



Institut National  
Universitaire  
Champollion

# PHD POSITION IN ENGINEERING FOR HEALTH AND LIVING SYSTEMS (GEET DOCTORAL SCHOOL) PLAS-FOOD PROJECT

**Category:** A

**Employment type:** PhD contract, full time fixed-term contract

**Funding:** Région Occitanie and INU J.F. Champollion

**Contract duration:** 3 years

**Start date:** October 2023

**Net monthly salary:** 1643 - 1848 € + possible teaching stipend at University

**Location:** Institut National Universitaire Champollion

Equipe DPHE (Diagnostics des Plasmas Hors Equilibre)

Campus d'Albi

Place de Verdun

81000 Albi

## ***JOB DESCRIPTION***

### ***1. CHALLENGES, MOTIVATION AND STATE OF THE ART***

Food industry must continuously adapt to the requirements of an increasing population by proposing an adequate amount of food products and at the same time insure the nutritional and the safety of these products. The necessity to limit the negative effects of the technologies currently used to ensure the safety of food products lead to the development of novel food decontamination technologies. Cold atmospheric pressure plasmas, due to their biocidal potential could be used as an alternative technology to the chemical products for the decontamination in food industry [1]. Cold atmospheric pressure plasmas are ionized gases that produce high amounts of reactive oxygen and nitrogen species (RONS) such as atomic oxygen, ozone, hydroxide and nitrite. These species act in synergy with charged particles, electric field and radiations to inactivate microorganisms. Numerous studies demonstrated the deleterious effect of plasma exposure on bacteria cell wall and cell membrane, on proteins and DNA [2]. More recently, some research groups showed that plasma exposure can significantly decrease antibiotic resistance genes (ARGs) and their conjugative transfer frequency [3].

### ***2. RESEARCH OBJECTIVES***

This interdisciplinary project aims to assess the atmospheric pressure plasma potential in the biological decontamination of food products with a special interest on the effect of plasma on antibiotic resistant bacteria (ARB) and the transfer of ARGs. The work plan includes four aspects:

- characterization of the plasma set-up (e.g. optical emission spectroscopy, RONS production evaluation)
- determination of the bacterial contamination profiles in vegetal food matrices as well as their antibiotic resistance
- assessment of the bactericidal effect of plasma exposure using ARB isolated from vegetal food products
- evaluation of plasma effect on the degradation of ARGs and the horizontal gene transfer



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## SCIENTIFIC REFERENCES

**Champollion** [1] Niemira BA. Cold plasma decontamination of foods. *Annu Rev Food Sci Technol*. 2012; 3: 125-42. doi: 10.1146/annurev-food-022811-101132.

[2] Alkawareek M.Y., Gorman S.P., Graham W.G., Gilmore B.F. Potential cellular targets and antibacterial efficacy of atmospheric pressure non-thermal plasma, *International Journal of Antimicrobial Agents*. 2014; 43(2): 154-160. <https://doi.org/10.1016/j.ijantimicag.2013.08.022>.

[3] Li H; Kang Z, Enli Jiang, Ruiying Song, Ying Zhang, Guangzhou Qu, Tiecheng Wang, Hanzhong Jia, Lingyan Zhu, Plasma induced efficient removal of antibiotic-resistant *Escherichia coli* and antibiotic resistance genes, and inhibition of gene transfer by conjugation, *Journal of Hazardous Materials*. 2021, 419. <https://doi.org/10.1016/j.jhazmat.2021.126465>.

## PROFILE

You have a master's degree or equivalent, preferably in Biology – Health, Microbiology.

You are comfortable with experimental work. You like to work in a multi-disciplinary team, and you have good communication and relationship skills. You are fluent in English.

Creative and innovative, rigorous and organized, you have the ability to manage research projects from design to conclusion, including organizing and planning operations, interpreting research results and sharing conclusions.

## PHD ENVIRONMENT AND SUPERVISORS

### Localisation and Supervision

The PhD student will be mainly located in the laboratory “Diagnostics des Plasmas Hors Equilibre” (DPHE), in Albi, France. He/She will be working under the supervision of Ph. Guillot (full professor), Cristina Muja (engineer in biology) and Thomas Maho (engineer in plasma physics).

**Applications** have to be sent by mail at:

Dr. Philippe GUILLOT - [philippe.guillot@univ-jfc.fr](mailto:philippe.guillot@univ-jfc.fr)

Dr. Cristina MUJA - [cristina.muja@univ-jfc.fr](mailto:cristina.muja@univ-jfc.fr)

Dr. Thomas MAHO - [thomas.maho@univ-jfc.fr](mailto:thomas.maho@univ-jfc.fr)

The application will include a complete CV, a motivation letter, transcripts of Master 1 and 2, references and a recommendation letter.