

Applying Gene Circuits for Microbiome-Based Therapeutics

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Today there is strong evidence that an imbalance in the microbiome (dysbiosis), signalling molecules and metabolites can strongly affect our health; it may cause inflammation, cancer, and other diseases. In turn, inflammations and abnormal metabolite levels may interrupt the microbiome's ecosystem.

Our motivation in this study is to develop a bacterial-based platform to treat gastrointestinal diseases by applying synthetic biology tools. Specifically, we will engineer microbial consortia that can detect biomarkers in the gut microenvironment, treat diseases, and rebalance the microbiome by administering engineered beneficial microbial manufacturing factories.

This novel strategy, based on engineered microbiome would restore normal host function. The engineered bacteria are designed to sense different biomarkers indicating gastrointestinal diseases in a local target along the GI tract, then, they track these changes and respond correctly to rebalance the ecosystem and treat diseases according to the programmed treatment protocol, either by producing or decomposing biomolecules.

This synthetic microbiome as a novel field that combines tools of synthetic biology – genetically engineered systems – and microbiome, has the potential of next-generation therapy for healthcare. *In vivo* experiments of an animal model to imitate human body complexity for accurate investigation of treating diseases would be conclusive proof.