Supergen Bioenergy Hub

Submitted by synbio on Thu, 12/05/2019 - 14:20

The University of Edinburgh has officially become a member of the Supergen Bioenergy Hub which works with academia, industry, government and societal stakeholders to develop sustainable bioenergy systems that support the UK's transition to an affordable, resilient, low-carbon energy future.

The Hub provides a variety of funding opportunities on bioenergy research including a one year fellowship, rapid response and flexible funding.

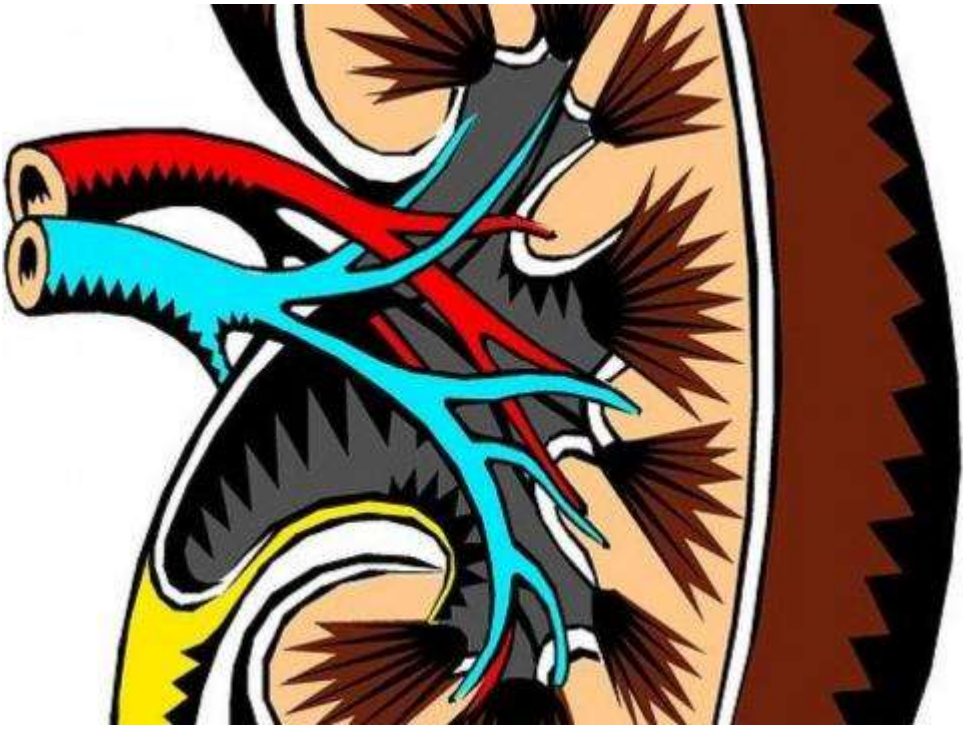
Dr Abdelrahman Zaky and Dr Ondřej Mašek are the main points of contact at the University. SynthSys member and sponsored Research Fellow in the Chris French Lab, Abdelrahman Zaky, was also elected a Chair for the early career network (SHARE). This network provides travel grants and free workshops and conferences for Early Career Researchers. All ECRs working on bioenergy are encouraged to join.

Useful Links

- Supergen Bioenergy Hub
- SHARE

Naked Scientist - Making mini kidneys

Submitted by synbio on Thu, 11/28/2019 - 15:21



Professor Jamie Davies went native with the *Naked Scientist* podcasters to discuss his work using stem cells to create kidney organoids.

Kidney failure is a common problem globally and the need for kidney transplants outstrips supply. While blood dialysis is one solution, it's time consuming and a strain on the body. Jamie and his team are working on using a patient's own stem cells to create new kidney cells that could be coaxed into mini-kidney-like organs and ultimately replace lost kidney function.

Find out more by listening to the Naked Scientist podcast

Image Credit *CCO*, by Pixabay

Can living computers do better than silicon ones?

Submitted by synbio on Thu, 11/28/2019 - 11:49

A recently published collaborative paper in *Nature Communications* argues that living matter offers entirely new opportunities for digital and analogue computation.

Co-Author and SynthSys PI Diego Oyarzun says ' We call this 'cellular supremacy', akin to the concept of quantum supremacy recently popularised by the latest research at Google. Living cells provide a different computing substrate than silicon, which paves the way for exploring unconventional models of computation beyond combinatorial circuits and towards non-Turing models. In the paper we discuss domains in which biocomputing may offer superior performance over traditional computers.'

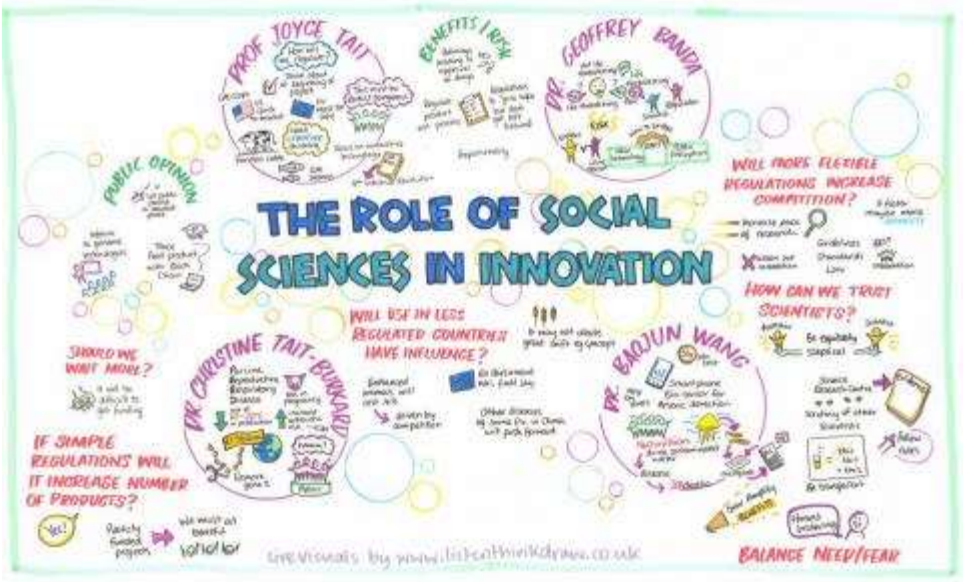
This is a result of a cross-institutional collaboration between computer scientists, physicist and computational biologists.

Paper: Pathways to cellular supremacy in biocomputing

Photo: Dr Diego Oyarzun, University of Edinburgh

Stimulating debate: barriers to new technology adoption

Submitted by synbio on Tue, 11/19/2019 - 08:27



As part of the ESRC Festival of Social Science, the Innogen Institute brought together social science researchers and scientists from the Roslin Institute and the Centre for Synthetic and Systems Biology (SynthSys) at the University of Edinburgh for a free public event exploring the opportunities arising from the latest genetic technologies and the regulatory issues they are facing.

Over forty attendees had the chance to engage with researchers and through hands-on activities find out more about how gene editing works and decide what research projects they would invest in.

The panel discussion that followed was chaired by Innogen Director and Professor of Politics, Innovation and Development at The Open University, Theo Papaioannou. Roslin Research Fellow Dr Christine Tait-Burkard talked about her work using gene editing to protect pigs from a deadly virus, and Dr Baojun Wang from SynthSys explained how it is possible to harness the arsenic-sensing ability of bacteria to make a smartphone-compatible biosensor that detects the contaminant in drinking water. They both highlighted the need to balance the risks and benefits of genome editing and genetic modification and find ways to improve the acceptance of these technologies.

Innogen co-Directors Professor Joyce Tait and Dr Geoff Banda spoke about their work on understanding the risk of new technologies and determining the best way to regulate them. By working with the Government Office for Science and the Better Regulation Executive (BRE) and the British Standards Institution, Innogen is examining how regulation and standards should be designed to enable innovation and drive safe, inclusive and sustainable economic growth.

At the end, the audience were able to ask the panellists questions, leading to further conversations about the consequences of delaying the deployment of new technologies and flexible regulation.

"This event gave us the opportunity to highlight the role of social sciences in the deployment of innovation. It enabled us to raise awareness of emerging genetic technologies and their potential uses, encourage engagement with the science underpinning these technologies and stimulate public debate on how they should be regulated," said Theo Papaioannou, Director of the Innogen Institute.

"*I found the co-presentation of emerging innovative technologies by scientists and the teasing out of the socio-economic and political framing and understanding of risk very useful*," said Geoff Banda, Lecturer in Global Food Security and Innovation at the University of Edinburgh's School of Social and Political Science and Deputy Director of the Innogen Institute.

Research Data Management: benefit not burden

Submitted by synbio on Fri, 11/15/2019 - 10:40

The 'BioRDM' team was created by the UK Centre for Mammalian Synthetic Biology to improve data management practices. The team's main goal is to help researchers incorporate good data management policies into their daily research workflows, turning data management into a benefit rather than a burden. They help labs adhere to the FAIR data principle: Findable, Accessible, Interoperable and Reusable.

Thanks to ISSF3 funding, the team's activities have now expanded across the School of Biological Sciences and the College of Medicine and Veterinary Medicine. The BioRDM team have been very busy this year delivering a wide range of new resources and activities highlighted below.

You can now share microscopy data using OMERO thereby making your research more accessible, reusable and impactful. OMERO – is client-server software for managing, visualizing and analyzing microscopy images and associated metadata – handles over 140 image file formats and allows to view, organize and share your data in a central repository. Together with the School of Biological Sciences, the BioRDM team set up the **Public OMERO** (https://publicomero.bio.ed.ac.uk) where researchers can publish imaging data. You can check the recently published dataset at: https://publicomero.bio.ed.ac.uk/webclient/?show=project-55 To make the transition of *your data* to the public repository easier, the team hired Dr Andrew Romanowski as data curator. Andrew is an experienced biological researcher and he can curate or even deposit your datasets for public release.

Aside from activity on Omero, the team develops and delivers a wide range of valuable training including

- How to write a data management plan
- How to manage synthetic parts and designs (SBOL, ICE, SynBioHub)

- How to use the Wiki as a free alternative to Electronic Lab Notebooks

The team is working hard to help the local biological sciences community have solid data management plans and solutions that meet the specific needs of their research. There is no one-size-fits-all solution when it comes to managing data. Their expertise and advice has ensured the success of grant applications and which the team is developing and delivering customized data Management solutions. Like for example, the team has established OpenNGS – a platform for storing, processing and documenting next generation sequencing data and analysis – for the group of Dr Sander Granneman.

They have also been busy writing and publishing well received review and thought-leadership works in the area of Open Science and Research Data Management. You can view them below.

- Grant is dead long live the data - migration as a pragmatic exit strategy for research data preservation: https://doi.org/10.12688/wellcomeopenres.15341.2
- Better research by efficient sharing: evaluation of free management platforms for synthetic biology designs: https://doi.org/10.1093/synbio/ysz016
- Practical evaluation of SEEK and OpenBIS for biological data management in SynthSys: http://hdl.handle.net/1842/12236

If you are ready to share the images behind your results, would like to hear more about the Public Omero server, other data repositories or need help with your data management plan **contact the Bio RDM Team** at bio_rdm@ed.ac.uk. Further information (UoE staff only) on the wiki (https://www.wiki.ed.ac.uk/display/RDMS/) where you can find useful materials and stay up to date with activities.

BioRDM Team: Prof Andrew J. Millar (not in photo), Dr Tomasz Zielinski (top left), Dr Andrew Romanowski (bottom left) and Johnny Hay MSc (top right).

iGEM 2019

Submitted by synbio on Mon, 11/11/2019 - 13:42

Congratulations to both Edinburgh teams who won medals at the 2019 Giant iGEM Jamboree – the annual showcase of student-driven synthetic biology projects.

Interdisciplinary teams of undergraduate and overgraduate (or postgraduate) students spent their Summer designing and building and their hard work paid off at this year's competition.

Both teams aimed to tackle real world environmental and sustainability issues.

A Gold medal went to the Undergraduate Team who grappled with managing sustainability with affordability. Their project ' Hydrolyte' set out to design an energy project centred on helping those most at need. Read more here

A Silver medal was awarded to the Overgrad Team who worked on Improving Dye-Degrading Enzymes for Environmental and Human Health. More on their project 'Remedye' here

Thanks to all team supervisors and advisors who volunteered their time, lab space and resources including Prof Chris French, Dr Heather Barker, Dr Elise Cachat, Dr Stephen Wallace and Holly Robertson-Dick.

Learn more about the iGEM competition here

Undergrad Team

Overgrad Team

Congratulations in order

Submitted by synbio on Fri, 10/11/2019 - 14:55

Congratulations to Scott Neilson, our Genome Foundry lab technician, who graduated from Fife College with top marks for his HND in *Applied Biological Sciences*.

Scott started with the Centre in July 2015 as a Modern Apprentice (Life Sciences Lab Technician) in our mass spectrometry facility (now Edinomics). After he qualified, he joined the Edinburgh Genome Foundry, one of Edinburgh's most high profile Research Facilities, and is now an invaluable member of the team. Scott enjoys keeping the robots in good working order and assembling DNA for customers.

The Centre is proud to be part of the Modern Apprentice scheme and would like to thank Fife College (especially Yvonne Bayne) and Scott's mentor at the University, Mrs Eliane Salvo-Chirnside, for their support of Scott over the years.

Open Doors for synthetic biology

Submitted by synbio on Mon, 09/30/2019 - 13:01

The autumn sunshine brought out the crowds to the University's Doors Open Day with hundreds of people enjoying the amazing variety of science ongoing on their doorsteps in Edinburgh.

This year, we welcomed 250 visitors to the Roger Land Building on Saturday 28th September. There they enjoyed hands on arts and crafts activities to engineer their very own bugs with superpowers that could help to save the planet. Families enjoyed the challenge posed by Alessia Lepore of seeing what diversity of structure they could build with the same bioparts (aka Lego). We also had some large fluffy designer E. coli on display, which explained how synthetic biologists can redesign genetic networks with great accuracy.

This year, other groups from across the School of Biology got involved with topics such as microscopy, immunology and malaria. Gorgeous glassware made by the Wellcome Centre for Cell Biology as also on display along with an opportunity to get your own science-based tattoo.

The University constructed the Roger Land Building in the 1960s to house the Animal Research Organisation. The architect, Sir Basil Spence, is renowned for his modernist design of Coventry Cathedral, destroyed during WWII. The Roger Land Building then housed the

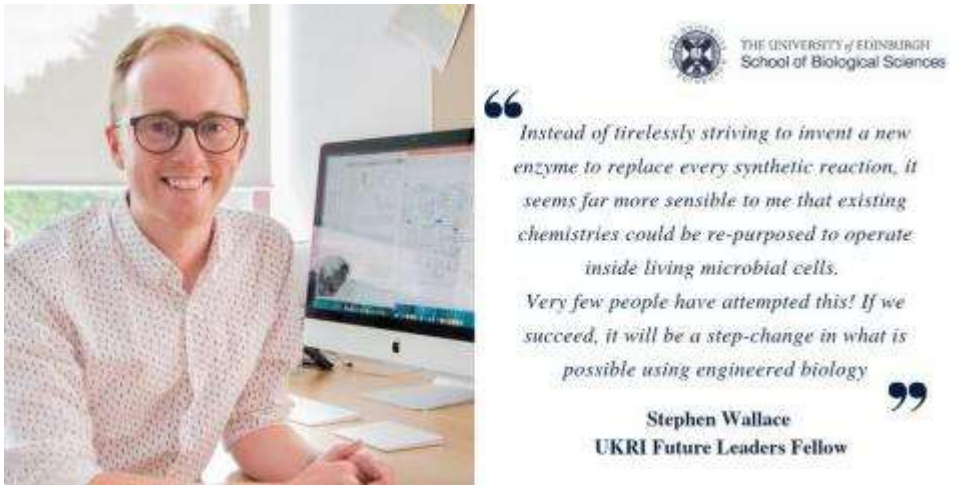
Institute for Stem Cell Research before being renovated for the School of Biological Sciences and the hub for the UK Centre for Mammalian Synthetic Biology.

Doors Open Days is Scotland's largest free festival that celebrates heritage and the built environment. It offers free access to over a thousand venues across the country throughout September, every year. The aim of Doors Open Days is to ensure that Scotland's built heritage, new and old, is made accessible to people living and visiting the country on weekends in September.

It is coordinated nationally by the Scottish Civic Trust and is part of European Heritage Days along side Scottish Archaeology Month, coordinated by Archaeology Scotland (formerly known as the Council for Scottish Archaeology). Both are supported by Historic Environment Scotland.

Stephen Wallace awarded UKRI Future Leadership Fellowship

Submitted by synbio on Mon, 09/23/2019 - 10:06



Congratulations to Dr Stephen Wallace, Lecturer in Biotechnology and member of the Centre for Synthetic and Systems Biology, who is the recipient of a UK government fellowship that supports early career researchers and innovators with outstanding potential.

Stephen Wallace's group at the Institute of Quantitative Biology, Biochemistry and Biotechnology study how bacteria could be used as environmentally-friendly living factories to produce chemicals.

Read full story here

Other useful Links

Stephen Wallace's Lab

The Benefits of Synthetic Biology, Chemistry World, Royal Society of Chemistry

UKRI Future Leaders Fellowships

Tilo Kunath wins prestigious award for Parkinson’s research

Submitted by synbio on Mon, 09/16/2019 - 11:13

Congratulations to Dr Tilo Kunath, SynthSys PI and Group Leader at the MRC Centre for Regenerative Medicine, who has won the Tom Isaacs Award 2019 for his outstanding work in Parkinson’s research.

The Tom Isaacs Award was created in memory of The Cure Parkinson’s Trust’s (CPT) co-founder and President Tom Isaacs who died in May 2017, aged 49. It is presented annually by CPT and the Van Andel Institute, Michigan to a researcher who has shown the greatest impact on the lives of people living with Parkinson’s and/or has involved people with Parkinson’s in a participatory way in their work.

Dr Kunath was chosen as this year’s recipient in recognition of his empathy and enthusiastic engagement with the Parkinson’s community and for his willingness to share his expert research knowledge. He was nominated by a number of people in the Parkinson's community because, as one person describes, 'He whole-heartedly supports the Edinburgh Parkinson’s group and regularly hosts research interest group meetings'. Another person described Dr Kunath as 'always willing to respond to questions about both his and other areas of research, by email or in person'. Another person praised Dr Kunath's commitment to the Parkinson's community saying, 'he regularly runs the PD Park Run supporting people with Parkinson’s'.

Read full Centre for Regenerative Medicine article

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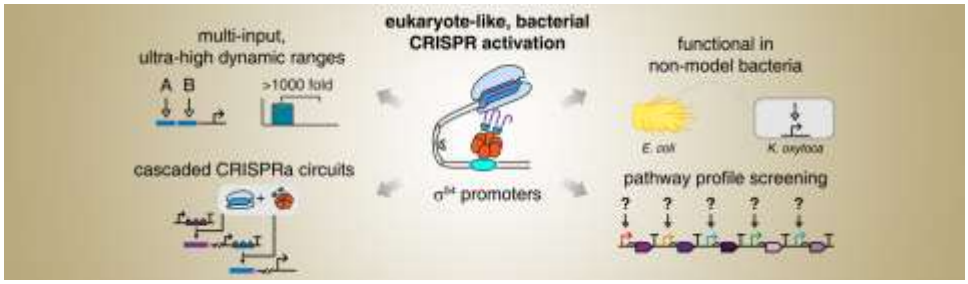
Read full Centre for Regenerative Medicine article

Hi-tech bacteria gene tool revealed

Submitted by synbio on Mon, 08/26/2019 - 17:03



Bacteria could be used to produce large quantities of medicines and fuels using a new gene programming technique, research suggests. The powerful method could enable bacteria to be used as cheap and environmentally friendly living factories that make a range of useful products. It will allow researchers to target genes that are normally difficult to activate, including those involved in infections, or with industrial applications.

The advance could also make it easier to study how harmful strains of bacteria thrive and cause infections, researchers say.

Dr Baojun Wang and his team in SynthSys invented the new technique – known as programmable gene activation – which enables them to control a wider range of genes and increase product yields.

Until now, a lack of techniques that work well in bacteria has hindered research and limited their ability to be used to make useful products.

Using the new method, levels of gene activation are around 100 times higher than existing techniques, the team says. Current methods also mainly target basic genes involved in bacterial survival.

The team's technique is adapted from an approach that uses scissor-like molecules – called CRISPR molecules – to make precise changes to the genetic code. They adapted the technology by attaching small guide molecules and proteins that target and switch on genes.

Their technique was developed for a widely studied species called *Escherichia coli* and a soil bacterium with potential industry applications. The method is also likely to work in many other species of bacteria, researchers say.

The team also developed a reusable scanning platform that makes it faster and cheaper to find the best ways of activating multiple genes in a pattern that produces high yields of useful substances.

The study, published in the journal *Nature Communications*, was funded by the Biotechnology and Biological Sciences Research Council, UK Research and Innovation, Leverhulme Trust and Wellcome.

Liu Y, Wan X and Wang B, “Engineered CRISPRa enables programmable eukaryote-like gene activation in bacteria”, ***Nature Communications*****,** 2019, https://doi.org/10.1038/s41467-019-11479-0

2019 Synbitech

Submitted by synbio on Mon, 08/05/2019 - 09:33

In late June, the Centre attended the first “SynbiTECH” synthetic biology industry conference in London’s QEII Conference Centre in Westminster.

The conference brought together several hundred academic researchers, industrialist and investors together to share opinions, insights and expertise. Along with the other five Synthetic Biology Research Centres, the UK Mammalian Synthetic Biology Research Centre had a stand during the event, enabling it to generate several new business leads.

Synthetic biology based products and services have generated a multi-million dollar industry and the UK is fast becoming one of the top global centres for synthetic biology based businesses. There was a tangible buzz to the event and great to see so many exciting new UK companies being showcased during the 2 day event.

Dr Jason Kelly, Founder of Boton-based Gingko Bioworks, set the tone for the event giving an inspiring talk on the power of synthetic biology and the incredible growth of this innovative company. Panel discussions on a wide variety of topics, were interspersed with Sessions showcasing a wide range of industry themes from food to fabrics, diagnostics to technology platforms.

Dr John Cumbers, the founder of the synbio network SynBioBeta, also attended to give his ‘state of the nation’ report and providing convincing evidence that there is only one direction for synbio industry – that’s upwards.

Sir David Willetts, arguably the architect of UK synbio investment, rounded off the meeting with a cry for continued funding so that the UK can continue to be a global leader in the field.

We hope Mr Johnson is listening!

SynbiTECH 2020 will be held on July 1 and 2 in 2020.

Building solid foundations for the next generation

Submitted by synbio on Mon, 08/05/2019 - 09:24

Staff from the Centre and wider School of Biological Sciences hosted two Foundation Apprentices during the summer. Foundation Apprenticeships are a relatively new scheme that provide senior school students an opportunity to carry out some workplace learning in more vocational subjects. During June, Ally and Nicole were hosted by the labs of Professor Lynne Regan and the School's Biological Teaching Laboratories respectively. Here Dr Louise Holyoake, a postdoctoral research in Lynne's lab, tells us more.

"Ally came to work in our lab group for three weeks in June as part of her foundation apprenticeship at Fife College. The time taken to show Ally how to do tasks was rewarding as she quickly learnt how to do these tasks with minimal input from myself. During her stay, Ally made media and protein gels for our lab group and I quickly learnt to trust the care that she put into her work.

The apprenticeship (which was from Monday to Thursday during school hours) provided Ally a good opportunity to chat to other lab members and understand the different roles that members play within the group. She had opportunities to see the type of problem solving that can come up day to day and shared her thoughts on how to approach these. We discussed how instructive it was to see the skills she had learnt in classes at College used in our lab.

A Foundation Apprenticeship placement gives the opportunity for someone who has so far been in full time education to gain some work experience. This helps students with choosing their future career paths as well as making them more employable.

Taking on a Foundation Apprentice should not be taken lightly as they do require full time supervision and a well-planned programme of work. I would however highly recommend it and the Regan lab will definitely be taking on another student next year."

Photo: Ally and Nicole visited the Edinburgh Genome Foundry, hosted by Scott Neilson (centre).

Cheers! Centre supports Pint of Science 2019 evening

Submitted by synbio on Tue, 06/04/2019 - 13:11

The Centre supported a Pint of Science 2019 event dedicated to synthetic biology on May 22.

For three evenings in May, beer met biology through some engaging presentations (in some cases performances) by some of the Centre researchers.

Sophie Stone expanded the vision of the audience talking about the notions of the human and our bodies on synthetic biology. Dr Gaynor Campbell showed her skills as a budding stand-up comedian taking us on the origins of genetic manipulation through to some rather dubious DIY biohacking. Prof Lynne Regan then used us some fun facts about the role of the proteins and their biomedical importance – props from large building bricks included.

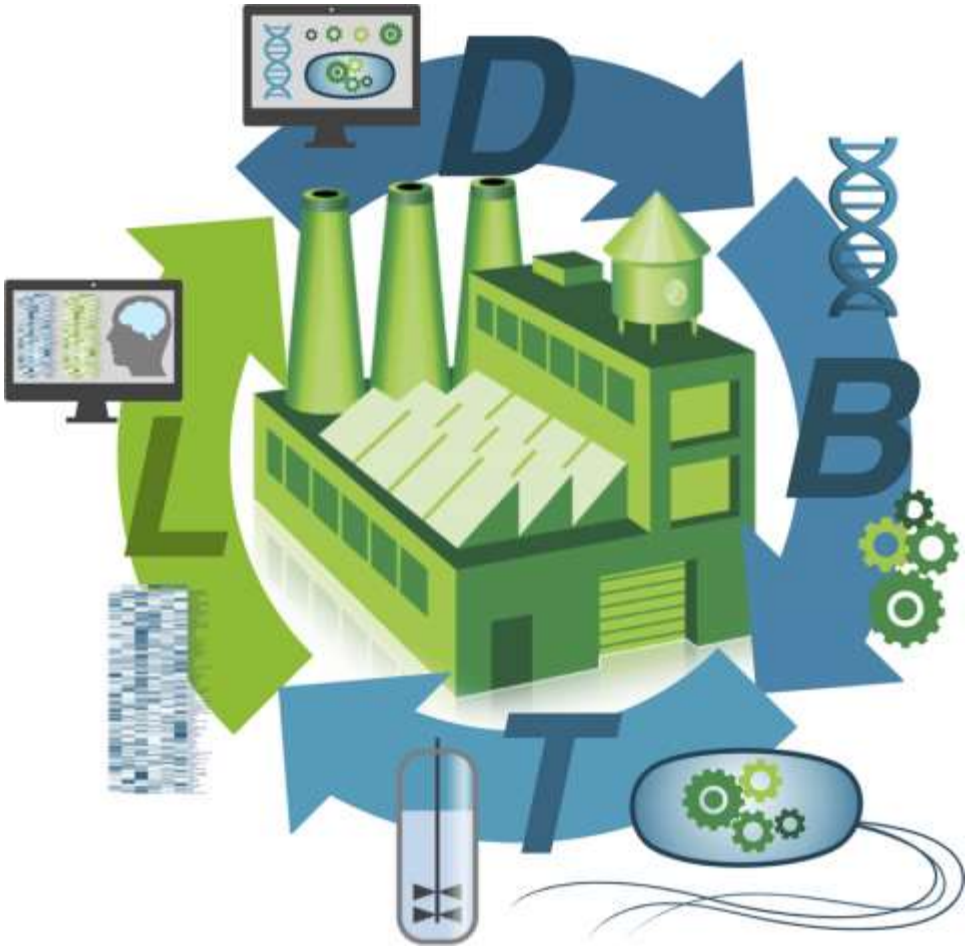
During the night, the audience had the opportunity to draw their own genetically augmented product – with prizes for the most artistic and the craziest ideas.

Dr Elisa Pesenti from the UK Centre for Mammalian Synthetic Biology coordinated this year's event which was a sell-out success.

Photo: From left - Liz Fletcher (Centre manager), Prof Lynne Regan and Dr Gaynor Campbell

Global Alliance of Biofoundries launched

Submitted by synbio on Mon, 05/13/2019 - 13:45



A new network of the world's leading Biofoundries was launched to drive forward synthetic biology research in academia and industry.

The Global Alliance of Biofoundries (GBA) brings together 16 institutions from countries including the UK, US, Japan, Singapore, China, Australia, Denmark and Canada. The Centre for Synthetic and Systems Biology and the Edinburgh Genome Foundry are signatories on this exciting new collaboration.

The GBA will share knowledge, infrastructure and expertise to tackle global challenges and play a central role in the 'synthetic biology revolution' and the transition to a new global bio-based economy.

Globally, many universities and institutions have established Biofoundries to provide the infrastructure and technology needed by both academic research and the rapidly emerging synthetic biology industry. Edinburgh is home to one of these Foundries – Edinburgh Genome Foundry – funded by the BBSRC through the RCUK's Synthetic Biology for Growth Programme.

The GBA was launched at an event at the University of Kobe, Japan. An article in *Nature Communications*, published to coincide with the launch, explains how the members will collaborate to address globally relevant challenges.

Prof Susan Rosser, Co-Director of the Edinburgh Foundry and Director of the UK Centre for Mammalian Synthetic Biology, attended the launch event. "*We are delighted to be a key partner in this alliance. With one of the most fully automated DNA assembly platforms here in Edinburgh, we are looking forward to working with our international partners to fully harness the power of synthetic biology and the revolution offered by biomedical automation*."

Global Alliance of BioFoundries https://www.biofoundries.org/

Nature Communications Article https://www.nature.com/articles/s41467-019-10079-2

Image Credit: Christopher Johnson, DOE Agile BioFoundry, Golden, CO, USA

UKRI Future Leader Fellow

Submitted by synbio on Fri, 05/10/2019 - 16:35

Congratulations to Dr Amanda Jarvis of the School of Chemistry and member of the Centre for Synthetic and Systems Biology, who is one of four University scientists awarded government fellowships to help them become leaders in research and innovation.

The awards form part of the Government's modern industrial strategy, which aims to secure the UK as world-leading in scientific research and innovation. UKRI will provide up to £900 million in support over six competition rounds over three years for the Future Leaders Fellowships, typically awarding around 200 new fellows each year.

Amanda studies the design of novel metal centers into protein scaffolds to create artificial metalloenzymes. The biological nature of these artificial metalloenzymes allows for the rapid evolution of the catalysts towards exceptional selectivities and activities that cannot be obtained with just the metal catalyst itself, thus reducing waste and energy costs. The Future Leaders Fellowship will enable her to build up her research group and to develop these catalysts further, providing chemists with a new tool that can be used to develop in cellular chemical "factories" producing complex products directly from sustainable resources.

Useful Links

- UKRI Press release
- Future Leaders Fellowships
- https://www.amandajarvis.co.uk/

Chief of US Naval Research visits Centre

Submitted by synbio on Fri, 05/10/2019 - 08:21

The Centre was delighted to host Rear Admiral David Hahn, Chief of US Naval Research and Director of Innovation, Technology Requirements, and his Flag Aide Lieutenant Jason Penland on May 9th.

Our guests enjoyed an overview of the synthetic and systems biology research ongoing in Edinburgh and an update on a project ongoing in the lab of Dr Teuta Pilizota.

Last year, Teuta received funding from the Office for Naval Research and Defence Advanced Research Projects Agency to understand how bacteria swim to stay alive. The work could lead to the development of bacterial 'biosensors' to help the US Navy navigate at sea.

The research will also aid understanding of bacteria's potential as biosensors and could lead to new insights on why bacteria swim and whether this helps them evade the body's defenses and cause infection.

You can read more about the project here.

http://www.synthsys.ed.ac.uk/news/tapping-bacterial-survival-strategies-ocean-navigation

UKRI Future Leadership Fellowship

Submitted by synbio on Thu, 05/09/2019 - 15:51

Congratulations to Dr Baojun Wang, Reader in Synthetic Biology at the School of Biological Sciences and member of the Centre for Synthetic and Systems Biology, who is one of four University scientists to have been awarded government fellowships to help them become leaders in research and innovation.

The awards form part of the Government's modern industrial strategy, which aims to secure the UK as world-leading in scientific research and innovation. UKRI will provide up to £900 million in support over six competition rounds over three years for the Future Leaders Fellowships, typically awarding around 200 new fellows each year.

Baojun leads the Synthetic Biological Circuit Engineering Lab and will focus on designing synthetic genes to customise cellular behaviour. His team will also research the manufacture of bespoke protein-based materials and antibodies for the biotechnology industry and for therapeutics.

Useful Links

- UKRI Press release
- Future Leaders Fellowships
- Wang Lab website

Business minister visits Centre and Foundry

Submitted by synbio on Mon, 04/29/2019 - 09:05

The Rt Hon Lord Henley, Parliamentary Under Secretary of State at the Department for Business, Energy and Industrial Strategy (BEIS), visited the Centre for Synthetic and Systems Biology on April 26th along with a tour of the Edinburgh Genome Foundry.

Lord Henley was welcomed by Prof Dave Robertson, Vice Principal and Head of the College of Science and Engineering. Prof David Gray, Head of the School of Biological Sciences, then provided an overview of the University's plan to develop a biotech hub linking together the many areas of expertise in this highly multidisciplinary field. Lord Henley was then introduced to the breadth of exciting synthetic and systems biology ongoing at the UK Centre for Mammalian Synthetic Biology by its Director, Professor Susan Rosser.

The visit was completed with a tour of Edinburgh's Genome Foundry, where Lord Henley and his team met with Foundry staff and could watch the automated genome assembly platform in action.

Image: Lord Henley (far right) and the Foundry directors and staff.

Driving the 4th industrial revolution across the Central belt

Submitted by synbio on Tue, 04/02/2019 - 15:52

The Centre is involved in an exciting collaboration that has been shortlisted for the first wave of UK Research and Innovation's (UKRI) Strength in Places Funding. The project aims to boost the economic impact of the burgeoning Industrial Biotechnology sector in Scotland's Central Belt. It will fast track the pathway from research to commercial deployment by filling gaps in the existing innovation system to unlock further economic impacts from the 'bio-revolution' - developing biology-based products and platforms

The consortium includes expertise from industrial and academic players in synthetic biology (Ingenza, GSK), biorefining (Cellucomp, Celtic Renewables, 3FBio, Marine Biopolymers Ltd) and Grangemouth cluster colocation providers (Ineos, Calachem and Forth Ports) as well as other leading academic institutes in the region. Crucially the bid has the support of Scottish Enterprise, Scottish Development International, Scottish Futures Trust, Scottish Funding Council and the local authorities across the region. IBioIC is an important actor in the UK Bio-economy Strategy and Scotland's National IB strategy.

With £50,000 of seed funding, the consortium will work to develop full-stage bids for £10 million and £50 million each to carry out projects designed to drive substantial economic growth.

Key activities proposed include creating:

1. A **Centre of Excellence for Engineering Biology ('the Centre')** headquartered at the University of Edinburgh (but including Universities of Glasgow and Strathclyde, Heriot Watt University and the James Hutton Institute) **with an incubator** to support new companies in engineering biology products and services and biorefining.

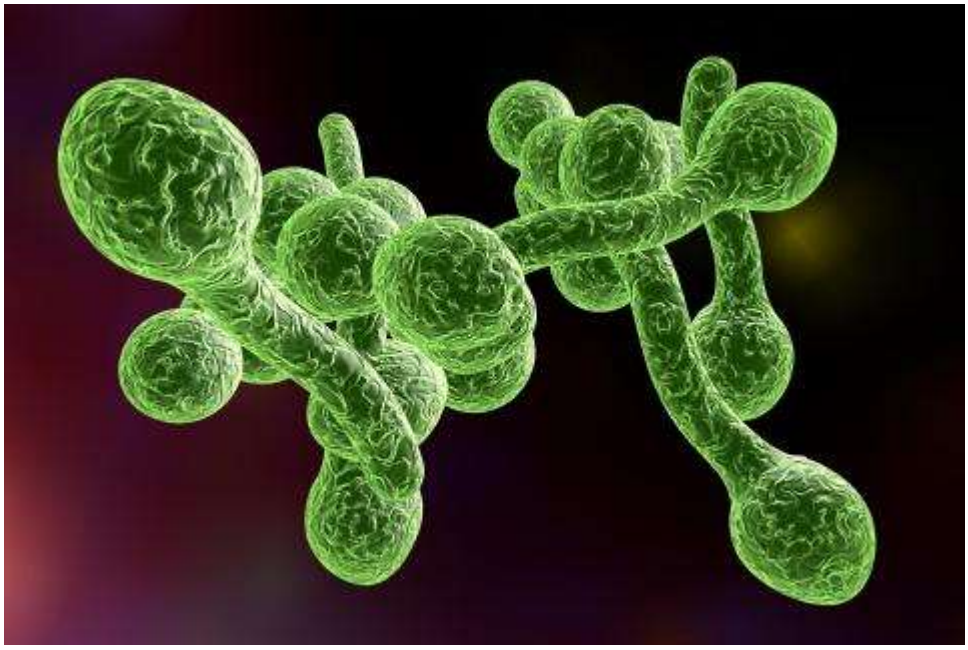
2. **Enhanced bioprocess technology scale up facilities (the 'Facilities')**, extending those established by the Industrial Biotechnology Innovation Centre (IBioIC) to enable existing and new businesses to graduate their technologies from TRL 4-7.
3. A physical **industry partnership and skills hub (the 'Hub') with enhanced digital/data collaboration technologies** for near-to-market businesses approaching commercial demonstration stage (TRL 8-9). Located **at the new Forth Valley College campus at the heart of the Grangemouth Industrial Cluster**, the Hub will enable businesses to access the vital supply chain and local, award winning, industrial skills training. It will enable the emerging cluster companies to connect and collaborate with other UK Centres of academic and manufacturing excellence and to secure colocation sites locally within the cluster. This is a partnership with industry to ensure that the physical infrastructure and sites are available for investment.

Announced as part of the government's Industrial Strategy in November 2017, the Strength in Places Fund will benefit all nations and regions of the UK by enabling them to tap into the world-class research and innovation capability that is spread right across the country. The fund brings together research organisations, businesses, and local leadership on projects that will lead to significant economic impact, high-value job creation and regional growth.

Image by Harry Stilianou from Pixabay

SynBioBlog: Could microbes be our smallest collaborators in biotechnology?

Submitted by synbio on Tue, 04/02/2019 - 08:37



Synthetic biology, a developing area of research focused on designing and building with DNA, tends to attract attention for several reasons. Some synthetic biologists have engineered baker's yeast and other microorganisms to produce such diverse products as vanilla flavouring, cow milk proteins, and spider silk. Others involved with the field are concerned that similar scientific strategies could be employed to produce biological weapons, a concern notably articulated in a recent report from the US National Academy of Sciences. And, in projects more inclined to incite human wonder and curiosity than concern about safety and the shape of global agriculture, landmark projects are redesigning complete genomes for bacteria and yeast to test longstanding scientific questions and, perhaps, to make even better living platforms for additional engineering.[i]

Whatever the focus, synthetic biology is usually about control. Scientist aim to understand how DNA sequences yield cellular functions so comprehensively that designing with DNA and building living cells with custom functions might not be much harder than designing and building with wood or steel—or, more aptly, with a programming language.

Achieving this level of control with living organisms is difficult. Synthetic biology has seen great success with pathways of several genes linked together to produce a specific molecule of interest or a very simple cell behaviour. More ambitious designs, however, rapidly slam into a problem: living cells are extraordinarily complex and there remains a great deal that we don't yet know about them.

One response to that challenge is to work hard to more fully understand how cells hold together. Another response is to try to make "life" simpler by identifying the absolute basics a cell needs to survive and then building them from scratch using just those elements. But a

third option—and maybe a more achievable one at least in the near-term—involves de-emphasizing control and working *with* living things to achieve design goals.

Yeast and bacteria—the microorganisms with which synthetic biologists do most of their work—are not wood and steel nor, for that matter, are they computer programs. A major distinguishing factor is responsiveness: living organisms change and respond to their surroundings and other organisms much faster than non-living materials. Synthetic biology projects often involve trying to dampen this tendency for living organisms to change so that cells do only what they are told and other cell activities don't interfere with human designs.

Rather than trying to make living things more like non-living materials, however, another option involves working with cells' abilities and propensities to accomplish something together in what you might call a 'multispecies collaboration.'

The synthetic yeast project, the first effort to build a complete eukaryotic genome entirely out of redesigned DNA, is applying this sort of approach toward building yeast genomes better adapted to survive stressful environments.

Working *with* living cells might be productive for scientists' efforts to achieve design goals. But just as important is the shift in perspective toward other creatures that the idea of "multispecies collaboration" might engender.

Trying to control other creatures to serve human needs has tended to put the lot of us – humans, other species, and the planet – in massive trouble. Synthetic biology is often about trying to help get us out of that trouble by reducing our dependency on fossil fuels and devising more sustainable modes of production. Humans are recognizing that growing what we need may be a better option than mining, smelting, or burning. Simultaneously, however, we humans are increasingly attentive to the needs of non-humans, not only—but not least—because human wellbeing depends on the wellbeing of other species.

Microbial life may be easy to ignore because it's small, but microorganisms are vitally important to the survival and wellbeing of all life. As we seek better ways to live in community with all of the inhabitants of this planet, human and otherwise, we might keep in mind that even our smallest companions have lives of their own, and seek to expand our capacity to work and communicate with them as living creatures rather than seeking only to increase our control over them. Microbes are more than tiny machines. Let's see what we might learn from them, and even what we might accomplish together.

By Drs Erika Szymanski and Jane Calvert, Science, Technology & Innovation Studies, School of Social and Political Science

For more on Szymanski and Calvert's work, see https://www.nature.com/articles/s41467-018-05332-z

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[i] See, for example, https://www.theguardian.com/science/2017/jan/23/organisms-created-with-synthetic-dna-pave-way-for-new-entirely-new-life-forms and https://www.theguardian.com/science/2017/mar/09/synthetic-yeast-genome-nearly-complete-paving-way-for-bespoke-organisms

Smartphone-based biosensor to tackle arsenic poisoning

Submitted by synbio on Wed, 03/27/2019 - 10:07

A smartphone-compatible biosensor could help millions of people avoid drinking water contaminated by arsenic. The portable device uses bacteria to detect unsafe arsenic levels. It attaches to a smartphone and generates easy-to-interpret patterns, similar to volume-bars, which display the level of contamination.

In resource-limited countries, there is a lack of sufficiently skilled personnel and healthcare facilities to test water for contamination. At a cost of less than 30 pence per test, the biosensor could replace current arsenic tests that require specialist laboratory equipment or expensive portable test kits that produce toxic chemicals.

Arsenic is naturally present in the groundwater of a number of countries, such as India and Bangladesh. UNICEF reports that arsenic-contaminated drinking water is consumed by more than 140 million people worldwide. Long-term exposure to unsafe levels leads to skin lesions and cancers, and is linked to 20% of all deaths in the worst affected regions.

Researchers at the University of Edinburgh developed the biosensor by altering the genetic code of the harmless bacteria Escherichia coli, to trigger them to produce fluorescent proteins in the presence of arsenic. Water samples are fed into the clear, plastic device containing bacteria with different levels of arsenic sensitivity, seeded in a pattern that produces volume-bars. The team were able to precisely control the bacteria's sensing ability, boosting it up to 5000 fold, by adding genetic components that act as amplifiers when arsenic is detected.

The development tackles a key problem with existing biosensors, which are difficult to use and are not sensitive enough for real-world conditions. To tackle concerns about the modified bacteria escaping the device, the team trapped the bacteria using internal chambers or suspended them in a gel. The approach could be used to develop ultrasensitive biosensors with many uses, such as detecting other environmental toxins, diagnosing diseases or locating landmines, researchers say.

The study published in Nature Chemical Biology, was funded by BBSRC, Leverhulme Trust and Wellcome.

We have tested our sensors with water samples from wells in a local village in Bangladesh. The arsenic levels reported by the sensors are consistent with lab-based standard tests, demonstrating its potential as a new low-cost, easy-to-use monitoring tool in the field.

Dr Baojun Wang, lead author, School of Biological Sciences

Our signal amplification method can also be used to develop other bacteria-based sensors for a number of environmental contaminants such as pesticides.

Xinyi Wan, first author, PhD Student, School of Biological Sciences

Skin swab test for Parkinson’s on horizon

Submitted by synbio on Wed, 03/20/2019 - 15:21

A study has identified chemicals in the skin responsible for a unique scent in people with Parkinson’s disease. The chemicals can be detected in an oily substance secreted from the skin called sebum, the researchers found. The findings suggest Parkinson’s disease could one day be diagnosed from skin swabs, potentially leading to new tests.

Super smeller

There are no tests for Parkinson’s disease at present. Patients are diagnosed from observation of symptoms, a process that can take several years. Dr Tilo Kunath, from the UK Centre for Mammalian Synthetic Biology and the MRC Centre for Regenerative Medicine at the University of Edinburgh first had the idea that Parkinson’s might be diagnosed from chemicals in the skin when they met Joy Milne, the widow of a former patient. Here acute sense of smell had noticed that people with the disease have a unique scent. In a pilot study, Joy accurately differentiated Parkinson’s patients from healthy people by smelling T-shirts they had worn for 24 hours. Using a specialised technique that mimics the human nose, researchers at The University of Manchester analysed sebum samples of patients with Parkinson’s Disease. They identified three molecules in sebum linked to the odour caused by Parkinson’s Disease. Researchers say this could lead to new tests.

This is a really exciting step towards a test for Parkinson’s that could cut short the time it currently takes to reach a diagnosis. Having a conclusive test would have a huge impact, not only for patients, but could also aid research for new treatments.

Dr Tilo Kunath Medical Research Council Centre for Regenerative Medicine, University of Edinburgh

Parkinson’s disease

Parkinson’s is caused by a loss of nerve cells in the part of the brain that controls body movement. There currently is no cure, but researchers hope that spotting affected people sooner could help them in the search for treatments. The research, published in the journal ACS Central Science, was funded by Parkinson’s UK and the Michael J. Fox Foundation.

Natural blue colouring pioneers win collaboration award

Submitted by synbio on Thu, 03/07/2019 - 08:18

Researchers from SynthSys and the biotech firm Scot Bio have won a prestigious Scottish Life Sciences Award for their pioneering collaboration on natural blue colourants.

The partnership won the Innovative Collaboration prize for two years of work that has developed new molecular biology and extraction techniques to boost the yield and purity of Scot Bio's phycocyanin product, a blue pigment it derives from spirulina algae.

Scot Bio aims to be a global leader in the rapidly growing market for natural food and drink colourants, and to become a major player in the pharmaceutical market, where phycocyanin has potential uses in cancer and liver treatments. Polly Van Alstyne, Chief Operating Officer at Scot Bio, said: "This award is a welcome endorsement of the hard work carried out by everyone at Scot Bio and the University of Edinburgh, and a clear example of how collaboration between academia and the private sector can have huge potential in the creation of high value jobs and in commercialising intellectual property."

Phycocyanin occurs naturally in spirulina. Scot Bio, based at BioCity Scotland in North Lanarkshire, uses a patented growing method to increase the volume of phycocyanin that the spirulina produces, resulting in higher yields than traditional pond-grown spirulina. By producing spirulina in reactors rather than open-pond systems favoured by other suppliers, the company can offer traceability and security of supply that is highly desirable for brands using the blue colourant in their products.

The company has collaborated with the University since 2013 on multiple research projects, led by Dr Andrew Free, Dr Attila Molnar and Dr Alistair McCormick from the University's

School of Biological Sciences, and involving several PhD and masters students. Scot Bio's head of R&D, Dr Rocky Kindt, began his company-sponsored PhD at the University of Edinburgh in 2013 and joined the company in 2016.

On winning the award, Dr McCormick said: "We are delighted to have developed such a strong relationship with ScotBio – our collaborative projects have been highly beneficial for all staff and students involved. "Working with ScotBio has helped to develop an interdisciplinary culture, and our research has since expanded into several new areas. This has led to significant fundamental and applied scientific advances, and high impact publications. This is a prime example of what can be achieved when academia and industry work together. We look forward to continued success in the future."

Two of the collaborative research projects are focused on synthetic biology, seeking to manipulate the gene sequence to increase pigment production, while a third developed an economically viable purification process to produce phycocyanin at scale at medicinal grade purity. Scot Bio has recently scaled up its production capability to 16,000 litres and is looking to move from 2,000-litre tanks to 50,000-litre tanks within months. Its staff has grown from three to nine, and it has plans to increase its team by around 20 to accelerate its R&D and sales and marketing.

Support for AI boosts postgraduate researchers

Submitted by synbio on Tue, 02/26/2019 - 16:25

Two new postgraduate programmes in artificial intelligence are being supported as part of a package of funding announced by the UK Government.

The investment will create postgraduate training centres (so-called CDTs) in Natural Language Processing and in Biomedical Artificial Intelligence. It forms part of a drive to train the next generation of experts in AI (Artificial Intelligence) and build on the UK's reputation for emerging technologies.

Researchers will aim to support the understanding and development of devices and technologies that use AI. These can enable complex tasks to be completed quickly and help to glean useful insights from large quantities of information.

The UKRI **CDT in Biomedical Artificial Intelligence** will seek to develop techniques to extract knowledge from biomedical data sets, with potential impact for public health and the economy.

The CDT, led by Professor Guido Sanguinetti of the School of Informatics and Centre for Synthetic and Systems Biology, aims to spearhead the development and deployment of AI techniques in the biomedical sector. It will focus on the technical, biomedical and socio-ethical aspects of biomedical AI with a particular focus on cancer and antimicrobial resistance.

The CDTs are two of the 16 newly created CDTs in the UK. They will support 1,000 PhD students and work with a total of 300 partners including Google, Rolls-Royce and AstraZeneca. The initiative is funded by £100m investment from UK Research and Innovation with £78 million in cash or in-kind contributions from project partners and £23 million from partner universities.

Further details https://www.ukri.org/news/200m-to-create-a-new-generation-of-artificial-intelligence-leaders/

Strategic industry collaboration announced

Submitted by synbio on Mon, 02/11/2019 - 16:52

The Centre is delighted to be involved in the Fujifilm Diosynth Biotechnologies (FDB) “Centre of Excellence in Bioprocessing 2.0” collaboration.

FDB is a leading Contract Development and Manufacturing Organization with experience in the development and manufacture of recombinant biopharmaceuticals and gene therapies.

The new Centre of Excellence will be led and funded by FDB in partnership with leading academic institutions: the University of Edinburgh, the University of Manchester and University of York.

Andy Topping, chief scientific officer at Fujifilm said of the Centre: “Fujifilm has historically supported a significant number of innovation projects globally. The FDB Centre of Excellence in Bioprocessing 2.0 builds on Fujifilm’s historical support of research here in the United Kingdom and allows us to develop long term partnerships with these world class universities to support the growth of our business.”

Formal announcement of the establishment of the CEB took place at the Industrial Biotechnology Innovation Centre (IBioIC) Annual Conference 2019, ‘Industrial Biotechnology for a Sustainable Future’, which was held this past 30 and 31st of January 2019 at the Technology Innovation Centre, Glasgow. Fujifilm is a core member of the IBioIC, which provides access to funding, events and access to other companies within its network. Over the past few years, Edinburgh has had several partnerships with FDB and will look forward to developing deeper and more strategic ties.

Stem cell approach could aid Parkinson's fight

Submitted by synbio on Fri, 01/04/2019 - 16:00

A team of scientists, which includes researchers in the UK Centre for Mammalian Synthetic Biology, have taken a key step towards improving an emerging class of treatments for Parkinson's disease. The advance could markedly improve a next generation of therapies for the condition, which affects around one in 350 people in the UK, by aiding in the development of the promising treatment – known as cell replacement therapy – which was first used in a clinical trial this year. The study, published in the European Journal of Neuroscience, was funded by the UK Centre for Mammalian Synthetic Biology, the pharmaceutical company UCB Biopharma and The Cure Parkinson's Trust.

Experts hope the approach, which involves transplanting healthy cells into parts of the brain damaged by Parkinson's, could alleviate symptoms such as tremor and balance problems. The latest development addresses limitations in the treatment in which, over time, transplanted tissue can acquire signs of disease from nearby cells.

Researchers at the University of Edinburgh have created stem cells – which have the ability to transform into any cell type – that are resistant to developing Parkinson's. They snipped out sections of DNA from human cells in the lab using advanced technology known as CRISPR. In doing so, they removed a gene linked to the formation of toxic clumps, known as Lewy bodies, which are typical of Parkinson's brain cells.

In lab tests, the stem cells were transformed into brain cells that produce dopamine – a key brain chemical that is lost in Parkinson's – in a dish. The cells were then treated with a chemical agent to induce Lewy bodies. Cells that had been gene-edited did not form the toxic clumps, compared with unedited cells, which developed signs of Parkinson's.

Researchers say the advance could be most beneficial to younger patients living with Parkinson's and those with an aggressive form of the condition, but that the advance had to be tested in human trials.

We know that Parkinson's disease spreads from neuron-neuron, invading healthy cells. This could essentially put a shelf life on the potential of cell replacement therapy. Our exciting discovery has the potential to considerably improve these emerging treatments.

Tilo Kunath - University of Edinburgh
Cell replacement therapy represents one experimental approach to regenerative medicine for people with Parkinson's. This new research by Dr Tilo Kunath and his team at the University of Edinburgh provides another advancement in the development of this treatment. The Cure Parkinson's Trust is thrilled to be associated with this inspiring and innovative research.

Simon Stott - Cure Parkinson's Trust

Picture: Dr Tilo Kunath

Original paper