



## GUT REACTION | SPRING 2022

Spring brings with it renewed hope and optimism as we all get back to normality at APC where the labs are back to their pre-pandemic bustle, and the corridors are filled with chat and energy. It has been a tough two years and I really want to thank and commend everyone in operations and research for not just keeping the ship afloat but for doing such an excellent job and overextending themselves – a real team effort. Just before Christmas, the APC went through an exhaustive review of all our activities by an International panel which was conducted through our main funder Science Foundation Ireland. This root and branch examination required a huge preparative effort from all at APC and (despite storm Barra) the review went really smoothly. Indeed, feedback we received late February showed that APC scored really well on both our Science and Impact. In addition, our programme in Education and Public Engagement scored very highly – a testament to how deeply EPE is embedded into all at APC and also the hard work of EPE manager Aimee Stapleton who has since left APC – we wish her well.

The last four months have been a really successful time at APC and we have a lot to celebrate. Two of our early career stage investigators Maria Arburto and Piotr Kowalski both won highly prestigious European Research Council Starting Grants to pursue work on Brain/Gut and circular RNA work, respectively. They were also promoted to Professors at the University in recognition of this great achievement. The APC has also been very successful on the Industry side with some major contracts achieved with knowledge-based companies including Kraft Heinz, Nutricia and Tate & Lyle. Our researchers also continue to be successful in landing EU grants such as two Innovative Training Networks and GENEGUT, an EU funded project with approx €2 million coming to UCC / APC won by APC Faculty member Prof Caitriona O'Driscoll and colleagues in UCC School of Pharmacy in partnership with APC through Prof. Subrata Ghosh and Dr. Silvia Melgar [More info on GENEGUT](#)

This issue of Gut Reaction will cover many of these news items as well as highlighting some of our more notable publications over this period in journals such as Nature Microbiology, Nature Metabolism, Allergy, Scientific Reports and Frontiers in Microbiology.

So have a quick read over some of the most exciting things happening at APC Microbiome Ireland and, just to let you know, we are planning to have our annual Symposium on October 7th this year when we

will award the annual Charles Donovan prize to an individual who has made a huge contribution to microbiome science.

Prof Paul Ross

Director APC Microbiome Ireland

## APC Fellowship for a Ukrainian Scientist



APC Microbiome Ireland, a world leading SFI Research Centre has created a two-year Post-doctoral fellowship to host a scientist from Ukraine. [More Details](#)

## Focus on Industry



A major downside of the pandemic was our inability to host visits from our industry partners as well as prospective industry partners. And while we were able to adjust and continue our business development activities through webinars and online meetings, there is simply no substitute for a face-to-face meeting with industry to really develop a relationship. So in March we were delighted to welcome a delegation from Reckitt to the APC, led by Dr Deepak Sharma, to explore areas of mutual strategic interest and brainstorm project ideas. We really look forward to further discussions with Deepak and his team to explore concrete ways through which the APC can contribute to Reckitt's R&D objectives.



## APC deepens its research partnership with Kraft Heinz Company



The APC is delighted to announce a significant extension to its research partnership with the Kraft Heinz Company that was first announced in 2020, aimed at developing novel clean label ingredients through new natural cultures for food fermentations.

Fermented foods are created using controlled microbial growth, facilitated by microorganisms or microbial communities, usually in the form of starter cultures, adjuncts or probiotics. The fermentation process helps prolong shelf-life of foods, improve food safety and quality, and increase the palatability of foods. It may also enhance the nutritional and functional properties of foods due to the transformation of substrates to bioactive end-products. This collaboration focuses on a variety of these bioactive end-products and their applications in food systems. The initial one-year collaborative project with Kraft Heinz will run for a further 18 months to further develop and test the most promising novel cultures that were identified in the initial project phase. The effort will sustain a team of four researchers led by APC Principal Investigators Profs Paul Ross, based in UCC, and Catherine Stanton, based in Teagasc.

Commenting on the collaboration between Kraft Heinz and APC Microbiome Ireland, Robert Scott, President of R&D at Kraft Heinz said, *"Partnering with APC Microbiome Ireland aligns with our growth strategy with the growing consumer demand for simpler ingredients. As a company with a long history in fermented products, we are very excited by this collaboration with APC Microbiome Ireland as this partnership will further strengthen our research platforms, enabling the next generation of fermented products and ingredients."*

## Artugen Therapeutics

APC spin-out company and industry partner Artugen Therapeutics has reached another significant milestone in its journey to bring a live biotherapeutic to the clinic, having recently announced that it has merged with another Morningside Ventures company to form Adiso Therapeutics. Adiso is a clinical-stage biopharmaceutical company dedicated to improving the health of patients suffering from debilitating inflammatory diseases. One of the company's lead clinical candidates is ADS024, an oral single strain live biotherapeutic product (SS-LBP) developed by Artugen for the treatment of mild-to-moderate ulcerative colitis and prevention of C. difficile recurrence. The APC looks forward to working with Adiso CEO Scott Megaffin and his team and continuing our successful research partnership developed with Artugen through APC PIs Paul Ross and Colin Hill.

[Read more about Adiso Therapeutics here](#)

## APC and COVID-19



A Long COVID study from APC Microbiome Ireland, a world-leading SFI Research Centre based at University College Cork (UCC), finds that biomarkers of immune system activation are linked with impaired metabolism in Long COVID patients, which helps scientists understand the pathobiology of SARS-CoV-2 infection and associated long-term consequences.

The research led by Prof. Liam O'Mahony and first authored by Dr. Corinna Sadlier, published in the international scientific journal "Allergy", shows that the levels of multiple biomarkers are altered in serum from patients with Long COVID, even nine months after the initial infection with SARS-CoV-2. Over 1,000 molecules were measured in patient serum, and a subset of these molecules were shown to be at different levels in patients compared to healthy volunteers. These differences indicate an ongoing activation of the immune system, which were coupled with differences in molecules generated during metabolism. These differences in metabolism (e.g. decreased serotonin levels) give us some hints at what might be underpinning long term symptoms such as fatigue and brain fog. Overall the study findings identify novel mechanistic and potential diagnostic markers as well as potential therapeutic targets in Long COVID patients. [Read More](#)



## Selection of recent APC Publications



**Ternes D, et al (2022) The gut microbial metabolite formate exacerbates colorectal cancer progression. Nature Metabolism. 4, 458–475 (2022) [Read Paper](#)**

APC PI Prof Ines Thiele collaborated on this study which showed that formate, a metabolite produced by the bacterium *Fusobacterium nucleatum* promotes colorectal cancer development. The paper describes molecular signatures linking colorectal cancer phenotypes with *Fusobacterium* abundance.

**Mathur, et al (2022) Emulsion-Based Postbiotic Formulation Is Comparable to Viable Cells in Eliciting a Localized Immune Response in Dairy Cows With Chronic Mastitis. Front. Microbiol. 13:759649 [Read Paper](#)**

This project led by Paul Ross and Colin Hill shows that an emulsion-based formulation of the strain *Lactococcus lactis* DPC3147 was as effective as a commercial antibiotic formulation in treating sub-clinical and clinical cases of bovine mastitis, a disease which represents a significant ongoing concern in the dairy industry, leading to substantial losses in profits and revenue for farmers worldwide.

**Lyons KE et al (2022) The human milk microbiome aligns with lactation stage and not birth mode. Sci Rep. 12(1):5598 [Read Paper](#)**

This study led by Catherine Stanton analysed the human milk microbiome in a cohort of 80 lactating women and followed the dynamics in bacterial composition over the course of lactation from birth to 6 months. The paper outlines that lactation stage was the primary driving factor in milk microbiota

compositional changes over lactation from birth to 6 months, while mode of delivery was not a factor driving compositional changes throughout human lactation.

**Dinan TG et al (2021) Altered Stress Response in adults born by Caesarean section. Neurobiol Stress 28; 16:100425 [Read Paper](#)**

This study by John Cryan and his group assessed if there was any long-term impact of birth by C-section on psychological processes in a cohort of young male students. The paper outlines that while most of the initial effects of delivery mode on the gut microbiome did not persist into adulthood, young adults born by C-section exhibited increased psychological vulnerability to acute stress and a prolonged period of exam-related stress. This shows a potential enduring effect of delivery mode on the psychological responses to acute stress during early adulthood.

**Healy DB et al (2022) Clinical implications of preterm infant gut microbiome development. Nat Microbiol. 7(1):22-33 [Read Paper](#)**

This is an important review article in a leading journal looking at how perturbation of the preterm infant gut microbiome affects growth, development & health.

**Kuniyoshi et al (2022) An oxidation resistant pediocin PA-1 derivative and penocin A display effective anti-Listeria activity in a model human gut environment. Gut Microbes 14(1):2004071 [Read Paper](#)**

Listeriosis, caused by the Gram-positive bacteria *Listeria monocytogenes*, is considered one of the most serious foodborne disease due to its high mortality rate, particularly among the elderly, people with compromised immune systems, pregnant women, unborn and neonatal babies. This paper established that synthetic penocin A and the stable pediocin M31L derivative, heterologously produced, display effective anti-Listeria activity in a human gut environment.

**Udayan S et al (2022) Identification of Gut Bacteria such as Lactobacillus johnsonii that Disseminate to Systemic Tissues of Wild Type and MyD88–/– Mice. Gut Microbes 14(1):2007743 [Read Paper](#)**

This paper by Ken Nally and his group showed that certain gut-associated bacteria are capable of translocating to intestinal and systemic tissues in dendritic cells of mice and as such, these bacteria may represent immunomodulatory “endosymbionts”. If similar species can be identified in humans, these could be harnessed for therapeutic and probiotic potential.

**Almeida EL et al (2022) Geographical and Seasonal Analysis of the Honeybee Microbiome. Microb Ecol [Read Paper](#)**

Paul O’Toole and his group profiled the microbiome in returning forager bees from 10 to 12 hives in each of 6 apiaries across the southern half of Ireland, at early, middle, and late time points in the 2019 honey production season. They identified bacteria in the forager bee microbiome that correlated with hive health as measured by counts of larvae, bees, and honey production. These findings support the hypothesis that the global honeybee microbiome and its constituent species support thriving hives.

## FI Profile: Dr Sinéad Corr



**INTRO** Dr Sinéad Corr is an Associate Professor at the Dept. of Microbiology, Trinity College Dublin, where she leads the Microbiome & Mucosal Immunity Research Group, and is a Funded Investigator at APC.

**CURRENT RESEARCH** Dr Corr's research focusses primarily on the host-microbe interface within the GI tract. Using molecular based approaches combined with animal models and clinical samples, Dr Corr's research team target Microbiome, Metabolome, cytokine and microRNA networks to understand how healthy immune responses are maintained at the intestinal mucosal barrier and what processes override this during disease or in response to infection. A key focus of this research is on IBD. Dr Corr's research has a strong translational focus, maintained by active collaboration with clinician colleagues and industrial biopharma partners, with the aim of identifying therapeutic strategies or novel dietary interventions and bioactives to manipulate intestinal immunity and enhance the beneficial aspects of



the gut microbiome, with the ultimate goal of boosting gut health and reducing the severity of intestinal infectious and inflammatory diseases. Sinéad is lucky to have assembled a very talented team of young researchers over the years to help tackle these research goals.

**BACKGROUND** Sinéad qualified with a BSc Microbiology in 2002 and in 2007 with a PhD in Molecular Microbiology from University College Cork (UCC). This was followed by postdoctorate work as part of a collaboration between GlaxoSmithKline and the Alimentary Pharmabiotic Centre UCC (now APC Microbiome Ireland) (2006-2008) and subsequently with Prof. Luke O'Neill's Inflammation Research Group, at the School of Biochemistry and Immunology, Trinity College Dublin (TCD) (2008-2015). In 2011, Sinéad was awarded a Science Foundation Ireland Starting Investigator Research Grant and in 2015, obtained an academic position in the Dept. of Microbiology, TCD, where she established the Microbiome & Mucosal Immunity research lab. Sinéad subsequently received a Crohn's and Colitis Foundation of America, Litwin IBD Pioneer award and an SFI Frontiers for the Future award.

**HOBBIES** When not hanging out or camping with her kids, Sinéad enjoys SUP paddleboarding, Skiing & Snowboarding, a G&T and good conversation with friends ☺

## Faculty Profile: Dr John Kenny



**INTRO** Dr John Kenny is a Senior Research Officer at the Teagasc Food Research Centre and a faculty member at APC Microbiome Ireland. His research interests relate to the application of 'omics and synbio technologies to understand and apply the capabilities of microorganisms along the food chain.

**CURRENT RESEARCH** Current research in John's group focusses on the application of next generation sequencing to understand the role of bacteria in the food fermentation process, and the application of phages to target pathogens or to modify microbiomes in the food sector.

**BACKGROUND** After his BSc and PhD in molecular microbiology at UCC, John moved to work at the University of Liverpool. Initially, his research there focused on using ‘omics approaches to study MRSA and phages of pathogens, before transitioning to managing the next generation sequencing core facility, the Centre for Genomic Research. During that time he applied a range of microarray, and short and long-read sequencing technologies, as well as developed solutions for automated sample preparation and single-cell biology. These projects covered the spectrum of environmental, microbial, plant, and mammalian genomics research. After 13 years in Liverpool, he returned to Ireland to set up his own lab group at Teagasc and is a faculty member of the APC.

**HOBBIES** John has three small kids that keep him busy and on his toes outside work. In his spare time he tries to keep fit, and in particular “enjoys” trail running.

## APC In the Media

### Some of our Media Highlights from Spring 2022

- APC PI Colin Hill and researchers Julie Callanan and Stephen Stockdale acknowledge the foundational research of Professor John Atkins in the latest issue of [Independent Thinking](#)
- Dr. Maria Aburto and Dr. Piotr Kowalski’s European Research Council (ERC) grant successes were covered by [RTÉ](#), [Silicon Republic](#), [Cork Beo](#), [Irish Examiner](#) and the [Irish Times](#).
- Prof Fergus Shanahan’s election to the National Academy of Inventors was reported by [Echo Live](#)
- Dr Julie O’Sullivan was interviewed by the [Irish Examiner](#) about her research on the Skin Microbiome.
- Emeritus Professor Fergus Shanahan was interviewed about Gut Health by Brendan O’Connor on his [RTÉ Radio 1 Weekend Show](#)
- Emeritus Professor Ted Dinan was interviewed by Anna Geary on her [RTÉ Radio 1 Show SuperCharged](#)
- APC PI Prof Liam O’Mahony’s paper “Metabolic rewiring and serotonin depletion in patients with postacute sequelae of COVID-19” was covered on [Echo Live](#) and [Silicon Republic](#)
- APC Deputy Director Subrata Ghosh’s €5.6 million SFI Professorship Award was covered by [Irish Medical Times](#), [Silicon Republic](#), [Echo Live](#), [Irish Times](#), [Farmers Journal](#), [News Primer](#)
- Dr Serena Boscini & Caroline O’Leary’s Coffee Study was publicised by [Yay Cork](#), [Irish Examiner](#), [Cork Billy’s Blog](#) and [Craving Cork](#)

## World Microbiome Day 2022

World Microbiome Day has become an annual fixture in the APC calendar and for Microbe enthusiasts worldwide. This year it takes place on Monday 27th June. The 2022 theme is 'Celebration of the microbial world'. Start planning your events and make sure to register them on the official online map. <https://worldmicrobiomeday.com/about/>



## Equality, Diversity & Inclusion (EDI) Committee

APC has established an Equality, Diversity & Inclusion (EDI) Committee with members across all levels of the Institute, from the Director down. This Committee will convene regularly to drive the development of an APC EDI Strategy and the embedding of an EDI culture in the APC. It will work closely with the new UCC EDI Unit to ensure alignment and complementarity with institutional policy and practice.

## APC Awards Successes



### **BINC Award**

Dr. Harriët Schellekens, a funded investigator with APC Microbiome Ireland SFI Research Centre and lecturer in the department of Anatomy & Neuroscience has been awarded research funding from the Geneva-based BIOSTIME Institute Nutrition & Care (BINC) Foundation to explore the role of the gut microbiota in mediating the effects of early-life nutrition on neurodevelopment of appetite, food reward and food preference in adulthood, in a project called "PROTECT: PRiming fOr healThy Eating via the diet-miCrobioTa-gut-brain axis". The project will be conducted with collaborators Dr. Siobhain O'Mahony, University College Cork, Cork, Ireland and Prof Suzanne Dickson, Department of Physiology, University of Gothenburg, Sweden. [Read More](#)



### **Professor Gerald Fitzgerald Research Award**

PhD student Amel Sami of APC's Stanton Lab in Teagasc Moorepark won the UCC Microbiology 2021 Professor Gerald Fitzgerald Research Award for her paper "The ultra-structural, metabolomic and metagenomic characterisation of the sudanese smokeless tobacco 'Toombak'." [Read Paper](#)



### **UCC Sprint Awards**

APC Post-doctoral researchers Miguel Fernandez de Ullivarri and Florence Herisson each were recipients of UCC SPRINT awards for Miguel for clinical impact and Florence for public welfare impact.



### **Teagasc Walsh Scholars Travel Award**

Fatma Koc, has been awarded a three month Teagasc Walsh Scholars Travel Award. Fatma is a second year PhD student at School of Microbiology who is studying under supervision of Prof Catherine Stanton and Prof Paul Ross. University of Alberta will host Fatma as she works with Prof David Wishart at the Metabolomics Innovation Centre. Fatma says “I will be working on metabolomics changes in the mammalian gut during metabolic syndrome development. Besides microbiota, it is now evident that metabolites have an important effect on development of diseases including metabolic syndrome. We hope to find more answers to improve this condition with this study.”

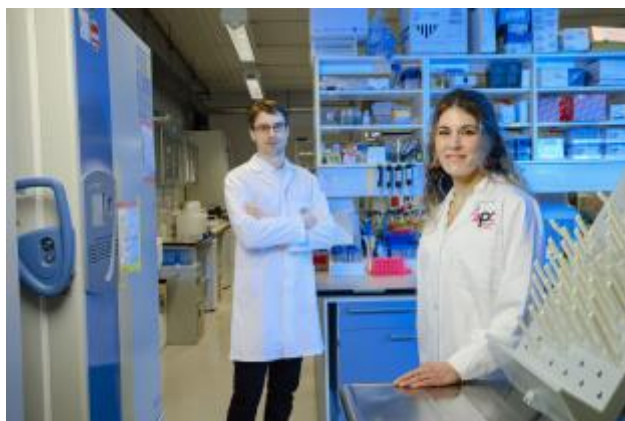
## APC Funding Success

Competing against over 4000 of the world’s brightest scientific minds, two APC researchers – Dr. Maria Aburto, UCC Department of Anatomy and Neuroscience and Dr. Piotr Kowalski, UCC School of Pharmacy secured prestigious and highly sought after European Research Council (ERC) Starting Grants.

Dr. Piotr Kowalski was awarded €1.5m for CIRCLE, a project developing cutting-edge circular RNA technology and new delivery methods to tackle unmet medical challenges such as sepsis, which is responsible for one in five deaths worldwide.

Dr. Maria Aburto was awarded €1.75m for RADIOGUT, a project investigating how our gut microbiome communicates with the brain by looking at development pre and post birth which could have ground-breaking implications for precision medicine and neurodevelopmental disorders such as autism. [Read More](#)

Congratulations to Maris and Piotr on their fantastic career-changing achievement!



## APC has two upcoming grant workshops

MSCA postdocs 14:00 on 27th April [bit.ly/APCMSA2023](http://bit.ly/APCMSA2023)

ERC workshop <http://bit.ly/ERCAPC> 28th April 14:00.

Email Saba Loftus for more details [saba.loftus@ucc.ie](mailto:saba.loftus@ucc.ie)



## EPE



Ana Velikonja was invited to speak at a TEDx talk organised by University of Ljubljana to talk about human microbiome and her research at APC. The talk was held in April in Ljubljana and was given in the Slovenian language. The video will be released in the coming weeks.



APC Post Docs Ivan Sugrue, Daragh Hill, Julie O'Sullivan, Natalia Rios Colombo, Elisa Di Stefano, Katherine Lavelle, Ciaran Lee, Jonathan Keane represented APC at the University College Cork undergraduate careers fair in April. The team, coordinated by APC Post Doc Association chair Julie O'Sullivan spoke to an audience of approx 300 undergraduate students about the potential career opportunities and benefits at APC.



### **Native Scientist**

On March 25th Florence Herisson led a Native Scientist workshop in Cork. Conducted in the French language primary level pupils enjoyed listening to several researchers representing different fields of expertise. Three biologists from APC spoke to the group: Dr Asma Amamou spoke about 'How does food travel through our body', Dr Karim Hayoun presented the microorganisms and the diversity of the living world and with Gaston Cluzel they discovered how does our body react to bacterial and viral threats, and thereby understand how do immune system and vaccines work.

The event was made possible by the collaboration of Native Scientist partners - Ambassade de France en Irlande; APC Microbiome Ireland, CRVB, University College Cork; Enfants Francophones de Cork.

## Contact Us



**APC Microbiome Ireland** is a world leading SFI research centre is a community of over 300 researchers, clinicians, managers and support staff based in University College Cork and Teagasc as well as partner institutions MTU, NUIG, UCD, NIBRT, UL and TCD.

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