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Systems Biotechnology for Industrial Microorganisms

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The emergence of systems biology, high throughput *omics*, a plethora of annotated genomes and the appearance of genome scale stoichiometric models are bringing unprecedented advances for the microbial metabolic engineering community. Genome scale models are changing the way we do gene knockouts, while high-throughput *omics* are revealing new functional genes and gathering unprecedented quantities of data in record times. With all these, the scientific community is faced with new avenues previously unexplored, resulting in better systems for the production of high value chemicals such as biopolymers, biopesticides, biofuels and novel pharmaceuticals.

Here, we explore the use of systematic over-expression of genes in the hyaluronic acid (HA) pathway of streptococci for the production of high molecular weight HA. We successfully break the 5 MDa barrier, up from 1-2 MDa for wildtype strains. This study highlights the power of systems biotechnology to tackle quality traits such as molecular weight. In parallel, we illustrate how systems biology is changing our understanding of actinobacteria biology. Using, proteomics, transcriptomics (RNA-seq) and a genome scale models we are gathering information of previously unknown mechanisms of cellular architecture and regulation.