UMR 1287 Ecophysiologie et Génomique Fonctionnelle de la Vigne (EGFV)

The UMR EGFV has opening for a doctoral position in plant Biology.

Doctorate thesis title

Epigenetic adaptation of grapevine to environmental challenges

The proposed research project will take place at UMR EGFV (INRAE, University of Bordeaux, Bordeaux Sciences Agro, https://egfv.bordeaux-aquitaine.hub.inrae.fr/), which is located at the Vine and Wine Science Insitute (ISVV, https://www.isvv.u-bordeaux.fr/fr/) at the INRAE campus of Villenave d'Ornon (https://www.inrae.fr/centres/nouvelle-aquitaine-bordeaux). The EGFV research unit is organized around 4 research themes (ADAPT, ROOTi, QUALyGrapE, GENEPI) investigating grapevine adaptation to its environment in the context of climate changes, from plant biology to vineyard management.
The doctoral student will have a stipend contract for three years, and will be integrated in the Bordeaux University Doctorate School Program. She/he will be supervised by Pr Philippe Gallusci (UMR EGFV), and work in close collaboration with Dr Armelle Marais-Colombel (UMR BFP) and Dr Agnès Calonnec (UMR SAVE). The project is funded by Plant2Pro, Institut Carnot.

Project summary

Climate change imposes numerous threats to agriculture, including viticulture, by generating various types of intense stress to plants. In viticulture, various strategies have been developed to mitigate such effects including changes of vineyard management practices but also the selection of new grapevine varieties and/or rootstocks that are better adapted to environmental stresses. In addition, recent evidence suggests that Epigenetics, which refers to heritable changes in genome functioning that are not mediated by DNA sequence variations, mediate adaptation of plants to their environment. In this context, grapevine, a clonally propagated grafted perennial, provides an opportunity to explore how environmentally driven parental epigenetic memories can be used as a driving force for the rapid adaptation to the environment of clonally propagated progenies.
In the proposed project we will investigate how plants asexually propagated by cuttings from the same mother plants, but grown in contrasting environments have evolved at both the physiological and molecular levels. We will explore how environmental conditions have influenced the phenotypes of the plants and how this correlates with molecular changes including gene expression programs, small RNA populations and epigenetic information. These plants will then be used to generate a new population to assess the inheritance of environmentally induced epigenetic variations through asexual propagation and its consequences for plant responses to controlled stresses.

Main objectives

The main objective of this work is to evaluate how environmentally induced epigenetic diversity can contribute to the resilience of plants under stress, and to investigate the stability of the parental epigenetic imprints during plant propagation. This will be achieved by using grapevine, a perennial grafted and clonally propagated plant, of major economic importance. Stressing parental plants to generate populations of young plants that are better adapted is a promising avenue that needs to be thoroughly evaluated to determine the stability of parental epigenetic imprints over time, as well as their consequences on the plant's resilience to stress.

It aims to investigate new approaches to increase plant resilience to stress thereby limiting the impact of viticulture on the environment. More fundamentally, we will investigate how the environment affects the

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epigenome of grapevine plants and which part of these epigenetic changes is transmitted to the next generation after asexual propagation and could be involved in the adaptation of plants to their environment.

Your Task

- Create plant populations by asexual propagation and evaluate their performance trade-off depending on the growing conditions of the parental plants.
- Conduct plant culture and perform abiotic stress experiments. Evaluate the plant response to various pathogens
- Perform a precise phenotypical characterisation of plants at the physiological and molecular levels.
- Perform the metabolomics, RNA seq, and epigenomic (methylome) characterisation of selected plants and integrate data.
- Prepare, publish and present research report and articles in international congress, and journals.

Your profile

- Master degree or engineer degree in plant biology, or related research area, including molecular biology, agronomy, viticulture or others related fields.
- Experience with quantitative analytical method of phenotypes and related R statistical package.
- Experience with bioinformatics analysis of RNA seq data (eventually including virome analysis), and /or metabolomics data, and /or epigenomic data and associated statistical methods.
- Oral and written English communication skills. French is not mandatory but would be helpful.
- Strong team spirit and ability to work in collaboration with several partners.
- The following would be a plus: previous experience in managing grapevine cultures and/or in the analysis of plant stress response, and/or in epigenomic studies.

We offer:

- A stimulating interdisciplinary scientific environment at ISVV and at the INRAE campus in Villenave d'ornon, with several laboratories and analytical platforms and expertise in plant biology, plant pathogen interactions, statistics and bioinformatics.
- Integration in a PhD program of Bordeaux University Doctorate school.
- Full funding for research work and travels
- Excellent network of national and international collaborators
- Support in personal career development

If you are interested please send CV and motivation letter, certificate of master's or engineer's degree, copy of the master/engineer thesis and names and contact of two reference persons to Pr Philippe Gallusci (philippe.gallusci@inrae.fr), Dr Armelle Marais-Colombel (armelle.marais-colombel@inrae.fr) and Dr Agnès Calonnec (agnes.calonnec@inrae.fr).