

## Funded PhD subject

**Developmental plasticity of the poplar root system  
in response to physical soil heterogeneities**Context and project

The root system development responds to soil chemical and physical variations, such water and nutrient availability, fungal signals or mechanical impedance. Root growth and lateral root production are finely regulated processes leading to resources acquisition optimization (Rellan-Alvarez et al., 2016). However, the developmental responses of the root system to a localized constraint are badly known, in particular their dynamics and the response specificity of the different root types. In addition, the local and systemic signalisations involved in the developmental plasticity of the root system have been overlooked (Rosales et al. 2019).

The first objective of the thesis is to characterise the developmental plasticity of the root system of young plants of poplar grown either in vitro or in rootboxes by manipulating the growth media to produce localised constraints including water deficit and mechanical impedance. A second objective aims at characterising the local and systemic signalisation of the plasticity using transgenic lines affected in the perception or the biosynthesis of different hormones.

More detail at : <http://doctorat.univ-lorraine.fr/fr/les-ecoles-doctorales/sirena/offres-de-these/developpement-du-systeme-racinaire-du-peuplier-en>

Scientific group:

This project will be done in the Phare team of UMR Silva ([https://www6.nancy.inrae.fr/silva\\_eng/Research-teams/PHARE](https://www6.nancy.inrae.fr/silva_eng/Research-teams/PHARE)) where the supervisors study the biophysical and molecular controls of root growth in response to environment, with multidisciplinary approaches.

This project will be conducted in collaboration with Claire Veneault-Fourrey (UMR IAM). The successful applicant will benefit from the supervisors' national and international scientific networks, from support of the technical team and from our root system imaging facility.

Recent publications

- Bizet F, AG Bengough, I Hummel, MB Bogeat-Triboulot, LX Dupuy (2016) 3D deformation field in growing plant roots reveals both mechanical and biological responses to axial mechanical forces. *J Exp Bot* 67:5605-5614. doi: <https://doi.org/10.1093/jxb/erw320>
- Bizet F, I Hummel, MB Bogeat-Triboulot (2015) Length and activity of the root apical meristem revealed in vivo by infrared imaging. *J Exp Bot* 66:1387-1395. doi: [10.1093/jxb/eru488](https://doi.org/10.1093/jxb/eru488)
- Cohen D, MB Bogeat-Triboulot, E Tisserant, S Balzergue, ML Martin-Magniette, G Lelandais, N Ningre, JP Renou, JP Tamby, D Le Thiec, I Hummel (2010) Comparative transcriptomics of drought responses in *Populus*: a meta-analysis of genome-wide expression profiling in mature leaves and root apices across two genotypes. *BMC Genomics* 11:630
- Kolb E, V Legue, MB Bogeat-Triboulot (2017) Physical root-soil interactions. *Phys Biol* 14. doi: <https://doi.org/10.1088/1478-3975/aa90dd>
- Royer M, D Cohen, N Aubry, V Vendramin, S Scalabrin, F Cattonaro, MB Bogeat-Triboulot, I Hummel (2016) The build-up of osmotic stress responses within the growing root apex using kinematics and RNA-sequencing. *J Exp Bot* 67:5961-5973. doi: <https://doi.org/10.1093/jxb/erw350>
- Youssef C, F Bizet, R Bastien, D Legland, MB Bogeat-Triboulot, I Hummel (2018) Quantitative dissection of variations in root growth rate: a matter of cell proliferation or of cell expansion? *J Exp Bot* 69:5157-5168. doi: <https://doi.org/10.1093/jxb/ery272>

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Supervisor : Marie-Béatrice BOGEAT-TRIBOULOT, [marie-beatrice.bogeat@inrae.fr](mailto:marie-beatrice.bogeat@inrae.fr)  
Co-supervisor : Irène HUMMEL, [irene.hummel@inrae.fr](mailto:irene.hummel@inrae.fr)

Doctoral school : SIRENa – Science et Ingénierie des Ressources Naturelles (Lorraine University)  
<http://doctorat.univ-lorraine.fr/en/apply-phd/why-PhD-UL>

Salary : Approximately 1420 € per month, 3 years

PhD start : 1<sup>st</sup> October 2020

Skills : Applicants should hold a Master 2 (or equivalent). Skills in experimentation, in vitro culture or image analysis are desirable. Interest in development biology or root biology, in plant response to abiotic stress and a good English level will be welcome.

**To apply:** Please send your curriculum vitae, a covering letter including the coordinates of at least a referent to [marie-beatrice.bogeat@inrae.fr](mailto:marie-beatrice.bogeat@inrae.fr) et [irene.hummel@inrae.fr](mailto:irene.hummel@inrae.fr)

**Closing date:** 20<sup>th</sup> June