Molecular tools to engineer cyanobacteria for industrial biotechnology

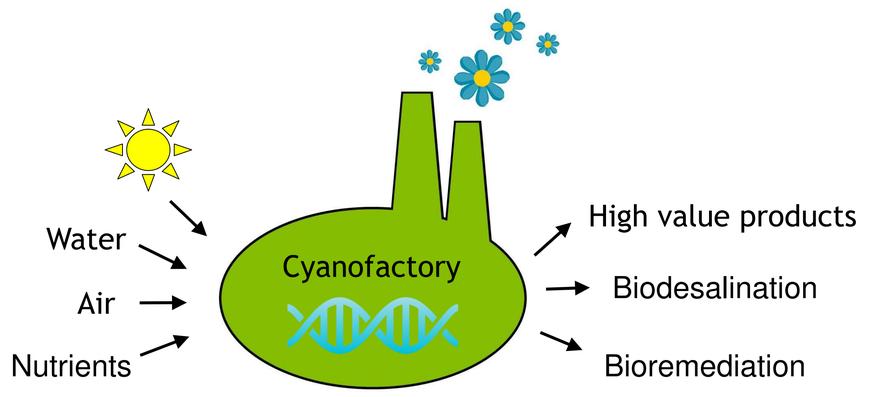
Mary Ann Madsen[1], Graham Hamilton[2], Thierry Tonon[3], Pawel Herzyk[2], Anna Amtmann[1]

[1] Institute of Molecular, Cell and Systems Biology, College of Medical, Veterinary and Life Sciences, University of Glasgow
[2] Glasgow Polyomics, College of Medical, Veterinary and Life Sciences, University of Glasgow, G128QQ
[3] Centre for Novel Agricultural Products, Department of Biology, University of York

Cyanobacteria as a sustainable chassis

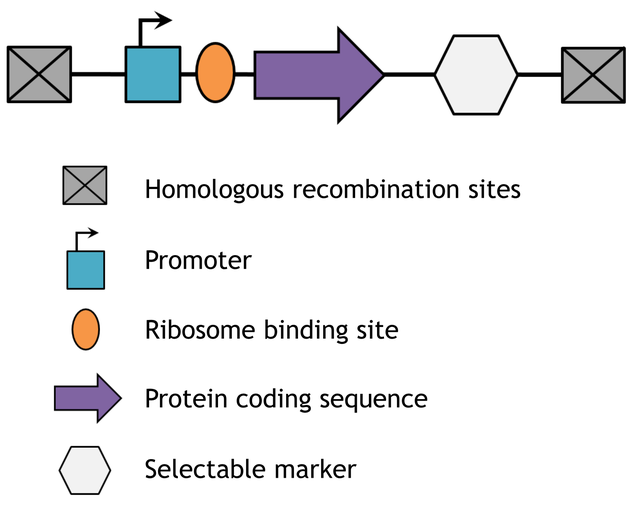
- Prokaryotes – simple organisms, rapid growth, small genomes, easily transformed
- Photosynthetic – minimal input, therefore cheap feedstock and lower risk of contamination
- Extremely diverse – habitat, morphology, metabolism, wide range of natural products

…but the engineering toolbox is still limited



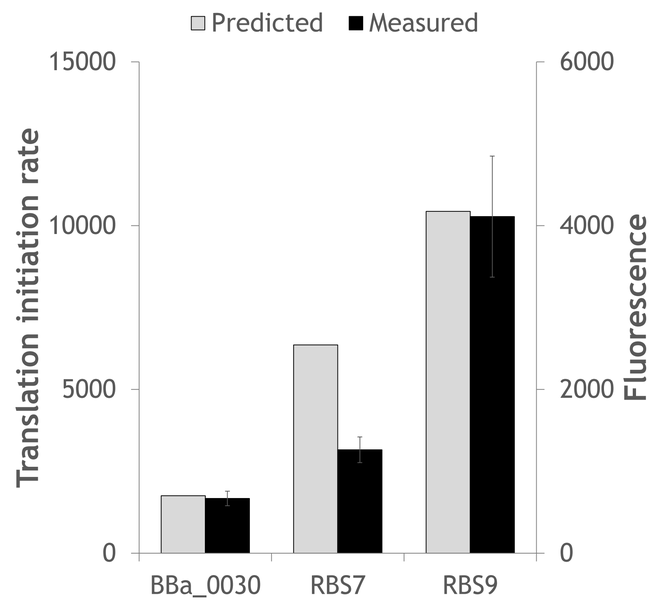
Introducing foreign DNA

- Plasmid vectors for stable integration to neutral sites in the genome
- BioBrick compatible



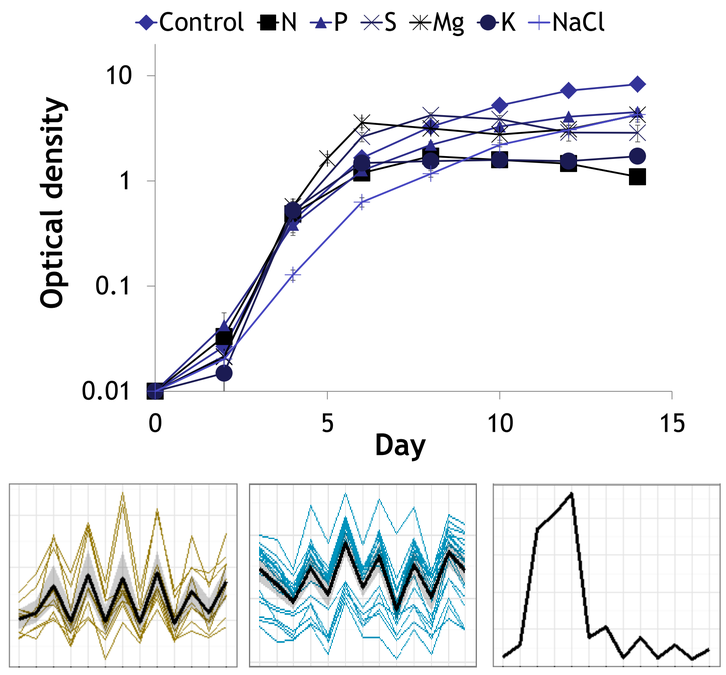
Controlling translation initiation

- Forward engineering of synthetic ribosome binding sites based on *in silico* calculators



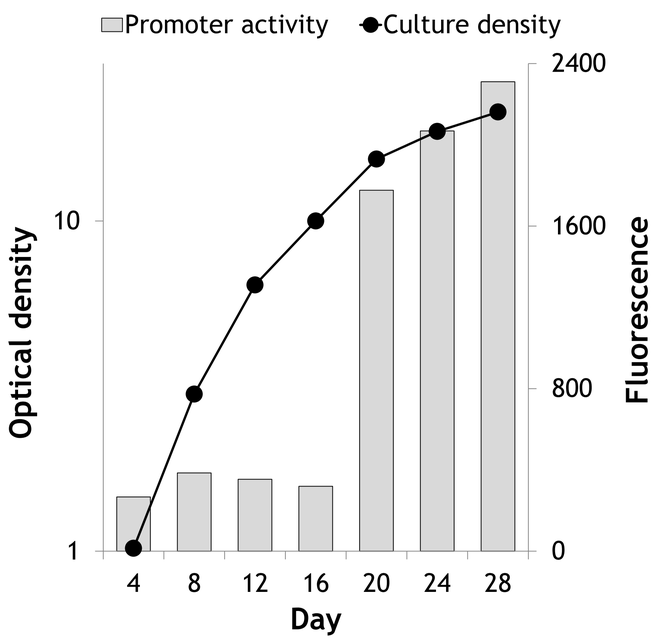
Controlling growth kinetics

- Defined conditions, extensive RNAseq analysis



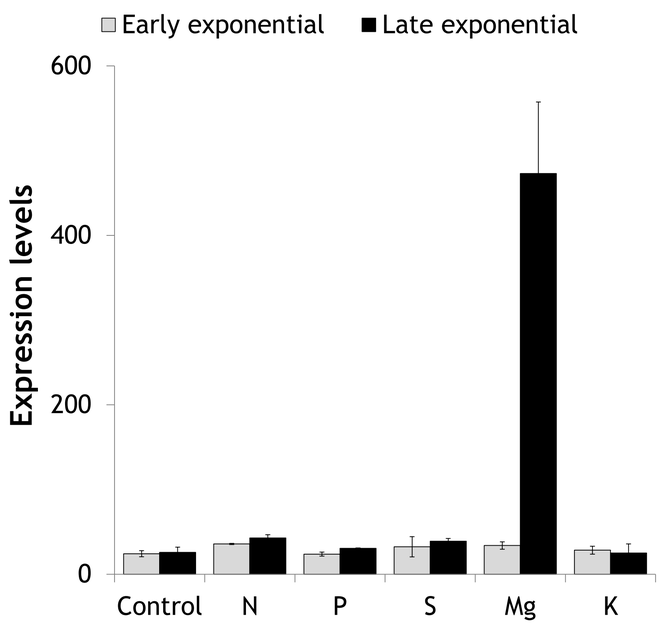
Growth-responsive transcription

- Induced in the late exponential phase



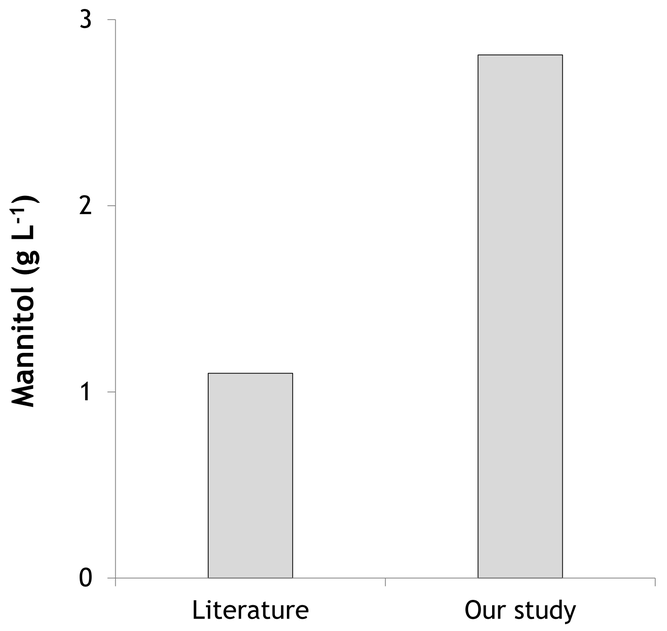
Nutrient-responsive transcription

- Induced under specific nutrient limitations



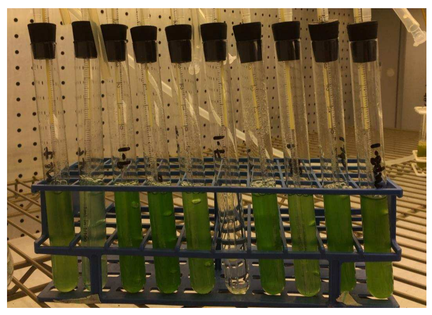
Enhanced product synthesis

- Better tools make for better titres



Summary

- A comprehensive toolkit has been established for rapid, rational design of cyanobacteria
- Control at various levels of the production process: culture growth, transcription, translation and ultimately product synthesis
- Novel conditions to modulate growth kinetics identified and transcriptomic responses analysed
- Novel growth phase- and nutrient-responsive promoters developed



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