Annual report VISTA 2014

Project title

Project director:	Dirk Linke
Post-doc/ scholar:	Jack C. Leo
Project duration:	1.3.2014-28.2.2017
Division head:	Christian Collin-Hansen
Project number:	6509

Object:

Several bacteria can reduce heavy metals and form discrete, homogeneous metallic deposits on the cell surface. These bio-nanoparticles (NPs) have unique catalytic properties and would be highly useful in industrial settings, e.g. as cracking catalysts for breaking down large organic polymers, and bio-NPs are attractive as eco-friendly, sustainable alternatives to physico-chemically synthesised NPs. Although the catalytic properties of bio-NPs have been studied in detail, so far the molecular mechanisms involved in their formation are poorly characterised. The aim of this project is to elucidate the molecular mechanism(s) of bio-NP deposition. The project began in March 2014 with developing screening assays to search for mutants defective in bio-NP formation; this work is ongoing. Once the assays are up and running, we will screen libraries of *E. coli* knock-out mutants to identify candidate genes. Once candidate genes affecting bio-NP deposition have been identified, the defects will be verified using electron microscopy and other techniques. This will allow elucidation of the molecular pathways leading to bio-NP formation and the proteins involved in the critical steps. Understanding all the components will allow manipulation of bio-NP pathways to produce higher yields, catalysts optimised for different applications, or NPs with specific electronic or magnetic properties.

Status:

The work started in March 2014. The first stage of the project is to develop a screening assay that will allow identifying mutants that are defective in bio-NP deposition. The aim is to use a colour-based assay for high-throughput screening. We are optimising assays using liquid cultures in 96-well plates. After some optimising, we were able to see a clear difference between bio-NP producers and control cells. Unfortunately, we recently suffered a setback in this and are currently troubleshooting the problem (a possible explanation is a difference in growth medium composition between earlier experiments and the more recent ones). Once the assay is running reliably again, we will optimise for

quantitative analysis and begin screening a transposon mutant library of the known producer strain MC4100.

Publications (scholar):
The project has not resulted in any publications yet. However, we were involved in another biotechnology-related project, where polymer beads were imprinted with bacteria. These imprints were coated with a positively-charged carbohydrate and serve as selective binding sites for bacteria of a given shape. This paper has been published in *Angewandte Chemie*. In addition, we have written two review articles on more distantly related subjects in bacterial pathogenesis; these are now in press at the *Journal of Medical Microbiology* and available online. VISTA has been duly acknowledged for funding in all publications.

Shen X, Bonde JS, Kamra T, Bülow L, **Leo JC**, **Linke D**, Ye L (2014): Bacterial imprinting at Pickering emulsion interfaces. *Angew Chem Int Ed Engl.*, 53(40):10687-90.

Mühlenkamp M, Oberhettinger P, **Leo JC**, **Linke D**, Schütz M: *Yersinia* adhesin A (YadA) – beauty and beast. *Int J Med Microbiol*., epub ahead of print. DOI:10.1016/j.ijmm.2014.12.008. Review.

Leo JC, Oberhettinger P, Schütz M, **Linke D**: The inverse autotransporter family: Intimin, Invasin and related proteins. *Int J Med Microbiol*., epub ahead of print. DOI:10.1016/j.ijmm.2014.12.011. Review.