**GluColi, a new generation of glue**


Caulobacter crescentus is a gram-negative bacterium and lives in aquatic environments. In its sessile stage, C. crescentus sticks to surfaces by synthesizing an adhesive at the tip of the holdfast, a polar organelle. This material is elastic, with gel-like properties and shows impressive tensile strength: the adhesive can adhere with a strength of up to 68 N/mm².

The holdfast biosynthesis pathway export and attachment in C. crescentus has already been characterized. The products of hfp C, C, E, G, H, J genes are involved in the holdfast biosynthesis. HfaA HfaB and HfaD proteins are required for the holdfast export. The anchoring of the holdfast polysaccharide is carried out by the HfaF gene products.

In order to produce a natural, non-toxic, and biodegradable glue, we planned to transfer the C. crescentus holdfast polysaccharide biosynthesis pathway to Escherichia coli. As E. coli possesses similar genes involved in the synthesis and the export of polysaccharides, we inserted an E. coli strain the hfpG and hfpF genes, thus GluColi was born.

**Experimental control and increase in robustness**

- a) We made the assumption that the complex’s formation is quick enough to be neglected, nor was “cell death” considered. This shows bistability, but not well regulated by IPTG.
- b) We take into account the formation of the quorum sensing complex and “cell death” bistable, effectively able to be switched ON by IPTG. But too sensitive.
- c) We add a toggle switch as a first regulatory step. Better robustness. Further research, exploration of the parameters and experimental validation is necessary to improve it.

**ETHICS AND PERSPECTIVES**

To avoid the use of antibiotics, we thought about inserting the Stisy™ strategy developed by Delphi Genetics, in our bacteria. The CcdB protein is cytotoxic through the DNA-gyrase complexes. Expression of this gene in the absence of the cognate ccdA antidote leads to death of the bacteria. The product of the ccdA gene antagonizes this toxic activity by forming a poison-antidote protein complex. Thus we can stabilize plasmids without using antibiotic resistance.

We should insert all the gene of C. crescentus polysaccharide biosynthesis pathway in E. coli to obtain the same glue properties as in Caulobacter crescentus.

The properties of the glue could offer a wide range of useful applications in the field of medicine, ship repairs or aeronautic industry.

**SPECIAL THANKS**

The staff of Bacterial Genetics and Physiology Laboratory (ULB) G. Koczyraff from BMT (Biologie Non Linéaire Théorique) group, Faculty of Sciences, Physics Department (ULB). J. Halley from USE group, Faculty of Sciences, Social Ecology Department, P. Leonard, Director of the Experimentarium (età) (ULB). J. Kappel, Professor at the Faculty of Philosophy, Department of English, ULB, A.-L. Pattoux and A.-C. Brouwers.