PROJECT TITLE: Enhancing Crop Protection Using Nanoparticles

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Project keywords: Plant and crop science, Crop protection, Sustainable Agriculture

Proposed start date: 1st July 2024

Project description:

Some 20-30% of potential crop yield is lost due to diseases, and new crop protection strategies are essential to feed the growing world population. Our research aims to prevent pathogens infections in crops by understanding and exploiting plant immune system without resorting to genetic modification.

Plants possess a natural defence mechanism involving the translocation of small RNAs (sRNAs) to suppress gene expression in interacting pathogens, known as trans-kingdom RNA interference (RNAi). This phenomenon holds immense potential for developing crops resistant to pests and pathogens. While prior studies have shown the efficacy of plant-derived antibacterial sRNAs in stopping bacterial infection, current methods involving direct dipping of plants into RNA extracts are impractical in agriculture[1]. Therefore the utilisation of carbon dots (CDs), small carbon-based nanoparticles[2-3], to deliver antibacterial small RNAs (sRNAs) into plants appears as a promising and effective crop protection strategy.

The aims of the project is to deliver antibacterial sRNAs into plants using CDs to prevent plant diseases.

Details of the investigation and methods: The student, based at the University of Bristol, will conduct *in vitro* and *in planta* assays to assess the ability of these nanoparticles to supress bacterial infection. This will involves the observation of fluorescently-tagged bacteria with a fluorescent microscope. These nanoparticles will be generated by CDotBio, a University of Bristol spin-out company based jointly in Bristol Life Sciences and Chemistry Departments.

The student undertaking this project will gain exposure to the cutting edge of plant pathology research, with the opportunity to learn essential laboratory techniques and develop greater understanding of plant immunity. The study's outcomes hold promise for developing non-transgenic, sustainable crop protection strategies, addressing global concerns regarding agricultural productivity, economic losses, and food security.

Candidate requirements: There is no special requirement. A mathematician or computer scientist is not required. Enthusiasm and willingness to learn are what matter most.

Background reading:

[1] Singla-Rastogi et al. (2019) BioRxiv. https://doi.org/10.1101/863902
[2] Swift et al. (2020) New Phytologist. https://doi.org/10.1111/nph.16886
[3] Doyle et al. (2019) BioRxiv. https://doi.org/10.1101/805036

Approximate Work Schedule: Lab based: 6 weeks, report writing: 2 weeks.