



# BIOTECH FOR BUSINESS



## CAREER FIT

Shannon ABC has recently been successful in being selected to host two Marie Curie Career Fit Plus Fellowships. These fellowships are administered by Enterprise Ireland and are aimed at enhancing the training and mobility of experienced researchers through the undertaking of individually-driven, market-focussed research projects. The program is open to Technology Centres and Technology Gateways in Ireland; there were 86 applications to this program and only 27 of these were funded.

Shannon ABC at TUS are lead host organisation in one of these projects and partnering in a second one.

Dr Sushanta Saha is mentoring a project entitled: "Investigating the commercialization potential of selected microalgae and addressing the constraints to commercialization of algae-based high-value products". This project is in collaboration with Tralee Bay Hatchery and will welcome Dr Prachi Varshney to the team at the end of November. Dr Varshney's work will be based on advancing intellectual property that has already been developed for microalgae through a range of funding programs. The successful use of knowledge developed from these projects is inherently reliant on being able to grow and handle microalgae at scales of 100s-1000s of litres. Depending on funding continuity, IP outputs can be just shelved and not used, or put on hold until future funds are secured. Based on Shannon ABC's expertise with microalgae and facilities of scale, this project will licence in IP from project outputs in Italy and Portugal and address the bottlenecks associated with lack of scale. We also plan to advance microalgal IP developed in TUS.

Dr Siobhan Moane and Dr Peter Downey from the CELLS research group have teamed up with Dr Barbara Doyle from UCC, Dr Chidananda Nagamangala from the company PlantEdit and Dr Raghuram Badmi to deliver a project entitled 'Improving Strawberry resistance and shelf-life through non-transgenic genome editing technology'. This project will last for 3 years, and will focus on non-GMO editing method to improve the resistance of strawberries to grey mold. Current crop protection strategies rely heavily on pesticides, which have direct biocidal activity. Consumers are increasingly concerned about the environmental impacts of pesticides and health hazards of pesticide residues in food products. In this project the team will determine how the grey mold infection progresses with time and how the strawberries respond to this spreading infection at the molecular level. Using this information they will identify the genes important for resistance against grey mold disease and which also help in increasing shelf-life of strawberries. Finally, using a novel non-transgenic genome editing method pioneered by PLANTeDIT, the genes so as to increase resistance of strawberries against grey mold disease and also increase their shelf-life. The work in TUS will focus on analysis of the produced strawberries key biomass end-points as well as metabolite profiling.

We look forward to welcoming both Dr Varshney and Dr Badmi to Shannon ABC, CELLS and TUS.



## Capital Equipment to support Irish Companies

Shannon ABC has secured further funding from the Enterprise Ireland Capital Equipment call for new equipment. The funding, won by 3 separate applications, has been used to purchase equipment to help support R&D activities with Irish enterprises.

### The equipment includes:

Sample Preparation and Extraction Suite (Super-critical fluid extraction, Combinatory Pressurised Liquid – Dispersive Solid Phase Extraction Module, microwave digester, micro-plate reader)

### Sample Preparation and Extraction Suite:

The proposed Sample Preparation and Extraction Suite is composed of 2 main equipment modules with supplementary attachments to address the majority of biological materials and compounds as well as being efficient, diverse and environmentally friendly. The suite will support our Industry partners in the replacement of conventional mechanical digestion, manual liquid-liquid extraction, manual solid-phase extraction and clean up, syringe and centrifugal filtration, and can be used in the rapid development of pre-treatment methods.

### Environmental Monitoring Suite (Elemental Analyser, Greenhouse Gas analyser):

This Environmental Monitoring Suite consists of an Elemental Analyser and a Greenhouse Gas Analyser. Together they will enable Shannon ABC to support Irish Industry in their efforts to mitigate global warming by measuring end points such as enhanced nitrogen use efficiency, calculating carbon sequestration and monitoring industrially produced greenhouse gases amongst many other research options.

A wide range of sectors can benefit from the instrumentation such as the Environmental and Agri-Food sector. The importance of more efficient land usage is central to sustainable development and an effective circular bioeconomy and improved land use efficiency. This Environmental Monitoring Suite will support Irish industry in achieving this

### Photosynthetic growth chambers:

The proposed facilities will extend the current capabilities of the CELLS research group and Shannon ABC beyond those attainable by most SME's and provide a fully functional bioresource platform for the benefit of growers and end-users. The proposed equipment will aid in the establishment, commercial scale-up, and optimisation of methodologies for technology-enhanced approaches to biomass production, development, sustainability, and enhancement. It will provide state of the art controlled photosynthetic environments to determine precise cultivation conditions and environmental enhancements e.g. specific light wavelength; humidity; fertilizer effects; atmospheric CO<sub>2</sub> effects etc. delivering bespoke growth enhancement technologies for food and bioactive rich crop industries.

These grant awards bring to €2.5m the amount of funding secured by Shannon ABC for capital equipment in the last 3 years.

## ICP-MS at Shannon ABC

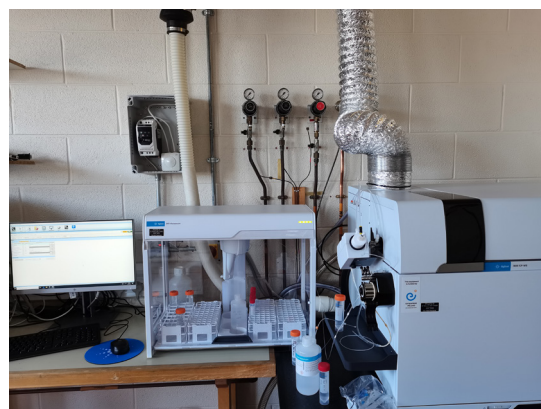
Since being introduced in the 1980's, Inductively Coupled Plasma Mass Spectrometry has become one of the most important techniques for elemental analysis. It surpasses rival techniques in terms of its low detection limits, high degree of selectivity and the fact that it can determine most of the elements in the periodic table.

At the heart of the ICP-MS instrument is the torch, where Inductively Coupled Plasma (ICP) atomises and ionises the sample at extremely high temperatures. These ions are then sorted according to mass and charge by the Mass Spectrometer (MS) part of the instrument. It is the coupling of these two unique instruments that gives ICP-MS its exceptional qualities in terms of detection, sensitivity and accuracy. The Inductively Coupled Plasma minimises interferences by offering exceptional ionisation, while modern mass spectrometers such as the quadrupole allow superb resolution.

ICP-MS has applications across a number of industries from pharmaceutical to food and environmental as it has now become the benchmark standard method for elemental determination in most sectors.

### Examples of use of ICP-MS:

- Heavy metal analysis in soil and water
- Mineral analysis in food and drink products
- Quality control in pharmaceutical analysis
- Biomass screening



## MEET THE TEAM

Shannon ABC is a collaboration between Technological University of the Shannon: Midlands Midwest and Munster Technological University and the Centre brings together a multidisciplinary team of researchers with commercial specialists so as to provide a centre of excellence in applied research, capable of exploiting opportunities in science and technology to the benefit of the Regional and National economy. Each quarter we will introduce you to some of our team.

**DR NIAL BURKE** Dr. Niall Burke holds the role of Scientific Project Manager and Principal Investigator with Shannon ABC at MTU. Niall received both his BSc in Physiology and his MRes in Microbiology (yeast physiology) from University College Cork. He completed his PhD in Cardiovascular Sciences at The Hatter Cardiovascular Institute of University College London, while researching the role of mitochondrial dynamics in cardiac ischaemia-reperfusion injury. Niall then worked as a postdoctoral fellow for Astrazeneca in Cambridge UK, where he was investigating the role of cell signalling kinases in drug-induced structural cardiotoxicity. Niall uses his cell culture and molecular cell biology experience to contribute to the planning and troubleshooting of Shannon ABC's mammalian and microbial cell culture research projects for both the biotechnology industry and academia. He is currently PI on numerous industrial client projects and co-supervisor for postgraduate academic projects.



**MARIA NIPO** Maria Nipo is a Research Assistant at Shannon ABC at TUS. Maria is currently working on an Enterprise Ireland funded Innovation Partnership, involved in the enrichment of topsoil using novel soil improvers and fertilisers for horticultural applications. Maria received her BSc in Biochemistry and holds an MSc in Molecular Biology, Biotechnology and Bioentrepreneurship in Plants, both from the University of Minho in Portugal. Both her BSc and MSc projects focused on bioactivities of grape berry extracts, from cultivars grown in Portugal. She was also involved in a project, entitled 'Identify the causes that lead to the darkening of wood', proposed by iSci- Science Interface Initiative and organized by the School of Science of the University of Minho (ECUM), in partnership with Fibromade. In addition, she has experience working in a greenhouse environment and tutored kids in the fields of science and chemistry.

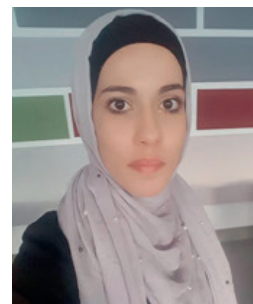


**FELIX AKHERE** Felix Akhere graduated from University of Benin (UNIBEN) at Nigeria in 2015 with a first class honours degree in Biochemistry of which he received the Dean Student award and best graduating student award for his academic excellence. During his undergraduate studies, Felix worked on a project that involved using locally available plants extracts to treat type 2 Diabetes, caused as a result of oxidative stress using a mouse model. He was able to demonstrate that the anti-hyperglycemic effects of this plant extracts was as a result of stimulation of the production of enzymatic antioxidants (Catalase, glutathione peroxidase) after streptozocin induction of diabetes on Wister albino mice.



He is currently conducting his postgraduate studies in a research that involved using "plant derived lipids for skin barrier repair" in Shannon ABC under the supervision of Dr. Joanna Tierney and Dr. Aleksandra Augustyniak. The aim of his research is to exploit the protective epidermal layer of plant leaves caused by waxy cuticle substance called cutin and also using an invitro inflamed skin cell model to screen for anti-inflammatory and anti-oxidant activities.

**HADIL ALAYDI** Hadil Alaydi received her Degree in Bioanalysis and Biotechnology from Limerick Institute of Technology (2016). During her four-year period, Hadil studied and trained in a wide range of biological and instrumentation theories and practices. Hadil received Beckman Coulter Biomedical Ireland Award of excellence for her achievements (2014). Her final year project was based on 'Novel microalgal Lutein extraction for nutraceuticals and cosmeceuticals application' with Dr. Patrick Murray.



In 2016, Hadil was awarded postgraduate studies with Shannon ABC and CELLS. Her research is entitled 'Novel Environmentally Friendly Supercritical Fluid with Carbon Dioxide (SC-CO<sub>2</sub>) Extraction, Identification, and Quantification of Polyphenols- as Health Promoting Bio-actives from Plant Tissues'. During her research, she has undertaken an academic position as an Assistant Lecturer within the Department of Applied Science in TUS. She also worked on several projects where she looked at the effect of water purification to enhance crops growth under controlled environment systems and performed analytical screening of extracts for bioactive properties for an EU funded project; EDEN-ISS.



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# Case Studies

## THE COMPANY

Copper Hawk Limited

## FUNDING SOURCE & VALUE:

Enterprise Ireland Innovation Voucher €5,000

## PROJECT TITLE

Investigation of bioactive composition of EireHide product

## PROFILE OF COMPANY

Copper Hawk is an Irish company dedicated to improving animal health through the development of veterinary products made from natural sources. Eire Hide® is one such product that incorporates a specific blend of botanical extracts.

## PROBLEM TO BE SOLVED

Copper Hawk have selected specific botanical sources with which to produce the EireHide product. Based on their extraction and production process, Copper Hawk wanted to determine the concentration of key bioactive compounds from each botanical source, and how the production process affected these compounds.

## HOW GATEWAY DELIVERED SOLUTION FOR INDUSTRY:

Shannon ABC reviewed the ingredients of the Eire Hide® product with Copper Hawk and agreed on the key compounds, and groups of compounds, to measure. Following extraction, a range of biochemical and analytical assays were used to provide quantification of a range of ingredients, as well as exploratory testing to determine the identity of compounds that may contribute to the product's activity. Examples included: phenolics, flavonoids, iridoids as well as terpenes and terpenoids. Shannon ABC provided a final report to the company detailing all aspects of the analysis and interpretation of the data.

## IMPACT FOR THE COMPANY:

Copper Hawk have developed an effective veterinary product. The data from the Innovation Voucher has provided the company with an insight of the potential mechanism of action of the product. In addition, data provided comparing raw ingredients and finished product will also support the company in potential future product development.

## COMPANY TESTIMONIAL:

*"We worked with Shannon ABC as a Knowledge Partner through Enterprise Ireland. They worked with us on a project to get a better understanding of the chemical composition of one of our products, a herb infused ointment for animals called Eire Hide.*

*Shannon ABC assigned us a project lead in Dr Lena Madden who took an active role in the planning and implementation of the studies. Her knowledge and expertise are excellent, and she was always open to discussion and providing us with regular feedback as her team started to produce results. The final report was able to provide us with useful information regarding the compound founds within the final product and pave the way for further studies and development."*

**Trevor Millard, Quality Associate**

