

This is a repository copy of *Molecular tools to engineer cyanobacteria for industrial biotechnology*.

White Rose Research Online URL for this paper:
<http://eprints.whiterose.ac.uk/132410/>

Conference or Workshop Item:

Tonon, Thierry orcid.org/0000-0002-1454-6018 (2017) Molecular tools to engineer cyanobacteria for industrial biotechnology. In: Cyanobacterial biotechnology: technologies to applications to products, 11-12 May 2017.

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

Molecular tools to engineer cyanobacteria for industrial biotechnology

Mary Ann Madsen¹, Graham Hamilton², Thierry Tonon³, Pawel Herzyk², Anna Amtmann¹

¹ Institute of Molecular, Cell and Systems Biology, College of Medical, Veterinary and Life Sciences, University of Glasgow

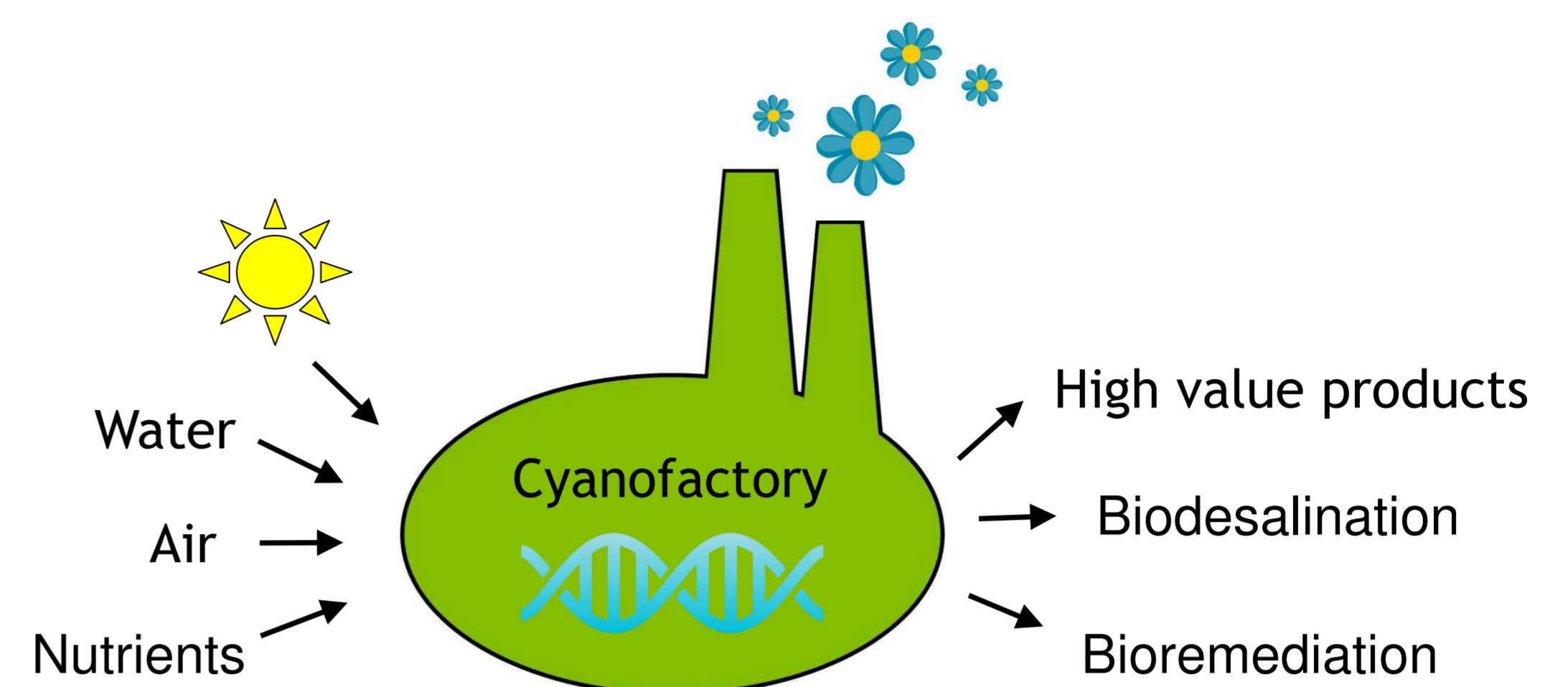
² Glasgow Polyomics, College of Medical, Veterinary and Life Sciences, University of Glasgow, G128QQ

³ Centre for Novel Agricultural Products, Department of Biology, University of York

Cyanobacteria as a sustainable chassis

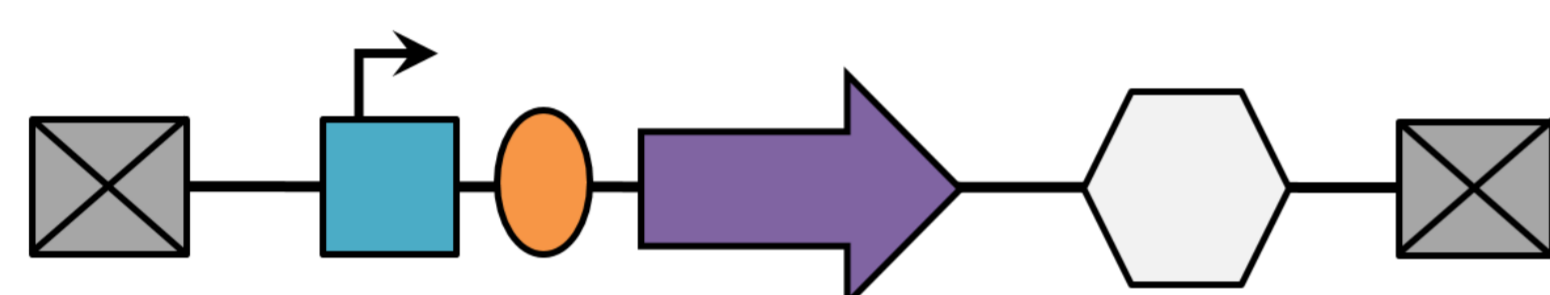
- Prokaryotes - simple organisms, rapid growth, small genomes, easily transformed
- Photosynthetic - minimal input, therefore cheap feedstock and lower risk of contamination
- Extremely diverse - habitat, morphology, metabolism, wide range of natural products

...but the engineering toolbox is still limited



Introducing foreign DNA

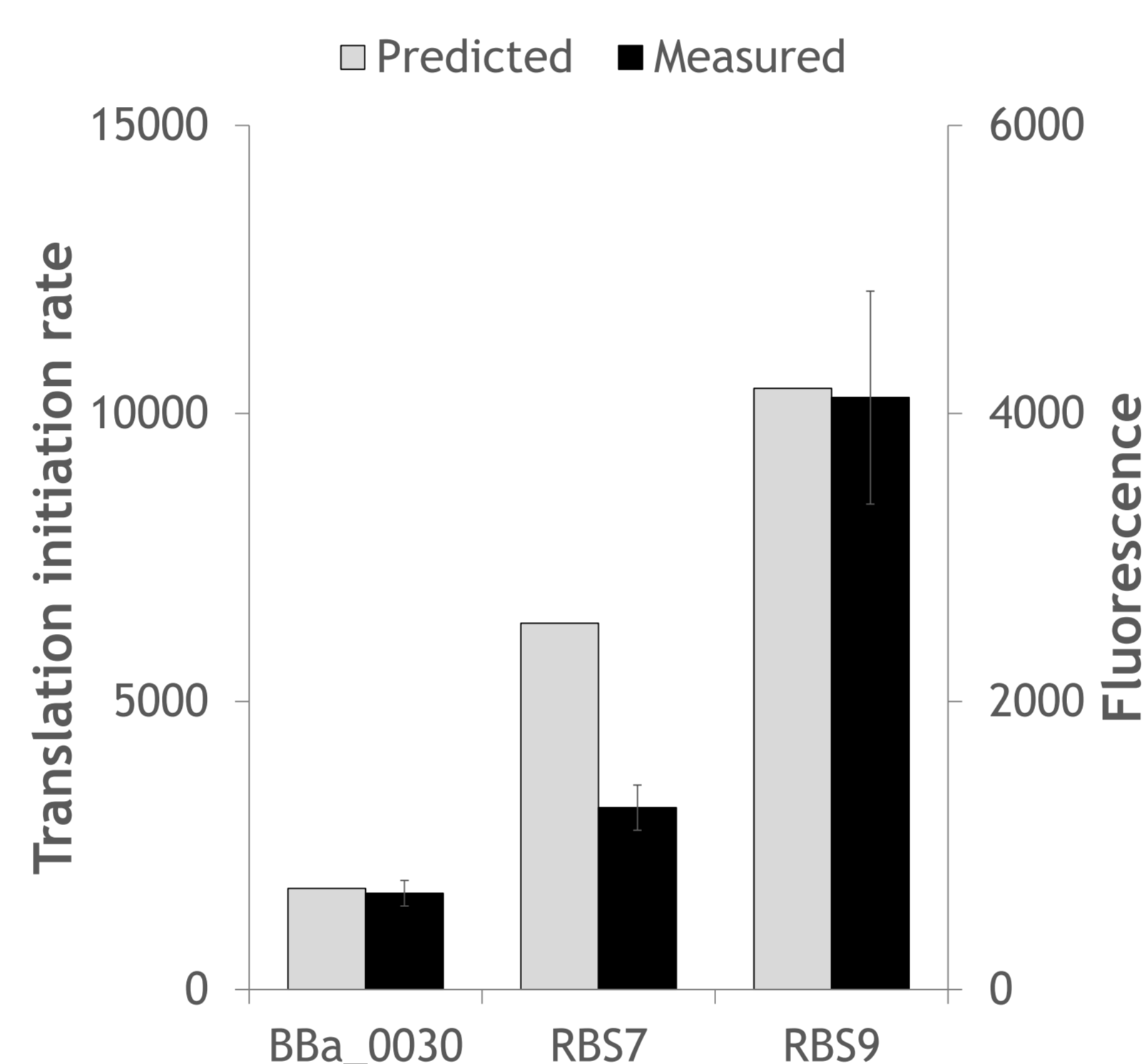
- Plasmid vectors for stable integration to neutral sites in the genome
- BioBrick compatible



- ⊠ Homologous recombination sites
- Promoter
- Ribosome binding site
- Protein coding sequence
- ⬡ Selectable marker

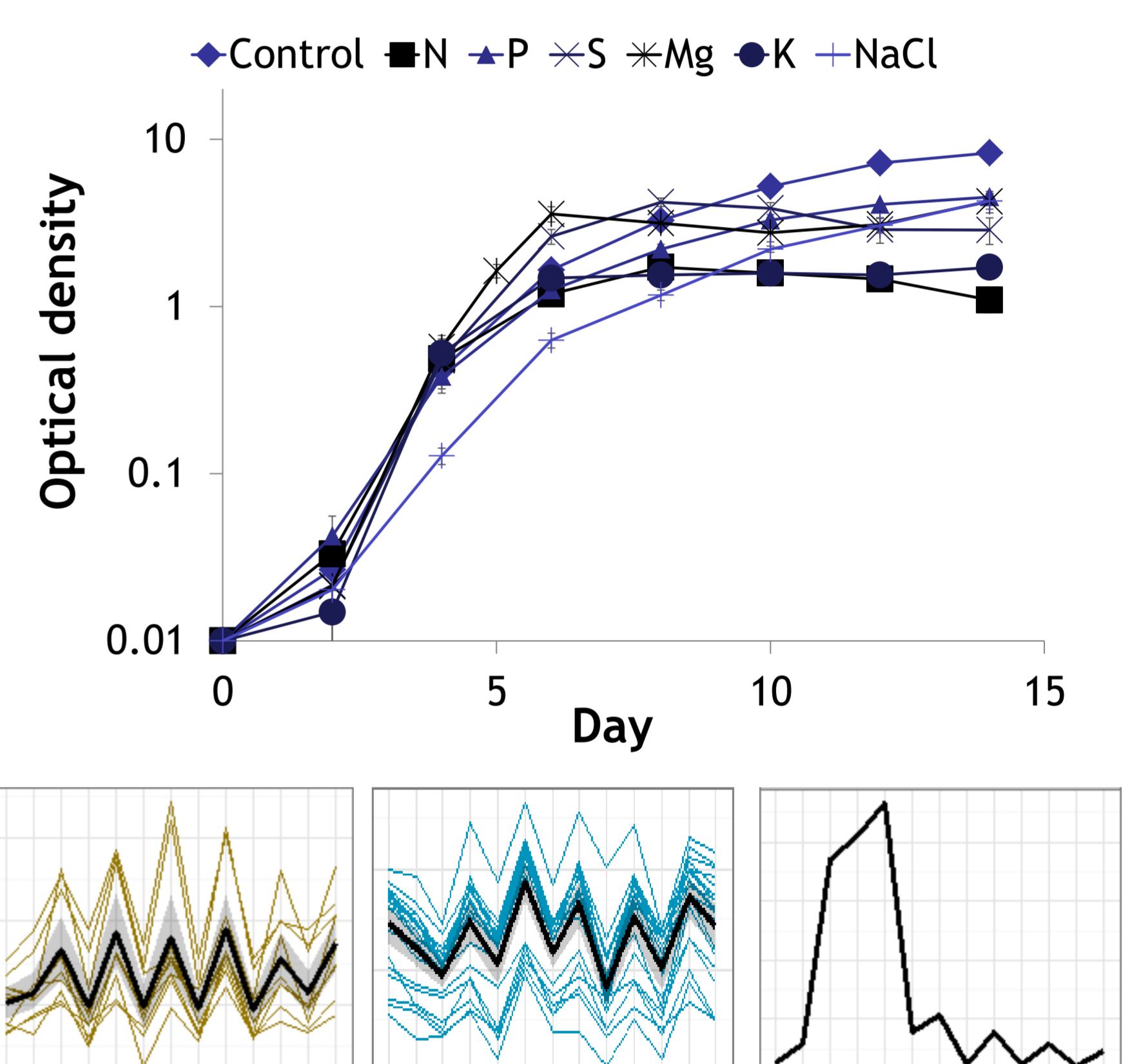
Controlling translation initiation

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



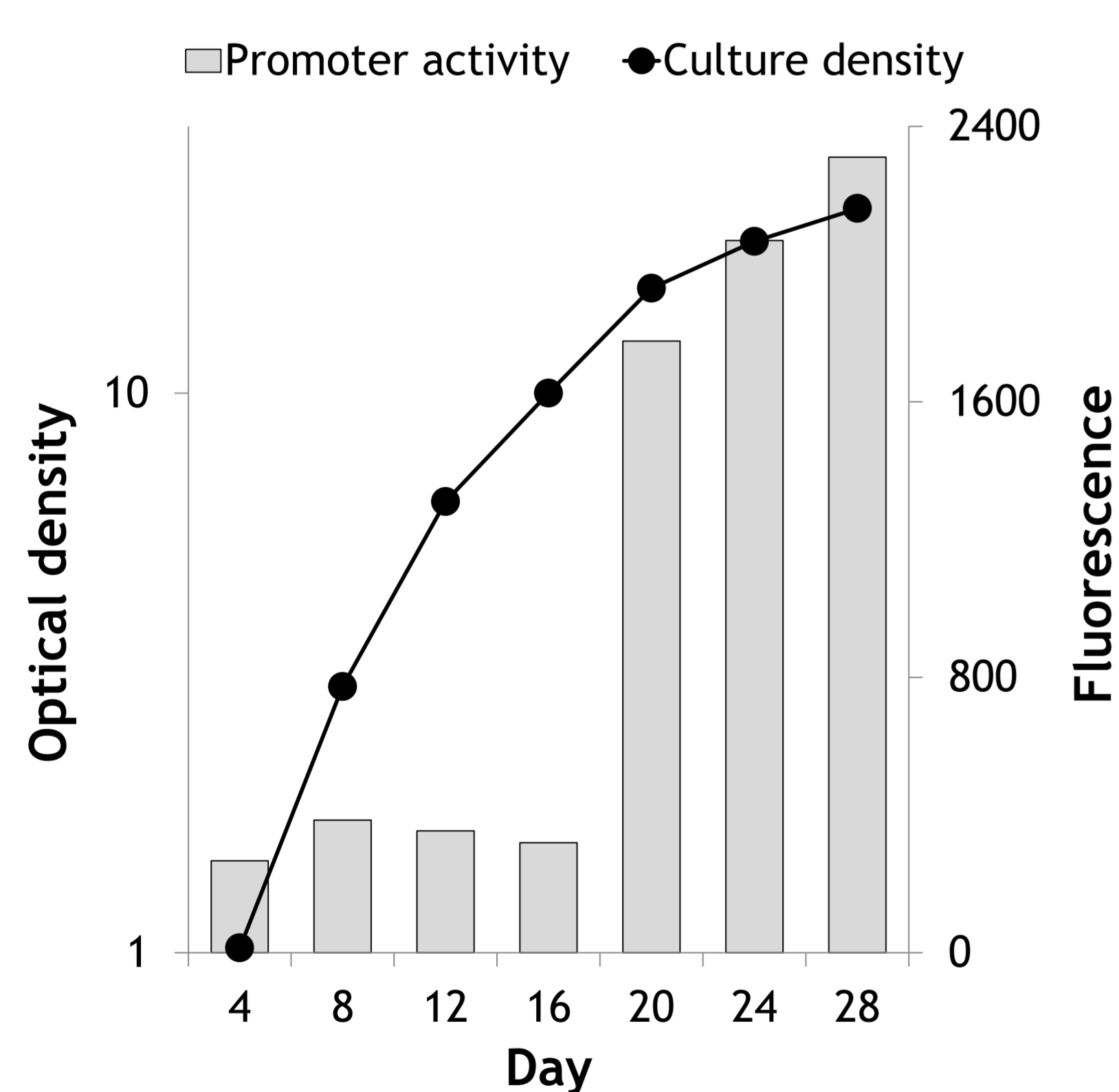
Controlling growth kinetics

- Defined conditions, extensive RNAseq analysis



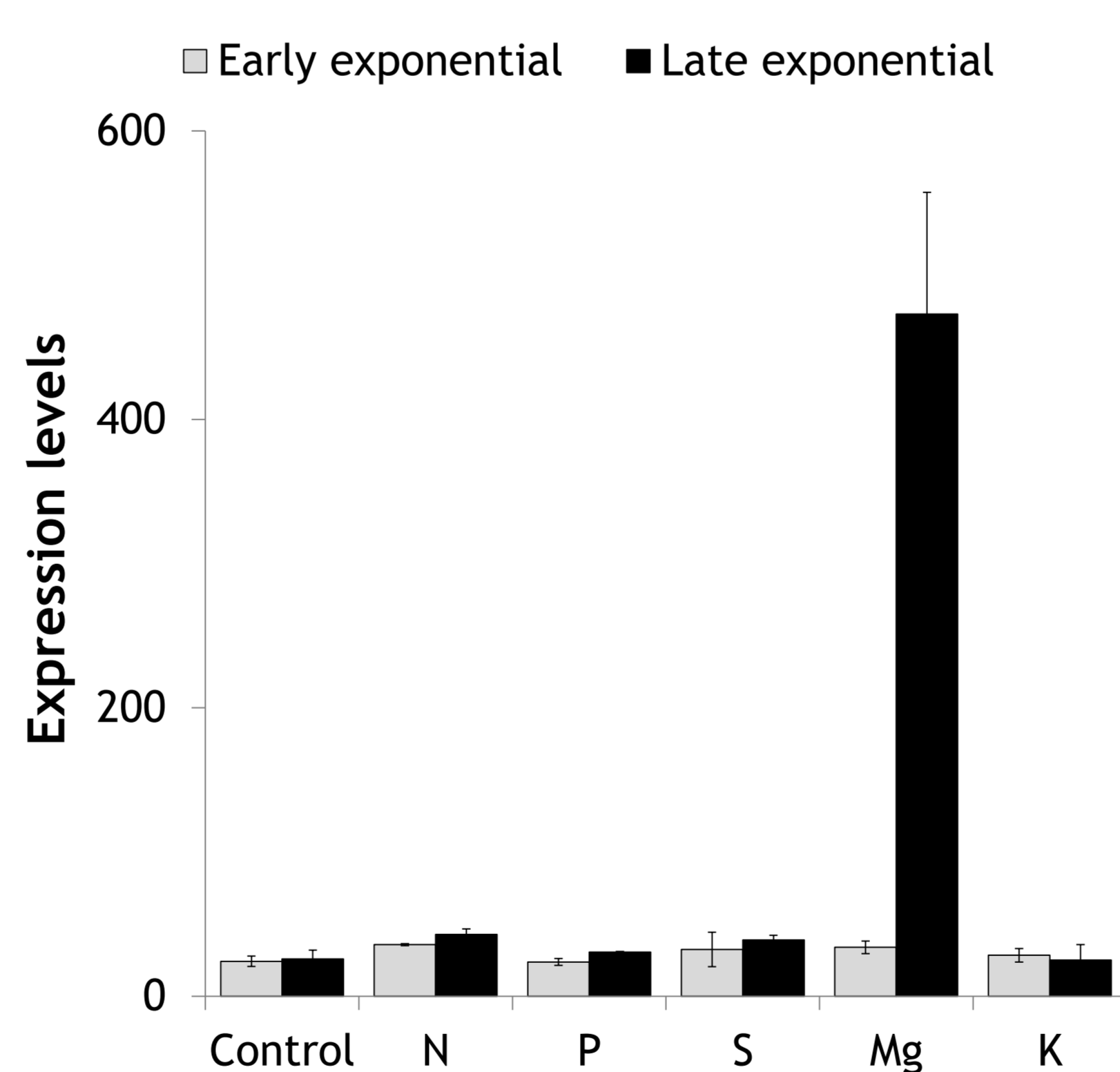
Growth-responsive transcription

- Induced in the late exponential phase



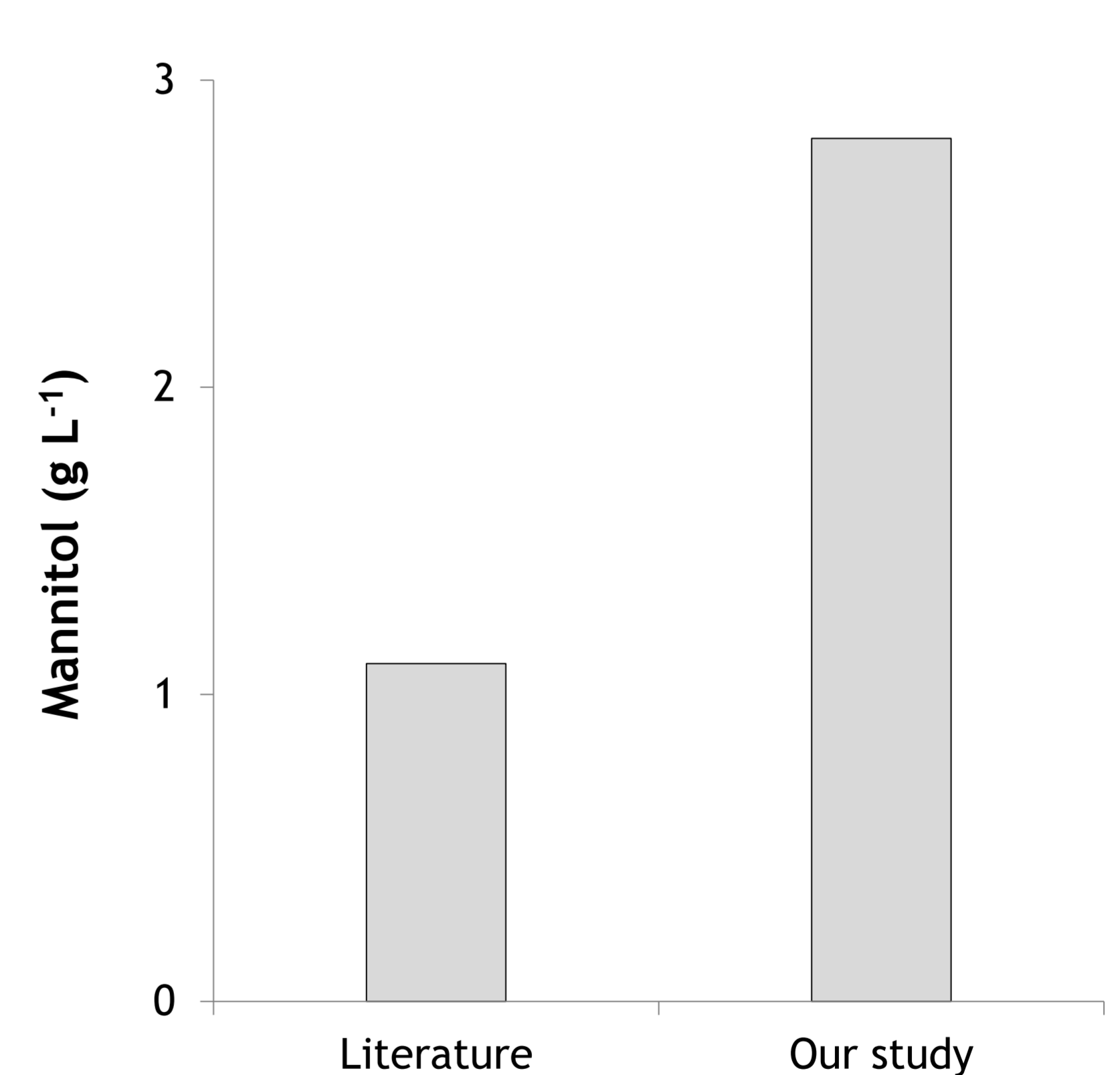
Nutrient-responsive transcription

- 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

