

PhD Opportunity: University of St Andrews and The James Hutton Institute, UK. Designing a Diagnostic Tool for the Detection of Viral Diseases in Agricultural Crops

Background: All types of agricultural crops are susceptible to virus infection, and they contribute to large economic losses for farmers and food producers. Current detection procedures are slow and expensive. Methods for simultaneous detection of multiple viruses are currently being developed, and next generation sequencing (NGS) has potential applications in this field [1]. Recently, viral disease diagnosis, resulting in actionable clinical management, has been achieved using NGS of human samples [2]. However, such work has never been applied to the diagnosis of viral diseases in crops, which is important for plant quarantine and stock certification practices, and in the wider context of global food security.

Research question: Can RNA-extraction/amplification protocols, sequencing and accelerated bioinformatics pipelines provide viral indexing for diagnostic purposes in crops?

Project Outline:

- 1. Investigation of RNA extraction and amplification protocols:** We will undertake a number of pilot RNA-sequencing experiments to explore the effect of sampling from different plant tissues, and using different extraction and enrichment protocols. For each extraction protocol we will assess the quality of the RNA extracted. Samples from the 'best' RNA extraction and amplification protocols will be taken forward for RNA-sequencing.
- 2. Design and implementation of a bioinformatics pipeline:** We will use NGS data from a variety of crops to develop a new plant virus diagnostics pipeline. This will include the use of a k-mer frequency method for rapid virus sequence identification [3]. The pipeline will be developed using the Galaxy workflow platform [4].
- 3. Real time application of complete pipeline:** With the optimized RNA collection, extraction and amplification protocol and bioinformatics pipeline in place, we will apply it to the viral diagnosis of crop plants (including high value perennials such as blueberry and raspberry, and annuals such as potato), to test its efficacy for real time viral diagnosis.

The Supervisors: This project is supervised by Dr Sue Jones & Dr Stuart MacFarlane (The James Hutton Institute), and Professor Lesley Torrance (University of St Andrews).

The Student: This project would suit a student from either a biological or computer science background, as the proportion of computing vs biology can be adapted to suit the applicant.

Career opportunities: *Bioinformatics has one of the greatest skills shortages within the sciences, with specific skills gaps in genomics and computing. This PhD is an excellent opportunity to gain the interdisciplinary skills for a career in genomics and bioinformatics.*



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Funded studentship starting Oct 2016

Further details on FindAPhD

<http://www.findaphd.com/search/ProjectDetails.aspx?PJID=67780&LID=1374>



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References: [1] Boonham et al., 2014. *Virus. Res.* 186:20. [2] Wilson et al., 2014. *New England. J. Med.* 370:2408, [3] Trifonov & Rabadan, 2010. *mBio.* 1:1-8. [4] Goecks et al., 2010. *Genome Biol.* 11:R86.