JOB OFFER: PhD in Plant molecular Biology

CNRS offers a 3 year PhD contract, to prepare a Doctorate at the University of Perpignan.

Contract:
Laboratory : LGDP, CNRS-UPVD, Perpignan, France
Laboratory Director : Prof. Olivier Panaud
PhD Supervisor : Dr. Cécile Bousquet-Antonelli,
e-mail: cecile.bousquet-antonelli@cnrs.fr
Starting date : October 1rst 2023
Salary : ~2100€/month before taxes

Student:
Degree : Master 2 in Plant Sciences or Molecular Biology
English : B2 or more
French : no level required

HOtTOPIC: Heat tOlerant TOmato Pollen in Cultivars

Turning up the heat: Characterizing LARP6C function in tomato pollen and using it to generate heat tolerant tomato lines

How to postulate : Send a CV and a letter explaining how you can contribute to the project and what are your motivations at cecile.bousquet-antonelli@cnrs.fr. Please also provide in your CV, the name and e-mail address of at least two people for recommendation. Recommendation letters are not compulsory.
French Citizenship is not compulsory.

Context : The CNRS offers a 3 year PhD contract in the frame of a collaboration between the LGDP (Perpignan, France) and the School of Plant Sciences at the University of Arizona (UA, Tucson, USA). The candidate will be a PhD student at the Doctoral School of the University of Perpignan (ED305) and will develop the project in the team of Dr. Cécile Bousquet-Antonelli (CBA) at the LGDP. The scientific program involves the team of Prof. Ravi Palanivelu (RP) and PhD student at UA, through a bi-lateral collaboration. In the course of the project the CNRS-PhD student will stay once a year at the UA to learn and conduct necessary experiments. Also the UA PhD student will stay in the French lab and will work together with the CNRS student.

Skills : We are looking for a motivated and talented student holding a Master 2 degree in Plant sciences or Molecular biology. A speciality or an experience in bioinformatics would be a plus. The candidate must be at least almost fluent in spoken and written English, French is not compulsory. The candidate must be able to travel abroad.

Missions : The PhD student will conduct an experimental wet bench work and with the support of bioinformatic engineers , in sillico analyses. He/she will analyse and interpret experimental results, design experiments and draw working hypothesis under the supervision of CBA and of RP at UA. He/she will explore the litterature related to the project and be involved in the formatting of his/her results and manuscript writing. He/she will stay at the University of Arizona during short (1 month) yearly periods, to perform experiments in our collaborator's team.

Scientific project :
Seed and fruit crops both depend on pollination, a process highly sensitive to heat. At elevated temperatures, pollen tubes fail to grow through the female pistil tissues and deliver sperm cells in ovules for fertilization and seed formation. An increase in average worldwide temperatures will thus undermine crop productivity.

The pollen tube growth phase is one of the weakest links in the heat sensitivity of angiosperm reproduction as it uses the heat stress (HS) response machinery for normal growth. Regulation of translation of pollen mRNAs is one of the molecular bases of this HS response and work previously conducted in the consortium identified LARP6C as a regulator of the translation in pollen in *Arabidopsis thaliana*.

LARP6C is an RNA binding protein largely conserved in eucaryotes and in particular tomato plants, which carry three LARP6C genes expressed in pollen. We speculate that the role of LARP6C is conserved in tomato and that these genes code for fonctions involved in the sensitivity of pollen to heat exposure.

The project will consist in characterizing the physiological and molecular functions of LARP6C proteins in tomato pollen and evaluate their importance in the sensitivity of pollen to temperature increase. The project will also explore the

possibility that LARP6C genes could be used as heat resistance genes and together with mRNA storage and translation dynamics be instrumental in the diverse heat sensitivity phenotypes observed amongst tomato cultivars.

The project is fully dedicated to tomato plant studies and will include crispr-based reverse genetics, pollen phenotyping, molecular biology , microscopy and RNA related techniques. It will also deploy bioinformatic approaches in particular RNA-seq analyses and genomic and protein sequence comparisons in tomato genomes.

Recommended readings :

1. WAHID, A., GELANI, S., ASHRAF, M. & FOOLAD, M. Heat tolerance in plants: An overview. *Environ. Exp. Bot.* **61**, 199–223 (2007).
2. Borg, M., Brownfield, L. & Twell, D. Male gametophyte development: a molecular perspective. *J. Exp. Bot.* **60**, 1465–1478 (2009).
3. Johnson, M. A., Harper, J. F. & Palanivelu, R. A Fruitful Journey: Pollen Tube Navigation from Germination to Fertilization. *Annu. Rev. Plant Biol.* **70**, 809–837 (2019).
4. Sze, H., Palanivelu, R., Harper, J. F. & Johnson, M. A. Holistic insights from pollen omics : co-opting stress-responsive genes and ER-mediated proteostasis for male fertility. *Plant Physiol.* **187**, 2361–2380 (2021).
5. Merret, R. *et al.* The association of a La module with the PABP-interacting motif PAM2 is a recurrent evolutionary process that led to the neofunctionalization of la-related proteins. *RNA* **19**, (2013).
6. Billey, E. *et al.* LARP6C orchestrates posttranscriptional reprogramming of gene expression during hydration to promote pollen tube guidance. *Plant Cell* (2021) doi:10.1093/plcell/koab131.
7. Zhou, L., Vejlupkova, Z., Warman, C. & Fowler, J. E. A Maize Male Gametophyte-Specific Gene Encodes ZmLARP6c1, a Potential RNA-Binding Protein Required for Competitive Pollen Tube Growth. *Front. Plant Sci.* **12**, (2021).
8. Bousquet-Antonelli, C. LARP6 proteins in plants. *Biochem. Soc. Trans.* **49**, 1975–1983 (2021).
9. Alonge, M. *et al.* Major Impacts of Widespread Structural Variation on Gene Expression and Crop Improvement in Tomato. *Cell* **182**, 145-161.e23 (2020).