

PhD PROPOSAL FOR THE DOCTORAL SCHOOL « Ecologie, Géosciences, Agronomie, ALimentation »

GENERAL INFORMATION

Thesis title: Develop a Quantitative Microbial Exposure Assessment model to assess the impact of key process steps on both risk for human health and commercial sterility failure rate
Acronym: QMEA
Disciplinary field 1: Food sciences Disciplinary field 2: Agronomy
Three keywords: Food safety, Modelling, Risk assessment
Research unit : SECALIM
Name of the thesis director: Jeanne-Marie Membré Email address of the thesis director : jeanne-marie.membre@oniris-nantes.fr Name of the thesis co-supervisor 1 (if applicable): Not yet defined Email address of the thesis co-supervisor 1 (if applicable): Name of the thesis co-supervisor 2 (if applicable): Email address of the thesis co-supervisor 2 (if applicable):
Thesis grant (funding origin and amount): EU
Contact(s) (mailing address and E-mail): jeanne-marie.membre@oniris-nantes.fr
Recruitment process: Recruitment process depends on thesis funding. To select the corresponding recruitment process, please visit the EGAAL website here . This information is needed for proposal publication. <input type="checkbox"/> Doctoral school contest <input checked="" type="checkbox"/> Interview <input checked="" type="checkbox"/> Other (indicate) : Important note: at the time of the recruitment, the researcher must not have resided or carried out his/her main activity (work, studies, etc.) in France for more than 12 months in the 3 years immediately prior to the date of the recruitment. Pre-selection: Have a Master Degree or equivalent, Respect the eligibility criteria for registration at the EGAAL doctoral school, i.e. transmission of a detailed curriculum vitae (academic background and research experiences), final transcripts and ranking of the two

ED EGAAL

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year of master's degree, cover letters, three letters of recommendation). This file must allow the evaluation of the eligibility of an application.

More info on EGAAL at <https://ed-egaal.u-bretagne-loire.fr/en>

Short-listed candidates will be interviewed.

All sections must be filled. Once filled, please save the proposal form in pdf format using the following naming: Supervisor Name_Unit_Subject Acronym_EN.pdf

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SCIENTIFIC DESCRIPTION OF THE PhD PROJECT

Socio-economic and scientific context : (10 lines)

Climate change and food safety have become interdependent worldwide research priorities. The overarching aim of this Innovative Training Network (ITN) is to provide high-level training in Predictive mOdelling Tools to evaluate the Effects of Climate change on food safeTy (PROTECT). The project will provide sound scientifically based knowledge for management options and decisions on new and emerging food safety threats due to climate change. Specific case studies will be focused on the dairy industry (e.g. cheese, yogurt, liquid milk) and emerging chemical and biological threats. Tools will focus on the change in chemical levels and microbial populations in relation to the dairy industry and assess how levels will change under climate change pressures. The skills and knowledge gained through the network will be a critically important step towards better management of future food supplies.

Assumptions and questions (8 lines)

How to develop a Quantitative Microbial Exposure Assessment (QMEA) model to assess the impact of key process steps on both risk for human health and commercial sterility failure rate (i.e. spoilage risk) ?

What are the key microbiological risks in the dairy sector, in the context of climate change?

How to identify and evaluate mitigation strategies to overall minimize microbial risk and environmental impact ?

The main steps of the thesis and scientific procedure (10-12 lines)

Task 1 Literature review, data collection and analysis: Evaluate existing risk models and set the model frameworks. Collection of data on i) impact of harvesting techniques, levels of raw material and factory environment contaminations (special focus on dairy factories in southern Europe), ii) impact of dairy-factory process on final product contamination, iii) microbial growth under ambient and hot conditions. A QMEA model framework will be developed for pathogenic and spoilage bacteria of interest.

Task 2 Development of risk and exposure assessment models: Development of QMEA models to assess microbial risks. Models will be implemented in @Risk and/or R software. Probabilistic models with uncertainty and variability separated, will facilitate the model interpretation.

Task 3: Recommendations of mitigation strategies: The expected effect of climate change on microbiological risks will be estimated by conducting a sensitivity analysis and by running what-if scenario. This will enable to identify relevant mitigation strategies to be recommended. Moreover, for recommended mitigation strategies dealing with pathogenic and spoilage bacteria, a Life Cycle Assessment will be conducted to evaluate the environmental sustainability of these potential mitigation strategies (performed at USC-Spain during secondment). A Multi-criteria decision analysis will be performed to balance microbial risks and environmental impacts

Methodological and technical approaches considered (4-6 lines)

Probabilistic modelling including Monte carlo simulation, Statistics, Data analysis, Expert elicitation

Scientific and technical skills required by the candidate

Food safety, modelling, risk assesment

THESIS SUPERVISION¹

Unit name: Secalim	Team name: Secalim
Unit director name: Marie-France Pilet	Team director name: Marie-France Pilet
Mailing address of the unit director: Marie-france.pilet@oniris-nantes.fr	Mailing address of the team director: Marie-france.pilet@oniris-nantes.fr
<p>Thesis director</p> <p>Surname, first name: Membré, Jeanne-Marie</p> <p>Position: Ingénieur de Recherche, PhD</p> <p>Obtained date of the HDR (Habilitation thesis to supervise research): 2012</p> <p>Employer: INRA</p> <p>Doctoral school affiliation: ED EGAAL</p> <p>Rate of thesis supervision in the present project (%): 60%</p> <p>Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 120%</p> <p>Number of current thesis supervisions/co-supervisions: 4 (including this one)</p>	
<p>Thesis co-supervisor 1</p> <p>Surname, first name: Boué, Géraldine</p> <p>Position: Lecturer</p> <p>Habilitation thesis to supervise research <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If yes, date diploma received:</p> <p>Employer: Oniris</p> <p>Doctoral school affiliation: Egaal</p> <p>Rate of thesis supervision in the present project (%): 40</p> <p>Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 0</p> <p>Number of current thesis supervisions/co-supervisions: 0</p>	
<p>Thesis co-supervisor 2 (if applicable) Not yet defined</p> <p>Surname, first name:</p> <p>Position:</p> <p>Habilitation thesis to supervise research <input type="checkbox"/> yes <input type="checkbox"/> no If yes, date diploma received:</p>	

¹ In EGAAL Doctoral School, if only one scientist in thesis supervision = 100% of supervision rate; if 2 people involved in thesis supervision = from 50% to 70% of supervision rate for the director; if 3 people involved in thesis supervision = 40% / 30% / 30% of supervision rate distribution among supervisors.

Employer:

Doctoral school affiliation:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

Private partner (if CIFRE funding, private funding,...) Not yet defined

Surname, first name:

Position:

Employer:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

International partner (if Cotutelle thesis)

Surname, first name:

Position:

Employer:

Rate of thesis supervision in the present project (%):

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%):

Number of current thesis supervisions/co-supervisions:

Professional status of previous PhD students supervised by director (from 5 years)

Please provide the following information for each PhD students supervised

Surname, first name: Boué, Géraldine

Date of PhD beginning and PhD defence: 2014-2017

Thesis supervision: Développement d'une méthodologie intégrative d'évaluation des risques et bénéfices santé liés à l'alimentation, en considérant les composantes toxicologiques, microbiologiques et nutritionnelles

Professional status and location: Maitre de Conférences, Oniris, Nantes

Contract profile (post-doc, fixed-term, permanent): Permanent

List of publications from the thesis work:

G. Boué, E. Cummins, S. Guillou, J.-P. Antignac, B. Le Bizec, J.-M. Membré. 2018. Public health risks and benefits associated with breast milk and infant formula consumption. *Critical Reviews in Food Science and Nutrition*. 58(1), 126-145

G. Boué, L.A. Wasiewska, E. Cummins, J.-P. Antignac, B. Le Bizec, S. Guillou, J.-M. Membré. 2018. Development of a *Cryptosporidium*-arsenic multi-risk assessment model for infant formula prepared with tap water in France. *Food Research International*. 108, 558-570.

G. Boué, E. Cummins, S. Guillou, J.-P. Antignac, B. Le Bizec, J.-M. Membré. 2017. Development and application of a probabilistic risk-benefit assessment model for infant feeding integrating microbiological, nutritional and chemical components. *Risk Analysis*. 37(12): 2360–2388. DOI: 10.1111/risa.12792

G. Boué, S. Guillou, J.-P. Antignac, B. Le Bizec and J.-M. Membré. 2015. Public health risk-benefit assessment associated with food consumption – A review. *European Journal of Nutrition & Food Safety*. 5: 32-58

Surname, first name: Dagnas, Stéphane

Date of PhD beginning and PhD defence: 2012-2015

Thesis supervision: Développement d'un modèle original d'inhibition de croissance de contaminants fongiques dans les produits de Boulangerie-Viennoiserie – Pâtisserie

Professional status and location: Chef de projet, Fromageries bel, Vendôme

Contract profile (post-doc, fixed-term, permanent): Permanent

List of publications from the thesis work:

S. Dagnas, M. Gougouli, B. Onno, K. P. Koutsoumanis, J.-M. Membré. 2017. Quantifying the effect of water activity and storage temperature on single spore lag times of three moulds isolated from spoiled bakery products. *International Journal of Food Microbiology*. 240: 75-84.

S. Dagnas, E. Gauvry, B. Onno, J.-M. Membré. 2015. Quantifying effect of lactic, acetic and propionic acids on growth of molds isolated from spoiled bakery products. *Journal of Food Protection*. 78: 1689 -1698.

S. Dagnas, M. Gougouli, B. Onno, K. P. Koutsoumanis, J.-M. Membré. 2015. Modelling red cabbage seed extract effect on *Penicillium corylophilum*: relationship between germination time, individual and population lag time. *International Journal of Food Microbiology*. 211 : 86-94.

S. Dagnas, B. Onno, and J.-M. Membré. 2014. Modeling growth of three bakery product spoilage molds as a function of water activity, temperature and pH. *International Journal of Food Microbiology*. 186:95-104.

S. Dagnas and J.-M. Membré. 2013. Predicting and preventing mold spoilage of food product: a review. *Journal of Food Protection*. 76: 538-551.

Surname, first name: Pujol, Laure

Date of PhD beginning and PhD defence: 2011-2014

Thesis supervision: Développement de méthodes et adaptation d'outils statistiques à la création d'un modèle de quantification du niveau

Professional status and location: Chef de projet, Novolyze, Dijon

Contract profile (post-doc, fixed-term, permanent): Permanent

List of publications from the thesis work:

L. Pujol, I. Albert, C. Magras, N. B. Johnson, J.-M. Membré. 2015. Estimation and evaluation of management options to control and/or reduce the risk of not complying with commercial sterility. *International Journal of Food Microbiology*. 213: 124–129.

L. Pujol, I. Albert, C. Magras, N. B. Johnson, J.-M. Membré. 2015. Probabilistic exposure assessment model to estimate aseptic-UHT product failure rate. *International Journal of Food Microbiology*. 192, 124–141.

L. Pujol, N. B. Johnson, C. Magras, I. Albert, J.-M. Membré. 2015. Added value of experts' knowledge to improve a quantitative microbial exposure assessment model – Application to aseptic-UHT food products. *International Journal of Food Microbiology*. 211 : 6–17.

L. Pujol, I. Albert, N. B. Johnson and J.-M. Membré. 2013. Potential application of quantitative microbiological risk assessment techniques to an aseptic-UHT process in the food industry. *International Journal of Food Microbiology*. 162: 283–296

Five main recent publications of the supervisors on thesis subject:

M. Ziane, I. Leguerinel and J.-M. Membré. 2019. A quantitative microbiological exposure assessment of *Bacillus cereus* group IV in couscous semolina, Algeria. *Microbial Risk Analysis*. 11: 11-22

J.-M. Membré and G. Boué. 2018. Quantitative Microbiological Risk Assessment in Food Industry: Theory and Practical Application. *Food Research International*. 106, 1132-1139.

J.-M. Membré and S. Guillou. 2016. Latest developments in foodborne pathogen risk assessment. *Current Opinion in Food Science*. 8, 120-126.

J.-M. Membré and V. Valdramidis (éditeurs). 2016. *Modeling in Food Microbiology: from predictive microbiology to exposure assessment*. ISTE Press and Elsevier. 102 pages. ISBN: 9781785481550.

J.-M. Membré, M. Diao, C. Thorin, G. Cordier, F. Zuber, S. André. 2015. Risk assessment of proteolytic *Clostridium botulinum* in canned foie gras. *International Journal of Food Microbiology*. 210 : 62-72

THESIS FUNDING

Origin(s) of the thesis funding: Europe, ITN Project PROTECT

Gross monthly salary 1758 € + Monthly mobility Indemnity 600 €

Thesis funding state : Acquired

Funding beginning date/Funding ending date: October 2019 – November 2022

Date: 29/05/2019

Name, signature of unit director:

AF Pilet 

Name, signature of team director:

Name, signature of thesis project director:

JM Membré 