis. More than 65,000 isoprenoid compounds are produced by nature. Among them, "Astaxanthin", a red xanthophyll carotenoid has a great significant commercial value due to its "Superior antioxidant" potential and wide applications in the aquaculture, food, cosmetic and pharmaceutical industries. Astaxanthin is mainly produced by chemical synthesis, however, the process is expensive and synthetic astaxanthin is not approved for human consumption. Considering the limited productivity of astaxanthin via extraction and the biosafety issues of chemical synthesis, microbial production of astaxanthin via metabolic engineering has become an attractive alternative. In our study, the following strategies have been used for the astaxanthin production in *E. coli* 1) Introduction of a heterologous MEP pathway. 2) Overexpression of the rate-limiting enzyme's genes. 3) Usage of constitutive promoter. 4) Enhancing the flux of isoprenoid precursors. 5) Stimulating the activity of key enzymes by culture media optimization.