

Research project TFM studies on bacterial conjugation: RNAseq analysis

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Bacterial conjugation is the process by which a conjugative element, often a conjugative plasmid, is transferred from a donor to a recipient cell via a channel connecting both cells. Many conjugative plasmids contain antibiotic resistance genes. Conjugation is the main horizontal gene transfer route responsible for the spread of antibiotic resistance, which is a serious worldwide problem.

Blocking conjugation is a way to impede the spread of antibiotic resistance. However, detailed knowledge on the different steps of the conjugation process is a prerequisite to develop drugs or strategies that can interfere with conjugation. In our laboratory we use the conjugative plasmid pLS20 of *Bacillus subtilis* as a model system to study distinct steps of conjugation. Over the last 10 years, we have achieved major advances. Most of these studies involve a multi-disciplinary approach including genetic, biochemical, cytological, structural, biophysical and bioinformatics techniques. A list of our recent publications is shown below.

Bioinformatics is becoming increasingly important for all our studies and therefore we collaborate closely with the Bioinformatics Facility of our centre. One major research in our lab is transcriptional regulation. As part of these studies, we have performed multiple RNAseq analysis during the last years of *B. subtilis* strains with or without the wild type plasmid pLS20 or derivatives. Some of this RNAseq data has been analysed to study how a plasmid gene of interest affects transcription of other plasmid genes. However, the majority of the RNAseq data is unexplored regarding likely effects of how plasmid and/or conjugation proteins affect transcription of the bacterial genome and vice versa, how bacterial genes can affect transcription of the plasmid. For instance, we have shown that the plasmid encodes a protein named sRok that is similar to the protein Rok encoded by the bacterial genome. Rok has been shown to play two important roles: regulating the expression of many bacterial genes and organising the bacterial genome. It will be interesting to study if and how the plasmid-encoded sRok can modulate the activities of the bacterial Rok protein, and if sRok (or Rok) has a specific role in the organisation of the plasmid. The interplay between sRok and Rok is only one example of how the plasmid and the bacterial genome may influence each other. The project proposed here is to analyse the available RNAseq data in close collaboration with the Bioinformatics Facility; for this, we need an enthusiastic bright student who likes challenges and is interested in bioinformatics.

Familiarity with the Linux operating system and shell scripting is required. Programming knowledge is also necessary (the languages Perl and R will be used mainly). Knowledge of RNA-seq data processing will be valued.

Currently there is no funding available to pay for the TFM, but there is the possibility of obtaining funds to carry out a PhD thesis.

1. [Conjugation Operons in Gram-Positive Bacteria with and without Antitermination Systems.](#)
Miguel-Arribas A, Wu LJ, Michaelis C, Yoshida KI, Grohmann E, Meijer WJJ.
Microorganisms.2022. PMID: 35336162
2. [pLS20 is the archetype of a new family of conjugative plasmids harboured by *Bacillus* species.](#)
Val-Calvo J, Miguel-Arribas A, Abia D, Wu LJ, Meijer WJJ.
NAR Genom Bioinform. 2021 PMID: 34729475
3. [A novel bipartite antitermination system widespread in conjugative elements of Gram-positive](#)

[bacteria.](#)

Miguel-Arribas A, Val-Calvo J, Gago C, Izquierdo JM, Abia D, Wu LJ, Errington J, Meijer WJJ. Nucleic Acids Res. 2021 PMID: 33999173

4. [Multiple Layered Control of the Conjugation Process of the *Bacillus subtilis* Plasmid pLS20.](#)
Meijer WJJ, Boer DR, Ares S, Alfonso C, Rojo F, Luque-Ortega JR, Wu LJ. Front Mol Biosci. 2021 PMID: 33816561 Free PMC article. Review.
5. [A Conserved Class II Type Thioester Domain-Containing Adhesin Is Required for Efficient Conjugation in *Bacillus subtilis*.](#)
Gago C, Val-Calvo J, Abia D, Díaz- A, Miguel A, Aguilar Suárez R, van Dijl JM, Wu LJ, Meijer WJJ. mBio. 2021 PMID: 33727345
6. [Reversible regulation of conjugation of *Bacillus subtilis* plasmid pLS20 by the quorum sensing peptide responsive anti-repressor RappLS20.](#)
Singh PK, Serrano E, Ramachandran G, Miguel-Arribas A, Gago-Cordoba C, Val-Calvo J, López-Pérez A, Alfonso C, Wu LJ, Luque-Ortega JR, Meijer WJJ. Nucleic Acids Res. 2020 PMID: 33045732 Free PMC article.