

## **Human identification through advanced forensic mass spectrometry of blood and fingerprints**

### **How to apply**

Applicants are requested to email a [postgraduate application form](#) (including a 1500 word proposal in section 9) to [HWB-DoctoralAdmin@shu.ac.uk](mailto:HWB-DoctoralAdmin@shu.ac.uk) by 12 noon on Friday 24 February 2017.

Where English is not your first language, you must show evidence of English language ability to the following minimum level of proficiency: an overall IELTS score of 7.0 or above, with at least 6.5 in each component or an [accepted equivalent](#). Please note that your test score must be current, i.e. within the last two years.

Please view our [eligibility criteria](#) before submitting an application.

### **Selection process**

Successful applicants will be required to attend an interview where you will be asked to talk through your research proposal.

### **Project details**

Director of Studies: Dr Simona Francese; Second Supervisor: Dr Laura Cole

The Centre For Mass Spectrometry Imaging, [Biomolecular Sciences Research Centre](#)

External partner: Dr Richard McColm, Defense Science and Technology Laboratory (Dstl), Porton Down

#### *Project description:*

In forensics and counterterrorism one obvious challenge is the retrieval of the identity of the suspect. Whilst the work of detectives is paramount, recent advances in forensic mass spectrometry (MS) may be of great assistance to eventually secure the right individual to Justice. Information such as a. ethnicity, b. age, c. sex and d. particular physiological states are certainly analytical challenges; however, conquering them would provide a fundamental contribution to profiling the suspect in a much faster way.

Blood and finger marks are both often encountered together at the scene of high profile crimes and can be a valuable source of chemical and biological intelligence of the kind described (a-d). However, either the relevant analytical methods reported in the literature are laborious and time consuming, not operational, or concerning other types of biological specimens, such as single hair, which impact on instrumental sensitivity.

This PhD programme aims to develop faster advanced MS protocols employing Matrix Assisted Laser Desorption Ionisation MS Profiling and Imaging (MALDI MSP and MSI) to provide

intelligence on a. geographical provenance, b. age of the individual, c. sex and d. haemoglobin variants from blood (stains/marks) and/or latent fingermarks.

MALDI MSP and MSI methods (often combined with Ion Mobility MS) to retrieve physical and chemical information from fingermarks have been pioneered worldwide by the Director of Studies at Sheffield Hallam University; through prestigious collaborations with the Home Office and West Yorkshire Police, they have proven their ability to contribute to criminal investigations [1-3].

Recently, the combination with proteomics based methods has enabled the robust and false positive-free detection of blood signatures in stains as well as their visualisation onto the identifying ridges of blood marks [4,5]. In addition to the above techniques, Liquid Extraction Surface Analysis and Desorption Ionisation will be evaluated for their ability to provide a matrix-free quick snapshot of the forensic information.

Finally, in the context of age determination, high resolution LC/MS/MS methods will be developed for markers quantification to strengthen the evidence presented in a Court of Law. Drs Francese and Cole will be responsible for training the students on all the relevant theoretical and practical aspects of mass spectrometry. The student will be expected to spend a brief period of time at Dstl every year where they will gain additional training on quantitative LC/MS/MS as well as on the legal aspects that the analytical process must comply with to yield evidence admissible in a Court of Law.

Successful applicants could receive the additional benefits of involvement in the University Alliance [Doctoral Training Alliance in Applied Biosciences for Health](#)

For further information, please contact Dr Simona Francese ([s.francese@shu.ac.uk](mailto:s.francese@shu.ac.uk))

#### *References:*

1. Francese S., Bradshaw R., Ferguson L.S., Wolstenholme R., Bleay S. and Clench M.R., *Analyst*, 2013, 138(15): 4215-28
2. Bradshaw R., Bleay S., Wolstenholme R., Clench M.R. and Francese S., *Forensic Science International*, 232 (2013): 111-124
3. Bradshaw R., Bleay S., Clench M.R. and Francese S., *Science and Justice*, 54 (2014) 110–117
4. Patel E, Cicatiello P., Deininger L., Clench M. R., Marino G., Giardina P., Langenburg G., West A., Marshall P., Sears V., and Francese S. *Analyst* (2016) 141(1):191-8
5. Deininger L., Patel E., Clench M.R., Sears V., Sammon C., Francese S., *Proteomics*, (2016) 16:1707-17