European Research Council Advanced Grant "SYM-BIOTICS":

Dual exploitation of natural plant strategies in agriculture and public health: enhancing nitrogen-fixation and fighting microbial infections (2011-2016)

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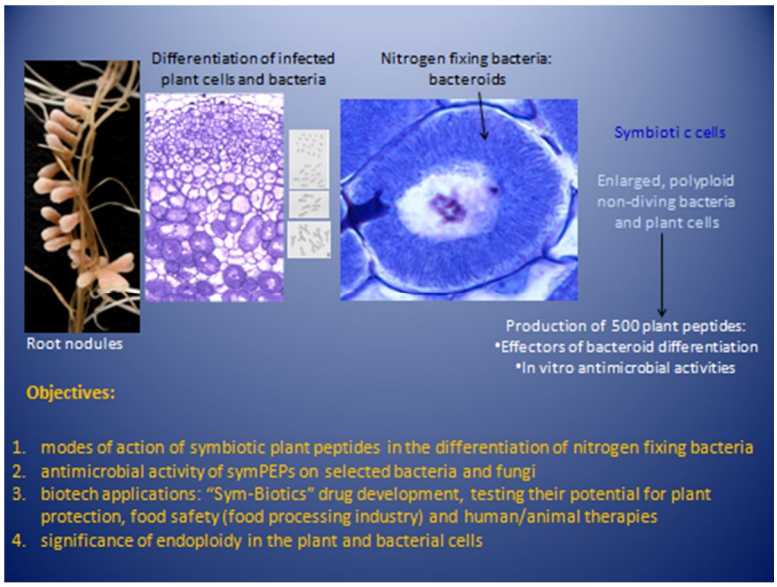
Higher agricultural production, enhanced food safety and protection against alarming rise of antibiotic resistant pathogenic bacteria are amongst the main challenges of this century. This proposal centered on *Rhizobium*-legume symbiosis aims at contributing to these tasks by i) understanding the development of symbiotic nitrogen fixing cells for improvement of the eco-friendly biological nitrogen fixation, ii) gaining a comprehensive knowledge on polyploidy having a great impact on crop yields and iii) exploiting the strategies of symbiotic plant cells for the development of novel antibiotics. Symbiotic nitrogen fixation in *Rhizobium*-legume interactions takes place in root nodules where giant plant cells host the nitrogen fixing bacteria. In *Medicago* nodules both the plant cells and the bacteria are polyploids and incapable for cell division. These polyploid plant cells produce hundreds of symbiotic peptides (symPEPs) that provoke terminal differentiation of bacteria in symbiosis and exhibit broad range antimicrobial activities *in vitro*. The activity and mode of actions of symPEPs are in the focus of the proposal; i) how symPEPs achieve bacteroid differentiation and affect nitrogen fixation and ii) whether symPEP antimicrobial activities provide novel modes of antimicrobial actions and iii) whether "Sym-Biotics" could become widely used novel antibiotics and iv) how different ploidy levels affect DNA methylation and the expression of *symPEP* genes.



Results foreseen

Basic science:

Understanding the governed bacterial differentiation strategies: More effective nitrogen fixation

Meaning of polyploid genome content (mutation rate, epigenome, whole or partial genome amplification)

Applied life sciences:

Antimicrobial symPEPs: Next generation of antibiotics, novel modes of action, effective killing of antibiotic resistant pathogen microbes without toxicity for human cells and animals

Non-antimicrobial symPEPs: range of activities related to inflammation, wound healing or cytotoxicity to tumor cells

Applications:

Sym-Biotics as green chemicals for plant protection

Proof of concept studies: decontamination of meat samples in meat factories

Initial steps towards human/animal therapeutic applications