PhD position in single-cell analysis of endoreduplicated cells from tomato fruit

Lab: INRAE UMR1332 Biologie du Fruit et Pathologie
Group: FDFE "Fruit Development, Flowering and Environmental constraints"

Research Topic:

A **fully funded 3-year PhD position** is open in the FDFE group to study the **transcriptome of endoreduplicated cells at the single cell level**. In multicellular organisms, the development of functional organs, such as fruits in plants, involves cell division followed by cell growth and differentiation. In fleshy fruits, final size depends on the precise **spatio-temporal regulation of the number and/or of the size of cells** formed during fruit development. Early during tomato fruit development, cells undergo a modified cell cycle, the endocycle, during which DNA replication occurs independently from mitosis. This process, called **endoreduplication**, leads to an increase in ploidy level and cell size. We have obtained transcriptome data and epigenomic profiles in populations of sorted nuclei from different ploidy levels and at different development stages. This data shows that changes in ploidy levels are associated with specific changes in gene expression. However, cells from a given ploidy level may still represent a heterogeneous population due to their specific location in the tissue and differentiation trajectory. In this project, we aim to **explore this heterogeneity** by analyzing **single cell transcriptome signatures** and **spatial gene expression data** within the tomato pericarp with the aim to understand the **trajectory of endoreduplicated cells** in the context of the development of the whole tissue. Pathways that will be revealed by these approaches will then be studied by genome editing and functional genomics approaches.

Methods:

Cytometry and nuclei sorting, single cell RNA-seq, in situ hybridization and spatial transcriptomics, confocal microscopy, bioinformatics, CRISPR-Cas9 genome editing, plant biotechnology and phenotyping.

Working Environment:

The FDFE team is part of the Laboratory of Fruit Biology and Pathology (BFP) located on the INRAE campus of Villenave d'Ornon, in the south suburb of Bordeaux. The campus hosts several **leading research laboratories** working in plant sciences, plant pathology and environmental sciences and **state-of-the-art infrastructures** for plant breeding, metabolomics and imaging. Cytometry and genomic facilities are located at Bordeaux University and INRAE Pierroton, within 15min of the lab. The PhD student will benefit from the scientific expertise of the supervisor Nathalie Gonzalez and members of her group in plant growth, endoreduplication, cell biology, functional genomics, imaging and bioinformatics. The student will join the Life and Health Sciences Graduate School at the University of Bordeaux which offers **interdisciplinary training**. Nested within the world-renowned wine region, Bordeaux offers an unparalleled environment combining a rich history, world-class education and a thriving cultural scene.

Candidate profile:

We are looking for a **highly motivated candidate** with prior experience in **plant development/reproduction** and possibly in **transcriptomics and bioinformatics**. Interest in developing an expertise in both data production and boinformatic analysis is required. A Master 2 degree or equivalent is mandatory. Strong oral and written communication skills in English are expected. A driving license for sample transport to nearby facilities would be appreciated.

Selected publications:

Tourdot et al., Plant J. 18(4):997-1015 (2024) 10.1111/tpj.16646
Tourdot et al., J Exp Bot, 31;74(20):6269-6284 (2023). doi: 10.1093/jxb/erad235
Swinnen et al., Plant Physiol, 188, 382-96 (2022). doi: 10.1093/plphys/kiab464
Pirello et al., Plant J, 93, 387-98 (2018). doi: 10.1111/tpj.13783

Application:

Please submit your application in a single pdf file, which should consist of: a cover letter, a CV, names and contact information of referees and record of transcripts for both your Bachelor's and Master's degrees. Applications should be submitted by August 15th to nathalie.gonzalez@inrae.fr and pascal.martin@inrae.fr . Starting date is Oct or Nov 2024.