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CROSSING BIOLOGICAL MEMBRANES NETWORK, A BBSRC NIBB

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Use of membrane complexes for the production of microalgal polysaccharides

The Challenge

The utilisation of microalgae for production of high value chemicals has seen major advances in the last decade. A key limitation is the yield of target products, which can restrict their commercial viability. This is particularly the case with exopolysaccharides (EPS), which are produced by many microalgae and represent a large biochemically diverse resource. Although methods for the production of EPS exist, increased yield would greatly improve its industrial potential.

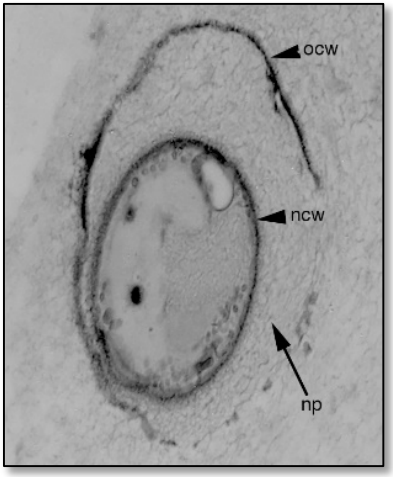
In *Prasinococcus capsulatus*, EPS appears to be synthesised in the Golgi apparatus and secreted through an adjacent transmembrane pore complex called the decapore. In order to increase EPS production, we need to better understand its transmembrane synthesis and secretion, including the precise role of the decapore in EPS synthesis, maturation, and secretion.

The Research

Dr Hoiczyk is a senior lecturer at the University of Sheffield. The research in his laboratory uses high-resolution light and electron microscopy to study the structure, dynamics and functions of important bacterial subcellular complexes.

GlycoMar is a biotechnology company, discovering and developing products for the healthcare and personal care markets.

Dr Hoiczyk applied for a CBMNet Proof-of-Concept award with GlycoMar. Their collaboration aimed to maximise future production of microalgal EPS, a product patented for use in healthcare and skin care, by better understanding its synthesis and secretion. Specifically, the goal of this project was to isolate and purify the decapore complex and to identify its protein constituents.



CBMNet Proof-of-Concept Award

The Result

A protocol for using cryo-electron microscopy to re-investigate the ultrastructure of the decapore was successfully developed, revealing further structural details of EPS secretion. Surprisingly, this data has fundamentally changed the concept of EPS secretion in *P. capsulatus*. Based on these observations, it became clear that the decapore is not involved in this process at all. Instead, it now appears plausible that the EPS is initially secreted at the cell surface into the space between cell wall and cytoplasmic membrane.

This newly gained insight into EPS secretion in *P. capsulatus* has benefited GlycoMar by identifying the key process involved in the synthesis and "secretion" of EPS, thereby preventing futile efforts studying the decapore complex.

The Future

GlycoMar are now in a position to optimize polymer production by systematically testing different growth regimens and their effects on the amount of formed material as well as the kinetics of its release. Mathematical modelling and quantitative experiments will be used to determine the optimal growth conditions and time point for harvesting the algae.

Following on from this collaboration, Dr Hoiczyk and GlycoMar will explore future avenues to receive funding for a continuation of their partnership. Dissemination of their data is planned in forthcoming publications.

GlycoMar

"This collaboration was eye opening for me with respect of industry's research needs (challenges?)"

Dr Egbert Hoiczyk
University of Sheffield

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