



Raghu Ram

BADMI

Technology Centre:	Shannon ABC EI Technology Gateway (Applied Biotechnology Centre)
Academic Mentor	Dr. Barbara Doyle Prestwich (UCC), Dr Peter Downey (Shannon-ABC, TUS) Dr. Siobhain Moane (Shannon-ABC, TUS)
Company Partner:	PLANTeDIT
Company Mentor:	Dr. Chidananda Kanchiswamy

Dr. Raghu completed his PhD in 2014 and moved to the United States (2015-2017) to work on Bioenergy crop Populus. He then moved to Norway (2017-2019) to work on Strawberry-Botrytis interactions during which he developed his independent idea for the current project. He then moved to Sweden (2019-2021) to work on plant beneficial fungal interactions during which he received the funding for the current project.

Dr. Barbara Doyle Prestwich (UCC)

Dr Prestwich is a leading expert in plant disease resistance, sustainable agriculture and alternative methods of plant modification and transformation. Dr. Prestwich's long-standing experience in crop research perfectly aligns with the present proposal and the career ambitions of the applicant. She is a Principal Investigator and Head of Plant Science in School of Biological Earth and Environmental Sciences and currently teaches fifteen undergraduate and one postgraduate module. Her research interests include: development of alternative methods of plant modification and transformation (CRISPR), promotion of sustainable development of potato-based systems and use of CRISPR technology in sustainable plant production relevant to an Irish context. These projects are funded by national and international agencies in Europe. She was the first female president of International Association for Plant Biotechnology in 60-year history. Of her numerous research achievements, her work on disease resistance in potato perfectly complements the aims of this project. Her experience on biological control agents, plant growth-promoting rhizobacteria, Microbial Volatile Organic Compounds (mVOC) will be valuable to the present project and will open-up opportunities for further grant proposals. Her experience in plant biotechnology and molecular biology is particularly relevant to this project for generating 'non-transgenic' strawberry plants. Her invaluable teaching and research experience of over 22-years will highly benefit the applicant's career training aspects and makes her a perfect mentor.

Dr Peter Downey (Shannon-ABC, TUS)

Dr. Downey is a Principal Investigator with Shannon ABC and Lecturer in the Department of Applied Science, TUS, where he is a co-PI for the CELLS research group (Controlled Environment Laboratory for Life Sciences). He has led a work package in Horizon 2020 funded EDEN-ISS project, focussing on food quality and safety during ground demonstration of plant cultivation technologies for safe food production in space and is currently leading an EI funded Innovation Partnership based on developing sustainable growth enhancers for a range of plant applications. His current research interests include: technology-enhanced production of secondary metabolites in plants; biofortification of commercial crops; food security and sustainability funded by EI. Dr. Downey teaches nine undergraduate modules and is currently supervising several research postgraduates in areas of encapsulation of plant-derived metabolites, biofortification of commercial crops, controlled environment enhancement of health-promoting compounds in plants, and supercritical-fluid extraction of polyphenols from Irish conifers. Dr. Downey's expertise in controlled environment systems and bioanalysis of plant metabolites and compounds have significant relevance to this project.

Dr Siobhan Moane (Shannon-ABC, TUS)

Dr Moane currently manages and co-ordinates the RUN-EU PLUS Horizon 2020 project for the RUN (Regional European Network) European University of which TUS is a member. She received her BSc in Analytical Science from the Dublin City University (DCU) and completed her PhD in Analytical Chemistry, also from DCU. Dr Moane has since completed a Certificate in Supervisory Management from the Irish Management Institute and a Diploma in Popular Forensic Psychology from Limerick Business School. Dr Moane previously held the position of Head of Research and Technology Transfer at Limerick Institute of Technology (LIT), having previously held a postdoctoral fellowship in the Toxicology Department in the State Laboratory, as well as the position of Biochemist at the Medical Bureau of Road Safety. Dr Moane is responsible for the implementation of the strategic research areas of LIT and support and development of the link between teaching and research, as well as the identification of technology transfer opportunities. Dr Moane is also a PI of the TUS LIFE Health & Biosciences Research Institute, Shannon ABC, CELLS and Food@TUS. She is a Senior Female Leader in the Aurora Women's Leadership Development programme providing mentoring support to female managers of TUS. She was the proposer and leader of the Faculty of Applied Sciences and Technology Research Supervisor Mentoring Programme. This initiative involves supporting new faculty masters and PhD supervisors in their supervisory roles across the TUS faculty of Applied Sciences and Technology. She is a member of the TUS Academic Council. Dr Moane's provision of academic leadership for research activities in LIT was vital in her involvement in the establishment of research policies and procedures at LIT.

PLANTeDIT

PLANTeDIT was founded in 2017 in Cork, Ireland with the overarching aim to produce DNA-free, consumer oriented sustainable genome edited crops and cost effective biopharmaceuticals. PLANTeDIT utilizes next generation genome editing technology developed by Toolgen.inc and swift transformation technology developed by PLANTeDIT to achieve these aims. PLANTeDIT is the first biotech company dedicated to use patented next generation genome editing tools CRISPR/Cas9 RNPs® combined with their transformation technology for efficient direct delivery and swift regeneration of genome edited plants. Their mission is to revolutionize plant transformation technology with our innovative, universal, cost effective, swift transformation system applicable to broad a range of crop species for direct delivery of genome editing tools.

Dr. Chidananda Nagamangala Kanchiswamy

PLANTeDIT's CEO and founder Dr. Chidananda Nagamangala Kanchiswamy is an expert in non-transgenic genome editing technology. He has a decade of experience in plant biotechnology, transformation, tissue culture and genome editing of several crop species. He obtained his PhD in plant biotechnology in 2011 from University of Turin (Italy). During his PhD he spent most of his time conducting research at the Max Planck Institute for chemical ecology Jena (Germany) and the Centre for Ecological Research Institute, Kyoto University (Japan). After his doctoral studies he moved to the Foundation Edmund Mach, Trento (Italy) as a Marie Curie postdoctoral fellow. He has 6 years postdoctoral and research scientist experience at the Foundation Edmund Mach, where he explored plant biotechnology and plant genome editing using the next-generation genome editing tool CRISPR/Cas9. He has a decade of experience in plant biotechnology, transformation, tissue culture and genome editing of several crop species. He has published more than 20 peer reviewed research articles during his research career. He was responsible for the supervision of several master and PhD students, technicians and technologists during his tenure at the research institute. He brings his immense research and management experience to make Plantedit company, a world leader in the development of ecofriendly, sustainable, healthier foods for human welfare. His experience in genome editing in apple and grapevine, DNA-free genome editing in apple and grapevine protoplasts, thereby creating the novel method for non-transgenic crop development will be immensely valuable for training the applicant in the project. The applicant's experience in strawberry protocols perfectly complement Dr. Kanchiswamy's expertise in crops ensuring high potential for success of this project.

Host Institution

School of Biological Earth and Environmental Sciences, University College Cork

The applicant will be hosted primarily in School of Biological, Earth and Environmental Sciences (BEES), University College Cork (UCC) and will also spend time in Shannon ABC, in Limerick Institute of Technology. The School of BEES holds an Athena Swan Bronze award and is currently applying for a Silver award. The research strategy of BEES is fully aligned with university, national and EU research strategies and Sustainable Development Goals. The Plant Science research group in BEES integrates overall research strategies of the School, and College of Science, Engineering and Food Science at large by taking advantage of extensive network of collaborative interactions including with the Environmental Research Institute. Key research strengths in BEES include study of plant responses to biotic and abiotic stress, molecular and environmental plant physiology, plant biotechnology, plant ecology, sustainable landscape management. Research infrastructure and platform technologies include a suite of research laboratories, including microscopy suite with SEMs, RAMAN FT-IR, plant pathology, molecular biology, chemical analysis facilities (HPLC, MALDI-TOF and GC-MS), facilities for genome and proteome analysis, plant growth rooms for sterile and non-sterile cultures. The applicant will have access to all these facilities in addition to office space, laboratory bench, freezer spaces in the lab. The applicant will be introduced to BEES research community, university intranet network, institutional email and library. The applicant will present their previous research in the weekly research frontiers series to encourage ideas exchange and collaborations within the School. The diverse research community and excellent state-of-the-art facilities available at BEES provides a perfect set-up for the present project and a well-balanced nurturing ground for the applicant to emerge as a future research leader.

Host Institution

Technological University of the Shannon: Midlands Midwest

Technological University of the Shannon (TUS) (previously Limerick Institute of Technology), is a multi-campus university spread across six vibrant campuses throughout Ireland's Midwest and Midlands region, with principal campuses at Limerick and Athlone, and is home to more than 14,000 students. Shannon ABC is a Research Centre and Technology Gateway that is a collaboration between TUS and Munster Technological University. The proposed project would in part be based in TUS where there is approximately 400m² of dedicated laboratory space for Shannon ABC with a range of facilities including: Analytical Suite, Microbiology Suite, Food grade microalgal growth suite, with access to dedicated Plant growth chambers within the Controlled Environment Laboratory for Life Science. Shannon ABC has significant network of research professionals and enterprise within Ireland and internationally. This network would be available for the applicant during the course of their project, in addition to the development of their own professional network.

Improving Strawberry resistance and shelf-life through Non-Transgenic Genome Editing Technology

Fruit and vegetables are integral to a healthy diet. However, global production of fruit and vegetables is increasingly threatened by pests and diseases. Current crop protection strategies rely heavily on pesticides, which have direct biocidal activity. Therefore, consumers are increasingly concerned about the environmental impacts of pesticides and health hazards of pesticide residues in food products. Excessive use of these chemicals can also lead to evolution of pesticide-resistant pathogen strains. This is especially observed in the case of strawberries where excessive use of anti-fungal pesticides are giving rise to resistant strains of the devastating grey mold disease. Accordingly, there is an urgent need to understand how the disease spreads and how the plant responds to the spreading disease. More knowledge on how plants respond to infection will help us to identify better ways to protect them. This already complex problem is also complemented by lower shelf life of strawberries that reduce the overall marketable fruit yields. Therefore, it is of utmost importance to identify appropriate solutions by increasing strawberry resistance against grey mold as well as increasing the shelf-life of strawberries for decreasing the crop losses during pre-and post-harvest storage and transportation. In this project, we will aim to increase both resistance against grey mold disease and shelf-life of strawberries. First, we will understand how the grey mold infection progresses with time and how the strawberries respond to this spreading infection at the molecular level. Second, using this information we will identify the genes important for resistance against grey mold disease and which also help in increasing shelf-life of strawberries. Third, using a novel non-transgenic genome editing method pioneered by PLANTeDIT, these genes will be modified so as to increase resistance of strawberries against grey mould disease and also increase their shelf life.