Centre for Sustainable & Circular Technologies

UNIVERSITY OF BATH

Centre for Sustainable and Circular Technologies; University of Bath

Project Title:	Water fingerprinting for health and lifestyle assessment
Lead Supervisor and co-supervisors:	Lead supervisor: Barbara Kasprzyk-Hordern Industrial co-supervisors: Shannon Nolan and Oscar O'Mara
Industrial Partner:	Ministry of Justice

Project Summary

The year 2020 witnessed a crisis in healthcare systems due to the COVID19 pandemic. SARS-CoV-2 has had an unprecedented impact on humanity globally. It exposed the acute inability to manage the virus due to lack of reliable surveillance systems focused on rapid identification of SARS-CoV-2 hotspots. Wastewater Based Epidemiology (WBE) has since enabled SARS-CoV-2 surveillance in the UK (UKHSA Sars-Cov-2 WBE surveillance). This is now developed further to include the advancement of big data driven WBE systems for new biological and chemical threats. This studentship will contribute to the development of strategically important post-pandemic infrastructure to deliver future early warning systems (EWSs) for community health and lifestyle assessment.

Assessment of community health status, wellbeing and lifestyle choices using WBE is lacking due to absence of methods and validated biomarkers. This project will investigate a panel of biomarkers: lifestyle chemicals and their metabolites (e.g. illicit drugs), characteristic endogenous biomarkers of physiological processes and biological responses (e.g. oxidative stress) as well as pharmaceuticals and their metabolites (e.g. antidepressants, anti-inflammatories, analgesics), also in the context of pharma misuse. This project will develop new, fully validated mass spectrometry-based methods to allow trace (sub ppt level) biomarker identification and quantification in complex wastewater matrices. The project will also take advantage of Bath Environmental Chemistry & Public Health (EChPH) group digital mass spectra repository (samples collected in years 2015-22) and new wastewater samples collected from both selected cities as well as near source locations (prisons) to allow biomarker validation in contrasting communities and using different scenarios (the general community and wastewater treatment plant sample collection vs near source prison environment sampling). Two types of mass spectrometers will be used: triple quadrupole for sensitive and selective targeted analysis and quadrupole-time of flight for wide scope biomarker screening and retrospective, time independent analysis. New normalisation approaches of wastewater fingerprints will be developed to enable full quantification as well as comparison of population-wide drug misuse, and general health and lifestyle status.

The research student will receive training in a range of modern analytical and bioanalytical techniques including state-of-the-art chromatography coupled with tandem mass spectrometry techniques. In addition, he/she will join an interdisciplinary team at the University of Bath with critical research expertise in the area and excellent research infrastructure. Experience of academic/government/industrial research, interdisciplinary and international working and development of legislation and water, public health policy, will provide an exciting opportunity for further professional development.

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Sustainability issues addressed

In today's increasingly global and interconnected world, over half of the world's population lives in urban areas. The coming decades will bring further profound changes to the size and spatial distribution of the global population. The proportion of the world's population living in urban areas is expected to increase to 66% by 2050. As the world continues to urbanize, sustainable development challenges will be increasingly concentrated in cities. The unprecedented speed of urbanization constitutes globally substantial risks to the resilience of cities with public health and welfare being the most critical concern. Urban environments can affect public health in many different ways, e.g. via exposure to pollutants in water, poor sanitation, rapid spreading of infectious diseases due to high density of population. Furthermore, cities are also powerful drivers of population mobility, which increase regional and global communicable disease risks. The 21st century has already seen the epidemic of SARS (2003), H1N1 (2009), Ebola (2014), Zika virus (2015) and SARS-CoV-2 (2019). This highlights global vulnerability to infectious diseases and shared global responsibility for surveillance and disease control.

To increase sustainability of urban dwellings, there is a need for an early warning system (EWS) identifying public health threats within the cities, which will (i) collate spatial and temporal datasets including real-time estimates of public health status and (ii) rapidly respond to environmental, policy or other changes within the surveyed system with the aim of disease prevention, and public and environmental health promotion. Such robust EWSs are currently not available. However, if operated in real-time and if linked with timely response systems, they could allow public health threats to be identified rapidly, at low cost, and instantly dealt with, reducing in this way burden on public health in Europe and ultimately worldwide. Urban water fingerprinting provides an ultimate solution.

Eligibility criteria and selection process

Application:

Formal applications should be made via the University of Bath's online application form for a PhD in Chemistry. Please ensure that you state the full project title and lead supervisor name on the application form.

http://www.bath.ac.uk/guides/how-to-apply-for-doctoral-study/

Estimated start: January 2023

Funding Eligibility:

This studentship includes tuition fees and a stipend (£17,668 per annum, 2022/23 rate) for up to 3 years. The studentship is open to both Home and International applicants; however, International applicants should note that funding does NOT cover the cost of a student visa, healthcare surcharge and other costs of moving to the UK

Information may be found on our fee status guidance webpage, on the GOV.UK website and on the UKCISA website.