# Post-doctoral fellowship in phyto- and analytical chemistry

# (from 01/01/2021 to 31/12/2021)

## Mass Spectrometry Imaging of complex phytoalexins in stressed grapevine

**Location :** **LCP-A2MC – University of Lorraine, Metz (France)**
http://lcp-a2mc.univ-lorraine.fr/

**Offer:** contract for 12 months (possible extension to 18) – Gross salary 45 k€/year

### Project

This project is a partnership between the University of Lorraine (UL, Dr Vincent Carré) and the University of Reims Champagne-Ardennes (URCA, Pr. Philippe Jeandet). It is included in the ResEx program dedicated to the development of a very high resolution mass spectrometry platform in the East of France and supported by the young researcher program of the "Région Grand Est".

### Background

Plants in their natural environment are facing large numbers of potentially pathogenic and beneficial microorganisms, mainly fungi and bacteria. To cope with these stresses, plants have evolved a variety of resistance mechanisms that can be constitutively expressed or induced. Phytoalexins, which are biocidal compounds of low molecular weight synthesized by and accumulated in plants as a response to stress, take part in this intricate defense system[1,2].

### Project description

One limitation in our knowledge of phytoalexins is the difficulty in analyzing the events occurring between the plant and the pathogen under natural conditions. Some attempts to determine the actual concentrations and the nature of phytoalexins directly in plant tissues in response to invading microorganisms have been carried out using spectroscopic methods[3]. Our group has already used mass spectrometry (ESI FT-ICRMS) [4] and imaging mass spectrometry techniques to evaluate the response of grapevine leaves to *Plasmopara viticola*, the causal agent of downy mildew. Most importantly, molecular mapping of grapevine leaves by laser desorption/ionization mass spectrometry has revealed a specific spatial distribution of some stilbene phytoalexins produced upon the infection process [5–7].

As part of this project, investigations will be extended and applied to highly polymerized forms of more fungitoxic stilbene phytoalexins including trimers, tetramers possibly allowing a better

understanding of the interaction mechanisms between grapevine and its various pathogens (Plasmopara viticola, Botrytis cinerea etc). For this purpose, imaging by MALDI mass spectrometry at very high MS resolution mode (FTICRMS) will be developed on infected grapevine leaves. Particularly, for this collaborative work, the grapevine cultures and their infections will be performed at URCA and IMS experiments will be conducted on the MS platform in Metz.

## Eligibility

The candidate will be a highly motivated researcher (PhD or PhD defense planned this year) and a strong background in the field of imaging mass spectrometry. Skills in using statistical tools and/or experience in metabolomics would be appreciated. The candidate should also have excellent communication skills in written and spoken English and be a good team player who can integrate and interact with different partners.

## How to apply

Your application must include your PhD manuscript (pdf) and certificate (or an official document for PhD defense), a short CV, a motivation letter and the email addresses of your PhD's supervisor(s) and at least two referee.

Please send your application to the project leaders:

vincent.carre@univ-lorraine.fr and philippe.jeandet@univ-reims.fr

**Application deadline: 18/12/2020 (Europe/Paris)**

## References


[1] P. Jeandet, C. Clément, E. Courot, S. Cordelier, Modulation of Phytoalexin Biosynthesis in Engineered Plants for Disease Resistance, Int. J. Mol. Sci. 14 (2013) 14136–14170. doi:10.3390/ijms140714136.

[2] P. Jeandet, E. Sobarzo-Sánchez, C. Clément, S.F. Nabavi, S. Habtemariam, S.M. Nabavi, S. Cordelier, Engineering stilbene metabolic pathways in microbial cells, Biotechnol. Adv. 36 (2018) 2264–2283. doi:10.1016/j.biotechadv.2018.11.002.

[3] P. Jeandet, A.C. Breuil, M. Adrian, L.A. Weston, S. Debord, P. Meunier, G. Maume, R. Bessis, HPLC Analysis of Grapevine Phytoalexins Coupling Photodiode Array Detection and Fluorometry, Anal. Chem. 69 (1997) 5172–5177. doi:10.1021/ac970582b.

[4] L. Becker, A. Poutaraud, G. Hamm, J.-F. Muller, D. Merdinoglu, V. Carré, P. Chaimbault, Metabolic study of grapevine leaves infected by downy mildew using negative ion electrospray – Fourier transform ion cyclotron resonance mass spectrometry, Anal. Chim. Acta. 795 (2013) 44–51. doi:10.1016/j.aca.2013.07.068.

[5] G. Hamm, V. Carré, A. Poutaraud, B. Maunit, G. Frache, D. Merdinoglu, J.-F. Muller, Determination and imaging of metabolites from Vitis vinifera leaves by laser desorption/ionisation time-of-flight mass spectrometry, Rapid Commun. Mass Spectrom. 24 (2010) 335–342. doi:10.1002/rcm.4395.

[6] L. Becker, V. Carré, A. Poutaraud, D. Merdinoglu, P. Chaimbault, MALDI Mass Spectrometry Imaging for the Simultaneous Location of Resveratrol, Pterostilbene and Viniferins on Grapevine Leaves, Molecules. 19 (2014) 10587–10600. doi:10.3390/molecules190710587.

[7] L. Becker, S. Bellow, V. Carré, G. Latouche, A. Poutaraud, D. Merdinoglu, S.C. Brown, Z.G. Cerovic, P. Chaimbault, Correlative Analysis of Fluorescent Phytoalexins by Mass Spectrometry Imaging and Fluorescence Microscopy in Grapevine Leaves, Anal. Chem. 89 (2017) 7099–7106. doi:10.1021/acs.analchem.7b01002.