Post doctoral position available
Systems biology and predictive modeling of the *Fusarium head blight* susceptibility in wheat

Working environment:

A 24-month post-doc position is available at GDEC, Clermont-Ferrand starting from June/July 2021 and funded as part of an industrial chair supported by the I-SITE CAP2025 pole of excellence.

The research work will be carried out in the Cereal Diseases team (MDC, team leader T. Langin, DR CNRS) whose objectives focus on the identification of sustainable sources of resistance to fungal diseases in wheat. More precisely, the post-doc will integrate the work dedicated to the characterization of the molecular and physiological determinants of wheat susceptibility to Fusarium head blight (leader L. Bonhomme, PR UCA). He/she will develop systems biology approaches that will aim to analyze and predict the establishment and functioning of this complex biological system in a holistic or reductionist manner using large - omics and phenotypic datasets. These integrative approaches will be carried out in close collaboration with M.-L. Martin-Magniette (leader of the GNET team, DR INRAE) of the Institut of Plant Sciences – Paris-Saclay (IPS2).

Project and objectives :

Plant diseases are controlled by a complex molecular dialogue driven by specific genetic programs activated in both the host and the pathogen. During the plant-pathogen interactions, the pathogen is able to produce a complex set of molecular effectors targeting the so-called plant susceptibility factors with the aim to establish a favorable environment for its own development and spreading. In wheat, the works of the MDC team on the *Fusarium* Head Blight (FHB) have revealed the tremendous complexity of the elementary components of this molecular dialogue by studying both the host's responses and the pathogen's strategies. All these data demonstrated that FHB susceptibility is driven by the set up of core dual-processes shaped by a complex arsenal of conserved effectors in different strains able to target very close cellular processes in different wheat genetic backgrounds. However, despite this knowledge and evidences of a number of determinants involved in disease development, the identification of the key functions and the master regulators that determine these processes remains to be discovered. Within this context, the aim of this post-doc position will be to develop original integrative approaches, using descriptive and predictive statistics, to provide new knowledge on this complex dual-biologic systems exploiting diverse -omics data that gather information from different hosts and contrasting pathogen strains. By merging data from both organisms, the aim of this work will also be to analyze the way in which the gene networks fit together and cooperate during this plant-pathogen interaction. In a second step, these data will be completed by FHB experiments in changing environmental conditions (PhD recruitment expected for October 2021). This will make it possible to open new insights in system biology of combined stresses in plants and to understand the non-trivial dynamic models of gene networks in plant stress response and their respective contribution to the plant phenotype.

Missions:

In line with these objectives, we are offering a 24-month post-doc position to design an integrative biology approach using the range of -omics data available in order to identify new susceptibility genes and their master regulators, and to evaluate their potential in improving FHB resistance in wheat upon changing environments.

The postdoc will mobilize skills in systems biology using dual-proteomics, dual-phosphoproteomics, dual-transcriptomics, dual-smallRNA and thorough phenotypings approaches to:

1) Identify the genetic determinants that contribute most to FHB susceptibility and those that represent the most promising levers for improving wheat resistance.

2) Characterize the basic arsenal of effectors required for FHB development and anticipate their putative targets

3) Set up an original approach to model the dynamics of these determinants upon abiotic stresses

This work will benefit from all the means necessary for the full realization of the project, such as access to computer resources (storage, calculation) available at the "MésoCentre" computing facility in Clermont-Ferrand.

Profile:
Highly motivated candidates with a PhD degree and having a strong background in biostatistics (data mining, interpretation, data aggregation...) and bioinformatics are encouraged to apply. Previous experience with analyzing integrative biology is required. The candidates should also have good communication skills evidenced by scientific publications. Ability to work in a team environment is required.

Technical skills: Master in bioanalyses, biostatistics and bioinformatics or a related field with relevant expertise in the project topics. Experience with R tools are mandatory as well as with high throughput data analysis, management and integration. Programming skills appreciated.

Significant publications on the topics:

F. Fabre, F. Rocher, A. Tarek, T. Langin and L. Bonhomme. 2020. Searching for FHB resistances in bread wheat: susceptibility at the crossroad. Frontiers in Plant Science. doi: 10.3389/fpls.2020.00731.

F. Fabre, J. Bormann, S. Urbach, S. Roche, T. Langin, L. Bonhomme. 2019b. Unbalanced roles of fungal aggressiveness and host cultivars in the establishment of the Fusarium head blight in bread wheat. Frontiers in Microbiology 10:2857.

F. Fabre, M. Vignassa, S. Urbach, T. Langin, L. Bonhomme. 2019a. Time-resolved dissection of the molecular crosstalk driving Fusarium head blight in wheat provides new insights into host susceptibility determinism. Plant Cell & Environment 42:2291–2308.

C. Chetouhi, L. Bonhomme, P. Lasserre-Zuber, S. Pelletier, J.-P. Renou, T. Langin. 2016. Transcriptome dynamics of a susceptible wheat upon Fusarium head blight reveals that molecular responses to Fusarium graminearum infection fit over the grain development processes. Functional & Integrated Genomics 16:183–201.

Project Title: Systems biology and predictive modeling of the Fusarium head blight susceptibility in wheat
Head(s) of the Scientific Project: Ludovic Bonhomme (UCA) and Marie-Laure Martin-Magniette (IPS2)

Offer type: Postdoctoral researcher (24 months)
Salary: 2 736,64 € gross/month (depending on experience)

Hiring Institution: University of Clermont Auvergne. The position is proposed to be taken up at GDEC, Clermont-Ferrand, it could be hosted partly at IPS2 within the GNET team upon request.

Application deadline: Applications (motivation letter, CV and references) must be sent in French or in English, by email, to L. Bonhomme : ludovic.bonhomme@uca.fr <u>and</u> M.-L. Martin-Magniette : marie_laure.martin-magniette@agroparistech.fr before the 31th May 2020.

Job starting date: June/July 2021.