# PhD Project Advertisement

**Project title:** New tools for Rapid Field Detection of clinical biomarkers in poultry
**Project No:** FBS2023-13-Deza-Cruz-sr

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## Project description:

**Problem:** Poultry production is a socially and economically important sector of agriculture and illustrates the importance of a 'One Health' approach that addresses both human and animal health. Antibiotics are used extensively to treat important infections in agriculture, including pathogenic bacteria, such as *Salmonella*, that can be transmitted to people by consuming poultry products. Diseases cause animal suffering and significant losses in production. Antimicrobial resistance (AMR) is common in poultry making it harder to treat. Agricultural antibiotic use (including treating birds in farms) contributes to the rise and spread of AMR, which is a major global public health risk, as bacterial infections become ever-harder to treat. It has become clear that industrial antibiotic use is one driver for a rise in 'superbugs' spreading across the world, which are resistant to multiple antibiotics. A major route of AMR from farm to human is through food production - in the case of poultry, through meat and meat products. As well as becoming a serious threat to human health and public safety, treatment of our animals – not just poultry but also companion animals – becomes ever-harder as antibiotics become less effective. Preliminary research suggests that not only is AMR common in poultry, but antibiotic resistance can be detected in a range of foods. A 'One Health' approach, where food producing animal and human health are addressed hand-in-hand, is now vital to tackle the global threat of AMR.

**Solution:** Conventional AMR tests (e.g. using agar plates) are very slow and can only be conducted in labs. As a result, vets must administer antibiotics without knowing which antibiotic will effectively treat an infection. This project combines several cutting edge tools for the first time, to create powerful yet simple new methods for faster AMR testing outside a laboratory. At Reading, we have focused on functional cellular assays that measure bacterial growth or killing when combined with antibiotics, using low-cost microcapillary devices read by smartphone cameras. At Surrey, the latest DNA techniques including isothermal amplification and whole genome sequence analysis, has made it possible to both rapidly detect specific AMR genes, and survey genomes of resistant organisms. Crucially, we will develop methods that combine these complementary technologies to both detect AMR genes, and measure functional antibiotic sensitivity; by combining these tools we will be able to gain unique insights into rise and spread of AMR. Ultimately, if we can rapidly test for antibiotic resistance on the farm, we can make sure that diseased animals are treated with safe and effective medication.

**Tools and Technology:** Microfluidics, the science of miniaturization, allows laboratory analysis to be taken outside the lab and can give more rapid results than conventional bioanalytical methods. At the same time, global demand for high quality smartphone cameras has made high performance digital imaging portable and affordable. Our research teams at Reading and Surrey have developed rapid and portable testing technology for both functional bacterial assays including antibiotic sensitivity measurement, and genetic detection for example for AMR genes. This PhD project will focus on combining these analytical tools to allow us to track both genetic and phenotypic AMR, and then applying the technology developed to tackling the problem of AMR in poultry production and food manufacture.

The student will develop skills in both technology development and in molecular microbiology for animal health and food safety. The project combines developing bioanalytical technology, with study of antimicrobial resistance in food production. Tools will be developed for a variety of complementary bioassay techniques relevant to food microbiology detection; the student will thus learn transferrable techniques (conventional plus microfluidic assays) alongside tackling an industrial and public health problem.

**Team:** This project brings together two complementary research groups: the leading veterinary and 'one health' microbiology team at Surrey and the Biomedical Technology Laboratory within the School of Chemistry, Food and Pharmacy. This will allow the student access to state-of-the-art microbiology and microbial genetics facility at Surrey, in addition to the bioengineering facilities at Reading.

### Training opportunities:

The project combines an opportunity to explore new methods and technology, with study of microbiology, plus field visits highly relevant to both one health and animal health. The study will be ecological in nature, but will provide the student with an extensive training in AMR modelling. You will utilise the latest bioengineering tools (e.g., microfluidics, 3D printing, open source robotics) and life sciences (e.g., next-generation sequencing and genomics) making use of extensive bioengineering facilities at the University of Reading, including the lead supervisors Biomedical Technology laboratory equipped with the latest 3D printers for rapid prototyping, plus imaging and microfluidics suite. The University of Surrey will provide training in metagenomic techniques and mathematical modelling. The project will apply new technology to 'one health' problems where 9 of 10 environmental health meets agricultural practices that impact human and animal health. The supervisory team and host institutes have a vibrant entrepreneurial and innovation research environment and will provide mentoring in research commercialization and technology transfer, as well as impact generation.

### Student profile:

This exciting cross-disciplinary project will suit an enthusiastic student from any relevant background who has an appetite to learn how to develop new technology to apply to vital challenges in public health, animal health and food safety. Suitable degrees would include microbiology, biology, agriculture, food science or a closely related science. We would also welcome applications from students from a bioengineering, biotechnology or biochemical engineering background with an appetite to gain life science research expertise.

### Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2022/23 this will be £17,668 and this will increase slightly each year at rate set by UKRI.

### Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website.

In accordance with UKRI guidelines, our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

### References:


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**For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.**