Title: Engineering of synthetic genetic circuits for dynamic pathway regulation in thermophiles

Industrial-scale microbial production of biochemicals and -fuels offers a sustainable alternative to the current petrochemical processes. However, many lab-scale engineering attempts to develop microbial cell factories fail in the upscaling phase because of the productivities, titers and yields still being too low. This bottleneck will be addressed in this competitive postdoctoral proposal by combining two innovative approaches: first, the use of a thermophilic host organism, which enables the development of a cost-effective high-temperature fermentation process and second, the introduction of metabolite-responsive regulation of gene expression. Starting from the fundamental study from natural (post-)transcriptional gene regulatory processes in thermophiles using genetic and genomic methodologies, biological parts, either riboswitches or transcription factors, will be harnessed to develop synthetic biology toolboxes that enable a predictable control of an engineered production pathway. In addition, novel genetic tools will be developed for the thermophilic host under study, such as efficient CRISPR-Cas based genome editing. Besides the engineering objective of improving productivities, this project will generate impact by developing synthetic biology insights, tools and parts that are more generally applicable for thermophile engineering for industrial biotechnology.

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