

Ph.D. project :

'Role of *Midichloria mitochondrii*, endosymbiotic bacterium of the tick *Ixodes ricinus*, in the development of its host'

Supervisors

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Scientific background

In temperate areas of the northern hemisphere, ticks are the most important group of disease vectors. In Europe, *Ixodes ricinus*, the most common tick species, transmits numerous pathogens including those responsible for Lyme diseases and Tick-Borne Encephalitis. Vector control against ticks is essentially based on the use of acaricides, but its applicability is reduced for *I. ricinus*, due to its widespread ecological distribution and its broad host range, as this species is capable to feed on numerous vertebrates from both wildlife and domestic fauna. This tick species harbours an intracellular bacterium, *Midichloria mitochondrii*, vertically transmitted and present with 100% prevalence of females in natural populations. *M. mitochondrii* is unique due to its capability to invade host mitochondria, but its role in the host physiology is still unknown.

Project description

The present Ph.D. project is focused on understanding the role of *M. mitochondrii* in the biology of *I. ricinus*, towards the development of a vector control method based on «antisymbiotic control».

The first part of the thesis will aim to evaluate the effects of *Midichloria* on *I. ricinus* fitness by the comparison of several tick life-history traits between a wild strain (harbouring *Midichloria*) versus an aposymbiotic strain (obtained after antibiotic treatment). A dual transcriptomic approach will also be conducted to identify differentially expressed genes from both the bacteria and the ticks. A vaccination approach, targeting specific *Midichloria* proteins will be conducted on rabbits and their effect on tick engorgement will be assessed. Skills in evolutionary biology, parasitology, microbiology, molecular biology and bioinformatics are desirable and will be positively evaluated for this Ph.D. project. Fluency in English is required for the proposed position, as it is the shared language between the two labs involved in this project. Fluency in French and/or in Italian will be helpful but not mandatory.

Funding notes

This Ph.D. grant is funded for 3 years by the call of project Vinci of the Université Franco-Italienne (<https://www.universite-franco-italienne.org/>) and will take place both in France (Nantes; UMR INRA-Oniris « BioEpAR » for 24 months ; <https://www6.angers-nantes.inra.fr/bioepar/L-unite2/Groupes-fonctionnels/TiBoDi>) and in Italy (University of Pavia; 12 months ; <http://sasseralab.unipv.it/>). The annual gross amount is 21 096 €. Applicants should send a CV, a cover letter summarising past experience and interest in the project, and two reference letters to olivier.plantard@inra.fr and davide.sassera@unipv.it. The dead line is the 8th of september 2017. Applicants will be contacted to schedule an interview that will take place in september. The project starting date is flexible, from 1st October to the end of 2017.

References:

- Ninio, C., O. Plantard et al. (2015). "Antibiotic treatment of the hard tick *Ixodes ricinus*: Influence on *Midichloria mitochondrii* load following blood meal." *Ticks and Tick-Borne Diseases*, 6 (5), 653-657.
- Sassera, D., N. Lo et al. (2006). "'Candidatus *Midichloria mitochondrii*', an endosymbiont of the tick *Ixodes ricinus* with a unique intramitochondrial lifestyle." *International Journal of Systematic and Evolutionary Microbiology* 56(11): 2535-40.
- Sassera, D., N. Lo, et al. (2011). "Phylogenomic evidence for the presence of a flagellum and *cbb3* oxidase in the free-living mitochondrial ancestor." *Molecular Biology and Evolution* 28(12): 3285–3296.
- Sassera, D., S. Epis, et al. (2013). "Microbial symbiosis and the control of vector borne pathogens in tsetse flies, human lice, and triatomine bugs." *Pathogens and Global Health* 107(6): 285-292.