SBRC - Nottingham Newsletter Issue 9

May 2020

Research News

by Alan Burbidge

Notification from BBSRC in February 2020 that the SBRC-Nottingham had been successful in its application for a fully-costed extension was received with a great deal of gratitude. It means that the critical mass of expert research staff is retained until at least spring 2021. It also clearly demonstrates that synthetic biology is seen by the funders as a really important research activity that has the promise to make key contributions to science over the coming years.

However, hard on the heels of that good news was the emergence of Covid-19 which is causing us all concern. The lock-down means that the labs are silent, but it also means that attention has turned to focus fully

on turning research results into journal publications. So whilst lab activity has paused, essential research work is ongoing.

To support the work of the SBRC grant bids have been submitted. New funding has been secured from BBSRC's Follow-on-Fund scheme award to support a programme of work to develop systems to tightly control and regulate bacterial sporulation. An additional £37k of funding has been secured from BBSRC's Flexible Talent Mobility Award II. This funding is to enable international scientists to spend time in biotechnology labs at Nottingham. Once the lock-down is over, we hope to be able to welcome a number of visiting scientists to the SBRC. If you are or know of early career post-doctoral researchers in academia or industry who would benefit from experiencing a biotechnology research environment at the University of Nottingham, please let us know. The FTMA application form is available at: https://sbrc-nottingham.ac.uk/industry/working-with-us/ftma2.aspx

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SBRC-Nottingham iGEM team 2020

It has been a testing time for all of us and although uncertainty clouded our plans, our current understanding is that the iGEM competition WILL go ahead, though maybe with a slightly different format. Despite difficulties in recruiting during lock-down, we are proud to announce our team for iGEM 2020. From a staggering 31 applicants and two days of interviews, the iGEM supervisors under the leadership of Andrew Dempster assembled a highly talented, multidisciplinary team of eight, who will hopefully maintain our now GOLD medal tradition! (No pressure LOL).

MEET THE TEAM

LUKE BARKS

"My name is Luke and I am a second year mathematics student here at Nottingham. During a usual week, I find myself spending my spare time exercising and playing various computer games. Besides this, I enjoy taking

photographs and researching new technological and computing concepts. By taking part in this year's IGEM competition, I hope to be able to explore new concepts outside my area of speciality, and work on meaningfully and impactful projects within the team. I also wish to acquire new skills and develop existing ones - potentially making use of my knowledge around videography and computing to assist with modelling and outreach work. There are so many pathways for graduates to take after completing their degrees, and by partaking in this year's IGEM project, I hope the choice I will make in about a year will become clearer."

SAACHI BHALLA

"My name is Saachi Bhalla. I am a first-year Biotechnology student and this year I have gotten the prestigious opportunity of being part of team UoN for iGEM 2020. I am a confident and driven individual, with an insatiable appetite for learning, which hence led to the deep-seated connection I have with synthetic biology. Additionally, I have always aimed to give my best in every endeavour I embark on. Over the years, I have also showcased strong leadership skills, holding numerous key positions and delivering constant results in the teams, initiatives and organisations that I have been a part of."

JAMES BIRCH

"I'm James, a second year Biotechnology student. My passion for science comes from its application in the real world and its potential to improve lives. I chose to study Biotechnology as it has a strong focus on the practical applications of biology and is currently the centre of a lot of innovation - Biotechnology is changing the world and I want to be a part of that. I've been eager to start making a difference for a long time and iGEM is providing me with the opportunity to start making an impact. I'm most looking forward to hopefully working in the labs over the summer and to build research skills that I hope will help me to go onto study for a masters and PhD. I'm honoured to be a part of the team and am excited to start."

KIERAN BIRD

"I am a second year Biochemistry and Biological Chemistry student, half Brazilian and enjoy playing in the uni's

american football team. Self proclaimed legend at salsa making, samba dancing and cachaça critique."

ALISTAIR CADOO

"Hello! My name's Alistair and I'm in my second year at Nottingham studying the one and only Biotechnology - on Sutton Bonington.I love sports - tennis, cricket and rugby are how I spend most of my time playing or watching. Outside of this and eating, I sometimes find time for my degree. I actually love biotechnology because it is so versatile and ranges across many subjects from medicine and pharmacology to biochemistry and microbiology. It is a fascinating area of research and development and especially current to a certain virus going around at the moment. As the biotech sector becomes only more important in the future, I am setting my sights on working in labs carrying out creative research. iGEM is the perfect opportunity to build the foundations for this - playing a role within a multi-disciplinary team tasked with creating a project with applications in the real world."

ALY SADOWSKA

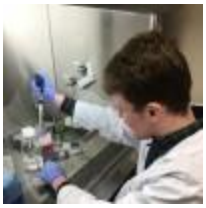
"I’m a 2nd year Maths student, particularly interested in the fields of Mathematical Biology and Number Theory. Outside of my degree, I like to keep my life busy, I love being around people and interacting with animals, especially my two cats. I try to keep active doing yoga, going ice skating or hiking. I have a passion for true crime shows and documentaries picturing different realities of people from around the globe. I hope that being a part of the iGEM team will help me gain experience in research and applying my mathematical skills to solve real-world problems. That should ultimately help me on my MathBio career path after university and in the meantime, I am sure we are all going to have a wonderful time working together.""

EUGENIA VUONG

"Hi, my name is Eugenia Vuong and I'm currently in my second year studying Bsc Biology. I'm an enthusiastic scientist that has had experience working in laboratories as well as field work in Krka national park, Croatia. During my time in Croatia I was a research assistant collecting data which included survey methods for freshwater fish, butterflies and bats such as pollard, acoustic and transect surveys. Other than scientific research, I enjoy being

active and so in my free time I love going on runs as well as practicing Muay Thai! What I hope to get from iGEM is the opportunity to work on an issue that will potentially impact a lot of people. I'm also excited by the prospects of working in state-of-the-art facilities and learning new laboratory techniques and skills. More importantly, I'm excited to work as a team with people from different scientific backgrounds bringing unique ideas to the table."

LUKE WIER



"I am currently in my second year studying genetics at the University of Nottingham. This past year I have taken various courses which have provided me with a greater insight into the world of scientific research. In a cell biology lab, I was able to work with NRK cells in various experiments such as cell staining, imaging and obtaining a growth curve. I found this to be fascinating and I hope that taking part in the iGEM program will also provide a great environment where I can learn and implement new techniques. A common theme in my classes last year was the ability to create your own experiment from the information provided by the lecturer to test certain hypotheses. I always enjoyed this. The iGEM experience allows me to take a project from idea to completion in a group setting which will be an invaluable experience."

Huge thanks to our team of supervisors, without whom iGEM Nottingham would not happen.

Supervisors 2020:

Andrew Dempster, Patrick Ingle, Raquel Rodrigues, Thomas Millat, Alex Rawson, Louise Dynes and Jacque Minton

iGEM website https://igem.org/

Responsible Research and Innovation Update

by Eleanor Hadley Kershaw

Eleanor (Interdisciplinary Responsible Research and Innovation Group) has presented SBRC social science work at several conferences and workshops. The inaugural University of Nottingham *Responsible Research and Innovation (RRI) Conference* took place in October 2019, bringing together more than 200 participants ranging from research students at the newly funded EPSRC Centres for Doctoral Training to senior University management. Eleanor delivered a plenary presentation during the closing panel on “Doing RRI”, alongside

From left to right:- Professor Richard Jones, Professor Sir Martyn Poliakoff
Dr Eleanor Hadley Kershaw and Dr Alison Mohr

Professor Sir Martyn Poliakoff (Nottingham) and Professor Richard Jones (Sheffield) , at Wageningen University and Research in November 2019 and online in April 2020. Topics of discussion included capacity for RRI within industry, the challenges faced by non-governmental and civil society organisations in engaging with Horizon 2020 funded projects, differences in take up of RRI across H2020 programmes, and opportunities for RRI in Horizon Europe (the next research and innovation framework programme of the European Commission).New HoRRIzon Consortium were hosted by the on RRI in the H2020 'Leadership in enabling and industrial technologies' programmeSocial Lab Workshops rd and 3nd2 was hosted by TU Delft in October 2019, and the Exploring Values in Technologies Across Methods and DisciplinesThree workshops have provided the chance to exchange knowledge on RRI with colleagues across Europe.

Dr Eleanor Hadley Kershaw at the ew HoRRIzons Workshop
in Wageningen, The Netherlands

Internally, RRI was on the agenda at the University of Nottingham Research Excellence Framework (REF) Environment Workshop on Research Ethics & Integrity in November 2019, where Eleanor presented an introduction to RRI and facilitated discussion on RRI activities at Nottingham during the REF assessment period.
Also in November 2019, the Science and Technology Studies 4 Cities Consortium Mobile Seminar: More-than-human? Ecology, Society and Interspecies Worlds was hosted by the University of Nottingham's Institute for Science and Society. Eleanor and co-authors from Keele, Leeds and Nottingham presented their paper 'Abundance in the Anthropocene'.

My Research Project

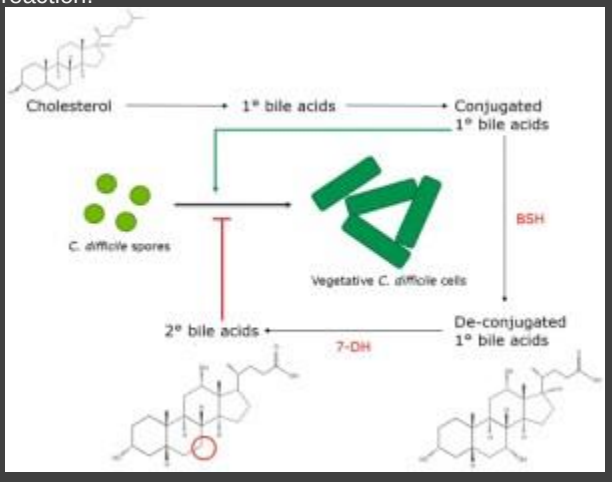
Bacteria-Host Interactions through Bile Acid Transforming Bacteria

by Patrick Ingle

The anaerobic, endospore-forming bacterium *Clostridioides difficile* is the leading cause of nosocomial antibiotic-associated diarrhoea and places a significant burden on healthcare providers. Symptoms of *C. difficile* infection (CDI) range from non-symptomatic colonisation to mild, self-limited diarrhoea to severe pseudomembranous colitis and toxic megacolon. CDI transmission occurs via inadvertent ingestion of *C. difficile* spores which are highly resilient and capable of withstanding exposure to oxygen and a wide range of chemical and physical agents. Disease progression is entirely dependent on the germination of these persistent endospores, which generates the vegetative cells capable of producing toxins A and B, the main virulence factors of *C. difficile* associated disease (CDAD).

Only recently have we begun to elucidate the mechanisms of *C. difficile* spore germination and the importance of bile salts in regulating this process. Bile salts are synthesised from cholesterol in the liver and secreted in bile into the small intestine via the gall bladder. In the small intestine, these conjugated primary (1°) bile salts act as detergents to facilitate the solubilisation and subsequent absorption of dietary lipids and lipid-soluble vitamins. During transit through the small intestine, conjugated 1° bile salts can be deconjugated by a wide range of microorganisms possessing bile salt hydrolases (BSH). Most bile salts are then returned to the liver via enterohepatic circulation, however some escape into the large intestine, where a select few bacterial species can covert the deconjugated 1° bile salts into secondary (2°) bile salts via 7-dehydroxylation (7-DH). Whilst primary bile salts trigger *C. difficile* spore germination, secondary bile salts have been shown to inhibit germination and/or the outgrowth of these spores. Hence, a model is proposed in which broad-spectrum antibiotic treatment leads to a dysbiosis of the gut microbiota and predisposes to CDI.

This project funded by a Sinergia grant from the Swiss National Science Foundation forms a collaboration between the SBRC-Nottingham and research groups at EPFL-Lausanne and the University of Bern in Switzerland. This international, interdisciplinary collaboration brings together expertise in the fields of clostridial genetics, specialist mouse models and bile acid analysis to ascertain the precise role of bile salt transforming bacteria in CDAD and to fully elucidate the genetic components underpinning the 7-DH reaction.



Conferences and Workshops

The Carbon Recycling Network - Conference 1
10 – 12 February 2020

by Louise Dynes

With much of the northern hemisphere-battling storm Ciara, Nottingham was the hot spot for the convergence of scientific minds to further technologies into to help develop the area of Carbon Recycling.

February 10th 2020 marked the start of a 2-day conference on "Carbon Recycling". Hosted by University of Nottingham's based BBSRC-NIBB "CCnet" and organised by network manager Louise Dynes. Along with the battling storm, the event also encountered last minute changes as a result of the original venue undergoing last minute refurbishment, the event was relocated to the Park Plaza Hotel, Nottingham, UK.

Formally starting with a Welcome dinner at the Hotel, there followed 2 days packed with talks, pitches and posters. With the aim of bringing together academic and industrial scientists, the conference attracted over 110 attendees, 29 of whom came from industry. Delegates were mainly from the UK, with 27 from Europe, 3 from the USA and one from South Korea. A total of 21 talks were presented, 4 of which were invited, the rest were selected from abstracts.
The Carbon Recycling Network Director Professor Nigel Minton opened proceedings as chairman and there followed high calibre keynote presentations from: Sean Simpson (LanzaTech, USA), Arren Bar-Even (Max Planck Institute, Germany), Irini Angelidaki (Technical University of Denmark) and Klaas Hellingwerf (Photanol, Netherlands).

Amid this star cast, 5 PhD students also gained valuable oral presenting experience with Ari Satanowski (Max Planck Institute, Germany) and Fabian Schwarz (Wolfgang Goethe University Frankfurt, Germany) carrying away a certificate of excellence and a network goodie bag. A total of 36 posters were presented with 17 from PhD students. Carrying away prizes for the best posters were Amaury Montarnal (University of Nottingham, UK), Helge M. Dietrich (Wolfgang Goethe University Frankfurt, Germany) and Tatiana Spatola Rossi (Oxford Brookes University, UK).

Delegates gave decent feedback for the conference:
94% of responders said it was well organised and that the programme was extremely/very engaging and met new contacts. They appreciated the high quality and variety in the programme. They also praised the opportunities for good discussion and networking. Many new relationships were forged which we are hopeful will initiate new collaborations.

"Brilliant conference, really enjoyed our time in Nottingham".
"Excellent speakers"
"Great line up and good spectral of topic areas relevant to CCnet interests"
"Considering the last minute changes to venue the conference was executed smoothly"

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NIBB-Director Prof Nigel Minton (3rd from left), NIBB-manager Louise Dynes (centre front) with the rest of the conference delegation at the Park Plaza Hotel, Nottingham

Newton Bhabha UK-India Industrial Waste Challenge Mid-Term Review Meeting 2 - 3 March 2020, IIT Mumbai

by Dr. Gareth Little

The UK-India Industrial Waste Challenge is a partnership between UK Research and Innovation (UKRI) and Department of Biotechnology, Government of India (DBT). This is a joint UK-India investment of £10 million, funding projects aiming to reduce industrial waste and pollution in India from the sugar cane, paper and pulp and municipal solid waste sectors.

There are 526 sugar mills operating in India, which crush more than 200 million tons of sugarcane annually. The vWa consortium is developing a bio-refinery platform for valorising waste from sugar cane and associated industries in India. These industries produce large amounts of waste biomass: 80 million tons (MT) of bagasse, 10 MT of press mud, 25 MT of cane waste and 45 billion litres of distillery spent wash and bagasse pith.

On arrival in sunny Mumbai, we took a 4-hour tourist trip by taxi to see the bustling city, with its extreme traffic and crowded streets. The mid-term meeting began later that evening with an outdoor meal and drinks reception, enabling the academic and industrial partners to meet. The following two days consisted of each project reporting on progress, along with discussion. This was enlightening due to several groups working on projects utilising lignocellulosic hydrolysate as a source of sugars for fermentation. Different methods for pre-treatment including microwaves, cavitation and ultrafiltration are being explored, and a variety of products targeted including food additives, bulk chemicals and biogas.

Following the mid-term meeting, four of us from the vWa project went on to visit the Vasantdada Sugar Institute (VSI) at Pune, and had a tour of the Baramati Agro Ltd sugar mill at Shetphalgadhe. The sugar cane industry in India supports nearly 60 million farmers and their families. The VSI is a research and consultancy cooperative, with 146 sugar mills and 74 distilleries as members. Each farmer cultivates a small 2-5 acre crop of sugarcane, and the sugar mill harvests the cane and takes it to the mill for processing.

The cane is shredded and crushed with a fibrizer and rollers to extract the juice, resulting in a mountain of bagasse waste. The juice is purified and crystallised by boiling, plus the addition of lime and sulphites, which creates a press-mud waste. The sugar mill generates 22MW of electricity from burning some of these wastes in a large boiler, of which approximately 7MW is used to power the mill. The molasses left after boiling the sugarcane juice are fermented and distilled to produce ethanol, with 50% purity ethanol sold to local pharmaceutical companies. The ethanol is further concentrated using molecular sieves to >98% for sale to fuel companies for blend-in to transport fuel. After departing the sugar mill, we joined these tankers, along with many other from the various chemical and pharmaceutical industries in the region, jostling for position on the road back to Mumbai.

I would like to thank the organisers and hosts from the UK and India of the meeting at IIT Bombay; Dr. Sanjay Patil and all the others from the VSI for their hospitality while in Pune; Prof. Nigel Minton and Dr. Ying Zhang for supervision; the BBSRC for funding.

Upcoming Events

Thursday, 7 May 2020, 11:00-12:30

#IdeasMeanBusiness: The Young Innovators Awards: What is innovation?
Are you passionate about ideas? Do you like to think outside the box? Are you good at finding solutions to problems? Then this is for you! As part of our Young Innovators campaign, we will be hosting two online events to allow you to explore your full potential and connect you to support available. More information: https://ktn-uk.co.uk/events/ideasmeanbusiness-the-young-innovators-awards-what-is-innovation

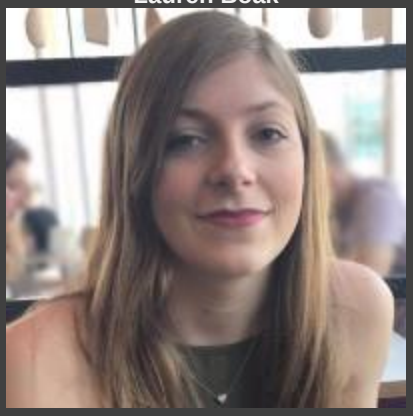
New Staff and Students

Ben Myers

"I am a doctoral student, funded by the BBSRC and based in the University of Nottingham Biodiscovery Institute. I graduated from the University of Nottingham with a 1st class BA (Hons) in Food Science,

which inspired a long- term research goal: To use nature as inspiration in developing novel ways of utilising waste streams to maximise the benefit from our planet's resources. My doctoral research is focused on bridging the gap between microbial respiratory pathways and bio- electrochemical circuitry, via the development of novel extracellular electron transfer mechanisms in industrially relevant organisms."

Lauren Boak



"I am a new BBSRC DTP PhD student under the supervision of Klaus Winzer. My project is based on solvent-producing Clostridium and quorum sensing. I previously studied microbiology for my undergraduate degree at the University of Nottingham and I am looking forward to continuing here. Some "fun" facts about me: I grew up in North Yorkshire, I enjoy hiking in the national parks, my favourite foods are lasagne and chocolate (separately), and I am currently learning how to paint."

William Morris

“I am a DTP student starting at the SBRC after finishing an MSc in Biotechnology at the University of Liverpool. My Master’s research project was investigating how a group of RuBisCO containing microcompartments called carboxysomes can have their carbon fixating activity increased when recombinantly co-expressed alongside RuBisCO activase proteins.
My PhD project has me back in my hometown of Nottingham where I will be developing genetic tools for and metabolically engineering Clostridium carboxydivorans. I look forward to getting to know you all during my time here over the next 3 years!”

Public Engagement and Outreach

Science in the Park
Wollaton Park
7 March 2020

by Jacque Minton and Ruth Cornock

March 6th-15th 2020 was British Science Week – a celebration of science, technology, engineering and maths across the UK, organised by the National British Science Association. In long standing tradition, the local branch of the BSA welcomed visitors to "Science in the Park" at Wollaton Park, on Saturday 7th March. This annual event was free to enter and allowed the whole family to enjoy interactive activities and live demonstrations from all branches of Science.

In past year's about 7000 have attended the event, though numbers were down, due to the beginning of the Corona virus crisis, it is estimated that 300 parents and children visited the SBRC/CCnet stand to learn that not all bacteria are bad, and some can even be used to make useful products.

Team leader Ruth Cornock reports "*Despite a small reduction in numbers, the event was still quite busy, and we had a continuous stream of visitors of all ages to the SBRC/CCNet stand, keen to learn more about what we do within our area of the university. Lots of children made their own microbes using plastcine and took them home in their very own petri dishes. While this was going on we took the time to speak to parents and carers and other visitors about the importance of the gas fermentation work we do, and how it may help to reduce reliance on fossil fuels, and fits into a circular economy. All conversations with visitors to the stand were very positive, and hopefully alleviate a few fears and concerns regarding the current events (COVID2019)!"*

Special thanks go to team leaders Ruth Cornock and Claudio Tomin Andrino and their band of enthusiastic helpers:- Louise McCluskey, Swapnika Challa, Benjamin Myers, Ruth Griffin, Margaux Poulalier Delavelle, Liam Wood, Cynthia Akaluka and Francois Seys.

Science Careers Day at Newark Academy

24 February 2020

by Louise McClusky

"This was a science careers day aimed at an 11-18 audience. There was an assembly for year 11's (about 120 students) in which 5 different scientists including myself gave a short introduction to our academic backgrounds and what we do as a scientist, covering a range of disciplines. They were trying to dispel common misconceptions about science, for example that science is not for women. There was also a question and answer session from the students.

I took part in and had a stand at the careers fair which took place over two hours and was open to the whole school. It was well attended and my stand was busy for most of the time. The aim was to engage students, get them interested in what things can be done with bacteria in improving health and sustainability, and demonstrate some of the things we research at the SBRC. There was the biofuels crossword which they were keen to complete, and also information leaflets and fact/question cards which they got competitive in answering."