



Genetics of Biofilms Laboratory - URA CNRS2172

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Abstract

Biofilms are communities of microorganisms, which develop on surfaces in natural and artificial environments. In medical settings, biofilms are found in association with catheters and prosthetic devices and may constitute an important source of nosocomial infections. Bacterial biofilms display specific biological properties that distinguish them from their planktonic counterparts. We use genetic, genomic and molecular biology approaches combined with different biofilm models to identify the bacterial factors involved in biofilm formation (identification of biofilm-specific genes, characterization of the biofilm matrix). We also investigate the specific functions that could be performed in this highly heterogeneous environment (horizontal gene transfer, cell to cell adhesion, bacterial communication within mixed species biofilms). These approaches may lead to a better fundamental knowledge of the bacterial biology within biofilm and help design biofilm control strategies in situation where they represent a sanitary problem.

Annual Report

I- Biofilm matrix production in *Escherichia coli*

Bacterial growth on a surface often involves the production of a polysaccharide-rich extracellular matrix that provides structural support for the formation of biofilm communities. In *Salmonella* sp, cellulose is one of the major components of the biofilm matrix and its production is regulated by CsgD and the di-guanylate cyclase AdrA that activates cellulose synthesis at a post-transcriptional level. We investigated cellulose and biofilm formation in a collection of *E. coli* isolates. We showed that cellulose synthesis is the primary cause for biofilm formation and multicellular behavior (*rdar* morphotype) in the commensal *E. coli* strain 1094. By contrast with the *Salmonella* cellulose regulatory cascade, in *E. coli* 1094, cellulose synthesis does not require CsgD or AdrA, which is indicative of an alternative CsgD-independent cellulose regulatory pathway. We identified the genetic determinant involved in this pathway and provided evidence of the existence of alternative cellulose regulatory networks in *E. coli* and possibly in other cellulose-producing Enterobacteriaceae.

- Da Re, S and Ghigo J.M. A CsgD-independent pathway for cellulose production and biofilm formation in *E. coli*. *J. Bacteriol.* *in press*

Identification of a Biofilm matrix associated protein in *Salmonella enterica* serovar Enteritidis

In this study realized in a collaboration led by Inigo Lasa's laboratory (Pamplona, Spain), we demonstrated that the protein encoded by the gene *stm2689* is required for air-liquid interface pellicle and biofilm formation. We also provided evidence that *Stm2689*, renamed BapA, (for Biofilm Associated Protein A), due to significant similarities with the *Staphylococcus aureus* Bap protein, plays a role in colonization of the murine intestine and subsequent organ invasion. The presence of surface proteins exhibiting homology with the Bap protein of *S. aureus* seems therefore widespread among diverse bacterial species. This suggests that the Bap proteins are required for an important and conserved function in bacterial biofilm development.

- Latasa, C. Roux, A. Toledo-Arana, A. ; Ghigo, J.M. ; Gamazo, C. Penadés, J. and I.Lasa (2005) BapA, a large secreted protein required for biofilm formation and host colonization of *Salmonella enterica* serovar Enteritidis *Mol Microbiol.* 58 :1322-1340

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