

ABSTRACT

The hard-to-treat chronic bacterial infection is one of the most significant challenge to standard antibiotic therapy. These chronic infections represent an elevated risk of the development of clinical severe consequences. Bacteria can form biofilm or persister cells to withstand harsh environmental stress and lethal antibiotic dosage. Both biofilm and persister cells can restore the bacterial population upon the removal of environmental stresses and antibiotics. Thus, biofilm and persister cells are regarded as major survival strategies that are highly likely to associate with distribution of bacterial chronic infections. As one of the major causes of human gastroenteritis in the world, the dilemma of the prevalence of *Campylobacter jejuni* is not fully understood yet: how this microaerophilic microbe can survive in the aerobic environment and disseminate throughout the food chain to eventually cause campylobacteriosis? We argue that bacterial biofilm and persister cells are the leading factors that contribute to the prevalence of *C. jejuni* in agri-foods. The objectives of this study are to identify the biofilm formation and the persister population of *C. jejuni*, and investigate the formation mechanisms. We found that *C. jejuni* could form both mono- and multispecies biofilms and biofilm formation was significantly influence by environmental stresses. The extracellular DNA was the factor that mediated this influence. In addition, we identified the presence of *C. jejuni* persister cells which accounted for ~ 0.01% of the total population. The transcriptome analysis of persister cells indicated that the low metabolic activity and bacterial dormancy could play important role in the formation of persister cells. In the end, a synergistic treatment using ajoene and Al₂O₃/TiO₂ nanoparticles in a combined manner was applied to generate a significant antimicrobial effect against *C. jejuni*. In this study, we comprehensively investigated the two major bacterial survival strategies, namely biofilm and persister cells, and applied innovative synergistic antimicrobial treatment to inactivate *C. jejuni*. The knowledge from this study provide insight to understand the survival and distribution of *C. jejuni* and aids in the development of intervention strategies to reduce the prevalence of *C. jejuni* and other pathogens.

BIOGRAPHICAL NOTES

Academic Studies: MSc, Zhejiang University, 2013

GRADUATE STUDIES

Field of Study: Food Safety

Courses

Food 600 Molecular Regulation of Cell Growth

Instructors

Dr. Eunice Li-Chan

AWARDS

2013-2017	UBC International Tuition Award
2016	UBC C W Roberts Jr Memorial Scholarship
2015	UBC Fred and Page Beeson Scholarship in Agricultural Sciences
2015	UBC Wilson Henderson Fellowship
2015	UBC Poultry Industries Scholarship
2015	IFT First place-George F. Stewart International Research Paper
2013-2017	UBC International Tuition Award
2014	UBC Wilson Henderson Fellowship
2014	UBC Jacob Biely Scholarship
2014	UBC Master of Food Science International Scholarship
2013	UBC C W Roberts Jr Memorial Scholarship

SELECTED PUBLICATIONS

- [1] **Jinsong Feng**, César de la Fuente-Núñez, Michael J. Trimble, Jie Xu, Robert E. W. Hancock, Xiaonan Lu, 2015. *In-situ* Raman spectroscopic-based microfluidic “lab-on-a-chip” platform for non-destructive and continuous characterization of *Pseudomonas aeruginosa* biofilms. *Chemical Communication*, 51, 8966-8969. (IF: 6.319)
- [2] **Jinsong Feng**, Guillaume Lamour, Rui Xue, Mehr Negar Mirvakliki, Savvas G. Hatzikiriakos, Jie Xu, Hongbin Li, Shuo Wang, Xiaonan Lu, 2016. Chemical, physical and morphological properties of bacterial biofilms affect survival of encased *Campylobacter jejuni* under aerobic stress. *International Journal of Food Microbiology*, 238, 172-182. (IF: 3.339)
- [3] **Jinsong Feng**, Jiang Jing, Liu Yan, Li Wei, Azat Ramila, Xiaodong Zheng, and Wen-Wen Zhou, 2016. Significance of oxygen carriers and role of liquid paraffin in improving validamycin A production. *Journal of Industrial Microbiology & Biotechnology*, 43, 1365-1372. (IF: 2.810).
- [4] **Jinsong Feng**†, Lujia Guo‡, Zecong Fang, Jie Xu, Xiaonan Lu, 2015. Application of microfluidics “lab-on-a-chip” for the detection of mycotoxins in foods, *Trends in Food Science and Technology*, 46, 252-263. (IF: 5.191; † denotes co-first author)
- [5] **Jinsong Feng**, Xiaonan Lu, 2017. Book review “*Campylobacter – Feature, Detection and Prevention of Foodborne Disease*”. *Trends in Food Science and Technology*, 66, 195. (IF: 5.191)

- [6] Jiaqi Li, **Jinsong Feng**, Lina Ma, Cesar de la Fuente Nuneze, Greta Golz, Xiaonan Lu, 2017. Effects of meat juice on biofilm formation of *Campylobacter* and *Salmonella*. *International Journal of Food Microbiology*, 253, 20-28. (IF: 3.339)
- [7] Wei Li, **Jinsong Feng**, Yan Liu, Jing Jiang, Xiaodong Zheng, and Wen-Wen Zhou, 2016. Novel spectrophotometric approach for determination of validamycin A in fermentation of *Streptomyces hygrosopicus*. *Journal of Bioscience and Bioengineering*, 122, 736-739 (IF: 2.240)
- [8] Hongwei Zhang, **Jinsong Feng**, Rui Xue, Xin-Jun Du, Xiaonan Lu and Shuo Wang, 2014. Loop-mediated isothermal amplification assays for detecting *Yersinia pseudotuberculosis* in milk powders. *Journal of Food Science*, 79, M967-M971. (IF: 1.815)
- [9] Junping Wang, Xinfang Xie, **Jinsong Feng**, Jessica C. Chen, Xin-jun Du, Jiangzhao Luo, Xiaonan Lu, Shuo Wang, 2015. Rapid detection of *Listeria monocytogenes* in milk using confocal micro-Raman spectroscopy and chemometric analysis. *International Journal of Food Microbiology*, 204, 66-74. (IF 3.339)

PRESENTATIONS

- [1] Oral presentation: **Jinsong Feng** and Xiaonan Lu, 2017. *In-situ* Raman spectroscopic-based microfluidic 'lab-on-a-chip' platform for non-destructive and continuous characterization of *Pseudomonas aeruginosa* biofilms. Institute of Food Technologists (IFT) Annual Conference, Las Vegas, Nevada, USA. June 25-28, 2017.
- [2] Oral presentation: **Jinsong Feng** and Xiaonan Lu, 2015. Chemical, physical and morphological properties of bacterial biofilms affect survival of encased *Campylobacter jejuni* under aerobic stress. Institute of Food Technologists (IFT) Annual Conference, Chicago, Illinois, USA. July 11-14, 2015.
- [3] Oral presentation: **Jinsong Feng** and Xiaonan Lu, 2015. Chemical, physical and morphological properties of bacterial biofilms affect survival of encased *Campylobacter jejuni* under aerobic stress. International Association for Food Protection (IAFP) Annual Conference, Portland, Oregon, USA. Jul 31-Aug 3, 2015.
- [4] Poster presentation: **Jinsong Feng** and Xiaonan Lu, 2014. Loop-mediated isothermal amplification assays for detecting *Yersinia pseudotuberculosis* in milk powders. Institute of Food Technologists (IFT) Annual Conference, New Orleans, Louisiana, USA. June 22-24, 2014.
- [5] Poster presentation: **Jinsong Feng** and Xiaonan Lu, 2014. Determination of α -tocopherol in vegetable oils using molecularly-imprinted polymers-surface enhanced Raman spectroscopic biosensor. Institute of Food Technologists (IFT) Annual Conference, New Orleans, Louisiana, USA. June 22-24, 2014.

SUPERVISORY COMMITTEE

Prof Xiaonan Lu
Prof Eunice Li-Chan
Prof Robert Hancock
Prof Jie Xu.



a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

Graduate and Postdoctoral Studies

PROGRAMME

The Final Oral Examination
For the Degree of

DOCTOR OF PHILOSOPHY
(Food Science)

JINSONG FENG

Wednesday, December 13, 2017, 4:00 pm
Room 203, Graduate Student Centre
Latecomers will not be admitted

“Characterization and Intervention of Campylobacter Jejuni Persistence and Biofilm Formation”

EXAMINING COMMITTEE

Chair:
Prof Robert Turner (Electrical and Computer Engineering)

Supervisory Committee
Prof Xiaonan Lu, Research Supervisor (Food Science)
Prof Eunice Li-Chan (Food Science)

University Examiners:
Prof Brett Finlay (Microbiology and Immunology)
Prof Keng Chou (Chemistry)

External Examiner:
Prof Jinru Chen
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