



SBRC - Nottingham Newsletter Issue 10



December 2020

Foreword

by Nigel Minton

It is difficult to imagine a more eventful year than 2020, dominated as it was by the global pandemic. Throughout we have 'done ourselves proud', leading the charge to resume laboratory-based research in July, with the SBRC being the largest single research group to become operational at the University after lockdown. For that we have many people to thank. From the SBRC, special thanks have to go to Alan (Burbidge), who masterminded much of the shift system we put in place, Shelly (Kelly), who played the leading role in SBRC risk assessments and safety issues, and Chris (Humphreys) who, amongst other things, discovered a new skill in the design and construction of laboratory infrastructure – a future job in Estates could be on the cards Outside of the SBRC, we must of course all be grateful to the strenuous efforts of Carl (Winfield) and his team and to Barney (King), the voice of common sense.

Despite all the difficulties, we have continued to pursue the goals of the SBRC, and the belief of others in what we are doing remains undiminished. Thus, we began the year with the news that the BBSRC had awarded us a further £2.3million to extend the funded lifetime of the Centre to 31st March 2021, and more recently, through a no-cost

extension, to 30th Sept 2021. We anticipate a further funding call early next year that will enable us to bid to extend the lifetime of the SBRC well into the future through a new initiative in 'Engineering Biology'. There has probably never been a more important time for us to pursue our interests in carbon recycling, as we enter a new year that will be dominated by climate change and the need to decarbonise. I believe the future remains bright, and with your help, the SBRC can make a difference.

Merry Christmas to all and a 'marvelous' New Year.

Nigel

SBRC-Nottingham iGEM team 2020

THIRD TIME GOLD!!!!

<https://2020.igem.org/Team:Nottingham>



Despite the pandemic, iGEM (international Genetically Engineered Machine) 2020 * went ahead this year, in a wholly "virtual" format with SBRC- Nottingham leading their team to GOLD for the third successive year!! Our talented, multidisciplinary team of eight undergraduates, made us proud by also being nominated for the competition's 'Best Model' and 'Best Therapeutic' project!!



THE PROJECT

Team Nottingham modelled a biotherapeutic to be administered by mouth to help prevent and delay of neurodegenerative diseases such as Parkinson's Disease and Alzheimer's Disease. Their clostridia-based product "Neurotone" was designed to increase the amount of D-β-hydroxybutyrate (DBHB) reaching neurons in the brain. Several studies have shown that DBHB has neuroprotective properties. Their idea was to introduce DBHB production into *C.sporogenes* then administer it to patients in tablet form. The bacteria then colonise the gut and produce DBHB which is absorbed across the gut into the blood and eventually reaches the brain to target and protect its neurons.

"With this project we aim to provide a new strategy to treat neurodegenerative diseases and open new doors to drug delivery techniques. Our project uses synthetic biology to engineer a bacterium which will protect against diseases which cause distress and illness to millions of people worldwide" said Team Leader James Birch

THE TEAM

The GOLD winning team was selected from Nottingham's finest! With fierce opposition for places, the final team of eight was truly multidisciplinary, with undergraduates from the Schools of Maths, Life Sciences and Biosciences. In lock-down isolation from their make-shift studios in bedrooms around the UK they beavered hard and learned new skills. With the help of their supervising team they produced mathematical models and

Minecraft worlds, wikis and videos, podcasts and posters. They interviewed world-leading experts and frontline health workers, collaborated with other teams, organised a sponsored charity event and became very, very good at running Teams meetings...



ABOUT iGEM

iGEM (International Genetically Engineered Machine) Foundation is an independent, non-profit organization that pioneered the synthetic biology industry and continues to advance the field through education, competition and industry collaboration. iGEM's annual student competition is the largest synthetic biology innovation program and a launchpad for the industry's most successful leaders and companies. The competition empowers thousands of local people to solve local problems around the world by engineering biology for safe and responsible solutions. Each year, the competition brings together more than 6,000 participants from across the globe to explore and create unique applications of synthetic biology with the mission to bring positive contributions to their communities and society at large. Beyond the technology, participants are evaluated on teamwork, responsibility, entrepreneurship, sharing, safety and more.

JUDGES COMMENTS

"Great presentation, poster, and wiki. Amazing HP, very apt for the current circumstance during the pandemic".

"The team members excelled in integrated human practice and with strong product development mindsets".

"You showed great background knowledge all around and a very very thorough and well documented dry-lab work in both design and modeling. This reflected in a very well designed and well planned project."

LAST BUT NOT LEAST

Huge thanks go to: -

Principal Investigators:

Nigel Minton & Andrew Dempster

Supervisors:

Patrick Ingle, Raquel Rodrigues, Thomas Millat, Alex Rawson, Eleanor Hadley Kershaw, Louise Dynes & Jacque

Minton

Sponsors:

The BBSRC and the Faculty of Medicine, University of Nottingham



iGEM website <https://igem.org/>

More Medals!!!!!!

Vice Chancellor Medals for Ruth Cornock and Michelle Kelly

The Vice-Chancellor's Medal recognises those who have delivered the most exceptional achievement or made the most outstanding contribution to our University community. On 25 November, Ruth Cornock and Michelle (Shelly) Kelly became the latest proud recipients of Vice Chancellor Awards for their Outreach work. Unfortunately, due to COVID-19 the normal pomp and ceremony was replaced with an online celebration but this did not diminish from the prestige of the event hosted by Vice-Chancellor, Professor Shearer West.



"Across a particularly challenging year, it is extremely heartening to see so many colleagues' and students' exceptional contributions to our own community and those around us" said the V C

Ruth and Shelly are Research Technicians working in the SBRC providing microbial molecular biology, synthetic biology expertise and research support. Three years in a row The SBRC has hosted an exhibition stand, highlighting great research done at the centre, at the New Scientist Live (a 4 day science festival held each autumn) at the ExCel Exhibition Centre in London, which last year attracted over 40,000 visitors. The NSL is the Centre's Outreach focus of the year and, although a team effort with 15 committee members and volunteers are involved, Ruth and Shelly stand out; they have been involved from the start, not only manning the stand for the 4 days but also contributing their valuable experience to each new team; adding new fresh ideas, giving hours of their time outside working hours during preparation and delivery.

Responsible Research and Innovation Update

by Eleanor Hadley Kershaw

Eleanor was invited to deliver a talk in the [European Biotechnology and Society Seminar Series](#), convened by the European Research Area Cofund on Biotechnologies (ERA CoBioTech) and colleagues at the Universities of Edinburgh and Durham. Together with Stevienna de Saille (University of Sheffield) and Carmen McLeod (Newcastle University, formerly SBRC-Nottingham), Eleanor presented 'RRI in ERA CoBioTech: Challenges and opportunities of using Lego Serious Play' on 14 October. The seminar was attended by 55 people and generated lively discussion on RRI methods, institutions and funding. Further information on the seminar series (including presentation slides) can be found [here](#).

If you are interested in RRI make sure that you don't miss our workshop in January. This will be hosted by Eleanor and The Carbon Recycling Network.

Responsible Innovation: Industrial Biotechnology and Engineering Biology

Online, 10:30-14:00 GMT, Monday, 25 January 2021. [Register here](#).

This free online event brings together the BBSRC Networks in Industrial Biotechnology and Bioenergy, the wider synthetic biology, industrial biotechnology and responsible innovation communities, and eminent speakers from across disciplines and sectors to explore current developments, challenges and opportunities for responsible innovation in industrial biotechnology and engineering biology.

Anyone with an interest in biotechnology, synthetic biology and the important role responsible innovation might play in their future development is welcome to attend!

Speakers include: Phil Macnaghten (Wageningen University); Rowan McKibbin (BBSRC); Sean Simpson (LanzaTech); Joyce Tait (University of Edinburgh); Lionel Clarke (Engineering Biology Leadership Council); Susan Molyneux-Hodgson (University of Exeter); Neil Parry (Unilever); Lotte Asveld (TU Delft); Megan Palmer (Stanford University); Directors of the six BBSRC NIBBs; and more!

The full programme is available [here](#) and you can register [here](#).

New Research Projects

SBRC Nottingham to participate in the Deep Branch Biotech-led REACT-FIRST consortium

by Dr Marco Garavaglia

Earlier this year, Deep Branch, a carbon recycling biotech company funded by former SBRC Nottingham researchers, achieved a remarkable success by securing £3M funding from Innovate UK, with a research proposal entitled "REACT-FIRST: Reduced Emission Aquaculture & Chicken Trial For Integrated, Responsible and Sustainable Transformation of CO₂ into animal feed". The aim of this project, which officially started on the 1st of October, is to significantly reduce the carbon footprint of UK's aquaculture and poultry industries, by replacing the fishmeal/soy component of currently used feeds with Proton, a sustainable microbial protein feed obtained using CO₂ as carbon source. SBRC Nottingham will be partnering with Deep Branch in the REACT-FIRST consortium, which also includes other academic collaborators such as Nottingham Trent University, the University of Edinburgh and the University of Sterling, as well as industrial partners such as Drax Corporate Ltd, AB Agri Ltd, Biomar Ltd and Sainsbury's Supermarkets Ltd. As the nominated researcher on this grant, I will be taking advantage of the SBRC's cutting-edge facilities, including the robotic suite and the aerobic gas fermentation unit, to identify and delete genes that are not essential for autotrophic growth in the model organism *Cupriavidus necator* H16 and other

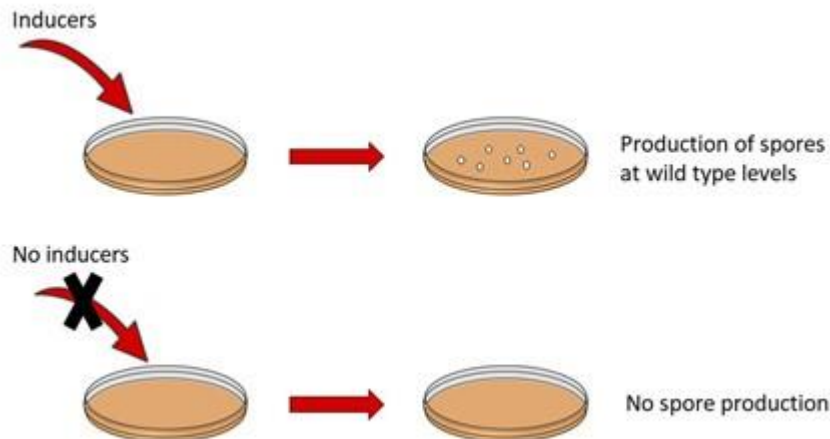
hydrogen-oxidising bacteria of industrial interest for Deep Branch, with the ultimate goal of improving the nutritional quality of the Proton single cell protein as well as the economics of the fermentation process. I am personally very excited to be part of this project since I believe it has the potential to revolutionise the animal feed industry, leading to a more sustainable agriculture. In addition, REACT-FIRST represents a fantastic opportunity for SBRC Nottingham to showcase all the brilliant science that it has produced over the last 5 years, apply it to a “real life” problem and provide a tangible contribution towards achieving the “net zero” greenhouse gases emission target, set by the UK government for 2050.



ABSCICS: Applied Bacterial Spore control in Industrial and Clinical Settings

by Dr Raquel Rodrigues

Clostridium species have the potential to be used in several relevant applications, from cancer treatment to solvent production. These species can produce spores, highly resistant structures that allow long-term storage and facilitate the use of anaerobic *Clostridia* in a clinical setting. However, when working with genetically modified strains, release of spores to the environment is a serious concern. Furthermore, spore contamination of industrial bioreactors is challenging and difficult to eliminate. This project aims to address those issues by generating conditionally sporulating strains. Those strains would be able to sporulate like wild type in the presence of two inducers, but their sporulation ability would be completely abolished in the absence of those inducers.



The goal is to generate conditionally sporulating strains of four different species: *Clostridium sporogenes*, *Clostridium novyi-NT*, *Clostridium butyricum* and *Clostridium acetobutylicum*. *C. sporogenes* and *C. novyi-NT* can be used in cancer therapy, while *C. butyricum* is being explored as a vehicle to deliver therapeutics to the microbiome. Finally, *C. acetobutylicum* allows the sustainable production of interesting chemicals such as 1, 3-propanediol. The tight control of sporulation in these species will therefore be highly beneficial to ensure the safe and easy use of *Clostridium* in clinical and industrial settings.

EraCoBioTech: Sustainable production of n-butanol by artificial consortia through Synthetic and Systems Biology approaches

by Dr Chris Humphreys

EraCoBioTech2018 (BBSRC). “Sustainable production of n-butanol by artificial consortia through Synthetic and Systems Biology approaches”. Minton NP, Humphreys CM (Nottingham), Soucaille P (Toulouse), Liebl W (Munich), Banyeras L (Girona) and BASF. €1,317,000. (Sept 2020 – Aug 2023).

One of the greatest challenges facing society is the future sustainable production of chemicals and fuels from non-petrochemical resources while at the same time reducing greenhouse gas emissions. Cellulosic feedstocks present in lignocellulosic plant biomass or in waste-paper and cardboard represent the largest source of renewable carbon on the planet, however current conversion processes inherently release a significant proportion of this carbon into the atmosphere as CO₂, and therefore achieve relatively low yields of value-added product.

In this project, SynConsort4Butanol, we will engineer synthetic bacterial consortia to convert, without net CO₂ production, the cellulosic fraction lignocellulosic materials to the platform chemical and biofuel, n-butanol. With industrial collaboration this will lead to the development of new “CO₂ free” sustainable production and conversion processes based on lignocellulosic feedstocks.

SynConsort4Butanol connects research partners in four different countries (Germany, UK, Spain, and France) with varied but complementary scientific and technological expertise. Our role in the SBRC will be the engineering and development of the acetogenic chassis *C. carboxidivorans* to capture and convert the CO₂ and H₂ produced by other members of the bacterial consortia, into a metabolite which can be reassimilated by the non-acetogenic species. This will increase the overall yield of n-butanol in the process to values close to the theoretical maximum.

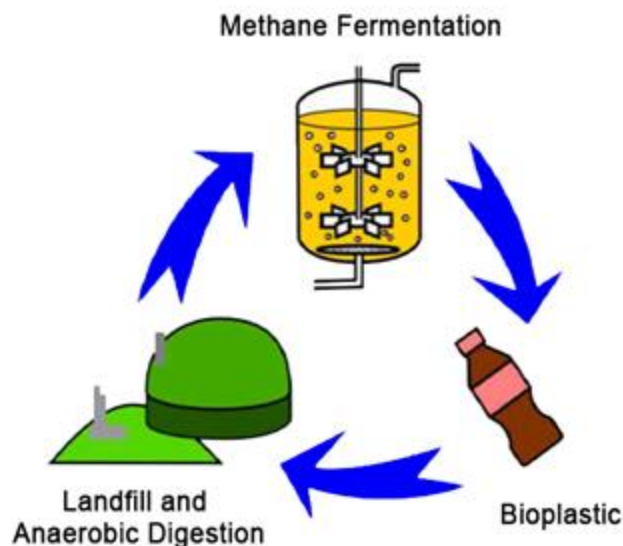


Case Study published by The Microbiology Society

"A Sustainable Future Case Study - PHB Bioplastic From Waste Methane"

by Benjamin Claxton Stevens

Production of the bioplastic PHB from bacteria offers a green solution to the current plastic crisis. Methanotrophs which are capable of PHB production offer a unique way to tackle this combined with utilising waste and low-quality methane containing biogas which would otherwise be wasted and contribute to greenhouse gas emissions. In a short case study for the Microbiology Society as part of their 75th Anniversary Sustainable Future Collection, we report some of the results of an upcoming paper from Ying Zhang's group on methane fermentation of PHB from real world biogas sources as well as an overview of the future of the technology and its potential as part of the circular economy aimed at the non-expert reader.



The full paper soon for publication in AMB Express is "Isolation and characterisation of *Methylocystis spp.* for poly-3-hydroxybutyrate production using waste methane feedstocks" Bashir L. Rumah, Christopher E. Stead, Benedict H. Claxton Stevens, Nigel P. Minton, Alexander Grosse-Honebrink, and Ying Zhang.

The full article is available at:

<https://microbiologysociety.org/our-work/75th-anniversary-a-sustainable-future/circular-economy/circular-economy-case-studies/phb-bioplastic-production-from-waste-methane.html>

Upcoming Events

Monday 25 January 2021, 10:30-14:00

The Carbon Recycling Network presents "Responsible Innovation and Industrial Biotechnology" An online workshop hosted by our very own Eleanor Hadley Kershaw and Louise Dynes.

This open, online event brings together the [BBSRC Networks in Industrial Biotechnology and Bioenergy](#), the wider synthetic biology, industrial biotechnology and responsible innovation communities, and eminent speakers from across disciplines and sectors to explore current developments, challenges and opportunities for responsible innovation in industrial biotechnology and engineering biology. Anyone with an interest in biotechnology, synthetic biology and the important role responsible innovation might play in their future development is welcome to attend!

[View this event](#)

Register for the event [here](#).

Wednesday 10 - Wednesday 17 February 2021

Thanks to Shelly Kelly, SBRC will be participating in [The Nottingham Festival of Science and Curiosity](#). For the last five years, the festival has been a key opportunity for researchers and students of every discipline from University of Nottingham to take their research off-campus and into the everyday lives of the people of Nottingham. The festival reached over 10,000 participants in February 2020, with over 60 events and more than 50 UoN staff and students involved.

Monday 8 - Friday 19 March 2021

The SBRC-Nottingham is pleased to announce that it is planning to host an event in support of the University's Diversity Festival to be held in March 2021. We will be highlighting the scientific and cultural contributions of colleagues from a range of backgrounds who have added a great richness to the SBRC community.

More details to follow.

Monday 22- Tuesday 23 November 2021

The Biochemical Society's annual conference, SBUK2021 is scheduled to take place a a live event at the University of Nottingham's East Midland's Conference Centre.

For more details click here...

[Synthetic Biology UK 2021 - Biochemistry](#)

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 carboxydovorans. I look forward to getting to know you all during my time here over the next 3 years!"

Danielle Rogerson



"Hello, my name is Danielle and I have recently begun my PhD journey at UoN after completing my master's degree here in 2019. The focus of my PhD is to create a conditionally sporulating strain of Clostridium novyi to enhance its efficacy in cancer therapy. I am very lucky to be working alongside Professor Nigel Minton throughout this project, and I am very much looking forward to the next few years. Outside of work, I love anything craft related to keep me busy, and I am always trying to plan my next city break!"

Harry Newton



I'm Harry and I am now looking at Hydrogen Oxidising Bacteria under Klaus and Ying and in association with Deep Branch. With regards to interests outside of work; I play music, enjoy woodworking and like strategy games!

Tayana Raper



I am from Cape Town, South Africa - born and bred! Ive been living in the U.K. since 13 November and this is my first time in the U.K. I am working for Deep Branch Biotechnology as an Associate Fermentation Scientist, with my key roles and responsibilities being to ensure a successful scale up.

I studied my undergraduate in Chemical Engineering at the university of Cape Town. I am currently finishing my MSc in Bioprocess Engineering under the supervision of Professor Sue Harrison with the Centre for Bioprocess Engineering Research (CeBER).

When I'm not at work I love to hike and walk and explore new places (can't wait to travel after this pandemic is under control!), spending time with my family and friends, meeting new people and making friends and in true South African style, I love a good braai (BBQ)! I adore doggies and dog training. I love a glass of wine and a fire, and a Sunday spent relaxing.

Publications in 2020

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- Hadley Kershaw, E, Hartley S, McLeod C, Polson, P. (2020) The Sustainable Path to a Circular Bioeconomy. *Trends in Biotechnology*.
<https://doi.org/10.1016/j.tibtech.2020.10.015>
- Hanko EKR, Paiva AC, Jonczyk M, Abbott M, Minton NP, Malys N. A genome-wide approach for identification and characterisation of metabolite-inducible systems (2020) *Nature Communications* 2020; **11(1)**: 1213
- Jin S, Bae J, Song Y, Percy N, Shin J, Kang S, Minton NP, Soucaille P, Cho BK. 2020. Synthetic Biology on Acetogenic Bacteria for Highly Efficient Conversion of C1 Gases to Biochemicals. *International Journal of Molecular Sciences*, **21**: 7639.
- Kotte AK, Severn O, Bean Z, Schwarz K, Minton NP, Winzer K. RRNPP-type quorum sensing affects solvent formation and sporulation in *Clostridium acetobutylicum*. *Microbiology*. 2020; **166(6)**: 579-592.
- McLeod C, Hadley Kershaw E, Nerlich B. (2020) Fearful Intimacies: COVID-19 and the Reshaping of Human-Microbial Relations. *Anthropology in Action*. 2020. **27(2)**: 33-39.
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- Rumah BL, Stead CE, Steven BE, Minton NP, Grosse-Honebrink A, Zhang Y. Isolation and Characterisation of *Methylocystis* spp. for Poly-3-hydroxybutyrate Production Using Waste Methane Feedstocks. *AMB Express*. 2020; *in press*
- Seys FM, Rowe P, Bolt EL, Humphreys CM, Minton NP. A Gold Standard, CRISPR/Cas9-Based Complementation Strategy Reliant on 24 Nucleotide Bookmark Sequences. *Genes*. 2020; **11(4)**: 458.
- Viacava K, Meibom KL, Ortega D, Dyer S, Gelb A, Falquet L, Minton NP, Mestrot A, Bernier-Latmani R. Variability in Arsenic Methylation Efficiency across Aerobic and Anaerobic Microorganisms. *Environmental Science Technology*. 2020; **54(22)**: 14343-14351.

Public Engagement and Outreach

Outreach and Public Engagement have been challenging with lockdown and social distancing but have begun to pick-up as we develop new skills and acquire new tools.

NEW SCIENTIST LIVE 2020

Though the live event at the Excel Centre, London, at which we are regular contributors could not take place, we were offered a great opportunity to create a one page spread for well-known New Scientist magazine. Louise Dynes and Jacque Minton put pen to paper to reach a potential audience of 88,000 subscribers in the 11 June 2020 issue. The article focused on the gas fermentation work being done at the SBRC and the role of BBSRC NiBB "The Carbon Recycling Network" in promoting Gas fermentation scale-up. The article also showcased our links with industry, especially LanzaTech and DeepBranch.



NET ZERO LIVE 2020

November 10-12 saw members of SBRC-Nottingham participate in “Net-Zero Live 2020” - “the biggest virtual event of its kind connecting thousands of energy, sustainability and resource efficiency professionals around a common purpose: to accelerate climate action and drive a green recovery.”

Taking place over three days in a virtual format, this event included high-level keynote talks, interactive panel discussions, facilitated networking sessions and educational masterclasses, as well as virtual exhibition booths showcasing the cutting-edge net-zero technologies and services that will shape the decade ahead.

Manning the BRC- Nottingham booth over the course of the event were a cast of real stars, our 9 volunteer academics (Students post docs and senior research fellows) ably supported the SBRC admin team. At the booth, visitors could watch our new two minute video about the work of our Centre as well as talk to our experts. We also produced a stand-alone website summarizing the work of the Centre and handouts for visitors to take away.

Around 300-400 visitors attended the event on each of the 3 days. We had a total of 23 visitors to our booth from Environmental products, Media, Government agencies, Health services and Energy generation. Our team spoke directly to around 9 attendees, mainly during the networking sessions. SBRC attracted 7 new followers on Twitter whilst The Carbon Recycling Network acquired 4 followers and 2 new members. One of the interactions generated talk of a potential collaborative project, but we still await further details of that.

Special thanks go to: Ying Zhang, Kati Kovacs, Craig Woods, François Seys, Swapnika Challa, Kavita Yadav, Andrew Dempster, Benedict Claxton Stevens and Jess Locker.

And not forgetting of course, the admin team: Alan, Loretta, Louise and Jacque.

For more details about Net Zero Live 2020 visit: <https://netzerolive.com/>

For the SBRC-Nottingham 2 minute video: <https://www.youtube.com/watch?v=E5HEbXWQczs>



"RADIO RUTH"

Ruth gave a 10 minute radio interview with Helen Seymour about getting women into STEM. In the final episode of this 2 part series, Helen Seymour discovers more job roles you wouldn't expect to find in the world of STEM, as well as talking about some of the amazing opportunities a STEM career can offer. Emma Nicholson, Ruth Griffin and Sinead Burke talk about their fascinating and varied roles, how they got into them, what advice they have for girls interested in science, and that all important question; what is their favourite biscuit? Interspersed with your favourite BCB Radio tunes.



Radio Broadcast on BCB Radio 106.6 FM at 10am on Thursday 29th October
Available to listen again at: <https://podcast.canstream.co.uk/bcb/>
<https://podcast.canstream.co.uk/bcb/index.php?id=55007>

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