



Call for Applications for a Doctoral Position

2025-2028

ENvironment, BIOlogical mechanisms and CARdio-renal health: focus on heart failure (ENBIO-CARE)

1. Background and Project Overview

Cardiovascular diseases (CVD) and chronic kidney disease (CKD) represent a major global public health challenge, highlighting the need for effective prevention strategies. In this context, nutrition plays a central role. The consumption of ultra-processed foods (UPFs)—industrial products formulated from refined ingredients, additives, and complex technological processes—has increased considerably over recent decades, reaching up to 60% of total energy intake in some countries. High UPF consumption has been associated with numerous cardio-renal and metabolic risk factors, including obesity, diabetes, and CVD. However, the biological mechanisms linking UPFs to cardio-renal health remain insufficiently understood. This gap has recently led the French Senate, along with several pioneering research teams, to emphasize the need for in-depth research aimed at better understanding these associations and their underlying mechanisms.

Furthermore, UPF consumption is not solely determined by individual choices but is also strongly influenced by physical and food environments. The density of fast-food outlets, accessibility to food products, and conversely, the presence of natural environments capable of modulating stress and eating behaviors, may play a key role in cardio-renal health.

In this context, multi-omics approaches combined with network analyses and machine learning methods offer promising perspectives for integrating complex data, identifying biological signatures, and deciphering the mechanistic pathways involved. Although their relevance has been demonstrated in cardio-renal epidemiology, particularly within the CIC-P, these approaches remain underutilized in nutrition research, especially in studies investigating the links between UPFs, CVD, and CKD.

At the same time, recent developments in applied and spatial econometrics now enable the analysis of relationships between environment, behavior, and health while accounting for territorial interdependencies, contextual effects, and individual heterogeneity, thereby improving the identification of causal mechanisms.

This project therefore aims, on the one hand, to better understand the environmental determinants of ultra-processed food consumption and, on the other hand, to identify the biological mechanisms linking this consumption to cardio-renal health, with a particular focus on heart failure.

To achieve this, the project will rely on the integration of omics data (lipidomics, proteomics) combined with advanced analytical methods including network analyses, machine learning, and statistical modeling. At the interface between public health and environmental economics, this PhD project aims to develop an integrative approach combining spatial econometrics, advanced biostatistics, machine learning, and network analyses. The objective is to identify robust biological signatures and prioritize the explanatory factors linking UPF consumption to cardio-renal health trajectories.

Beyond identifying these relationships, the project also seeks to better understand the development of socio-territorial health inequalities and to provide evidence that may support the evaluation of public policies in nutrition, urban planning, and prevention.

Research Framework

The doctoral project is part of scientific theme of the interdisciplinary program LIFE TRAVEL (Life Trajectories, Multimorbidity, Functional Ability, Quality of Life and Longevity), developed within the framework of the Initiative d'Excellence Lorraine (I-SITE Lorraine - France 2030) and which aims to characterize the interactions between complex determinants of health trajectories and longevity, and to elucidate the shared and non-shared etiological mechanisms underlying these trajectories throughout the life course.

The project will combine information related to multiple health determinants with geographical characteristics collected at different stages of life. This integrative approach will enable the exploration of trajectories across the entire life continuum (children and adults) within the longitudinal STANISLAS cohort and across different health states (healthy individuals, patients with heart failure, including advanced-stage heart failure), using several cohorts at different stages of disease progression. The integration of heterogeneous data will contribute to a better understanding of the complexity of individual mechanisms, particularly biological and environmental (social, economic, geographical, etc.), influencing health in both physiological and pathological states, thereby enabling a detailed characterization of life trajectories and their determinants.

Objectives of the Doctoral Project

This PhD project aims to better understand the role of ultra-processed foods in cardio-renal health through an integrated environment–nutrition–biology approach. The objectives are:

1. **To explore the influence of physical environments** on UPF consumption and cardio-renal health, particularly by studying proximity to natural spaces, fast-food outlets, and supermarkets.
 2. **To identify the biological mechanisms** linking UPF consumption to cardio-renal health by combining lipidomics, systems biology, and the study of compounds derived from UPFs (trans fatty acids, PFAS).
 3. **To further investigate the link between UPFs and heart failure** by analyzing fibrosis biomarkers and lipid profiles at different stages of heart failure, from the general population to patients with advanced heart failure.
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2. Supervision and Research Environment

PhD Supervisors

Nicolas Girerd is a cardiologist and coordinator of the Multidisciplinary Clinical Investigation Center (CIC-P). Internationally recognized, he is ranked among the world experts in heart failure on Expertscape. His research focuses on improving the understanding of the mechanisms underlying the emergence and progression of cardiovascular diseases, particularly heart failure.

Sandra Wagner is a researcher in epidemiology at the CIC-P, Nancy University Hospital. Her research investigates the impact of nutrition on cardiovascular and renal health.

Youba Ndiaye is an Associate Professor in Economics at the University of Lorraine and a member of the Bureau of Theoretical and Applied Economics (BETA) laboratory in Nancy. His research lies at the intersection of environmental economics, with a particular interest in spatial interactions and the evaluation of public policies using applied and spatial econometric tools.

Host Research Units

The CIC-P affiliated with Nancy University Hospital, is dedicated to clinical and epidemiological research. It provides advanced methodological and statistical expertise as well as privileged access to large-scale clinical and longitudinal cohort data, particularly the STANISLAS cohort. The CIC-P is a key actor in the production and analysis of health data related to cardio-renal diseases and their risk factors. It includes a research axis dedicated to nutrition and cardio-renal health.

The Acute and Chronic Cardiovascular Failure (DCAC) team, an INSERM research unit specializing in cardiovascular pathophysiology, has expertise in fundamental and translational research in biological mechanisms, systems biology, and integrative analyses.

The BETA is a joint research unit specializing in applied economics, recognized for its work in health economics, environmental economics, and econometrics. Economic challenges related to health and aging are central topics within the unit, particularly in the context of healthcare resource allocation and demographic transition.

The PhD project will be jointly conducted between BETA and CIC-P/DCAC.

Partners

The project will benefit from the expertise of the CaRMEN Laboratory in the field of lipid research.

3. Proposed PhD Topic

This PhD project will be structured around three main research axes based on the STANISLAS cohort, a family-based cohort from Lorraine that initially included more than 4,000 healthy volunteers between 1993 and 1995 and followed them over 20 years (visits every 5 to 10 years). Socio-demographic, dietary, clinical, and biological data were collected, along with extensive cardiovascular phenotyping enabling the assessment of subclinical cardiovascular damage such as arterial stiffness and atherosclerosis.

Axis 1. Exploring the Influence of Physical Environments

Accessibility to food retailers and environmental amenities will be assessed using geocoded residential addresses through indicators of distance, density, and structural indices. Advanced spatial accessibility measures (Two-Step Floating Catchment Area methods) will be used to simultaneously integrate supply, demand, and territorial characteristics. Associations with UPF consumption and cardio-renal health will be studied using statistical and econometric analyses. Finally, supervised machine learning approaches (particularly Random Forest and XGBoost) will be employed to model potentially non-linear relationships, identify the most influential environmental determinants, and refine exposure profile stratification, thereby combining artificial intelligence with approaches from social sciences applied to health.

Axis 2. Identifying Biological Mechanisms

Among low and high UPF consumers, the following will be identified:
A) lipid signatures (based on blood concentrations of fatty acids and sphingolipids) and their associations with cardio-renal health;

B) proteomic signatures (measured using Olink technology – 460 proteins), combined with complex network analyses to investigate biological pathways;

C) specific blood compounds generated during UPF synthesis or originating from packaging materials, their evolution over 20 years, and their associations with cardio-renal health.

Integrative models (including variable selection methods and machine learning approaches) will be used to identify combinations of biological markers associated with UPF consumption and cardio-renal phenotypes.

Axis 3. Investigating the Link Between UPFs and Heart Failure

Association analyses will be conducted between UPF consumption, fibrosis biomarkers, and predictive indicators of heart failure (HF), or its progression across the different stages of HF, from the healthy general population to patients with advanced heart failure.

The originality of the project lies in the integration of approaches from spatial econometrics, advanced biostatistics, machine learning, and network analyses to identify robust signatures and prioritize the explanatory factors linking UPF consumption to cardio-renal health trajectories.

4. Candidate Profile

Required Degree

- Master's degree in Public Health, Epidemiology, Biostatistics applied to Life Sciences, or Economic Sciences.

Expected Scientific Skills

- Good command of statistical tools (R or Python).
- Strong background in statistics or epidemiology.
- Knowledge in nutrition would be appreciate.
- Prior experience with cohort data analysis.

Languages

- Working languages: French and English.

Additional Qualities

- Scientific curiosity and enthusiasm for research.
 - Autonomy, rigor, and organizational skills.
 - Analytical and synthesis abilities, with strong oral communication skills.
 - Team spirit and ability to work within a hierarchical structure.
 - Scientific writing skills in both French and English.
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5. Contract Conditions

- Duration: 36 months.
- Location: Vandœuvre-lès-Nancy / Nancy, France.
- Starting date: from October 2026.
- Salary: €2,300 gross monthly salary (net salary: approximately less than 20% deductions from gross salary).
- Doctoral enrollment: BIOSE Doctoral School – University of Lorraine.

Funding for this PhD project has already been secured.

6. Application Procedure

Required Documents

- CV
- Cover letter
- Master's transcripts
- Master's thesis or scientific article
- Two recommendation letters

Submission Format: PDF format only.

Submission Addresses

- s.wagner2@chru-nancy.fr
- youba.ndiaye@univ-lorraine.fr

Application Deadline

June 14, 2026.

7. Selection Timeline

- Application deadline: June 14, 2026
 - Expected interview period: Week of June 15, 2026
 - Results announcement: June 22, 2026
 - Expected starting date: From October 2026
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8. Contacts

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CIC-P website
BETA website