

Description of Funded Research Projects

1<sup>st</sup> Call for H.F.R.I. Research Projects  
to support Post-Doctoral Researchers

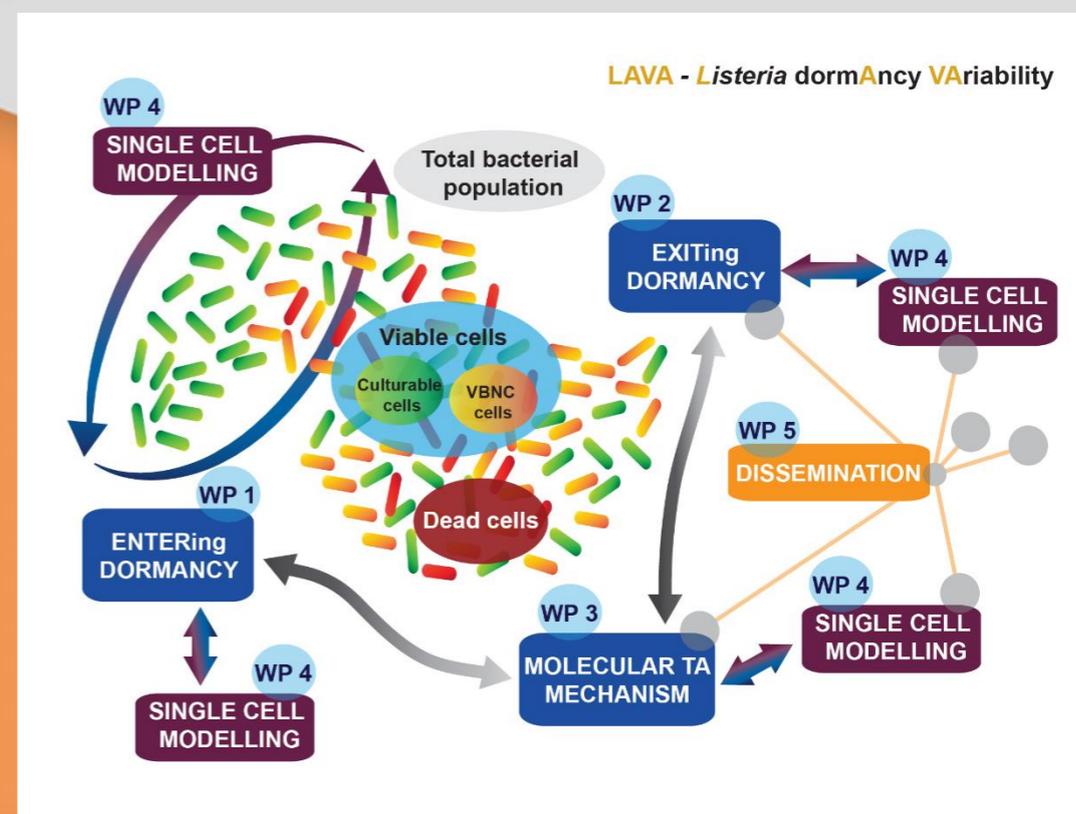


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Research Project Title:

**Integration of experimental investigation and  
computational modeling to decipher dormancy  
related stochastic phenomena in *Listeria  
monocytogenes***

**Principal Investigator:**  
**Artemis Giannakopoulou**



**Popular Title:**

**Integration of experimental investigation and computational modeling to decipher dormancy related stochastic phenomena in *Listeria Monocytogenes***

**Scientific Field:**  
**Agricultural Science**

**Host Institution:**  
**Agricultural University of Athens**



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The application of multiple barriers in the food industry aims at the inhibition of growth of spoilage and pathogenic microorganisms, in order to ensure the highest levels of quality and safety of the final products. *Listeria monocytogenes* is a foodborne bacterial pathogen often found in nature and in food processing environment, and causal agent of the well-known infection, Listeriosis, with a mortality rate of 20-30%. An environmental stimulus, such as a preservative agent in food, may induce changes in a microorganism's metabolism in aim to increase its survival potential. Several studies have highlighted the importance of the dormancy state as a bacterial response to unfavourable environment. While at this state, cells are called "Viable but non-culturable" (VBNC), they cannot multiply and are non-culturable in the laboratory media, but may regain their culturability when found back in favourable conditions.

The proposed multi-disciplinary study will address fundamental questions towards the characterization of VBNC mechanism in the foodborne pathogen *L. monocytogenes*. The kinetics governing induction of the VBNC cells and their resuscitation will be investigated for the first time. The development of a mechanistic model based on the kinetic outcomes, predicting the stochastic interchange of cell status at a single-cell level will deepen our knowledge on how pathogens transition into and out of this state. The combination of classical food microbiology, molecular biology, image analysis, mathematical modelling, computer simulation, and statistical pattern recognition, will provide an holistic approach to understanding the phenomenon of induction and persistence of *L. monocytogenes* cells in dormancy state and will also reveal potent risks for public health. Taking into account that the mechanism described previously pivots core survival and fitness tactics of microorganisms in nature, and that the current level of research is inadequate, this study is critical in establishing realistic estimates of VBNC food-related risks.

The proposed multidisciplinary project aims to study the factors that induce, govern and expunge the dormancy state in the bacterial pathogen *Listeria monocytogenes* cells. Given the centrality of this study to the stochastic effect of dormancy, and the prediction of random transition to this resistant physiological state in a single cell level, it is possible to simulate the prevalent conditions during food processing and gain further insights on the pathogen behavior and its impact on public health. A better understanding of the factors governing dormancy and resuscitation, is a prerequisite for the development of more efficient strategies capable to minimize the risk of pathogens in the food chain.

As there are as yet no similar studies, the acquired knowledge will improve food security and protect human health by eliminating listeriosis and any associated economic losses due to the presence of *Listeria* in the food supply.

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Being a recipient of this fellowship grants me the opportunity to follow a new career path, as it allows me to contribute to the scientific maturity of the people in my team. By managing this project, I will broaden my scientific knowledge, enhance my communication skills, develop new collaborations and contacts that will be influential for the development of my career. During this fellowship I will be engaged in practical and logistical competencies, which will enable me to acquire leadership skills, high quality science design and management.

Supervising my group will train me on how to lead diverse people and recognise their natural gifts, inspire performance and take responsibility and it will allow me to inculcate the importance of team effort in success. All the above will significantly add to my list of abilities and proficiencies as a person, while also introduce me to the challenges an independent researcher encounters

*The Principal Investigator,  
Artemis Giannakopoulou*

## Funding

Amount: **350,000 €**

Duration: **36 months**

Foundation: **H.F.R.I.**





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