

Examination of n-butanol membrane interactions by nanoplasmonic sensing

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. In addition, it has been previously shown that n-butanol interacts with lipid membranes, but we wish to gain a better understanding of the nature of this interaction.

Insplorion have developed a nanoplasmonic sensing (NPS) where changes in refractive index can be used to infer cell membrane architecture. This will allow the mechanism of disruption by n-butanol to be further identified. NPS has previously been used to study the deformation of lipid bilayers and peptide-bilayer interactions.

The Exchange

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.

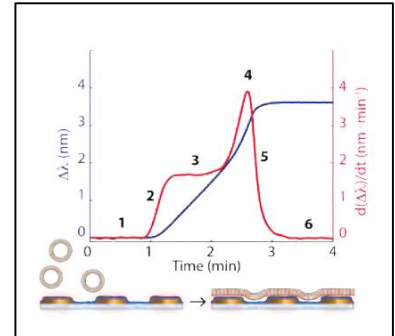
Insplorion is a Swedish company, which develops and sells its proprietary sensor technology NanoPlasmonic Sensing (NPS).

Dr Goddard applied for a CBMNet Industrial-Academic Exchange Grant with Insplorion to develop a collaborative partnership and produce preliminary data that could be built on in future funded projects.

The project aimed to use nanoplasmonic sensing to probe the nature of the n-butanol-membrane interaction.



Insplorion

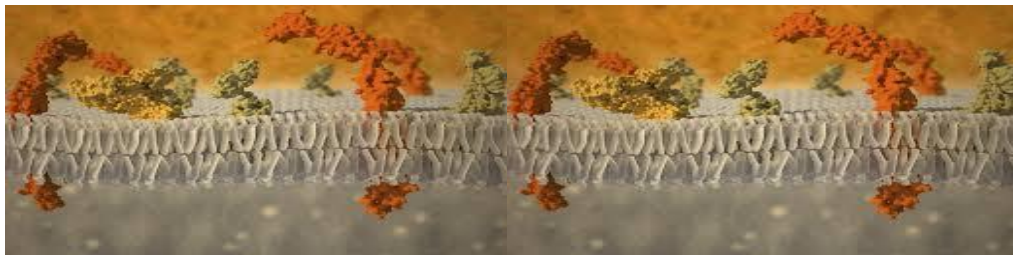


The Result

Dr Peter Sanderson, a CBMNet-funded Postdoctoral Researcher visited Insplorion in Sweden and gained hands-on experience of nanoplasmonic sensing.

He obtained results demonstrating that whilst n-butanol can interact with, and likely intercalate into membranes, it does not fully disrupt them.

When compared to detergents such as SDS, which fully solubilises the membrane and removes it from the chip surface, the lipid membrane remained intact even at high n-butanol concentrations.



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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.

“Due to this grant, I have received valuable training from Insplorion staff on the use of the NPS equipment and interpretation of the resulting data. More widely, the collaboration has given me confidence in building productive working relationships with technical experts from other fields”.

Dr Peter Sanderson
Early Career Postdoctoral Researcher
University of Lincoln

“Insplorion AB benefitted from the collaboration by assisting in the development of a further example of the utility of NPS technology and by being involved in research that will hopefully be published”.

Patrick Bjöörn,
Director at Insplorion