PhD Project Advertisement

Project title: Transgene free gene editing in plants via nanoparticles.
Project No: FBS2022-06-Lloyd-aq

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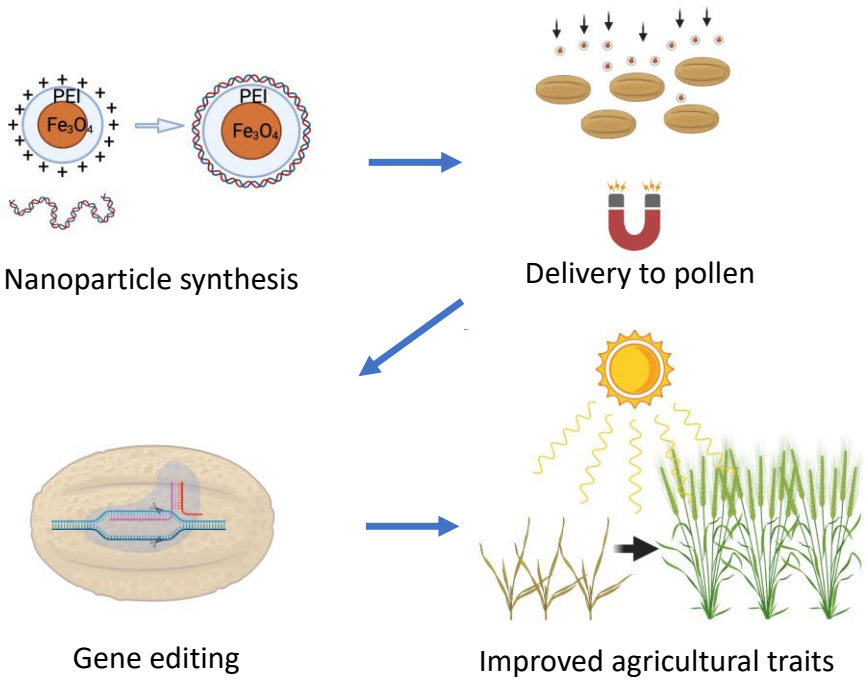
Project description:

CRISPR/CAS9 gene editing, and several closely related technologies, have emerged in the last decade as an extremely powerful tool in the life sciences, allowing precise and targeted editing of plant and animal genomes. The results of standard gene editing are indistinguishable from the types of genetic changes that occur naturally and that could be generated over much longer time frames by conventional breeding approaches. This powerful technology has the potential to help deliver stress or disease tolerant crops, remove allergens, and increase the nutritional value of foods. In recognition of this promise, the UK government has recently announced it will be making it easier to grow gene edited plants for research and development where the genetic changes introduced could have been achieved by traditional breeding. It also anticipates that gene editing will be vital in "helping us tackle food system challenges, climate change and biodiversity loss… protect our environment and help meet our ambitions on Net Zero and climate adaptation".

While gene editing shows much promise in crop development, there are two key limitations, both due to the plant cell wall which makes it challenging to deliver the required components to the right place at the right time. Firstly, most gene editing in plants requires foreign DNA encoding the editing machinery to be integrated into the plant genome making the plants "Genetically Modified" until this machinery can be removed. Secondly, a more precise form of gene editing – where a template sequence is provided to generate exact edits – is not feasible in plants.



Nanoparticles are a potential means to solve both of these limitations and transform plant gene editing. It has recently been shown that magnetic nanoparticles can efficiently deliver DNA into plant pollen through small naturally occurring holes or “apertures” in the pollen coat, while maintaining the pollen’s viability. This PhD project will build on this understanding to develop transformative techniques for gene editing in plants applicable across a wide range of species.

The student will be based at the University of Aberystwyth, learning cutting edge gene-editing techniques, molecular and cell biology and super-resolution fluorescence microscopy. They will establish plant lines that enable quick assessment of gene editing efficiencies and use these lines to optimise plant gene editing. The student will also spend time in the School of Pharmacy at Queen’s University Belfast working with experts in nanoscience and applied chemistry to synthesise and characterise nanoparticles with the right characteristics for plant gene editing.

Training opportunities:

This project offers multidisciplinary training in molecular plant genetics, biotechnology, and applied chemistry, equipping you for a successful research career in range of scientific disciplines either at a university or in industry. You will receive advanced training in state-of-the-art CRISPR/CAS9 gene editing, molecular plant genetics and super-resolution fluorescence microscopy at Aberystwyth University and nanoparticle synthesis during research placements at Queen’s University Belfast. You will also undertake a number of post-graduate courses at Aberystwyth during the programme, helping develop a wide set of transferrable skills.

You will be conducting research with real-world impact, developing new transformative technology to advance crop development and will benefit from a fantastic team of supervisors and collaborators with diverse backgrounds and expertise. You will also have the opportunity to showcase your research to the scientific community with funding provided to attend at least two international conferences.

Student profile:

This project would be ideal for a student with an interest in gene editing and biotechnology and a degree in biology, chemistry or a related area. Prior laboratory experience in genetics, molecular biology, applied chemistry or other relevant subject area is desirable, though not essential. We are looking for an individual with a genuine interest in understanding fundamental science and translating this understanding into applied outcomes for crop development.

References:

https://doi.org/10.1073/pnas.2004846117

https://www.gov.uk/government/consultations/genetic-technologies-regulation

Funding particulars:

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