



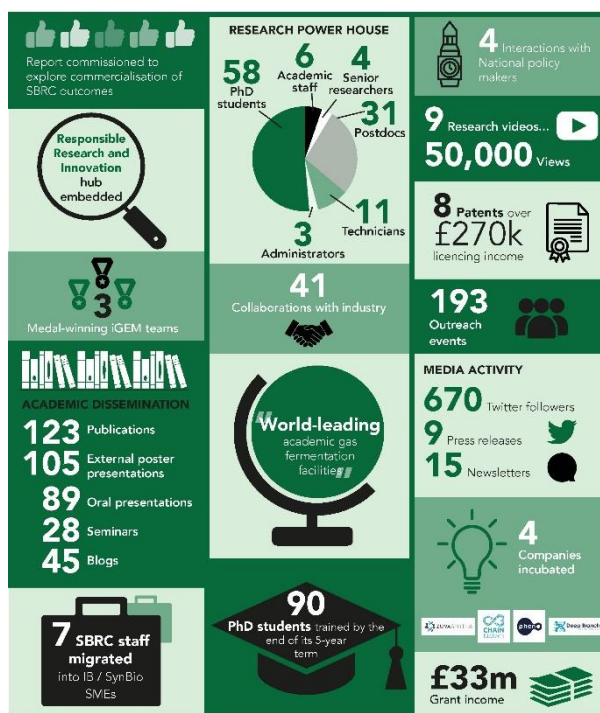
## SBRC - Nottingham Newsletter Issue 8

September 2019

### Research News

As the SBRC approaches the end of its fifth year, we reflected on the cumulative outputs to date and summarised them in an infographic. The numbers speak for themselves and do look pretty impressive. What is also impressive is the number of post-doctoral researchers and technicians who have passed through the SBRC over the last 5 years. The centre has benefited from the inputs of many and has hopefully added career value to all who have worked here. The SBRC continues to be industry-facing and is exploring new opportunities with companies and continuing to develop and protect intellectual property for industrial application.

#### SYNTHETIC BIOLOGY RESEARCH CENTRE - NOTTINGHAM ACHIEVEMENTS AT A GLANCE



## SBRC-Nottingham iGEM team Sniffs-Out Success

A group of undergraduate students from the University of Nottingham have formed an [iGEM](#) team\* to develop a new detection system that can “sniff out” when food packaging and preservation methods fail and allow the growth of dangerous botulinum bacteria. These bacteria can cause a type of food poisoning which may result in paralysis or even death.

Sounds terrifying, but the largest botulism outbreak in the UK was more than 30 years ago. This resulted in the hospitalisation of 27 people, all due to the consumption of contaminated hazelnut yogurt, which led to the shutting down of a major company. Now food companies subject their products to rigorous trials, to determine expiry dates in a process called challenge testing. Challenge testing involves injecting test food with bacteria in a lab to determine whether the food preservation method is good enough to prevent bacterial growth. Companies take this testing very seriously, as botulism food poisoning outbreaks are estimated to cost the food industry about £25 million per person!

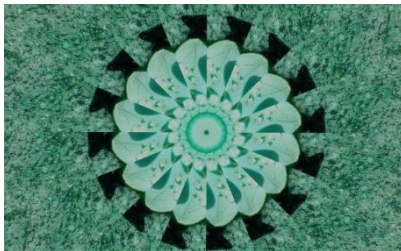
\*The iGEM (International Genetically Engineered Machine) competition brings together 375 teams from 45 different countries in an event that resembles the science Olympics. iGEM offers interdisciplinary teams of students the opportunity to design and test their own science product. The students work on biological projects that tackle issues in their local communities and far beyond. Teams tackle real-world problems, such as antibiotic resistance and climate change. Projects range from developing bacteria that can degrade plastics, to building a printer that allows you to create your own bacteria! Some teams have even gone on to start successful businesses. This year's iGEM team from the University of Nottingham consists of ten science-loving undergraduates studying a range of degrees, from Biotechnology to Computer Science and Mathematics. Their project, focusing on the safe detection of botulinum bacteria in food, aims to provide a cheaper and faster alternative to current food testing methods and could replace the need for animal testing which still takes place in many countries. In October, the team will present their project, '[NoTox - a nose ahead in food safety](#)', at a conference in Boston with over 6000 attendees. They hope to follow in the footsteps of last year's iGEM team and bring home a gold medal!!



*SBRC-Nottingham iGEM Team 2019 - going for GOLD!*

iGEM website <https://igem.org/>  
Nottingham iGEM team website <https://2019.igem.org/Team:Nottingham>

## Responsible Research and Innovation Update

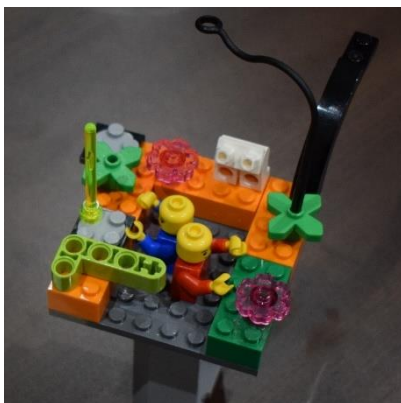


### **Circling Sustainability and Responsibility: Exploring Synergies between the Circular Economy, Synthetic Biology and Responsible Research and Innovation – An Interdisciplinary Workshop**

On 2nd April 2019, Dr Carmen McLeod (SBRC Senior Research Fellow) in collaboration with Dr Sarah Hartley (University of Exeter), organised a workshop exploring the synergies between the circular economy, the governance framework 'Responsible Research and Innovation', and synthetic biology research applications. The aim of the workshop was to capture a broader understanding of the linkages between these concepts, and what implications this could have at both national and international policy levels. The twenty-two delegates included social scientists and humanities researchers, bioscientists, policy makers and representatives from industry, as well as the Ellen McArthur Foundation. Following productive and lively discussions, the workshop concluded with a keynote lecture from Ken Webster (University of Exeter) entitled 'Closing loops and opening minds? Is a 'circular economy' business as usual or a harbinger of change?' A blog post about the workshop is available on the University of Nottingham 'Making Science Public' blog.

The University of Nottingham [Governance and Public Policy \(GaPP\) Research Priority Area](#) and the Nottingham [Synthetic Biology Research Centre](#) provided funding for the workshop.

### **Science and Technology 'LEGO® SERIOUS PLAY®' Workshop: Public views on using bacteria to make chemicals from waste gases**



On 3rd August 2019, Dr Carmen McLeod and Dr Eleanor Hadley Kershaw (SBRC Interdisciplinary Responsible Research and Innovation Group) organised a workshop in order to explore public views on using synthetic biology applications to make chemicals and fuels from waste gases. The workshop used an innovative format, which required the sixteen participants to respond to questions by building models with LEGO. Dr Stevienna de Saille (University of Sheffield), who is a trained Lego® Serious Play® facilitator, led the workshop. Two scientists from BIOMETCHEM also led a discussion on the work they are doing. Analysis and findings from the workshop will be shared with scientists and industry partners in the Nottingham SBRC, BIOMETCHEM, ENGICOIN, and the CCNet network, with the goal of encouraging further reflection and discussion about ongoing synthetic biology research. There was positive feedback from the participants at the workshop, who enjoyed both the workshop format and the opportunity to contribute to a discussion about synthetic biology applications.

Workshop feedback examples:

- "It was very interactive and building things from Lego was fun and really showcased your views."
- "I really enjoyed meeting and talking with the scientists"
- "Well-structured discussion allowing everyone to have their say"

Funding for the workshop was provided by the Nottingham Synthetic Biology Research Centre, CCNet, BIOMETCHEM and ENGICOIN.

## Recent Publications

- Annan FJ, Al-Sinawi B, Humphreys CM, Norman R, Winzer K, Köpke M, Simpson SD, Minton NP, Henstra AM. (2019) Engineering of vitamin prototrophy in *Clostridium ljungdahlii* and *Clostridium autoethanogenum*. *Appl Microbiol Biotechnol*. 103(11):4633-4648. doi: 10.1007/s00253-019-09763-6. Epub 2019 Apr 10. PMID:30972463
- Arenas-López C, Locker J, Orol D, Walter F, Busche T, Kalinowski J, Minton NP, Kovács K, Winzer K, 2019. The genetic basis of 3-hydroxypropanoate metabolism in *Cupriavidus necator* H16 *Biotechnology for Biofuels*. 12, 150
- Bilverston TW, Minton NP, Kuehne SA (2019) Phosphorylation and functionality of CdtR in *Clostridium difficile* *Anaerobe* Volume 58, August 2019 DOI:10.1016/j.anaerobe.2019.102074
- Cañadas IC, Groothuis D, Zygouropoulou M, Rodrigues R, Minton NP. (2019) RiboCas: A Universal CRISPR-Based Editing Tool for *Clostridium*. *ACS Synth Biol*. 2019 Jun 21;8(6):1379-1390. doi: 10.1021/acssynbio.9b00075. Epub 2019 Jun 7. PMID: 31181894
- Dahabiyeh LA, Tooth D, Carrell RW, Read RJ, Yan Y, Broughton-Pipkin F and Barrett DA. (2019) Measurement of the total angiotensinogen and its reduced and oxidised forms in human plasma using targeted LC-MS/MS *Analytical and Bioanalytical Chemistry* 411(2), 427-437 <https://doi.org/10.1007/s00216-018-1455-2>
- Dahabiyeh LA, Tooth D and Barrett DA (2019) Profiling of 54 plasma glycoproteins by label-free targeted LC-MS/MS. *Analytical Biochemistry* 567, 72-81
- Ding Y, Bertram JR, Eckert C, Bommarreddy RR, Patel R, Conradie A, Bryan S, Nagpal P. (2019). Nanorg Microbial Factories: Light-Driven Renewable Biochemical Synthesis Using Quantum Dot-Bacteria Nanobiohybrids. *J Am Chem Soc*. 2019 Jul 3;141(26):10272-10282. doi: 10.1021/jacs.9b02549. Epub 2019 Jun 19.
- Giraud, E., Hadley Kershaw, E., Helliwell, R., & Hollin, G. (2019). Abundance in the Anthropocene. *The Sociological Review*, 67(2), 357-373. doi.org/10.1177/0038026119830907  
The paper above was published both in the journal and also in a monograph:
- Giraud, E., Hadley Kershaw, E., Helliwell, R., & Hollin, G. (2019). Abundance in the Anthropocene. In: Latimer, J. & López Gómez, D. (Eds.) *Intimate Entanglements. The Sociological Review Monographs Series*. London: Sage, 113-129.
- Hanko EKR, Minton NP and Malys N. (2019). Design, cloning and characterization of transcription factor-based inducible gene expression systems. In: *Methods in Enzymology*, A. K. Shukla, ed. Elsevier. 621:153-169. DOI: 10.1016/bs.mie.2019.02.018
- Ingle P, Groothuis D, Rowe P, Huang H, Cockayne A, Kuehne SA, Jiang W, Gu Y, Humphreys CM, Minton NP. (2019) Generation of a fully erythromycin-sensitive strain of *Clostridioides difficile* using a novel CRISPR-Cas9 genome editing system. *Sci Rep*. 2019 May 31;9(1):8123. doi: 10.1038/s41598-019-44458-y. PMID: 31148548
- Li Q, Seys FM, Minton NP, Yang J, Jiang Y, Jiang W, Yang S. (2019) CRISPR-Cas9D10A nickase-assisted base editing in the solvent producer *Clostridium beijerinckii*. *Biotechnol Bioeng*. 2019 Jun;116(6):1475-1483. doi: 10.1002/bit.26949. Epub 2019 Feb 21. PMID: 30739328 <https://doi.org/10.1080/14636778.2019.1637721>
- Pander B, Harris G, Scott DJ, Winzer K, Köpke M, Simpson SD, Minton NP, Henstra AM. The carbonic anhydrase of *Clostridium autoethanogenum* represents a new subclass of  $\beta$ -carbonic anhydrases *Appl Microbiol Biotechnol*. 2019 Sep;103(17):7275-7286. doi: 10.1007/s00253-019-10015-w. Epub 2019 Jul 25. PMID:31346685
- Sarma S, Ortega D, Minton NP, Dubey VK, Moholkar VS. (2019). Homologous overexpression of hydrogenase and glycerol dehydrogenase in *Clostridium pasteurianum* to enhance hydrogen production from crude glycerol. *Bioresour Technol*. 284:168-177. doi: 10.1016/j.biortech.2019.03.074. Epub 2019 Mar 16.
- Schindl A, Hagen ML, Muzammal S, Gunasekera HA, Croft AK. (2019). Proteins in Ionic Liquids: Reactions, Applications, and Futures. *Frontiers in chemistry*, 7.
- Sheridan PO, Martin JC, Minton NP, Flint HJ, O'Toole PW, Scott KP. (2019) Heterologous gene expression in the human gut bacteria *Eubacterium rectale* and *Roseburia inulinivorans* by means of conjugative plasmids. *Anaerobe*. 2019 Jun 19;59:131-140. doi: 10.1016/j.anaerobe.2019.06.008. [Epub ahead of print] PMID: 31228669
- Pech-Canul AC, Ortega D, Garcia-Triana A, Solís-Oviedo RL., (2019) *Torulaspota delbrueckii*: Towards Innovating in the Legendary Baking and Brewing Industries. In: *Frontiers and New Trends in the Science of Fermented Food and Beverages*. Publisher: IntechOpen Published: January 21st 2019 DOI: 10.5772/intechopen.83522
- Woods C, Humphreys CM, Rodrigues RM, Ingle P, Rowe P, Henstra AM, Köpke M, Simpson SD, Winzer K, Minton NP. (2019) A Novel Conjugal Donor Strain for Improved DNA transfer into *Clostridium* spp. *Anaerobe*. 2019 Jun 30. pii: S1075-9964(19)30117-9. doi: 10.1016/j.anaerobe.2019.06.020. [Epub ahead of print] PMID: 31269456

## Conferences and Workshops

### 2019 Brazil-UK Workshop - Sustainable Chemicals and Fuels through Synthetic Biology

For 3 days in May (28 -30 May 2019) Centro Nacional de Pesquisa em Energia e Materiais (CNPEM), Campinas/SP, Brazil became home for this 100 strong, international workshop on "Sustainable Chemicals and Fuels through Synthetic Biology" <https://pages.cnpem.br/IndustrialBiotech/>.

Working with Director Eduardo do Couto e Silva and Scientific Director Mario T. Murakami, SBRC-Nottingham invited 30 world experts to review and debate the future of chemical and fuel production in a changing world to an audience of more than 70 working scientists from CNPEM and the UK-BR Year of Science and Innovation Programme Lead from the British Consulate in São Paulo, Rui Lopes.

Synthetic Biology potentially has a major role to play in replacing fossil fuels through the engineering of microbial strains (chassis) that are better able to directly convert lignocellulosic biomass, or derivative feedstocks such as sugar-rich hydrolysates or synthesis gas, into a more comprehensive array of products in processes that minimise, or even eliminate, CO<sub>2</sub> production. The objective of this workshop was to explore the numerous options available, ranging from the:

- microbial chassis available for manufacturing processes;
- most attractive chemical and fuel options;
- consideration of the most effective lignocellulose-derived feedstock
- identity of the most efficient strategy for minimising CO<sub>2</sub> production

The three-day workshop drew together leading UK and Brazilian synthetic biologists and industrial biotechnologists from both academia and industry. To broaden the pool of expertise, participants were invited from Argentina and the USA. Through the participation of relevant funding agencies (e.g., BBSRC, FAPESP, and CONICET) from the UK, Brazil and Argentina respectively the intention was to formulate a strategy for programmes of work that could form the basis of future funding calls.



*SBRC Director Prof Nigel Minton with his delegation and host Eduardo do Couto e Silva*

Featured talks from SBRC-Nottingham delegates:-

**Professor Nigel Minton** "CRISPR/Cas9, TraDIS and orthogonal expression systems"

**Professor Philippe Soucaille** "Increased butanol productivity through systems & synthetic biology"

**Dr Klaus Winzer** "Metabolic engineering of *Cupriavidus necator* H16 for the sustainable production of 3-Hydroxypropionic acid from CO<sub>2</sub>"

**Dr Ying Zhang** "Metabolic engineering of *Geobacillus thermoglucosidasius* bacilli for the production of chemicals and fuels"

**Dr Katlin Kovacs** Engineered microbial factories for CO<sub>2</sub> exploitation in an integrated waste treatment platform

More details <https://pages.cnpem.br/IndustrialBiotech/>

**The 1<sup>st</sup> International Conference on Biotechnology, Bioengineering, Biorefinary and Pollution Prevention,  
Chulalongkorn University, Bangkok, 1-2 August 2019**

The first two days of August 2019 saw Chulalongkorn University, Bangkok, Thailand open its doors to welcome Professor Nigel Minton as one of four international keynote speakers at “The 1<sup>st</sup> International Conference on Biotechnology, Bioengineering, Biorefinary and Pollution Prevention”.

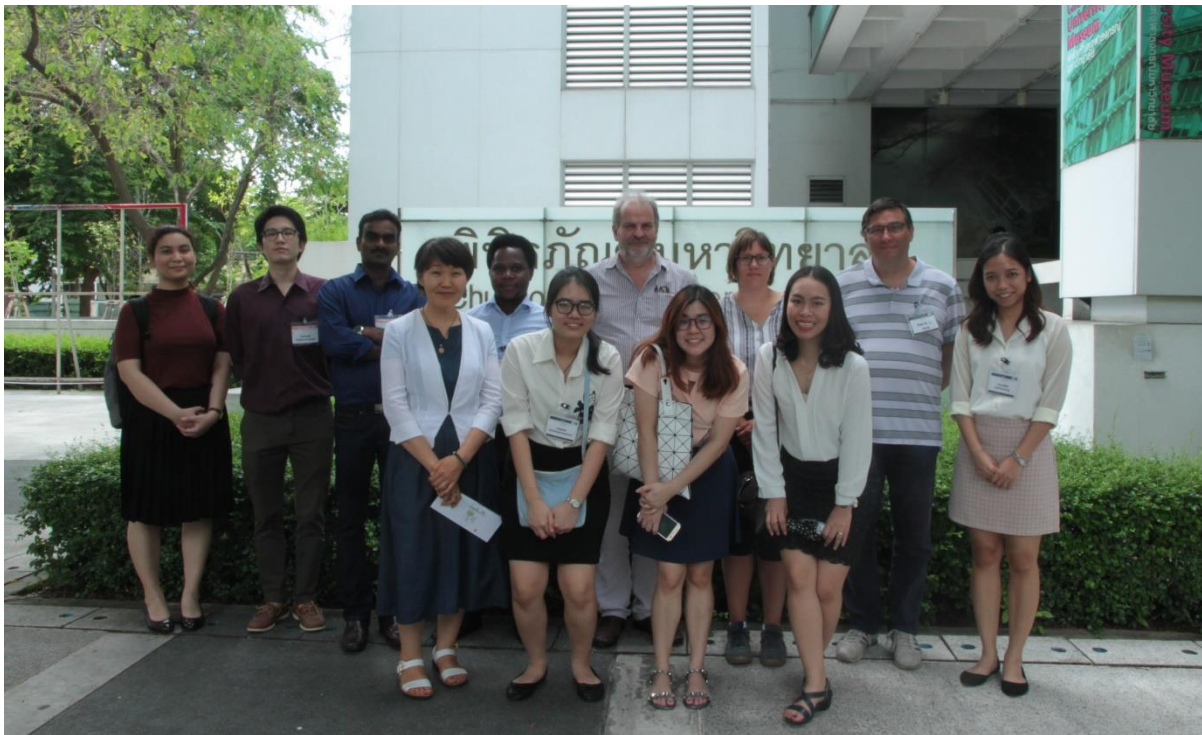
Hosted by Ass. Prof. Warawut Chulalaksananukul, the aim of the conference was to provide a platform for students, researchers and academics to share knowledge in the fields of new energy technologies, recombinant DNA methodologies and pollution prevention. As well as keynote talks, the programme included oral presentations, panel discussions and poster presentations and was divided into topics “Microbial and Enzyme Biotechnology”, “Environmental Biotechnology”, “Industrial Biotechnology”, “Bioinformatics and Biochemistry”, “ Genomic, Proteomics and Genetic Engineering” and “Synthetic Biotechnology”.

Nigel’s keynote talk “Application of recombinant DNA methodologies to exploit microbes for industrial benefits” focussed on the need to replace fossils fuels with alternatives which are clean, cheap and sustainable. He explained how microbes could gas fermentation could utilize single carbon (C1) gases (CO, CH<sub>4</sub> and CO<sub>2</sub>) as a feedstock, in a process called “gas fermentation” to produce chemicals, fuels and food, while at the same time reducing greenhouse gas (GHG) emissions.

Keeping Nigel company, other keynote talks were given by Prof. Piet N.L.Lens, University of Galway, Ireland; Dr Eldon R. Rene, IHE Delt Institute for Water Education, The Netherlands; and Dr Gilles Truan, INSA, Toulouse, France.

*“I was made to feel very welcome and see this as the beginning of some fruitful collaborations in the future”*

said Nigel



*SBRC Director Prof Nigel Minton with hosts and delegates*

## Upcoming Events

### 9 October 2019

Algae & Environmental Biotechnology Event (EBNet/Algae-UK)

[Read more](#)

### 10-13 October 2019

CCnet at New Scientist Live, ExCeL Centre, London

[Read more](#)

### 22-23 October 2019

International Biogas Congress & Expo, Brussels

[Read more](#)

### 7-8 November 2019

2nd Annual Synthetic Biology Congress, London

[Read more](#)

### 9 – 10 December 2019

Synthetic Biology UK 2019, University of Warwick

[Read more](#)

### 11-12 February 2020

CCnet Conference 1

East Midlands Conference Centre, Nottingham

## New Members of Staff

Dr Victor Uhunoma Irorere is a Research Fellow at the Synthetic Biology Research Centre (SBRC), University of Nottingham. He is working with Professor Nigel Minton and Dr Katalin Kovacs on a range of projects involving the metabolic engineering of *Cupriavidus necator*, a chemolithoautotrophic bacteria, for the production of bioplastics with desirable physico-chemical properties from carbon dioxide and other waste streams, using technologies such as gas fermentation. Victor completed his Master's degree in Applied Microbiology and Biotechnology from the University of Wolverhampton in 2011. His MSc project on the microbial conversion of waste cooking oil to bioplastic was featured in several bulletins and scientific reports including the BBC radio 4 in 2013. He was subsequently employed by the University of Wolverhampton, working on various projects including the fermentative production and application of a range of microbial biopolymers and the chemical synthesis of zeolitic materials, for the treatment of greenhouse gas emissions. Victor went on to study for his doctorate degree in Microbial Biotechnology and Biochemistry at Ulster University and was awarded his PhD in July 2019. He presently has over 12 publications in high impact journals.



## Public Engagement and Outreach

### I'm Scientist - Get Me Out of Here

by Christian Gude\*

I'm a scientist – get me out of here is a monthly online event that brings together scientists based in the UK with students aged 10 – 16. In a competition-style format, students ask questions in live chat sessions and on-forum and get to vote who their favorite scientist is.

I joined the event for a month because I feel very passionately about science - and not just my own scientific efforts, but also about helping the next generation of young scientists to pursue their curiosity and ideas, regardless of their social background or their current grades. Because puberty is often a difficult phase for young minds, during which many struggle with the idea of soon having to make “adult” decisions about their place in this world and their future careers, I wanted to offer a voice of encouragement in a time that is often defined by doubts and misconceptions.

I was challenged with many great questions – some were about science in general (When will the next ice age happen?), some were about my project (“How do you make plastics from CO<sub>2</sub>?”), some about my own career path (Why did you want to be a scientist?) and some personal (What is your favourite animal?). It was a great joy to answer all these questions and many more and I can only wholeheartedly recommend the experience. I learned to talk about my work in more layman-friendly terms without sacrificing too much scientific accuracy and often remembered how I felt when I was fourteen years old and had too many questions to ask about how everything worked than could be easily answered. And aren't the best questions always the ones that we have to admit we cannot answer at all?

Perhaps the best one I was asked about my project was from a thirteen-year-old girl from Northern Ireland. She asked me: “It's great that you make plastics from waste gases and I understand that this is more sustainable, but aren't plastics bad for our oceans?”

Having one's own research put into a critical perspective by young students is a fantastic experience that teaches us that even though we may be out of school, we have never stopped learning from others.

*\*Author Info: Christian Gude joined the SBRC DTP in 2016. His BBSRC/EPSRC funded project revolves around metabolic engineering of *Cupriavidus necator* to produce precursors for plastic production from industrial waste gases, such as CO<sub>2</sub>.*



SBRC PhD student with his iconic certificate and mug



## Wonder 2019 - A Community Event to Amaze and Inspire

On Saturday 15<sup>th</sup> June, the University of Nottingham threw its doors open to over 5000 curious minds of all ages for a day of hands-on fun at “Wonder 2019”. This year’s Wonder was particularly exciting, celebrating the 150th anniversary of the Periodic Table of the Elements and providing a brilliant way to showcase some of the awe-inspiring work done on campus with more than 100 activities, talks and events.

SBRC/CCnet’s contribution to day focused on “Carbon” with our own original board game “Game of Fuels”. Thanks to the help of our lab coat-clad volunteers:- Abubaker Madika, Rajan Patel, Jake Yeboah, Joanna Steczynska, Gareth Little, Francois Seys, Andrew Dempster, Amaury Montarnal and Jacque Minton, approximately 224 toddlers, teens and townspeople enjoyed learning about fossil fuels, greenhouse gases, global warming and research into biofuels and low carbon fuels.



SBRC volunteers demonstrate "The Game of Fuels"

*“It was a brilliant game, I would do it again”  
“Helpful facilitator”*

### Work Experience in SBRC

Between July 8-12 the SBRC provided a work experience for a Year 12 student from Winchester College. The student, Sean shadowed the work of Ms Temiloluwa Daike to learn about synthetic biology and bacterial cell-cell communication.

*“I was lucky enough to be able to shadow some research concerning my interest in quorum sensing in Dr Winzer’s group at the Synthetic Biology Research Centre Nottingham. I feel that not only was this a greatly enjoyable experience but that it was also an equally helpful one. The student whom I shadowed was kind and patient enough to explain the details which I didn’t understand. Through her explanations and demonstrations, I learnt of protocols and equipment which I had never even heard of before. I believe that having the opportunity to discuss questions with the people there, who have years more of experience and knowledge than me, has been incredibly helpful. Having observed some research, I realized that I had many misconceptions concerning this field. However, looking back on my week at Nottingham, this experience has helped me realize and reconfirm that science is the field for me.”* said Sean