EEES Project Proposal Form – 2022 entry

Project Title	**OU16 - Biocontrol of vector-borne diseases: a community led approach**
Key words	Environmental microbiology, Guyana, capacity building
Supervisory team (including email address	**PI: Olsson-Francis (k.olsson-francis@open.ac.uk)** Co-I: Andrea Berardi (andrea.berardi@open.ac.uk) Alessandra Marino (alessandra.marino@open.ac.uk**)**
Is the PhD suitable for part time study?	Yes ☐ No ☒

Project Highlights:

- Develop expertise in culturing *Bacillus thuringiensis israelensis* (Bti), which is used as biocontrol for vector-borne diseases.
- Working with Indigenous communities in Guyana develop an effective community-owned culturing strategy for producing Bti spores.
- Carry out community-based field trails to investigate the impact of the community-owned strategy on the local mosquito populations.

Overview

Figure 1: The project will involve field work, which will involve working with existing partnerships with indigenous communities

Malaria remains one the biggest global health challenges and, despite international efforts, is far from being eradicated (228 million cases and 405,000 deaths estimated for 2018). *Dengue* is the most rapidly spreading mosquito-borne viral disease worldwide (104 million cases and 40,467 deaths estimated in 2017). The established strategy for vector control is to break the transmission cycle through a vertical, top-down, 'command and control' and 'one-size-fits-all' approach using insecticides and water-body drainage/removal. However, the failure of the vertical command-and-control strategy in controlling vector-borne diseases in many regions has now resulted in increased calls for tailoring interventions to local contexts by engaging communities. Similarly, malaria vaccines – not yet rolled out across the globe - are top-down interventions that may hit a number of stumbling blocks: from distribution issues, to cost and uptake. For this reason, there are calls for empowering local communities to manage the vector control strategy with affordable and environmentally friendly strategies, such as locally cultured biocontrol.

The focus of this project is to optimize community-led long-term production of a bacterial species that is lethal to mosquito disease vectors. *Bacillus thuringiensis israelensis* (Bti) is a bacterium that is already commercially used to suppress the larval stages of mosquitos and can be readily bought in garden centres and online for home use (it is completely safe for humans and all other animals, including other insects, as the bacterium only targets mosquitos). Our strategy is to build on existing pilots that demonstrated the cost-effective culture of Bti in Indigenous communities using localised resources using coconuts, soybean flour and the by-product of cassava processing (Ernandes, Bianchi, and Moraes 2014). Our strategy is to now develop a standard protocol that can be applied within remote Indigenous communities at scale and integrated into our surveillance technology system, so that we can deliver the complete package: monitoring and control.

This work is part of a larger project that is scoping the possibilities of a community-led vector control strategy in Guyana, blending advanced space surveillance technologies to inform community-led biocontrol.

Methodology:

The student will work with Indigenous communities to identify local ingredients (culturally acceptable, cheap and easily accessible) as potential growth substrates to produce Bti. Once a list of potential ingredients has been identified, optimisation will be required to deliver a simple but effective community-owned culturing strategy. The initial optimisation work will be carried out in the laboratories at The Open University where microbial growth and spore production will be monitored (12 months) using different growth conditions. Once optimised, community-based field trials will take place to further optimise the culturing protocol according to local conditions, capacities and cultures. As part of the field trials, we will determine the impact of large-scale use of Bti on local mosquito populations and wider ecology of these sites, this will involve adapting a monitoring and evaluation framework that has been previously developed by the team. Breeding habitats will be selected for either control (not-treated) or experimental sites (treated with Bti). The sites will include a variation in environments e.g. clean running water, stagnant water pools (sites will be selected with local communities to ensure that there is a true representation of habitats).

Training and skills:

The student would be part of an active environmental microbiology team at the OU consisting of PDRAs, project officers and fellow students. The laboratories contain state-of-the-art equipment and are fully supported by technical support. The student will gain general training in microbiology techniques, including culturing by members of the research team. The student will also gain first-hand experience of fieldwork in the Global South, and of carrying out capacity-building activities with community members. Fieldwork will enable the development of strong outreach, communication and engagement skills that are highly transferrable to diverse publics.

Partners and collaboration:

Dr Rajini Kurup, University of Guyana, will support with the microbiology work in Guyana

Possible timeline:

Year 1: Literature review, and general training in microbiology. Fieldtrip 1 (March-April): Stakeholder engagement; initial context analysis with agencies, local and Indigenous communities in Guyana and baseline evaluation of challenges, needs, conditions.

Year 2: Culturing conditions optimise in the laboratory (September-January). Co-design of implementation strategy carried out with the communities in Guyana at the end of the dry season (February-March). Monitoring and evaluation established for the wet season (April-September).

Year 3: Analysis and thesis drafting. Write the results from publication and prepare thesis and submit.

Further reading:

Chilcott, C. N., and J. S. Pillai. 1985. 'The use of coconut wastes for the production of *Bacillus thuringiensis* var.israelensis', *MIRCEN journal of applied microbiology and biotechnology*, 1: 327-32.

Ernandes, Samara, Vanildo Luiz Del Bianchi, and Iracema O Moraes. 2014. 'Comparative Studies of Bacillus thuringiensis var. israelensis Metabolism in Different Concentrations of Cassava Flour Processing Waste Based Media', *Advances in Bioscience and Biotechnology*: 978-83.

Ventosilla and Palmira. 2010. "Biological Control of Mosquito Vector - Bti Initiative." In.: Guyana Environmental Capacity Development Project (GENCAPD).

Further details:

Students should have a strong background in microbiology, and an interest in international development and disease vector control. The student will join a multi-disciplinary research team that has 1) extensive experience in microbiology, as well as international development. More information can be found here: https://www.open.ac.uk/research-groups/astrobiology/.

Applications should include:

- An OU STEM application form, downloadable from: OU STEM application
- A CV with the names of at least two referees (preferably three and who can comment on your academic abilities)
- And an Open University application form, downloadable from: Home OU application form (if you are resident in the UK) or an Overseas OU application form (if you are an international applicant).

Applications should be sent to STEM-EEES-PhD@open.ac.uk by **12 noon** on **Friday, 7th January 2022**.