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Host laboratory:

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Title of the M2 research internship:

Determination of the role of MADS complex formation in seed and ovule development

Project summary:

MADS transcription factors (TFs) are master regulators of floral organ development. By forming different hetero-tetramers with others MADS partners, MADS TFs regulate expression of specific sets of genes and trigger specific developmental programs. SEPALLATA3 (SEP3) is a key MADS TF in flower organ development and SEP3, or one of its sister clade members, is required in all tetrameric MADS complexes studied to date. MADS function in ovules and seed development have been proposed but no in planta data have yet established the requirement for hetero-tetramer formation in these developmental programs. Based on our preliminary data, we have designed peptides and small proteins that target the tetramerisation interface of SEP3. Using these as tools to probe in planta function, we will determine the role of tetrameric MADS complexes in seed and ovule development. The aim of this project is 1) to produce and characterize tetramerisation inhibitor peptides and proteins 2) to validate their ability to disrupt tetramer formation in vivo using yeast two-hybrid experiments and in vitro via band shift assays and fluorescence anisotropy experiments and 3) to investigate how their expression in planta affects specific programs of seed and ovule development. These studies will reveal how tetramerisation of MADS TFs impacts function at both the molecular and phenotypic level. Experience in molecular and plant biology is a plus but not required.

Keywords:

MADS, protein interaction and dynamic, flower

Relevant publications of the team:

X. LAI, A. STIGLIANI, J. LUCAS, V. HUGOUVIEUX, F. PARCY, C. ZUBIETA. Genome-wide binding of SEPALLATA3 and AGAMOUS complexes determined by sequential DNA-affinity purification sequencing. *Nucleic Acids Res.* (2020) 48 (17) : 19637-9648.

CS. SILVA, A. NAYAK, X.LAI, S. HUTIN, V. HUGOUVIEUX, J. JUNG, I. LÓPEZ-VIDRIERO, JM. FRANCO-ZORRILLA, K. PANIGRAHI, MH. NANA, PA. WIGGE, C. ZUBIETA. Molecular mechanisms of Evening Complex activity in Arabidopsis. *Proc Natl Acad Sci U S A* (2020) 117(12): 6901-6909.

V. HUGOUVIEUX*, C.S. SILVA, A. JOURDAIN, A. STIGLIANI, Q. CHARRAS, V. CONN, S.J. CONN, C.C. CARLES, F. PARCY, C. ZUBIETA*. Tetramerization of MADS family transcription factors SEPALLATA3 and AGAMOUS is required for floral meristem determinacy in Arabidopsis. *Nucleic Acids Res.* (2018) 1;46(10):4966-4977.

V.M. CONN, V. HUGOUVIEUX, A. NAYAK, S.A. CONOS, G. CAPOVILLA, G. CILDIR, A. JOURDAIN, V. TERGAONKAR, M. SCHMID, C. ZUBIETA, S.J. CONN. A circRNA from SEPALLATA3 regulates splicing of its cognate mRNA through R-loop formation. *Nat Plants.* (2017) 18;3:17053.