



**HAL**  
open science

## **3D-Plant2cells project: Spatial metabolomic, spatial metagenomic, and 3D mass spectrometry imaging, to explore the impact of pesticides on plant metabolome and microbiota**

L F Nothias, Ivan Protsiuc, T Alexandrov, R. Knight, A Brunelle, D Touboul,  
P C Dorrestein

### **► To cite this version:**

L F Nothias, Ivan Protsiuc, T Alexandrov, R. Knight, A Brunelle, et al.. 3D-Plant2cells project: Spatial metabolomic, spatial metagenomic, and 3D mass spectrometry imaging, to explore the impact of pesticides on plant metabolome and microbiota. 64th Annual Meeting of GA and 9th Joint Natural Product Conference 2016, ociety for Medicinal Plant and Natural Product Research (GA), the Phytochemical Society of Europe (PSE), Società Italiana di Fitochimica (SIF), Association Francophone pour l'Enseignement et la Recherche en Pharmacognosie (AFERP), and the Japanese Society of Pharmacognosy (JSP), Jul 2016, Copenhaguen, Denmark. pp.S1-S381, 10.1055/s-0036-1596119 . hal-02060185

**HAL Id: hal-02060185**

**<https://hal.science/hal-02060185>**

Submitted on 18 Mar 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Abstracts

Georg Thieme Verlag KG Stuttgart · New York

## 3D-Plant2cells project: Spatial metabolomic, spatial metagenomic, and 3D mass spectrometry imaging, to explore the impact of pesticides on plant metabolome and microbiota

### LF Nothias

<sup>1</sup> Collaborative Mass Spectrometry Innovative Center, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, La Jolla, CA 92093, United States

<sup>2</sup> Institut de Chimie des Substances Naturelles, CNRS, ICSN UPR 2301, University of Paris-Saclay, Gif-sur-Yvette, 1 avenue de la terrasse, 91198, France

### I Protsiuc

<sup>3</sup> European Molecular Biology Laboratory, Meyerhofstrasse 1, 69117 Heidelberg, Germany

### T Alexandrov

<sup>1</sup> Collaborative Mass Spectrometry Innovative Center, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, La Jolla, CA 92093, United States

<sup>3</sup> European Molecular Biology Laboratory, Meyerhofstrasse 1, 69117 Heidelberg, Germany

### R Knight

<sup>4</sup> Department of Computer Science and Engineering

<sup>5</sup> Department of Chemistry and Biochemistry, School of Medicine, University of California, San Diego, La Jolla, California 92093, United States

### A Brunelle

<sup>2</sup> Institut de Chimie des Substances Naturelles, CNRS, ICSN UPR 2301, University of Paris-Saclay, Gif-sur-Yvette, 1 avenue de la terrasse, 91198, France

### D Touboul

<sup>2</sup> Institut de Chimie des Substances Naturelles, CNRS, ICSN UPR 2301, University of Paris-Saclay, Gif-sur-Yvette, 1 avenue de la terrasse, 91198, France

### PC Dorrestein

<sup>1</sup> Collaborative Mass Spectrometry Innovative Center, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, La Jolla, CA 92093, United States

<sup>4</sup> Department of Computer Science and Engineering

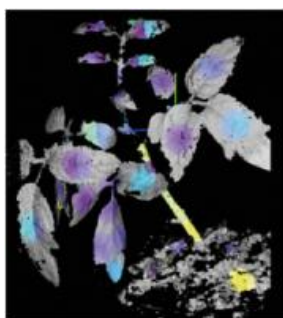
### > Author Affiliations

Further Information

Congress Abstract

Full Text (/products/ejournals/html/10.1055/s-0036-1596119)

The "3D-Plant2Cells" project investigates the impact of the agricultural mode on crops grown for human consumption. We are developing an innovative interdisciplinary approach to study the metabolome and the microbiota of plants in three-dimension (3D) at three different scales: the whole plant, the fruit, and the cellular scales. The objective of this study is to get a new insight on the metabolome and microbiota response to pesticide treatment. The hypothesis is that the chemistry and microbiome could change upon the use of conventional cultivation managements. To explore this hypothesis, two groups of plants are cultivated in growth chamber and one receives pesticide treatments. The metabolome and the plant-associated microbiota are explored on the whole plant surface (plant scale) by using an innovative interdisciplinary approach [1,2]. Samples are collected on the whole plant and their metabolite content profiled by high-resolution tandem-mass spectrometry (HR-MS/MS) and plant-associated microorganism communities by amplicon sequence analysis (metagenomics) [1]. Results of these both inputs are compiled into a bioinformatic model representing a 3D topological map of the metabolome/microbiome over the entire organism surface [1]. Mass spectrometry data will be further interpreted using MS/MS molecular networking [1]. In the meantime, we are studying fruits of the cultivated specimens by 3D mass spectrometry imaging<sup>3</sup> to study the metabolome/microbiota response to pesticide treatments along with the pesticide distribution in 3D. The fruit and cell scale are explored by analyzing serial sections using MALDI, nanoDESI, 3D-TOF-SIMS coupled to HR-MS/MS. The presentation will aim at introducing the project, and to highlight some methodological approaches used to study the microbiota-chemistry relationships in species or ecosystem.



(<https://www.thieme-connect.de/media/plantamedica/2016S01/10-1055-s-0036-1596119-i011.jpg>).



*Acknowledgement:* The 3D-Plant2Cells project is funded by the European Union under the Horizon 2020 framework programme for research and innovation (Marie Skłodowska-Curie Actions, individual global fellowship, MSCA-IF-2016, 704786).

**Keywords:** spatial metabolomic, spatial metagenomic, 3D mass spectrometry imaging, molecular networking, plant-associated microbiota, pesticide.

**References:**

- [1] Bouslimani A, Porto C, Rath CM, Wang M, Guo Y, Gonzalez A, Berg-Lyon D, Ackermann G, Christensen GJM, Nakatsuji T, Zhang L, Borkowski AW, Meehan MJ, Dorrestein K, Gallo RL, Bandeira N, Knight R, Alexandrov T, Dorrestein PC. Molecular cartography of the human skin surface in 3D. *Proc Natl Acad Sci* 2015; 112: 2120 – 2129
- [2] Palmer AD, Alexandrov T. Imaging mass spectrometry at its tipping point. *Anal Chem* 2015; 87: 4055 – 4062
- [3] Touboul D, Brunelle A. What TOF-SIMS can bring more than other MS imaging methods?. *Bioanalysis* 2016; in press, doi:10.4155/bio.16.11.