Company or University + lab:
Institut de Recherche pour le Développement,
UMR DIADE (DIversité, Adaptation et Dévelopement des plantes)

Address:
911 avenue Agropolis,
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Supervisor (to be contacted for applying):
- Last name: LUCAS   /   TRANBERGER
- First name: Mikaël   /   Tim
- Position: Researcher (Chargé de Recherche)
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Internship title:
DEvelopment of a Decision Tool for **G**ene Regulatory Networks **I**nference Experimental Design and Analysis (**DEGI**)

Keywords:
Gene network inference, transcriptomics, plant biology, modeling, tool development

Internship description :

General Objective:
Exploration of effectiveness and limits of two methods of inference for gene regulatory networks, DIANE (Cassan et al. 2021, BPMP) and TDCor (Lavenus and Lucas 2022).
Creation of a decision-tool system to assist life-science researchers in selecting optimal experimental set-ups for reconstruction of gene regulatory networks.

Problem and Context:
We are increasingly confronted with large transcriptome data sets, searching for genes that underlie particular biological phenomena, and while it is critical to identify the best candidates to go forward with more work intensive functional analyses, the sheer amount of data makes it difficult to pinpoint candidate genes. One type of data includes time courses, either with short term treatments (hours, e.g. Jasmonate, ethylene, stress etc….) or developmental stages/transitions, which can be on larger time scales (days). One approach that can help select candidate genes is to reconstruct either co-expression or causal gene regulatory networks (GRN) based on these transcriptome time courses, and then analyse these networks to identify genes of interest. Several methods of inferences have been proposed in the literature, two of which (DIANE and TDCor) are routinely used in DIADE. This project aims to confront those methods with the diversity of time-course datasets available in the DIADE UMR, to design a tool that would help guide researchers in their data analysis and/or experimental design.

Objectives and Program:
We propose an M2 student project (UM Bioinfo, 2023) to study the diverse datasets available from different DIADE teams. The project has the objective to construct and analyse gene expression networks from those datasets to compare the two different methods (DIANE and TDCore) for each study. The comparison tests will be done first on a control dataset from *Arabidopsis* already used for network inference and validated previously (Lavenus et al, The Plant Cell, Vol. 27: 1368–1388, May 2015). The student will use subsets of the *Arabidopsis* dataset fitting the modalities of the other available datasets from different source material (oil palm, rice, etc..) and with varied time temporal

scales (from hours to days) and in different biological contexts (fruit, roots, inflorescences…). The results of this analysis should provide insight into the limitations and benefits of the two inference methods. The output data will be used to infer GRN from the diverse DIADE datasets, if possible given the limitation of inference methods, with the implication of DIADE team members for the definition of the list of genes to be included in the inference and for the biological interpretation of the inference results.

The student will also be responsible for the creation of an interactive "Guide/Questionnaire/Decision" tool system (in a website format) to assist researchers in the UMR (and possibly beyond) to optimize future experimental design and downstream analyses of gene regulatory networks.

The student will be integrated within the DIADE UMR, in Montpellier.

Calendar: Jan-Jun 2024, M2 student project (6 months)

Salary or allowance: Standard intership rate of ~600 euros per month (27,30 euros per working day)