

Dr Nicholas James Birse MRSC FHEA

<https://scholar.google.com/citations?user=v9cEUEIAAAAJ&hl=en>

I am a successful and motivated analytical chemist with a PhD degree in the use of mass spectrometry for food and feed analysis. I am skilled in the development of mass spectrometry and liquid chromatography methods, and in the operation and maintenance of instrumentation from multiple vendors. Highly productive, dedicated and diligent, I now lead my own research group to undertake activities in two areas; mass spectrometry for food and feed analysis, focusing on the development of methods and workflows which can make use of new and innovative mass spectrometry platforms, and the critical analysis of food security through supply chain analysis, the development of digital twins and increasingly, AI-led risk assessments to best detect and deploy the food testing methodologies my group develops. I work closely with stakeholders, from instrument vendors and food producers to government bodies and charitable organisations to undertake this work.

Academic Experience

Queen's University Belfast – Lecturer in Mass Spectrometry

2023-present

Lecturer in Mass Spectrometry, operating my own independent research group which focuses on two key areas – the first, the application of advanced analytical techniques, primarily mass spectrometry and ion-mobility spectrometry to detect food safety and security issues, deliver improved food quality and reduced food wastage, and the second, the early detection of food safety and security issues through better understanding of complex food supply chains through the use of digital twins, supply chain mapping and similar modelling techniques.

The use of AI and increasingly complex modelling for both strands of research forms one of the core capabilities of my research group, joining together the results from the advanced analytical techniques to deliver a deeper understanding of long-term trends in supply chains, particularly around the prevalence and likelihood of both natural and man-made food security risks.

I have worked closely with a range of stakeholders on several projects in recent years, making use of the extensive network of contacts in the instrumental analysis sector to allow my research group to undertake development testing of new technologies from vendors such as Agilent, Bruker, MOBILion and Waters in the areas around small molecule contaminants such as antibiotic, pesticide residues, mycotoxins and alkaloids. I also collaborate with a wide variety of fellow academics both internally at Queen's University, and from a number of different institutions to develop mass spectrometry methods that can support their research, this can range from the adaptation of core methods from my research group to be compatible with alternative sample types, through to the development of bespoke methods for the quantitation of complex biological markers of health and disease.

Research forms most of my responsibilities, however I am responsible for teaching and module co-ordination within the School of Biological Sciences, and teach on several of the core biochemistry and analytical chemistry modules across several of our degree pathways, as part of these activities, I'm responsible for typical teaching tasks such as exam co-ordination, grading and student guidance activities.

Grant and Other Funding

The following grants are a combination of those I have developed myself, and some previously funded under Professor Chris Elliott, for which I now act as Principle Investigator (PI) with the relevant research councils.

- Royal Society of Chemistry – 'Development and Application of Novel Natural Deep Eutectic Solvents in the Extraction of Mycotoxins and Antibiotics in Foods' £10,000, Birse N; 2024-2025
- EPSRC – 'Exploring (Emerging) Mycotoxins Risk in Beans: A Global Alliance For Climate Change Resilience' £144,149. Birse N, Dall'Asta C, Marko D, Petchkongkaew A, Karoonuthaisiri N; 2024-2028
- BBSRC – 'SCATMAN-MSD : Software to Convert And Transfer, Model, Analyse and Notify on Mass Spectrometry Data'. £19,900. Birse N; 2024-2025
- BBSRC – 'Application of rapid evaporative ionisation spectroscopy as a rapid tool to measure meat quality including nutritional density'. £30,000. Scollan N, Birse N; 2023-2025
- BBSRC Resilience in Agrifood Systems: Supply Chain Configuration Analytics Lab (RASCAL). £1,378,077. Srar J, Settanni E, Smith E, Stavridou E, Else M, Birse N, Wu D, Durand S, Kasturiratne D, Chen H, Liu S; 2024-2027
- BBSRC ReImagining Supply Chains Network Plus (RiSC+). £6,637,316. Guo H, Anosike A, Birse N, Butterfield J, Campbell E, Gadanakis Y, Garcia L, Gault A, Guida A A, Hunter L L, McLaughlin K, Nockemann P W, Oxborrow L L, Shin H, Simo R, Smith L G; 2024-2028
- MOBILion – ion mobility mass spectrometry system seed instrument, initial loan for 1 year. Instrument value \$350,000

Selected Publications

- Hong, Y., Birse, N., Quinn, B., Li, Y., Jia, W., McCarron, P., Wu, D., da Silva, G. R., Vanhaecke, L., van Ruth, S., & Elliott, C. T. (2023). Data fusion and multivariate analysis for food authenticity analysis. *Nature Communications*, 14(1), 3309. <https://doi.org/10.1038/s41467-023-38382-z>
- Birse, N., Burns, D. T., Walker, M. J., Quaglia, M., & Elliott, C. T. (2023). Food allergen analysis: A review of current gaps and the potential to fill them by matrix-assisted laser desorption/ionization. *Comprehensive Reviews in Food Science and Food Safety*. <https://doi.org/10.1111/1541-4337.13216>
- Birse, N., McCarron, P., Quinn, B., Fox, K., Chevallier, O., Hong, Y., Ch, R., & Elliott, C. (2022). Authentication of organically grown vegetables by the application of ambient mass spectrometry and inductively coupled plasma (ICP) mass spectrometry; The leek case study. *Food Chemistry*, 370, 130851. <https://doi.org/10.1016/j.foodchem.2021.130851>
- Hong, Y., Birse, N., Quinn, B., Montgomery, H., Wu, D., Rosas da Silva, G., van Ruth, S. M., & Elliott, C. T. (2022). Identification of milk from different animal and plant sources by desorption electrospray ionisation high-resolution mass spectrometry (DESI-MS). *Npj Science of Food*, 6(1), 14. <https://doi.org/10.1038/s41538-022-00129-3>
- Khan, S., Rai, A. K., Singh, A., Singh, S., Dubey, B., Lal, R. K., Negi, A. S., Birse, N., Trivedi, P. K., Elliott, C., & CH, R. (2023). Rapid metabolic fingerprinting with the aid of chemometric models to identify authenticity of natural medicines: turmeric, Ocimum and Withania somnifera study. *Journal of Pharmaceutical Analysis*. <https://doi.org/10.1016/j.jpha.2023.04.018>
- Robson, K., Birse, N., Chevallier, O., & Elliott, C. (2022). Metabolomic profiling to detect different forms of beef fraud using rapid evaporative ionisation mass spectrometry (REIMS). *Npj Science of Food*, 6(1), 9. <https://doi.org/10.1038/s41538-022-00125-7>
- Osorio, J. et al. Ambient mass spectrometry as a tool for a rapid and simultaneous determination of migrants coming from a bamboo-based biopolymer packaging. *J. Hazard. Mater.* 398, 122891 (2020).

Recent Conferences and Webinars

- Agilent Technologies (January 2024) ‘Something to Chew On’ webinar – presenting “Rapid food and feed testing through VOC analysis using SICRIT technology”
- ASEAN-ASSET (November 2023) – conference committee member and oral presentation “Rapid Mass Spectrometry for the Safety Assurance of Future Foods”
- Bruker Applied Mass Spectrometry and National & Kapodistrian University of Athens workshop (November 2023) “Unveiling the Truth: Journey into the Authenticity and Quality of Food through Mass Spectrometry” – featured speaker.
- AOAC (August 2023) – Agilent vendor seminar “Rapid food and feed analysis through VOC analysis using SICRIT technology”

Work Experience

Queen’s University Belfast – Research Fellow

2021-2023

Research Fellow in Ambient Mass Spectrometry – PI : Professor Chris Elliott

This postdoc position followed on closely from my PhD project, but as a postdoc, was given additional responsibilities including the training and day-to-day supervision of new PhD students joining the Elliott group.

I was jointly responsible for securing a seed instrument from Agilent Technologies (value \$250,000) to undertake ambient mass spectrometry projects, as an add-on to the Elliott Thought Leader Award from Agilent. This work initially centred on the development of Direct Analysis in Real Time (DART) mass spectrometry, but following a change in ownership of the DART IP, Agilent asked that I undertake development work on an alternative ambient ionisation source, known as SICRIT. This work has been ongoing from early 2023 and has transitioned into one of the tasks I now lead on as a PI myself.

The postdoc allowed me to build on key academic and commercial collaborations that I had began to develop as a PhD student, and as during my PhD, I travelled to several major academic conferences to present the outputs of my work both during my PhD and during my time as a postdoc.

My final overseas trip as a postdoc was to spend a week working with Agilent Technologies at their German research and development site, testing several new instruments and assessing the compatibility of the SICRIT source with instrumentation not available at Queen's University.

The collaboration with Agilent was significant during my time as a postdoc, and I have maintained the relationships which were developed during my time working with the Elliott Thought Leader Award with the intention that further mutually beneficial collaborations can be developed between myself and Agilent.

CXR Biosciences (now Concept Life Sciences)

2010-2011

One Year Industrial Placement within Molecular & Cellular Toxicology Group as part of my BSc (Hons) at University of Dundee.

Education

PhD

Exploring recent innovations in ambient mass spectrometry to deliver a paradigm shift in food safety, security and authenticity

Queen's University Belfast – Institute for Global Food Security

2017-2020

MSc – Instrumental Analytical Science (Drug Analysis & Toxicology)

Analysis and characterisation of sildenafil 'oral jelly' by means of a variety of analytical methods

Robert Gordon University, Aberdeen

2015-2016

BSc (Honours) – Pharmaceutical Chemistry

University of Dundee

2007-2011

Professional Memberships

Royal Society of Chemistry – Member (MRSC)

Advance HE – Fellow (FHEA)

Activities

I enjoy SCUBA diving, and served as the Queen's University of Belfast Sub-Aqua Club President during 2019 and 2020. I am a qualified instructor with the British Sub-Aqua Club (BSAC) and hold several relevant qualifications including several safety, instructional and technical qualifications, such as compressor operation and practical rescue management. I also enjoy visiting the local cinema at Queen's University and have an interest in their selection of art-house and independent cinema.

Referees

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