

**Université de technologie de Compiègne – Thesis proposal**

Part 1: Scientific sheet	
Thesis proposal title	<b>Lyme Borreliosis Diagnostic: Combine <i>in silico</i> and <i>in vitro</i> approaches : (DiaBoLyc)</b>
PhD grant	Doctoral work contract based on a Ministry of Research Grant
Research laboratory	GEC, CNRS 7025 research team: Biomimicry and Molecular Diversity web site: <a href="http://www.umr7025-gec.fr/">http://www.umr7025-gec.fr/</a>
Thesis supervisor(s)	Séverine Padiolleau, HDR
Scientific domain(s)	<ol style="list-style-type: none"> <li>1. Biology, biomedical and health sciences</li> <li>2. Biotechnology</li> </ol>
Research work	<p><b><u>Context and general presentation of the project</u></b></p> <p>Lyme borreliosis is a tick-borne disease caused by bacteria known as <i>Borrelia burgdorferi sensu lato</i>. Patients with Lyme borreliosis suffer from various symptoms, some of which -such as erythema migrans- are characteristic, whereas others induce blurred clinical features such as fatigue, impaired memory or concentration, headaches, arthralgia and myalgia. The diagnosis of Lyme borreliosis is the subject of many debates and controversies due to the actual diagnosis limits. The current diagnostic test is based on serology, which is an indirect measurement of antibodies secreted consecutively to infection, leading to false positive as well as false negative results. Therefore, <b>a proper detection of Lyme borreliosis is essential to propose an adequate treatment to patients and avoid persistence of pathogens.</b> Moreover, the variety of pathogens implied in Lyme borreliosis emphasizes the interest of a multiplexed test.</p> <p>The present project proposes a paradigm shift in diagnosis thanks to <b>direct detection of the pathogen</b>, while aiming for a <b>multiplexed approach</b> based on <b>rationally designed peptides</b>.</p> <p><b><u>Objective and scientific approach</u></b></p> <p>The project aims to implement a new diagnostic test for Lyme disease by circumventing current limitations. We will exploit the structural data available in the literature on targeted proteins exposed on the surface of the pathogen. With the aim of bioinspiration, we will design <i>in silico</i> a mimicry peptide capable of interacting with a bacterial surface protein. This will then be produced and tested <i>in vitro</i> by different approaches (ELISA, SPR, WB, Flow Cytometry). The final objective is to pave the way for a multiplexed test using a diagnostic arsenal allowing the detection of the different pathogens involved in Lyme borreliosis. We will thus bypass the two main limitations of current diagnostic tests, (i) by allowing direct detection of infection, and (ii) by detecting a wide variety of pathogens involved in Lyme borreliosis.</p>
Key words	Lyme Disease, Diagnostic, Bioinformatic, Molecular modelling, molecular interaction, Immunotechnology.
Requirements	The candidate will have skills in immunology and biochemistry related to the molecular interactions. Knowledge of bioinformatics and experience -or a strong interest- concerning <i>in silico</i> molecular modeling, will be an asset. English B1 Level has to be validated.
Starting time	October 1st 2021
Location	UTC, GEC laboratory

<b>Part 2: Job description</b>	
Duration	36 months
Additional missions available	Teaching
Research laboratory	<p>GEC combines the understanding of biological processes with the application of innovative biotechnological approaches and technologies lying on the concept of Bioinspiration.</p> <p>GEC is organized in two teams: The "plant metabolism and bioresources" team, and the "biomimicry and molecular diversity" team. This latter team addresses themes related to molecular diversity and molecular recognition with a bioinspiration and biomimicry point of view. The scientific aspects addressed in this topic are in particular the interactions between biomolecules, including the diversity genesis, the implementation of selection tools, and exploiting structural modeling tools, for further application in the field of health. The candidate will carry out his research work in this latter team, whom skills lay on antibody engineering, selection, libraries (antibody fragments, peptides, aptamers) and related technologies (Phage Display, SELEX), study of structure-function relationships, expression of recombinant proteins.</p>
Material resources	<p>Equipment: Biochemistry laboratory, analytical platforms (Spectrophotometry, Fluorescence, SPR, Mass Spectrometry), L2 laboratory (including equipment for cell culture, biochemistry and molecular biology).</p> <p>Office facilities are available.</p> <p>Project Partner: Expertise in bioinformatic with molecular modeling and docking workstations + scientists and clinical network related to the cryptoinfection field.</p>
Human resources	Team including one professor, two lecturers, one CNRS researcher, several PhD and internships, and one technician
Financial resources	Various call for proposals under evaluation (Emergence SU, FEDER...)
Working conditions	Collective and personal informal meetings, Regular supervision. Participation in national and international congresses.
Research project	<p>Project under evaluation: Emergence SU, FEDER</p> <p>Envisaged call for proposals: Lyme specific funding</p>
National collaborations	Polyclinique Saint Côme, Learn Society SERC, Cordeliers Research Center INSERM (SU)
International collaborations	<p>Contacts with an American Startup <i>Medical Biotechnology Engineering</i></p> <p>Material transfer agreement with Pr. P. Kraickzy, Frankfurt University</p>
International cosupervision (cotutelle)	No
Contact	<p>Séverine PADIOLLEAU UMR 7025 CNRS UTC – Rue Roger Couttolenc CS 60319 60203 COMPIEGNE CEDEX Tel : (00) 33 3 44 23 46 21 Courriel : <a href="mailto:severine.padiolleau@utc.fr">severine.padiolleau@utc.fr</a></p>

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