2018, April 23rd

PhD co-supervision
Saint-Etienne University (France) / Firenze University (Italy)
September 2018 – August 2021

Title
Evolution and domestication of NUDX1, a gene involved in the fragrance of roses

Thesis Topic
In 2015, we discovered a new biosynthetic pathway for geraniol, the main odorant compound in roses (Science 349, 81-83). Indeed, while all plants studied to date make this compound with a geraniol synthase, roses have diverted a cellular sanitation enzyme to achieve this function. The NUDX1 protein is a Nudix hydrolase that destroys oxidized mutagenic nitrogen bases. In the rose, this function is lost in favor of a function of biosynthesis of geraniol. This new pathway is not yet fully known both upstream and downstream of NUDX1. It is also not known at the evolutionary level. The thesis topic proposes to answer three fundamental questions: how is the pathway of biosynthesis organized at the cellular level? where does this specialization of the *NUDX1* gene come from in the evolution of Rosaceae? is there a diversity of alleles in the current varieties or has the Man selected only one allele? The first question will concern more precisely the subcellular origin of the substrate of the reaction and the diversity of the products formed by this reaction. Indeed, the substrate (geranyl diphosphate) is usually formed in plastids while NUDX1 is active in the cytosol. The second question is based on an analysis of wild roses and other Rosaceae to identify when NUDX1 switched from a sanitizing function to a volatile compound production function. The third question is based on an analysis of current varieties. This thesis will be proposed in co-supervision with the University of Firenze with access to a world-famous historical rose garden (Roseto Fineschi). It will also benefit from our recent collaboration with the Meilland-Richardier establishments, world leader in varietal creation.

Co-supervision of the PhD
A thesis co-supervisory file will be created as soon as the candidate is recruited. This file will be sent to Jean Monnet University, the University of Firenze and the french AURA Region for validation request and scholarship application. PhD work will take place mainly at the Saint-Etienne site (Plant Biotechnology laboratory applied to Aromatic and Medicinal Plants). The candidate will spend 6 to 12 months in Firenze, Italy (CNR Institute for Sustainable Plant Protection).

Laboratoire BVpam
Université Jean Monnet
Faculté des Sciences et Techniques
23 rue du Docteur Paul Michelon
42023 Saint-Étienne Cedex 2
+33(0) 4 77 48 15 25
caissard@univ-st-etienne.fr

Candidate Profile
The candidate must master the tools of plant molecular biology (cloning and sequence comparison) as well as data processing tools (ANOVA, ACP, PLS-DA, Heatmap, etc.). He will also have to know the theoretical principles of molecular phylogenies, even if he has never used them.
The candidate will have to show a particular motivation for botany and the study of the evolution of a particular gene in roses. Some knowledge, even theoretical, about cell compartments and gas chromatography would also be a plus to his candidacy.
The candidate will have his(her) driver's license because the fields of production and harvest of the roses are located between 20 and 50 km from the laboratory without access by public transport. Finally, occasionally and depending on the results obtained, he may have to spend a few days on a mission with an academic or industrial partner (mainly regions around Nice, Strasbourg or Angers).

Application and schedule
The application must be validated by our laboratory before May 18th, 2018 at 12h00. At this time, we will go back two candidates to the Doctoral School. The two candidates must pass the competition of the Doctoral School (oral presentation of CV and project work planned for the thesis) on May 22th, 2018. The transport costs will be supported by the laboratory if needed, but competition by Skype is allowed.

Reference websites
https://www.univ-st-etienne.fr/fr/lbvpam.html
http://edsis.universite-lyon.fr/
https://sites.google.com/view/rosascent/accueil?authuser=0
https://www.gdr-mediatec.cnrs.fr/
https://gdro3.wordpress.com/
http://www.ipsp.cnr.it/?lang=en
http://www.rosetofineschi.it/

Contact
Jean-Claude Caissard
Laboratoire de Biotechnologies Végétales appliquées aux Plantes Aromatiques et Médicinales (CNRS/UDL/UJM FRE 3727)
23 rue du Docteur Paul Michelon F-42023 Saint-Etienne Cedex 2, France
(+33) 4 77 48 15 25
caissard@univ-st-etienne.fr