Issue
7
December
2020

QUEEN'S UNIVERSITY BELFAST

WELLCOME-WOLFSON INSTITUTE FOR EXPERIMENTAL MEDICINE

Professor José Bengoechea
WWIEM Director

Welcome,

2020 has been a complex year for everyone. Since the Institute entered in lockdown in March following NI Executive and Queen's University guidelines, WWIEM staff and students quickly adapted to an ever-changing context. In doing so, they were agile in minimizing the impact of the disruption of activity when we entered lockdown, proactive in equipping the cat 3 Laboratory for COVID-19 research, and in ensuring that critical research could continue even during lockdown. Our researchers and clinical academics have made key contributions in the fight against the pandemic.

They have secured competitive funding for COVID-19 research, they have worked in the frontline of the NHS attending patients, and they have conducted crucial clinical trials to find and test much needed COVID-19 therapies.

Their work is already showing key outcomes in the form of significant papers improving our understanding of the disease, and diagnostic tools. Our researchers have been active in public engagement and have become familiar faces to the larger NI public thanks through their efforts to engage with media and provide expert information and updates on the pandemic evolution and our fight against the virus.

Shortly after lockdown, the Institute started to work in a recovery plan that allowed for a swift return to lab activity in early June, guaranteeing that essential research activity could restart for all laboratories with the highest safety standards. This was done as part of a joint team effort with our colleagues of Estates and Health and Safety services with the support of the School and the Faculty. Graduate and undergraduate teaching, as well as the rest of our non-research activities had to become virtual in record time and the different teams across the Institute step up to the challenge in a continued effort, allowing for these to become our new normal.

The approval of the Pfizer/BioNTech vaccine and the first vaccination wave in recent days mark the start of a new phase in the global battle against COVID-19 and a turning point. There are still many challenges ahead, and it is important everyone acts responsibly, following the social distancing guidelines, and health and safety measures in the coming weeks to ensure not only a safe Christmas, but also a safe return to the laboratories in the new year. Hopefully, early in 2021 our efforts will bring the Institute's activity fully back to normal.

QUEEN'S UNIVERSITY BELFAST

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Meet our Researchers

Dr David Simpson

David's research aims to provide a better understanding of the causes of eye and vascular diseases by application of advanced molecular biology approaches to provide novel insights. This enables both development of new treatments and design of improved diagnostic and prognostic tests. His specific interest include

- Retinal gene expression and ophthalmic genetics
- during hyperoxia and hypoxia, including changes in gene expression; and mutations in genes which cause retinal degeneration.
- Role of microRNAs (miRNAs) in regulating gene expression to control developmental pathways and other cellular functions in the retina.
- Single cell RNA-Sequencing (scRNA-Seq)

He was instrumental in establishing the Faculty Genomics Core Technology Unit which provides access to NGS technology within the University, and the development of single cell RNA-Sequencing.

Prof Noemi Lois

Noemi Lois is a Clinical Professor of Ophthalmology at WWIEM and an Honorary Consultant Ophthalmologist and Vitreoretinal Surgeon at the BHSC Trust.

Since joining Queen's in 2013, Noemi has led a programme of preclinical and clinical research focused on diabetic retinopathy and its complications, spaning from pathogenic mechanisms of disease and risk stratification to new therapies. Noemi is Chief Investigator of two large NIHR-HTA funded multicentre trials:

EMERALD (Effectiveness of Multimodal imaging for the Evaluation of Retinal oedema And New vesseLs in Diabetic retinopathy) and DIAMONDS (Diabetic Macular Oedema aNd Diode Subthreshold micropulse laser). Author of over 100 articles in peer review journals [Scopus h-index (January 2019)=37], 13 book chapters and editor of 3 textbooks; Noemi is also is ad-hoc referee for numerous peer-review journals and funding bodies.

Dr Fionnuala Lundy

Fionnuala's research focuses on pain and inflammation in the oral cavity and respiratory tract. She has developed non-animal models, including neuronal models differentiated from adult human dental pulp stem cells and induced pluripotent stem cells (iPSCs) to gain a better insight into neuronal responses that reflect human physiology. Her work on pain and neurogenic inflammation, and the neuro-inflammatory response to infection, has extended into the field of transient receptor potential (TRP) channel research and the modulation of these channels during the inflammatory and regenerative processes.

She is particularly interested the interplay between the innate immune response to infection, and the reparative and regenerative potential of adult stem cells; the stability of host defence peptides and proteins in the inflammatory milieu, and in the design of peptide mimetics with resistance to proteinases and enhanced efficacy against bacterial and fungal pathogens in biofilm form.

Prof Cliff Taggart

Professor Taggart's research focuses on evaluating mechanisms of excessive inflammation in lung disease and how this may predispose to infection in the lung. His primary disease interests are Cystic Fibrosis, Chronic Obstructive Pulmonary Disease and Acute Respiratory Distress Syndrome. He is interested in how the innate immune response becomes dysregulated during excessive inflammation as a result of elevated protease activity. Findings from his group have been published in high-ranking Respiratory journals including the American Journal of Respiratory and Critical Care Medicine and the European Respiratory Journal. His research brings him in to contact with Pharma and Diagnostics companies, from whom he receives funding for translational studies. He has been funded by the MRC, the EPSRC, EU H2020, EU FP7, Innovate UK and the Cystic Fibrosis Foundation.

Awards, Prizes and distinctions

Dr Fionnuala Lundy appointed Editor-in-Chief of the Elsevier journal 'Archives of Oral Biology'.

This is the first female appointment to the role since the journal was established in 1959.

Archives of Oral Biology is an international Elsevier journal publishing papers in the oral and craniofacial sciences. Having served as Associate Editor for 4 years, Fionnuala was appointed to the role of Editor-in-Chief earlier this year. Fionnuala is the first female to be appointed Editor-in-Chief since the journal was established in 1959.

Derek Brazil wins Queen's teaching award 2020

This Teaching Award in the Student-nominated category is presented to Dr Derek Brazil, a highly motivated teacher who actively seeks out and uses student feedback to adapt his learning approaches. As an early adopter of the Canvas VLE at Queen's, he has effectively used this resource to enhance student engagement, provide formative assessment and to offer remote and flipped learning approaches. In their nominating statement his students noted, "Dr Brazil goes over and above his duty to help promote the student voice and maximise our learning experience. Dr Brazil is very passionate about his subject and indeed his research."

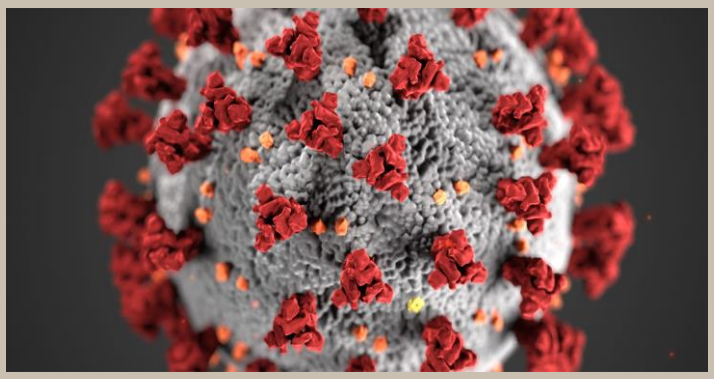
Dr Connor Bamford receives "The Conversation" Prof Sir Paul Curran Award for Excellence in Academic Journalism 2020

Praising his contribution to the Conversation's extensive international coverage of the pandemic, the jury highlighted how Connor's writing stands out as clear, sober and yet incredibly engaging. "He displays the craft and timeliness that we hope are hallmarks of great Conversation journalism. He has also successfully encouraged colleagues to participate in this form of science communication and appeared in a live webinar discussion on vaccines".

Dr Alerie Guzman de la Fuente wins the Faculty Research Excellence postdoc prize for her leadership in establishing networks and driving her research, honours from her field, funding applications and quality outputs.

Dr Lindsay Broadbent wins the Faculty Outstanding Engagement postdoc prize for many activities including over 400 contributions to written press, radio and TV coverage of COVID-19 and her role in informing public policy.

COVID-19 WWIEM – Research outcomes



Since the COVID-19 crisis started, our researchers have been in the forefront of the research effort to overcome the pandemic. In our previous issue, we shared the portfolio of projects which had just been secured and were in their initial stages. We are excited to be able to share now the early outcomes of some of those projects, in the certainty that soon we will be able to celebrate more remarkable results.

Combined COVID-19 and Flu molecular diagnostic test deployed

A combined COVID-19 and flu molecular diagnostic test has been launched, as a result of the H2020 - EU funded project **"Development and validation of rapid molecular diagnostic test for nCoV19".** Prof Cliff Taggart is partner in the consortium led by the Irish company HiberGene. The combined COVID-19 and Flu molecular diagnostic test, allows health officials to test for both illnesses using a single swab.

Up to four samples can now be tested in parallel for Flu A, Flu B and COVID-19 in 60 minutes on a single HG Swift Plus unit.

EU The HiberGene COVID-19 test development is supported by a grant of €930,000 from Horizon 2020, the EU programme for support to research and innovation.

The combined test is currently undergoing the CE marking process and is currently available for research use only.

NATURE publication – Prof Danny McAuley

Genetic mechanisms of critical illness in COVID-19

The paper reports the results of a genome-wide association study (GWAS) in 2244 critically-ill COVID-19 patients from 208 UK intensive care units (ICUs), representing >95% of all ICU beds; The study was conducted within the global collaborative study to understand the genetic basis of critical illness GenOMICC (Genetics Of Mortality In Critical Care).

Since susceptibility to life-threatening infections and immune-mediated diseases are both strongly heritable traits, the authors reasoned that host genetic variation may identify mechanistic targets for therapeutic development in COVID-19. Ancestry-matched controls were drawn from the UK Biobank population study and results were confirmed in GWAS comparisons with two other population control groups: the 100,000 genomes project and Generation Scotland. They identify and replicate three novel genome-wide significant associations.

Accelerated article preview Published online 11 Dec 2020
https://www.nature.com/articles/s41586-020-03065-y

COVID-19 WWIEM – Research outcomes

LANCET Infectious Diseases publication – Tom Waterfield, Chris Watson

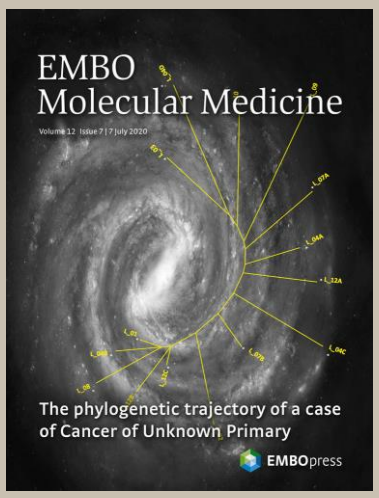
Kinetics and seroprevalence of SARS-CoV-2 antibodies in children

The paper reports the results of the second round of antibody testing in children from a prospective multicentre cohort study in the UK. Recruitment took place in April 2020, at five UK sites (Belfast, Cardiff, Glasgow, London, and Manchester) and included healthy children aged 2–15 years. Follow-up visits at all five UK sites took place between June and Aug, 2020.
The results indicate that antibody titres in children exposed to SARS-CoV-2 remain at a detectable level for at least 62 days, and that in this cohort mean antibody titres increased over time. This finding is consistent with available data on antibody titres in adults.

https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30884-7/fulltext

EMBO publication – Prof Jose Bengoechea

SARS-CoV-2, bacterial co-infections, and AMR: the deadly trio in COVID-19?



The paper highlights how SARS-CoV-2 and bacteria in the lungs may affect each other's ability to cause damage, and with the immune response to the virus being different when bacteria are present, the clinical outcome and the severity of COVID-19 in a patient could worsen. The paper also suggests the likeliness of the gut microbiota being disrupted in severe COVID-19 patients, which may affect disease outcomes, including predisposition to secondary bacterial infections of the lung.

https://www.embopress.org/doi/full/10.15252/emmm.202012560

REALIST- COVID19 Trial

The recruitment to the REALIST- COVID-19 cohort has been recently completed ahead of schedule. This stage of the project is the first phase 2 trial in the UK of cell therapy for patients with COVID-19 to complete.
REALIST clinical trial, led by Professor Danny McAuley and Professor Cecilia O'Kane, is investigating the use of allogenic Mesenchymal stromal cells (MSCs) in patients with Acute Respiratory Distress Syndrome (ARDS) caused by COVID-19.
Patients in the trial will be treated with a purified population of MSCs derived from umbilical cord tissue called ORBCEL-C. The ORBCEL-C therapeutic is manufactured under licence by the UK NHS Blood and Transplant Service for the REALIST COVID-19 trial.

COVID-19 WWIEM – Research outcomes

Novavax trial

The Novavax trial, led in NI by Prof Danny McAuley and Prof Judy Bradley, completed recruitment of 15,000 patients throughout the UK and NI recruited almost 500 patients. The National Institute for Health Research (NIHR)-supported Novavax Phase 3 COVID-19 vaccine trial has achieved its recruitment target of 15,203 volunteers just two months after opening in the UK – including 482 participants from Northern Ireland. This is the first COVID-19 vaccine trial to take place in Northern Ireland and the number recruited surpassed the original target of 350. Two members of WWIEM's clerical team have been providing additional support to ensure the successful delivery of the local phase of this trial.

RECOVERY
Randomised Evaluation of COVID-19 Therapy

RECOVERY-RS trial has now recruited 539 patients.

This national clinical trial, one of the largest non-invasive respiratory trials in the world, aims to identify treatments that may be beneficial for people hospitalised with suspected or confirmed COVID-19. The NI site is led by Prof Danny McAuley.

The study is taking place in NHS hospitals (in England, Wales, and Northern Ireland) or purpose built-hospitals with wards and critical care areas. It is aiming to recruit 4002 people who have COVID-19 or are suspected of having COVID-19.

The study compares three different treatments that help with breathing.

A) Continuous positive airway pressure (CPAP

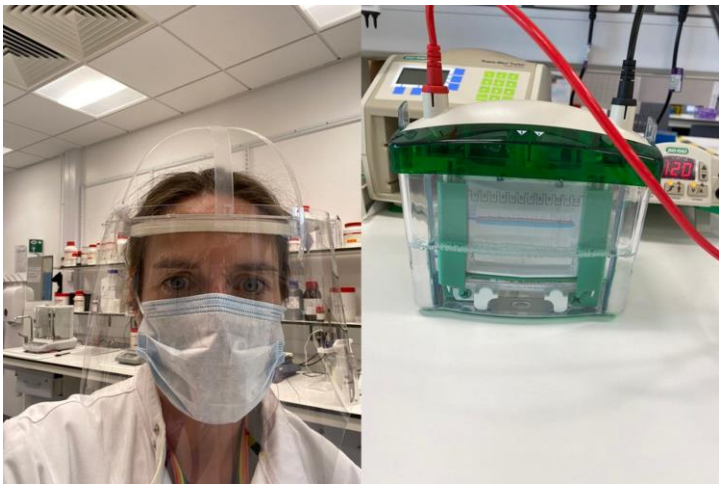
B) High flow nasal oxygen (HFNO)

C) Standard care

The trial aims to identify which is best at keeping oxygen levels high enough and preventing a patient from needing more help with their breathing. All three treatments are in common use within the NHS.

COVID-19 WWIEM's RESPONSE

All the lab-based personnel and students returned to the Institute in early June in a swift process planned to ensure as limited as possible disruption of our activity.
The coordinated work of the technical team, together with the clerical team and colleagues from Estates and Health Safety services made possible to resume work in the laboratories without leaving anyone behind.



Technical team

When considering that still at this time there are many research facilities across the UK where researchers have not been able to return to full time work in the laboratories, the effort across all the units to make it possible, is even more remarkable.

During most of this year the technical team, led by Mervyn McCaigue have contributed decisively to the planning and then to the implementation of the different measures adopted. First, they delivered on the sudden closure when NI entered the first lockdown, by allowing researchers to minimize the loss of work.

During lockdown, they remained operational, providing additional support to other centres and Schools, getting the CAT3 Laboratory approved to work with SARS-CoV-2, sourcing and procuring PPE and PCR reagents, and implementing the sharing of equipment with other stakeholders towards NI testing efforts.

Key part of the WWIEM Business Recovery Group once in lockdown, their contribution was instrumental in securing that WWIEM was the first unit at Queen's to re-open for research in early June. They delivered on site training, detailed guidance for the use of equipment and protocols to work under social distancing rules, making WWIEM a safe environment to work.

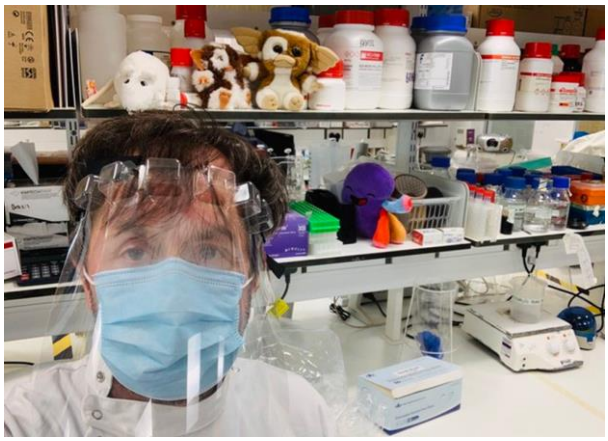
Clerical team

The clerical team, under Zoe Hunter's direction, has provided an excellent service to facilitate the continuity of the Institute's operations during this year, playing an important role in the Institute's response to the COVID-19 pandemic, and also in preparations for Brexit. They have provided uninterrupted support to colleagues in the Institute and elsewhere eg, ensuring that orders were put through to allow the labs to resume activity quickly once the initial lockdown was lifted and currently, working to ensure that groups are able to make preparations to minimise any disruption associated with Brexit.

Their assistance in moving the Institute's seminar programme to a virtual platform; as well as with switching the face-to-face PGR processes for 120+ PhD students to an online event, and their support to 20+ remote viva's, arranging remote interviews for potential PhD students, leading to successful recruitment to both our PhD and Masters programmes for students starting in October 2020, are examples of their remarkable contribution to the Institute's life.

The team's flexibility and agile approach to the significant challenges which we have faced this year has allowed the Institute to carry on our vital research work. Their commitment to our research groups and their ability to quickly adjust to new ways of working, during a very stressful period clearly state the quality of their work.

COVID-19 WWIEM's RESPONSE



Central to the return to work was WWIEM Recovery Group. Together with representatives of the SMT, Estates and Health and Safety, the SMDBS Gender Equality Committee representative and the staff representative took part in the group discussions. Here they share their experience in the process.

COVID-19 Recovery Group WWIEM – gender equality perspective – Dr Yvonne Dombrowski

From the onset, the WWIEM Recovery Group invited the Institute's SMDBS Gender Equality Committee (GEC) representative, Dr Yvonne Dombrowski, on board who led discussions from a gender equality perspective on the impact of the pandemic and changing working conditions on gender equality. As the GEC representative Dr Dombrowski also linked discussions and initiatives around gender equality during the pandemic on School level to the Institute and vice versa, for instance as part of the general WWIEM and the School-wide gender equality surveys.

Key equality objective of the WWIEM Recovery Group was to recognise individual circumstances for each staff and student that might impact on their mode of working during the pandemic. As part of this key priority, the central action of the Recovery group was flexibility to accommodate individual and changing circumstances, open communication channels, and support of line managers within WWIEM to help address their staff/students' individual circumstances and accommodate a suitable working environment for each person. Examples of this priority are reflected in the implementation of shift patterns upon re-opening of the institute, to accommodate for preferences of individuals and the flexibility in which WWIEM enabled changes when personal circumstances changed, e.g. due to childcare availability.

COVID-19 Recovery Group WWIEM –staff representative experience – Dr Peter Barabas

As representative of the staff, my role was to provide a voice for employees. The aim was to create an environment that is safe and sustainable, with built-in mechanisms to adjust and correct protocols, but also one that would need little adjustment – to avoid subjecting staff to continuously changing rules. The COVID-19 Recovery Group understood, that we needed simple and robust enough guidelines that could be learnt fast, adhered to relatively easily and even if there was a breach, they should still offer enough protection to stop Sars-Cov-2 transmission.

I thought that our plans ticked all these boxes, a testament to the knowledge and talent of the people in the Recovery Group, with research, clerical and technical backgrounds working together in a smooth and efficient way. Implementation was heavily reliant on the technical and clerical teams to estimate safe occupancy levels, distances, obtain and distribute supplies and provide the additional training, just to name a few on a long laundry list of tasks on their plate. We set up parallel communication pathways between the Recovery Group and staff: emails to the Group members were encouraged, a Workplace group specifically for this purpose was created, and several meetings with PIs and all-staff on Teams were arranged. After most staff returned, we circulated a questionnaire and I invited people to talk to me either personally, via Teams meetings and emails to voice their fears, problems and ideas. The Recovery Group itself met weekly and then monthly to discuss feedback and outcomes as well as any requested or planned changes to the policies – with the minutes of the meetings made available for all PIs to read.

Trying to find the best compromise between keeping ourselves safe and get our job done is difficult journey. So far, we - all of us! - have been doing a fantastic job, as not a single transmission has occurred in the building! I do cherish the very small part I played in this and truly thankful for the opportunity to do my bit. We need to talk to each other and hopefully, this time next year we will be talking about Christmas celebrations.

WWIEM Seminar series 2020

The Wellcome-Wolfson Institute for Experimental Medicine hosts research seminars from a range of renowned international speakers. Our Seminars are usually held on Tuesdays at 1pm -before, in the Basement Seminar Room; during lockdown they continued virtually. Details of the external speakers for the last six months an be found below. Our seminars are open to all QUB staff and students and to members of the general public.

June

- Dr Inga Weßels, University Hospital RWTH Aachen, "Zinc in inflammatory diseases"
- Dr Cecilia O'Kane and Dr Jon Silversides, WWIEM, "Clinical trials for COVID-19"
- Professor Jose Bengoechea, WWIEM, "Decoding Klebsiella pneumoniae infection biology, and opportunities for new therapeutics"
- Professor Christine Curcio, University of Alabama at Birmingham, “Signal sources for autofluorescence imaging of retinal pigment epithelium in age-related macular degeneration”
- Professor Tim Corson, Indiana University School of Medicine, “Ocular Neovascularization: New Mechanisms, Targets, and Treatments”

July

- Professor Ultan Power, WWIEM, "SARS-CoV-2/COVID-19 - a virologist’s perspective"

September

- Assistant Professor Jennifer Brazil, University of Michigan, 'Role of glycosylation in regulating neutrophil-epithelial interactions and neutrophil function in the gut'
- Dr Paul Kasher, University of Manchester, "When blood hits brain: Using zebrafish for haemorrhagic stroke research

October

- Professor Dr Urs Greber, University of Zurich, “Cell Biology of Virus Infection - Uncoating, Import & Persistence of Viral DNA in the Nucleus”
- Dr Brownen Connolly, WWIEM, “Critical care physiotherapy – respiratory, rehabilitation, recovery, and resilience”
- Professor Olivier Guenat, University of Bern, “Organs-on-Chip as Preclinical Models, with a Focus on the Lung Parenchyma”
- Dr Beata Wojciak-Stothard, Imperial College London, “Endothelial microRNAs and pulmonary arterial hypertension”

November

- Professor Susan Brain, King's College London, "Elucidating neurovascular regulatory mechanisms“
- Professor Gianni Virgili, CPH “Systematic reviews of animal studies: a review on statins for lowering cholesterol”
- Dr Luiz Carvalho, The Francis Crick Institute, "Orphan enzymes and uncharted metabolic pathways in Mycobacterium tuberculosis“
- Professor Gill Elliott, University of Surrey, “Unravelling the molecular mechanism of herpes simplex virus transmission in human epithelia”

December

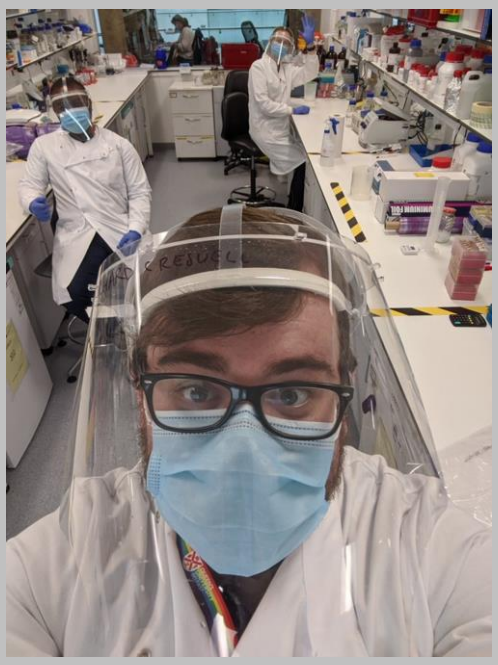
- Dr Lindsay J Hall, Quadram Institute, ‘Exploring early life microbiota dynamics’
- Professor Christoph Scheiermann, Ludwig-Maximilians-Universität München, “Circadian regulation of adaptive immunity”
- Dr Jorge Bernardino de la Serna, Imperial College London, “Membrane Lipids as Functional Adaptive Sensors at the Respiratory Immunological Barriers”

WWIEM
Postdoctoral Development Committee

The PCDC committee have had a successful year, continuing to contribute to the enrichment of postdoctoral employment in WWIEM and providing worthwhile career and community development events.

Career Insight Seminars: This new initiative began in mid-2020 to support career development of our postdocs. Seminars are held on the last Friday of each month. These online seminars host two speakers in each session, one from academia and one from industry, explaining their career track and engaging in conversation with postdocs and other participants. Inspired by the success and impact of PCDC career seminars, it has now been made a faculty-wide event and these are now being broadcasted across the faculty and we are starting to have speakers and audience from across MHLS.

Annual Symposium: WWIEM's first-ever virtual Postdoc Research Symposium will be held over an afternoon and a morning on 28th and 29th January 2021 online. We'll have top quality external speakers as well as poster and oral presentations from postdocs. All postdocs have been asked to submit their abstracts and this postdoc symposium is mandatory to attend! There will awards for postdocs sponsored by companies.



The Buddy Scheme: this continues to be one of our most impactful ongoing activities, welcoming new postdoctoral staff to the WWIEM. Since July 2020, despite the pandemic, the WWIEM PCDC has welcomed 6 postdocs with the buddy scheme. The feedback from the postdoc buddies showed that they felt helpful, it was an interesting/enriching experience and provided a networking opportunity.

The Coffee mornings have been ongoing despite the pandemic and turned into Virtual coffee mornings are now being held on teams once a month.

ThinkPeople hosted a virtual workshop on Leadership & Communication over Teams on the 4th and 5th June. 24 postdocs attended.

WWIEM PhD Vivas

During the year, more than 20 students presented their viva, either live, or virtually from March onwards.

Date	Student	Primary Supervisor
January 2020	Lajos Cscink	Imre Lengyel
	Ewan Patterson	Imre Lengyel
	Xuan Du	Heping Xu
February 2020	George Eleftheriadis	Denise Fitzgerald
	Rachael Bell	Yvonne Dombrowski
	Hayley McMillan	Ikhlas El-Karim
March 2020	Ciara Ross	Jose Bengoechea
	Karis Little	Heping Xu
	Meiadd Khayat	Noemi Lois
	Ellie Gill	David Grieve
	Luke Barry	Liam Heaney
May 2020	Marina Afami	Fionnuala Lundy
	Tom Waterfield	Mike Shields
	Pietro Bertelli	Reinhold Medina
June 2020	Rejina Verghis	Bronagh Blackwood
July 2020	Kevin Harkin	Mei Chen
August 2020	Stuart Mc Keown	Alan Stitt
	Louise Dutton	Derek Brazil
September	Michael McKelvey	Cliff Taggart
October 2020	Ryan Wong	David Simpson
November 2020	Mark Watson	Tim Curtis

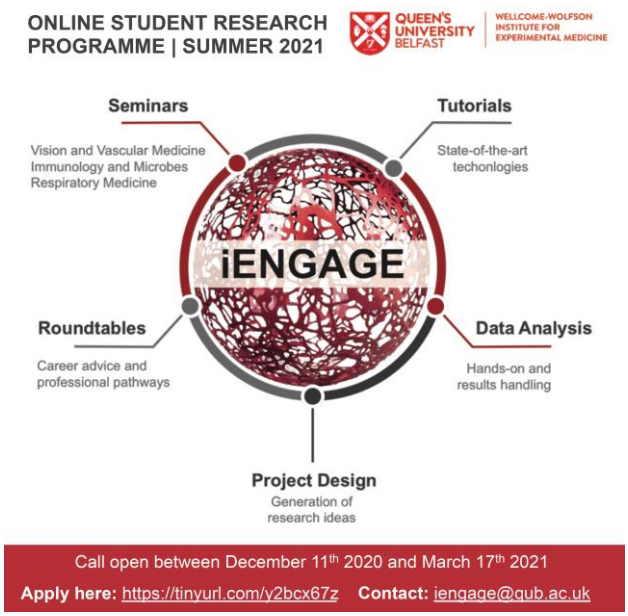
WWIEM Summer Student Programme

iENGAGE – NEW ONLINE SUMMER STUDENT PROGRAMME

The WWIEM summer student programme for 2021, **iENGAGE** will be delivered online for the first time. Including seminars, roundtables, tutorials and project design modules, the programme will run as a virtual programme for 6 weeks during summer 2021. **iENGAGE** facilitates the access of students from under-represented groups; those from lower income families, people with disabilities and ethnic minorities as well as students from low and middle income countries.
Worldwide applications are welcome

iENGAGE Summer Student Programme

Every year, the Institute runs an annual Summer Student Programme for undergraduates who would like to experience a research environment. The programme, supported by the School of Medicine, Dentistry and Biomedical Sciences, provides students with the opportunity to achieve hands-on research experience during the summer months. With the aim of training the next generation of scientists, this programme supports our goals of sharing our research whilst inspiring scientists of the future.
We have designed **iENGAGE** to expand the reach of our widening participation efforts to as many students as possible, and to facilitate the access to our Summer Student Programme to students from low and middle income countries, for the summer of 2021.



Through our Programme, students typically work as part of an enthusiastic research team who are working at the forefront of their fields and get a realistic experience of day-to-day life in a lab. Students also attend a number of career and research events and are encouraged to take part in the Institute's life, joining researchers for discussions and seminars. At the end of the Programme, students present their work in a short talk at our Annual Summer Student Research Symposium.

This new online summer student research programme will:

- Provide remote interactions with WWIEM researchers, designed to develop scientific skills
- Offer high-level insight and experience into world-class research
- Deliver remote technical training in a range of cutting-edge experimental techniques
- Expand summer educational activities to worldwide participation

The programme will be delivered via Microsoft Teams over a period of 6 weeks in the summer of 2021 (28th June - 6th August).
Queen's University students who complete iENGAGE will be eligible for Degree Plus accreditation.

For further details visit:
https://www.qub.ac.uk/research-centres/wwiem/EducationandTraining/iENGAGE/

Outreach

WWIEM at the Northern Ireland Science Festival 2021 – Virtual edition

NI Science Festival is taking place 15-28 February 2021 and WWIEM will contribute to this event, as have been doing in the past years. Organized as a virtual Festival of Science in 2021, WWIEM contribution will focus on the Institute's ongoing COVID-19 research activities, and expertise.
Our central event will be a live, streamed session, covering:

- Background to SARS-CoV-2, and present on their current research
- COG-UK (Sequencing of SARS- CoV2 for lineage tracing, Analysis of outbreaks, mutation detection
- SARS-CoV-2 seroprevalence in children
- RECOVERY Trial
- Novavax vaccine trial in NI and contributions to the trial effort

Barcroft medal 2021 - Professor Sarah Gilbert

Professor Sarah Gilbert is the recipient of the 2021 Barcroft Medal.
Professor Gilbert is Said Professor of Vaccinology, Jenne Insitute and Nuffield Deparment of Clinical Medicine at Oxford Unbiversity.
She has been making and testing vaccines designed to induce T cell responses for over ten years, chiefly using antigens from malaria and influenza. Several of the vaccines developed in her laboratory have progressed into clinical trials.
Professor Gilbert is the lead professor behind the Oxford-AstraZeneca COVID-19 vaccine.
She will receive the 2021 Barcroft Medal on March 10th 2021.

Research

Grants and awards

David Courtney, ERC Starting Grant

"Post-transcriptional regulation of *influenza A* virus RNA".

David Courtney was awarded in September an ERC Starting Grant to develop his project "Post-transcriptional regulation of *influenza A* virus RNA".

One of the most prestigious and competitive grant schemes in the world for basic research, ERC Starting Grants aim to help early-career scientists and scholars to build their own teams and conduct pioneering research across all disciplines. The grant, part of the EU's Research and Innovation programme Horizon 2020, will support the development of David's independent laboratory, with an award of over €1.5 Million for 5 years

BBSRC
COVID-19: role of co-infections, and drug repurposing for treatment
PI: **Jose Bengoechea**
Co-I: **Guillermo Lopez-Campos, Ultan Power, Adrien Kissenpfenning, David Simpson, Connor Bamford**
Funded value: £485,793

Clinical studies have reported co-infections in at least 20% of COVID-19 patients. This figure is likely underestimated because ICU mechanical ventilation results in up to 75% of patients developing nosocomial pneumonia. Moreover, pathological analysis of post-mortem biopsies of lung from patients who died of severe COVID-19 revealed histopathologic findings consistent with superimposed bacterial pneumonia in some patients. Alarmingly, this occurs in a scenario of a limited arsenal of antibiotics to target these infections. Nothing is known on the effect of co-infections in SARS-CoV-2-induced pathophysiology. It is also unknown whether SARS-CoV-2 infection may affect the pathophysiology of nosocomial infections. Addressing this knowledge gap is critical if we are to develop therapeutics; otherwise, treatments may tip the balance from one infection to the other. This happens in a scenario of a limited arsenal of antibiotics to target nosocomial infections. We will investigate the interface between SARS-CoV-2 and bacterial infections (*Klebsiella pneumoniae, Pseudomonas aeruginosa, Acinetobacter baumannii and Staphylococcus aureus*) by exploiting relevant translational research models: well-differentiated primary human airway epithelial cell cultures (WD-PAECs), excellent surrogates of human airway epithelium in vivo, and PBMCs, reflecting the complexity of the human immune system. Single-cell RNA seq and multiplexed single-cell mass cytometry (CyTOF) will reveal cell-type specific immune pathways associated with the infections. These responses might be suitable for therapeutic manipulation. Cytopathogenesis, viral and bacterial replication in co-infection, and cytokines/chemokines will be additional read-outs. The effect of SARS-CoV-2 and bacteria on each other's virulence will be analysed by determining the transcriptome of exposed bacteria, and investigating viral and bacterial infection parameters upon infection of WD-PAECs and PMBCs. We will screen a panel of FDA-approved drugs affecting host-pathogen interactions to identify drugs against SARS-CoV-2 in the co-infection interface. These drugs shall be considered as new therapeutics entering clinical trials.

Research

Grants and awards

MRC

The Role of the Extracellular Immunoproteasome in Acute Respiratory Distress Syndrome

PI: **Cliff Taggart**

Co-I: Masao Takata, **Sinead Weldon, Cecilia O Kane, Danny McAuley**, Brian Walker

Funded value: £462,666

During an infection the body normally responds by mounting an immune response. This generally involves the recruitment of white blood cells that play a role in removing the invading organism. In some cases of disease, excess numbers of cells arrive in significant numbers to the lung, and other organ sites, not as result of infection but, as a result of a poorly-defined inflammatory process. When they arrive at the lung these cells become involved in causing damage to the lung tissue. We have uncovered a recently described protein, the Extracellular Immunoproteasome, which may play role in bringing, or attracting, damaging levels of these inflammatory cells to the lung. In addition, we propose that the Extracellular Immunoproteasome in the lung may bring these inflammatory cells to the lung by activating another group of proteins, called protease activated receptors (PARs), in the lung. We will confirm our proposal by using a combination of models to confirm a role for Extracellular Immunoproteasome in inflammatory cell recruitment. The very clear application of this study is in the targeting of Extracellular Immunoproteasome to regulate lung damage and lung injury in disease, although there is a potential role for this Extracellular Immunoproteasome - mediated pathway in other disease processes including inflammatory disorders. To this end, we have a developed a very specific inhibitor of the Extracellular Immunoproteasome which is much more specific for the immunoproteasome than other therapeutic proteasome inhibitors. Future studies looking at the clinical evaluation of Extracellular Immunoproteasome inhibitors in lung disease is a very real possibility as we are set-up to carry out such studies in Queen's Belfast as part of the UK Respiratory Translational Research Partnership.

EPSRC

VIPIRS - Virus Identification via Portable InfraRed Spectroscopy

PI: H Wang

Co-I: **Ultan Power,** Hugh J Byrne, Paul Maguire, James Andrew McLaughlin

Funded value: ££410,729

Spectroscopic techniques such as infra-red, Raman, and mass spectrometry have long been used to identify chemical compounds and biological species, including bacteria and viruses, usually in specialised lab conditions with high performance instrumentation. Virus identification in realistic clinical/field environments, using low cost instrumentation, is appealing, as it can be widely deployed and so is very suitable for diagnosis, prevention and management in pandemics such as COVID-19. However, low cost instrumentation produces poorly-resolved spectra with added noise. Our recent work has investigated machine learning algorithms applied to spectra from low cost near infra-red (NIR) spectrometers to extract identifiable patterns from targets with complex backgrounds and limited experimental control/processing.

Our latest study shows that it is possible to use the technique to accurately differentiate respiratory syncytial virus and Sendai virus in different media, and quantify their viral loads.

We aim to develop a spectrometer-fronted, cloud-based system for in-situ SARS-CoV-2 detection with three deliveries. The system will record spectra from patient nasal samples in the field and return a positive/negative diagnosis within ~ 1 minute, based on model-driven analytics running on a cloud-based service. The detection model will be developed, trained and validated using spectra from the SARS-CoV-2 virus in (a) lysis buffer and (b) nasal aspirate simulant; the model will then be used to determine whether the virus is present in the sample using a 'subsumption' operation in the learning algorithm. The system will be validated in real environments in collaboration with our partners in Northern Ireland Regional Virology Lab (RVL).

EPSRC Light-activated, disposable antiviral and antimicrobial plastic films for PPE and other applications
PI: Andrew Mills
Co-I: **Connor Banford,** Brendan Gilmore
Funded value: £297,764

Dyes and semiconductor photocatalysts are able to generate a myriad of reactive oxygen species which destroy viruses and bacteria. However, never before has this technology been harnessed to make inexpensive, disposable anti-virial and anti-microbial plastic films before and this is the primary aim of this research proposal. At present in hospitals and care homes thin plastic disposable films are common in PPE (e.g. gowns and aprons) and curtains and coverings for bedside cupboards and tables; but these films do not have any antiviral or antimicrobial activity, despite the fact that this feature is desperately needed as many viruses and bacteria are able to survive on plastic surfaces for several days (for COVID-19: it is 3 days!); this project addresses this need. The key work packages involve:

(i) Extrusion of thin, flexible antiviral/antibacterial plastic films containing either a visible light absorbing photocatalyst or dye; with different dyes and photocatalysts to be tested to produce an optimised product.
(ii) Testing of plastic films for antiviral activity and feedback to film production - so that an optimised product can be generated
(iii) Testing of plastic films for antiviral activity and feedback to film production - so that an optimised product can be generated
(iv) Engagement with commercial providers of healthcare PPE and related products, such as Clonallon Ltd. a collaborator, in order to identify the best route to market.
Potential: As the materials to be used are inexpensive, the method of production of the thin plastic films easily scaled, the likely impact is immeasurable.

US/Ireland DfE
Developing the Next Generation of Cardiac Organoid Systems
NI PI: Andriana Margariti
US centre: CELL-MET (Boston University) - Rep of Ireland centre: CÚRAM (National University of Ireland, Galway)
Funded value: £300,000

The Cardiac Organoid Systems Partnership (COSP), is a collaboration between the NSF Engineering Research Center (ERC) for Cellular Metamaterials (CELL-MET), the SFI Research Center for Medical Devices (CÚRAM), and the Wellcome-Wolfson Institute for Experimental Medicine (WWIEM). The goal of this US Ireland tripartite Center-to-Center (C2C) collaboration is to exploit our combined expertise in cardiac tissue engineering, laser metal interactions, and stem cell programming to develop high throughput, nanoscale metallic patterning on structures that enable functional cardio biosystems. The novelty and impact of COSP lies in the use of advanced metallization techniques to facilitate the unctionalisation of the scaffold material.

The use of laser micromachining technologies enables the scale-up fabrication (cm2–>m2) of scaffold constructs for metrology, sensing and pacing. Direct Laser Writing (DLW), of the kind being pioneered at CELL-MET, currently allows for the high speed writing of complex tissue engineered mechanical scaffolds with nanoscale features. This collaboration will develop its complement, an all-laser metallization scheme for cellular focal attachment points and imbedded wiring. Together, these features will allow for high speed, all-laser fabrication of tissue scaffolds.

Connor Bamford is Co-I in the following **SFI/DfE** COVID-19 related projects:

- DELAY-COVID: Dysregulated innatE immunity in Liver disease Amplifies the severitY of COVID-19
  PI: Dr Mark Robinson
- An integrated system for all-island SARS-CoV-2 wastewater surveillance and reporting
  PI: Prof. John McGrath
- Investigation of the mechanisms of COVID-19 associated neurological disease
  PI: Dr. Nicola Fletcher

Horizon 2020 EU
RECOGNISED project (Retinal and cognitive dysfunction in type 2 diabetes: unravelling the common pathways and identification of patients at risk of dementia
PI: Rafael Simo
Co-I: Noemi Lois, Alan Stitt
Funded value: € 5,998,272.50 (QUB: € 763,001.25)

RECOGNISED will explore the biological pathways that may link the alterations observed in the retina with those present in the brain in people with type 2 diabetes (T2D).
The four-year long RECOGNISED project will study the biological mechanisms that cause structural and functional alterations in the retina in people with type 2 diabetes, to determine whether these same pathways play a role in the events observed in the brain during the development of cognitive impairment and dementia. Importantly, RECOGNISED will reveal whether evaluating the retina, easily accessible with current non-invasive technologies, could help in identifying earlier cognitive impairment in people with T2D, so that appropriate support can be given. RECOGNISED will also analyse previously-collected data and samples from registries, cohorts and biobanks. By gaining knowledge on the mechanisms of disease, RECOGNISED will help to identify new potential therapeutic interventions.
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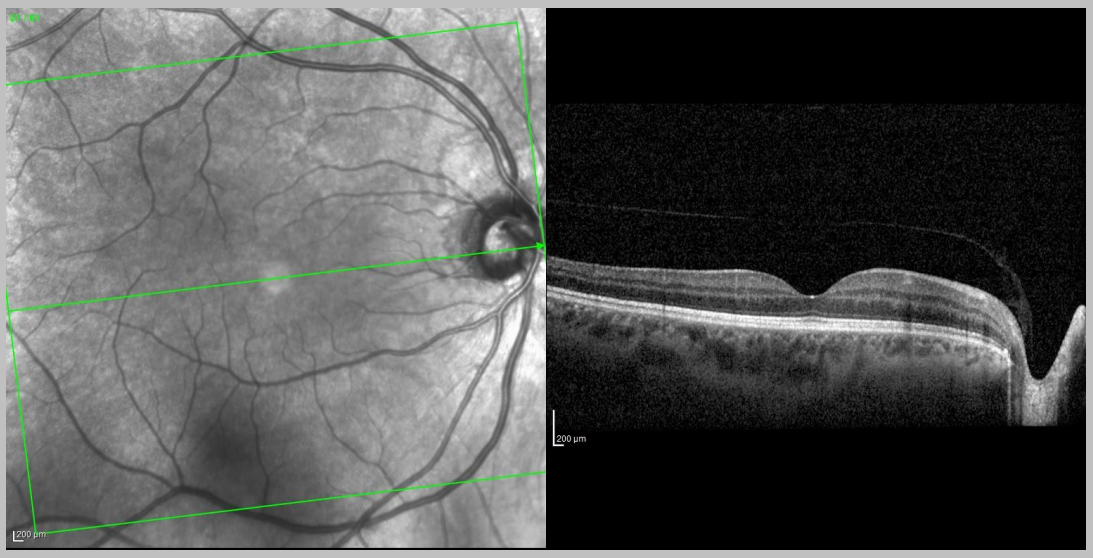
RECOGNISED brings together 21 partners from nine different countries, including academic institutions, small and medium enterprises (SMEs), the European infrastructure for translational medicine (EATRIS) and patient organisations, with complementary knowledge and expertise. RECOGNISED will receive almost €6 million in funding from the EU Horizon 2020 towards this programme with the final goal of improving the quality of life of people living with diabetes. In RECOGNISED, basic scientists and clinicians with extensive expertise in diabetes, ophthalmology and neurology will use state-or-the-art technologies to undertake the experimental and clinical studies that form part of this ambitious project.



It's been a tough year for students, but pupils at Wallace High Lisburn are doing amazing things for research at Queen's. Pupils have raised £2,150 for Cystic Fibrosis research!

Principle Deborah O'Hare, Dr Damian Downey, Heather Gracey, Geoffrey Cherry

Help support the pursuit of world-class education and life-changing research

If you would like to donate to any of the research programmes within WWIEM, please contact **Sarah-Jayne Cassells**, Development Manager (Health), Queen's University Belfast; Tel: (+44) 028 9097 5073; Email: S.Cassells@qub.ac.uk. Alternatively, go to

Queen's Foundation - Donate Now @ https://daro.qub.ac.uk/DonateNow.

Within the donation form, you can specify how you would like your gift to be used.

Queen's Foundation have launched a new online fundraising guide for people who would like to raise money directly for WWIEM. The simple guide provides helpful tips on planning and promoting a fundraising event, using JustGiving and it includes poster / flyer templates and a sponsorship form. Check it out online at @ **https://daro.qub.ac.uk/file/QUB_fundraising_Guide.pdf** or contact Sarah-Jayne Cassells for more information**.**