CBMNet
CROSSING BIOLOGICAL MEMBRANES NETWORK, A BBSRC NIBB

The University Of Sheffield.

UNIVERSITY of York

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Identifying and characterising protective lipid changes under solventogenic stress

The Challenge

Solventogenic Clostridia are used by Green Biologics to generate n-butanol from a variety of feed-stocks providing sugars for fermentation. However, n-butanol is expensive to purify from the fermentation broth. The cost of in-situ solvent removal is greatly decreased by fermenting at higher concentrations of n-butanol. However, n-butanol is toxic to Clostridia at concentrations above ~2%.

It has been recently demonstrated that this toxicity is likely due to damage to the plasma membrane and that interactions with n-butanol occur in a lipid-dependent manner. To gain a more complete understanding about which changes in membrane lipid composition may be protective, and the mechanisms underlying this, it is essential to perform lipidomics experiments complemented by i*n vitro* assays.

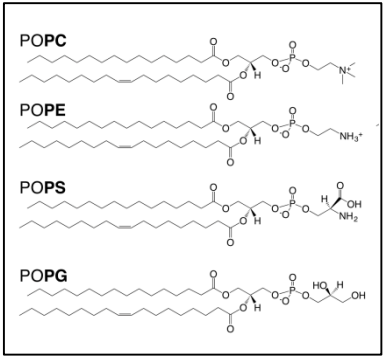
The Research

Dr Alan Goddard is a Lecturer at Aston University. The research in his laboratory focusses mainly on the lipid membrane that surrounds cells and the integral proteins residing within this. He has a particular interest in biochemical and biophysical assays.

Dr Tony Larson is Head of CNAP metabolic profiling at the University of York. His research interests centre on small molecule measurements and metabolomics and novel methodologies for probing changes in these.

Green Biologics converts a wide range of sustainable feedstocks into high performance green chemicals. They combine advanced, high productivity fermentation utilising superior-performing Clostridium microbial biocatalysts to produce renewable n-butanol and acetone.

Dr Goddard and Dr Larson applied for a CBMNet Proof-of-Concept Grant as a result of a previously successful Business Interaction Voucher with Green Biologics. The aim was to develop their collaborative partnership and produce further preliminary data that could be built on in future funded projects. The project aimed to use a combination of lipidomics and *in vitro* experiments to identify and characterise protective changes in the cell membrane.



CBMNet Proof-of-Concept Grant

The Result

This project demonstrated that Clostridia undergo dramatic changes in their cell membrane lipid composition as a result of n-butanol production.

Intriguingly, many of the lipids produced are unknown, indicating the need for further research in this area.

In addition, *in vitro* assays demonstrated that lipids isolated from Clostridia grown in high concentrations of n-butanol were more resistant to solventogenic stress than those from bacteria grown at low n-butanol concentrations.

Dr Peter Sanderson, a CBMNet-funded Postdoctoral Researcher gained a wide variety of biochemical and biophysical techniques as well as gaining the opportunity to interact with industrial and academic researchers on a collaborative project.

The Future

The data generated in this project will feed into a future research council funding application to continue the collaboration between Dr Goddard and Green Biologics.

Dr Goddard has a PhD student starting in October 2017 who will continue to work to decipher the precise nature of the n-butanol-membrane interaction in order to better understand how to engineer more resistant strains, initially focussing on how the lipid composition of the membrane changes throughout n-butanol fermentation.

"This award has been integral to establishing my research profile in this area, allowing me to employ and train a postdoctoral researcher and continue a very productive collaboration with Green Biologics Ltd.".

Dr Alan Goddard
University of Aston

"The data generated in this project will be combined with that from other CBMNet-funded projects to give a critical mass of data for larger grant applications".

Dr Preben Krabben
Green Biologics

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