20-21 October 2014, London, UK

Global Engage Ltd

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Synthetic Biology Congress

CUTTING EDGE RESEARCH, STRATEGIES, AND SOLUTIONS TO KEEP YOU UP TO DATE WITH LATEST ADVANCEMENTS, INVESTMENT OPPORTUNITIES, NOVEL METHODS & APPLICATIONS OF SYNTHETIC BIOLOGY IN THE HEALTHCARE & AGRICULTURE SECTORS

Global Engage is pleased to announce as part of their successful Genomic series of events the Synthetic Biology Congress, which will be held on October 20-21 in London, UK and will be co-located with our 2nd Annual qPCR and Digital PCR Congress.

Attracting over 150 industry & academic experts working in areas such as synthetic biology, bioengineering, biochemical / metabolic / chemical / genetic engineering, systems biology, microbiology, computational / molecular biology, chemistry, mathematics, computing, biochemistry, drug discovery and plant science this will examine the latest strategies, developments and case studies using synthetic biology to further research in healthcare and the agriculture sectors. The congress will also have a dedicated section focusing on finance, aimed at those looking for investment opportunities and those seeking funding to exploit their research.

Predicted to be worth $10.8bn globally in 2016, synthetic biology is a fast-growing research area making tremendous scientific, technological and economical impacts worldwide. The conference will therefore provide a timely interactive networking forum offering the opportunity to take home cutting edge research, strategies, methods and solutions to allow you to keep up to date with the latest advancements, investment opportunities, novel methods, and applications of Synthetic Biology within your field. This will be achieved through a vibrant exhibition room full of technology providers showcasing their technologies and other solutions, poster presentation sessions, expert led case study presentations and interactive Q&A panel discussions from a 40 strong speaker faculty examining topics on four separate tracks detailed below.

Confirmed Speakers Include:

Paul Freemont
Co-founder and co-director of the EPSRC Centre for Synthetic Biology and Innovation, Imperial College

Jean Peccoud
Associate Professor, Synthetic Biology Group, Virginia Bioinformatics Institute, USA

Anne Osbourn
Director, Norwich Research Park Industrial Biotechnology and Bioenergy Alliance, John Innes Centre

Conference Synopsis

Healthcare / Drug Discovery

- Overview, introduction and Impact of Synthetic Biology
- Academic & Pharmaceutical SynBio case studies
- Genome engineering
  - Technology and tool development
  - Gene and genome synthesis
  - Genome and pathway design
  - Genome editing - CRISPR/ TALENs / ZFNs etc
  - Engineering cells – novel / optimising pathways
  - Programming behaviour
  - Systematic engineering for better function prediction and modeling
- Applications of SynBio in health research
  - Development of drugs, vaccines, antibiotics etc
  - Disease identification
  - Reprogramming stem cells
  - Synthetic DNA based therapeutics
  - Antibody / Protein engineering
  - Biosensor development
  - Gene therapy
  - Bacteria engineering
  - Drug delivery
- SynBio for exploiting and designing proteins
  - Protein alteration & post-translational modification (PTM)
  - Novel screening strategies
  - Protein production
- Bottom up approaches – cell building / genome assembly / building synthetic life
- Bio-manufacturing
  - Biocatalysis and biotransformation innovation
  - Function and use of enzymes as biocatalysts
  - Enzyme engineering
- Opportunities, challenge, & future applications of SynBio in healthcare

Plant Synthetic Biology

- Potential of Synthetic Biology in plant research
- Genome and pathway design / engineering
- Natural product biosynthesis
- Genome Engineering / editing – CRISPR / TALENs etc
  - Enriching plants through synthetic biology
  - Programmable behaviour
  - Metabolic engineering
- Improving DNA assembly methods
- Applications at molecular, cell and plant levels
- Plant research case studies
  - Trait design / improvement
  - Nitrogen efficiency
  - Efficient water use
  - Conservation
  - Biosensors
  - Biofuel
- Plant research for biofuels / bioproducts and pharmaceuticals
- Potential of Synthetic Biology in plant research

Investment, Funding and Bioethics

- Funding opportunities for Synthetic Biology
- VC investment
- Social and BioEthics
- Startup / Small company showcase
- Venture Capitalism, Biotechnology Start-ups and Partnering Opportunities

Speakers

HUMAN

Paul Freemont, co-founder and co-director of the EPSRC Centre for Synthetic Biology and Innovation, Imperial College

Tanja Kortemme, Professor and Vice Chair, Department of Bioengineering and Therapeutic Sciences, University of California San Francisco

Sarah Lau, Patent Attorney and Partner, Kilburn & Strode LLP, UK

Joyce Tait, Director, Innogen Institute, Professor, The University of Edinburgh

Guillermo Montoya, Full Professor, Research Director Structural Biology Program, Novo Nordisk Foundation Center for Protein Research, University of Copenhagen, Denmark

Barbara Di Ventura, Group Leader Synthetic Biology, Heidelberg University

Richard Kitney, Chairman of the Institute of Systems and Synthetic Biology; and Co-Director of the EPSRC National Centre for Synthetic Biology and Innovation and The UK National Industrial Translation Centre for Synthetic Biology (SynBiCITE), Imperial College London, UK

HUMAN / PLANT

Jutta Heim, Senior Scientific Advisor, Evolva, Switzerland

Dek Woolfson, Professor of Chemistry & Biochemistry, Director, BrisSynBio, a BBSRC/EPSRC-funded Synthetic Biology Research Centre, School of Chemistry, University of Bristol

Pier Luigi Luisi, Director Synthetic Biology Lab, Department of Biology, Roma Tre University

François Kepes, Research Director, institute of Systems and Synthetic Biology, Genopole, CNRS, France

Matias Zurbriggen, Group Leader/ Assistant Professor, Synthetic Biology, Faculty of Biology, University of Freiburg

Robert Edwards, Professor and Head of the School of Agriculture, Food and Rural Development (AFRD), Newcastle University

Jules Beekwilder, Senior Scientist, Plant Research International, Wageningen University, The Netherlands

Siobhan Brady, Assistant Professor, Department of Plant Biology and Genome Center, UC Davis

PLANT

Birger Lindberg Møller, Director, Centre for Synthetic Biology, Department of Plant and Environmental Sciences, University of Copenhagen

Anne Osbourn, Director, Norwich Research Park Industrial Biotechnology and Bioenergy Alliance, John Innes Centre

Neal Stewart, Professor of Plant Sciences, Ivan Racheff Chair of Excellence in Plant Molecular Genetics, & Co-Director of the Tennessee Plant Research Center

Christian Rogers, Scientific Programme Manager, Engineering Nitrogen Symbiosis for Africa (ENSA), John Innes Centre

Greta Nölke, Group Head, Metabolic Engineering, Department Plant Biotechnology, Fraunhofer Institute for Molecular Biology and Applied Ecology

Joshua Yuan, Associate Professor and Director, Texas A&M Agrilife Synthetic and Systems Biology Innovation Hub, Texas A&M University

Nicola Patron, Head Synthetic Biology, The Sainsbury Laboratory

Dominique Loque, Director of Cell Wall Engineering, and Staff Scientist, Lawrence Berkeley National Laboratory

Also

Alfonso Jaramillo, Professor of Synthetic Biology, School of Life Sciences, University of Warwick

Max Hodak, Founder & CEO, Transcriptic, USA

Jon Chesnut, R&D Leader, Synthetic Biology and Cell Engineering, Life Technologies

Michael Sadowski, Head of Bioinformatics, Synthace

Carlos Olguin, Head of Bio/ Nano/ Programmable Matter Group, AutoDesk, Inc.

Marc Valer, Senior Product Manager, Emerging Genomics Applications, Agilent Technologies

Simon Bayly, Partner, Epiphany Capital, UK

Nathan Nagel, Chief Executive, LifeScience Ventures Ltd, UK

Jonathan Lewis, CEO & Director, ZioPharm

Vincent Martin, Canada Research Chair in Microbial Genomics and Engineering, Professor, Department of Biology, Co-Director, Centre for Applied Synthetic Biology, Concordia University

Johnathan Napier, Professor, Rothamsted Research

Martin Parry, Associate Director, Rothamsted Research, UK

Stuart John Dunbar, Head Mode of Biological Action Group, Syngenta

James Locke, Research Group Leader, Sainsbury Laboratory, University of Cambridge

Rupert Fray, Associate Professor, Plant Molecular Biology, University of Nottingham

Morten Nørholm, Senior Scientist and Academic-Entrepeneurial Research Group Leader, Novo Nordisk Foundation Center for Biosustainability

Brian King, Post Doc, Department of Plant and Environmental Sciences, University of Copenhagen

Venue

London Heathrow Marriott Hotel
Bath Road
Hayes, UB3 5AN
United Kingdom

A discounted group rate is available to all attendees. Details of how to book are available on registration. Space is limited and accommodation is available on a first come basis.



Co-Located with the:

With a focus on areas such as molecular biology/diagnostics, gene expression, genomics, biomarkers, pathogen detection, GMO, mRNA, NGS, bioinformatics and data management, this congress will examine the latest developments, opportunities and applications of both dPCR and qPCR through case studies across diverse areas such as oncology, infectious diseases, vaccines, prenatal diagnosis, diagnostic & clinical applications, microbiology, food microbiology, plant/ecology genomics and other novel applications.

For further information, contact info@globalengage.co.iuk or call +44 (0) 1865 849841

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Agenda: Day One – Monday, 20 October 2014

08.00-08.50	**Registration & Coffee**
08.50-09.00	**Global Engage Welcome Address** **Stream Chair's Opening Remarks**
09.00-09.35	**Keynote Address:** **Synthetic Biology - The Systematic Design and Construction of Novel Biological Systems and Cells for Useful Purposes** Synthetic biology is primarily an application-focused field attempting to develop and apply a systematic engineering approach to the design and construction of new biological systems and cells at the genetic level. In this presentation I will describe some of the foundational technology developments, including DNA assembly, whole genome engineering, part/device characterization and computational design/modeling tools that are now allowing the field to tackle some of the major challenges in bio-based manufacturing and personalized medicine. CONFIRMED: **Paul Freemont, co-founder and co-director of the EPSRC Centre for Synthetic Biology and Innovation, Imperial College, UK**
09.35-10.05	**Solution Provider Presentation** **Precision Genome Engineering and Synthetic Biology: New Tools for designing and editing genomes** The fields of synthetic biology and genome engineering have expanded into many applications including the rational optimization of complex pathways, construction and characterization of genetic circuits of increasing complexity and the functional design, construction, and modification of new and existing biological systems. These tasks can be facilitated by a comprehensive toolbox under development at Thermo Fisher that includes intelligent metabolic and genetic design software, sequence verified, scaled, cost-effective gene synthesis and precise genetic assembly and editing technologies able to address genetic constructs of various size ranges. We present the latest offering of integrated technologies that provides a state-of-the-art toolbox that addresses the design and engineering of living systems. These tools include genome editing tools such as TAL effector and CRISPR nucleases. We have put this toolbox to use for relevant applications and will present case studies describing creation and repair of mutations in patient-derived induced pluripotent stem cells (iPSC). CONFIRMED: **Jon Chesnut, R&D Leader, Synthetic Biology and Cell Engineering, Life Technologies**

	Track 1 - Synthetic Biology in Healthcare	Track 2 - Plant Synthetic Biology
10.05-10.10	**Stream Chair**	**Stream Chair**
10.10-10.35	**Synthetic Biology for Cancer Research** CONFIRMED: **Yaakov (Kobi) Benenson, Professor, Synthetic Biology Workgroup, ETH Zurich, Switzerland**	**Making New Molecules** CONFIRMED: **Anne Osbourn, Director, Norwich Research Park Industrial Biotechnology and Bioenergy Alliance, John Innes Centre, UK**
10.35-11.45	**Morning Refreshments & Poster Presentation Sessions** **One to One Meetings**	
11.45-12.10	**Synthetic DNA Based Therapeutics in Human Cancer** • We are developing novel synthetic DNA based therapeutics for a range of cancers • We are able to regulate in vivo expression of DNA in humans and have demonstrated successful multigenic expression of therapeutic proteins • Industrial application of synthetic DNA to cancer will likely result in significant improvement in outcomes and efficiencies CONFIRMED: **Jonathan Lewis, CEO & Director, ZioPharm, USA**	**Development of Novel Approaches for Cell Wall Bioengineering** • Development of synthetic biology tools to fine-tune gene expression in plants • Rewiring secondary cell wall regulatory network. • Lesson and learn in lignin engineering CONFIRMED: **Dominique Loque, Director of Cell Wall Engineering, and Staff Scientist, Lawrence Berkeley National Laboratory, USA**
12.10-12.35	**Utility of Synthetic Biology in Discovering Novel Chemical Structures** Synthetic biology has been heralded as a new bioengineering platform for the production of bulk and specialty chemicals, drugs, and fuels. Here, we report on the isolation of approx. 100 novel pharmaceutical compounds produced using a combinatorial genetics approach with artificial chromosomes in baker's yeast. Of the molecules found, >75% have not been described previously; 20% of the compounds exhibit novel scaffolds. Their structural and physicochemical properties comply with established rules of drug- and fragment-likeness and exhibit increased structural complexities compared to synthetically produced fragments. In summary, the synthetic biology approach described here represents a completely new, complementary strategy for hit and early lead identification that can be easily integrated into the existing drug discovery process. CONFIRMED: **Jutta Heim, Senior Scientific Advisor, Evolva, Switzerland**	**Precision Engineering of Plant Genomes Using CRISPR/Cas** The modification of existing biological systems is essential for synthetic biology in organisms in which bottom-up engineering is not yet possible. The CRISPR (clustered regularly interspaced short palindromic repeats)/Cas (CRISPR-associated) type II prokaryotic adaptive immune system is used by various bacteria and archaea to mediate defense against viruses and other foreign nucleic acid. We are using a re-engineered CRISPR/Cas system as a tool for targeted genome engineering in order to control transcription, to deliver proteins to specific genome locations and to make single and double-stranded DNA breaks in predetermined sequences to activate the non-homologous end joining (NHEJ) and homology-directed repair (HDR) mechanisms. CONFIRMED: **Nicola Patron, Head of Synthetic Biology, The Sainsbury Laboratory, UK**

12.35-13.00	**Applications in Drug Development (Infectious Diseases)** RESERVED: **Timothy Lu, Associate Professor, Synthetic Biology Group, Research Laboratory of Electronics, Dept. of Electrical Engineering and Computer Science, Dept. of Biological Engineering, MIT Synthetic Biology Center, USA**	**Benchmarking and Standardising DNA Editing Technologies** CONFIRMED: **Morten Nørholm, Senior Scientist and Academic-Entrepeneurial Research Group Leader, Novo Nordisk Foundation Center for Biosustainability, Denmark**
13.00-13.30	**Solution Provider Presentation** **Title to be Confirmed** CONFIRMED: **Marc Valer, Senior Product Manager, Emerging Genomics Applications, Agilent Technologies**	Agilent Technologies
13.30-14.30	**Lunch**	
	Track 1 - Investment, Funding and Bioethics	**Track 2 - Plant Synthetic Biology**
14.30-14.55	**Governing Synthetic Biology** CONFIRMED: **Joyce Tait, Director, Innogen Institute, Professor, The University of Edinburgh**	**Developing Tools for Synthetic Biology in Plant Roots** *Agrobacterium rhizogenes* is able to transform plant genomes and induce the production of "hairy roots". We describe the use of *A. rhizogenes* in tomato to rapidly assess gene expression and functionand for plant synthetic biology. A root cell-type and tissue-specific promoter resource has been generated for domesticated and wild tomato (*Solanum lycopersicum* and *S. pennellii*) using these approaches. Imaging of tomato roots using *A. rhizogenes* coupled with laser scanning confocal microscopy is facilitated by the use of a TagRFP marker present in binary vectors. Finally, transcriptional reporters, translational reporters and CRISPR/Cas9 genome editing demonstrate that SHORT-ROOT and SCARECROW gene function is conserved between Arabidopsis and tomato. CONFIRMED: **Siobhan Brady, Assistant Professor, Department of Plant Biology and Genome Center, UC Davis, USA**
14.55-15.20	**Developing a Culture of Security in Synthetic Biology** RESERVED: **Edwad Perello, Head of Business Development and Founder, Desktop Genetics, UK**	**Synthetic Biology: From Understanding Signalling Processes to Tool Development** CONFIRMED: **Matias Zurbriggen, Group Leader/ Assistant Professor, Synthetic Biology, Faculty of Biology, University of Freiburg, Germany**
15.20-15.45	**Synthetic Biology Ethics** Invitation to: **Emma Frow, Lecturer, Science Technology and Innovation StudiesSchool of Social and Political Science ,The University of Edinburgh**	**Plant Transcriptomes as a Source of Parts for the Reconstitution of Synthetic Alkaloid Pathways in Yeast** CONFIRMED: **Vincent Martin, Canada Research Chair in Microbial Genomics and Engineering, Professor, Department of Biology, Co-Director, Centre for Applied Synthetic Biology, Concordia University, Canada**
15.45-16.15	**Panel Discussion** **Venture Capitalism, Biotechnology Start-ups and Partnering Opportunities** • VCs vs. High net worth individuals vs. crowd funding vs. other creative funding options • Where are the business opportunities in Synthetic Biology research? • Appetite for partnering and contractual expectations • Sources of IP and technology CONFIRMED: **Nathan Nagel, Chief Executive, LifeScience Ventures Ltd, UK** **Simon Bayly, Partner, Epiphany Capital, UK** RESERVED: **Michael Koeris, co-founder and COO, Sample6 Technologies** **Senior Representatives Start Up x2**	**Synthetic Biology Approaches to Engineering the Nitrogen Symbiosis on Cereals** Engineering Nitrogen Symbiosis for Africa (ENSA) is a Bill & Melinda Gates Foundation sponsored project to test the feasibility of developing cereal crops capable of fixing nitrogen, as an environmentally-sustainable approach for farmers in sub-Saharan Africa to increase maize yields. It will initiate the first steps towards the transfer of biological nitrogen fixation to cereals, through engineering nodulation signalling in maize and *Setaria viridis*, an emerging model system for the engineering of Panicoid grasses. The work builds on the knowledge that cereals already possess the symbiosis signalling pathway and readily establish the mycorrhizal symbiosis. The ENSA project uses the tools of synthetic biology combined with the gain-of-function mutations in symbiosis signalling genes to allow the isolated study of component parts of the nodulation signalling pathway. CONFIRMED: **Christian Rogers, Scientific Programme Manager, Engineering Nitrogen Symbiosis for Africa (ENSA), John Innes Centre, UK**
16.15-17.05	**Afternoon Refreshments & Poster Presentation Sessions** **One to One Meetings**	

	Track 1 – Start up / Innovation Flash Presentations	Track 2 - Plant Synthetic Biology
17.05-17.30	**IP and Synthetic Biology** CONFIRMED: **Sarah Lau, Patent Attorney and Partner, Kilburn & Strode LLP, UK**	**Heterologous synthesis of omega-3 long chain polyunsaturated fatty acids in transgenic plants via iterative metabolic engineering: a terrestrial source of fish oils** We have been evaluating the possibility of producing omega-3 LC-PUFAs in different transgenic hosts, to provide a sustainable source of these important nutrients. Attempts to metabolically engineer plants with the primary algal biosynthetic pathway for LC-PUFAs has been successully carried out in a range of species, allowing insights into factors constraining the accumulation of these fatty acids in non-native hosts. The use of lipidomics has allowed us to identify further metabolic bottlenecks in the transgenic pathway, ultimately leading to the breakthrough production of a transgenic oilseed crop which contains up to 30% omega-3 LC-PUFAs in its seed oil. This omega-3 trait represents probably the most complex plant metabolic engineering to undergo field-trialing to date, and as such, has implications for applied synthetic biology in agriculture. CONFIRMED: **Johnathan Napier, Professor, Department of Biological Chemistry and Crop Protection Rothamsted Research, UK**
17.30-17.45	**Flash Presentation - Title to be Confirmed** CONFIRMED: **Max Hodak, Founder & CEO, Transcriptic, USA**	**Synthetic Plant Pathways and Organelles to Enable High Terpene Yield for Biofuels and Bioproducts** Photosynthetic Terpene hydrocarbon production represents one of the most direct and efficient route for 'drop-in' biofuels. In addition, terpenoids can be broadly used as fuels, chemicals, nutriceuticals, drug precursors and others. We address the key scientific and technical challenges of photosynthetic terpene production by biodesign of synthetic pathways, enzyme complexes and organelles to achieve maximized carbon repartition toward high value terpene products. In particular, synthetic pathways were introduced to couple photorespiration C2 product rechanneling with terpenoid production to significantly increase the terpene yield to the record-level of 2800mg/G FW. Isotopic labelling and metabolomics analysis suggested that the C2 redirection to terpenoid has led to the significant repartition of photosynthetic carbon toward high value terpene product. In addition to synthetic pathways, we further designed and implemented new storage organelle to increase terpene production yield by about 4 folds. The latest stimulated raman microscopy imaging confirms that the organelle contains the high level of targeted terpene product, offering a novel approach to increase terpene yield and remove the pathway inhibition. Overall, several synthetic biology strategies have been developed to maximize the photosynthetic output for teprene production, which can have broad impacts in the production of fuels, chemicals, pharmaceuticals, and nutriceuticals. CONFIRMED: **Joshua Yuan, Associate Professor and Director, Texas A&M Agrilife Synthetic and Systems Biology Innovation Hub, Texas A&M University, USA**
17.45-18.00	**An Open Interface for Scriptable Liquid-Handling on the CyBio Felix** In this talk I will present as a case study the results of an ongoing collaboration between CyBio, a laboratory automation manufacturer based in Jena, Germany, and Synthace – the UK's first dedicated synthetic biology company, based in London. The goal of this collaboration has been the definition of an open, scriptable interface for programming CyBio laboratory automation systems, as part of the wider aim of generating a truly cross-platform language for laboratory automation. This interface allows automated script writing for complex, single-shot protocols, as well as many other benefits such as cross-platform execution and code reuse and continues the pioneering work of PrPr, Clotho and SILA in paving the way to an environment for laboratory automation which can experience the benefits of modern programming practices. CONFIRMED: **Michael Sadowski, Head of Bioinformatics, Synthaca** CyBio An Analytik Jena Company	
18.00-18.15	**15 Minute Industry Flash Presentation** Invitation to:	**Introducing a protein microcompartment into chloroplasts to increase yields – Title to be Confirmed**
18.15-18.30	**15 Minute Industry Flash Presentation** Invitation to:	CONFIRMED: **Martin Parry, Associate Director, Rothamsted Research, UK**
18.30	**Chairman's Closing Remarks and End of Day 1**	
18.30-19.30	**Drinks Reception**	

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Agenda: Day Two – Tuesday, 21 October 2014

09.00-09.40 Keynote Address:
Title to be Confirmed

CONFIRMED:
Richard Kitney, Chairman of the Institute of Systems and Synthetic Biology; and Co-Director of the EPSRC National Centre for Synthetic Biology and Innovation and The UK National Industrial Translation Centre for Synthetic Biology (SynBiCITE), Imperial College London, UK

09.40-10.10 **Solution Provider Presentation**
Title to be Confirmed

Autodesk

CONFIRMED:
Carlos Olguin, Head of Bio/Nano/Programmable Matter Group, AutoDesk, Inc.

10.10-11.00 **Morning Refreshments**
Poster Presentation Sessions

	Track 1 - Synthetic Biology in Healthcare	Track 2 - Plant Synthetic Biology
11.00-11.30	**Computational dESIGN of Reprogrammed and New Protein Functions** • Computational methods to design functional proteins • Design of modular sensor/actuators that can detect and respond to small molecule signals in living cells • Engineering of a protein machine that can be controlled reversibly with light CONFIRMED: **Tanja Kortemme, Professor and Vice Chair, Department of Bioengineering and Therapeutic Sciences, University of California San Francisco, USA**	**Synthetic Plant Biology: The Ultimate Way to Go Green** Photosynthetic organisms are able to use solar energy and carbon dioxide for the production of organic compounds. Based on initial formation and subsequent turn-over of carbohydrates, plants channel energy flux and carbon into specific biosynthetic pathways to optimize growth and development and adapt to environmental challenges by producing bioactive defense compounds when attacked by insects and microbes. Using the "share-your- parts" principle of synthetic biology, we have now succeeded in breaking the evolutionary compartmentalization of energy generation and production of bioactive natural products by relocating an entire P450-dependent pathway for a bioactive natural product into to the chloroplast and driving the pathway by direct use of the reducing power generated by photosystem I in a light-dependent manner. Key target compounds are structurally complex diterpenoids that are costly to synthesise by chemical means such as forskolin and ingenol-3-angelate. CONFIRMED: **Birger Lindberg Møller, Director, Centre for Synthetic Biology, Department of Plant and Environmental Sciences, University of Copenhagen, Denmark**
11.30-11.55	**BuD, A Helix-Loop-Helix DNA-Binding Domain for Genome Modification** In a search for putative DNA-binding domains we found BurrH, a protein that recognizes a 19 bp DNA target, was identified. Here, its apo and DNA-bound crystal structures are reported, revealing a central region containing 19 repeats of a helix-loop-helix modular domain (BurrH domain; BuD), which identifies the DNA target by a single residue-to-nucleotide code, thus facilitating its redesign for gene targeting. New DNA-binding specificities have been engineered in this template, showing that BuD-derived nucleases (BuDNs) induce high levels of gene targeting in a locus of the human haemoglobin β (HBB) gene close to mutations responsible for sickle-cell anaemia. Hence, the unique combination of high efficiency and specificity of the BuD arrays can push forward diverse genome-modification approaches for cell or organism redesign, opening new avenues for gene editing. CONFIRMED: **Guillermo Montoya, Full Professor, Research Director Structural Biology Program, Novo Nordisk Foundation Center for Protein Research, University of Copenhagen, Denmark**	**Synthetic Promoters and Transcription Factors for Precise Gene Expression in Plants** • Synthetic promoters can be designed for precise gene expression • Synthetic transcription factors based on TAL effectors can enhance gene expression • These tools, along with other advanced tools in plant biotechnology can provide a level of precision heretofore not attained in transgene expression. CONFIRMED: **Neal Stewart, Professor of Plant Sciences, Ivan Racheff Chair of Excellence in Plant Molecular Genetics, & Co-Director of the Tennessee Plant Research Center, USA**
11.55-12.20	**Chemical Synthetic Biology as a Proof of Concept for Molecular Evolution** According to the modern life science view, there is no preordered pathway in the path of evolution. This view rises the interesting question, why things in nature are in one way and not in another one. I will suggest that synthetic biology has the means to tackle this question. As a particular example of this, "the never born proteins" will be presented. Another project will be presented, with the question: can synthetic biology make living minimal cell from scratch without genetic manipulation? To tackle this question, the notion of "minimal cell" will be discussed, with data leading to a proposal for the origin of cellular metabolism. CONFIRMED: **Pier Luigi Luisi, Director Synthetic Biology Lab, Department of Biology, Roma Tre University, Italy**	**Syngenta's Strategy and Activities in Plant Synthetic Biology** The talk will present the role Synthetic Biology has in Agriscience. I will discuss the opportunities we believe the science affords us in addressing the challenges the world faces with feeding and increasing population with reduced resources such as land and water. I will illustrate the talk with a product designed using synthetic biology approaches CONFIRMED: **Stuart John Dunbar, Head Mode of Biological Action Group, Syngenta, UK**

	Track 1 - Synthetic Biology in Healthcare	Track 2 - Plant Synthetic Biology
12.20-12.50	**Peptide and Protein Design in Synthetic Biology** Prof Woolfson will describe the process of rational peptide and protein designs, and it's potential and possible applications in synthetic biology. He will demonstrate how this has led to new insight into protein structure, and, of more relevance to synthetic biology, how completely de novo and useful structures can be constructed. He will illustrate this will a project aimed at making protein-based assemblies with applications in vaccine development and enzyme encapsulation. CONFIRMED: **Dek Woolfson, Professor of Chemistry & Biochemistry, Director, BrisSynBio, a BBSRC/EPSRC-funded Synthetic Biology Research Centre, School of Chemistry, University of Bristol, UK**	**Engineering Plant Secondary Metabolism with Polyprotein Technology** Polyprotein technology represents a flexible system to express multiple proteins in stoichiometric quantities to construct artificial pathways or structural components in any eukaryotic host. Successes to date include the reconstruction of the flavonoid C-glycosylation pathway from cereals and the production of dihydrochalcone derivatives in fungal and plant hosts. The latter has proven particularly interesting, in that pathways that function to produce the dihydrochalcone skeleton are rare in plants, but are favoured in yeast allowing the potential to produce a wide range of hitherto undescribed products which have the potential to be developed into novel flavouring agents, agrochemicals and nutraceuticals. The potential for further exploiting this technology for applications in health care and crop protection will be discussed. CONFIRMED: **Robert Edwards, Professor and Head of the School of Agriculture, Food and Rural Development (AFRD), Newcastle University, UK**
12.50-13.50	**Lunch**	
13.50-14.15	**Synthetic Integrons: A Powerful Novel Recombineering Tool** As the field of synthetic biology expands, strategies and tools for the rapid construction of new biochemical pathways will become increasingly valuable. Purely rational design of complex biological pathways is inherently limited by the current state of our knowledge. Selection of optimal arrangements of genetic elements from randomized libraries may well be a useful approach for successful engineering. We tested the construction and optimization of metabolic pathways using the inherent gene shuffling activity of a natural bacterial site-specific recombination system, the integron. Integrase mediated recombination generated thousands of genetic combinations overnight. We were able to isolate a large number of arrangements displaying varying fitness and production capacities of a chosen compound. We have now extended this approach by creating synthetic attC sites “à façon”, that are recombinogenic. We have now encrypted secondary functions in these synthetic attC sites, such as in frame linker peptides or promoter sequences, to expand the recombineering potential of integron derived tools. CONFIRMED: **Didier Mazel, Director Genetics and Genomics, Institute Pasteur, France**	**Improvement of Resource-Use Efficiency and Productivity in Crop Plants** Global population growth requires higheragricultural productivity to meet food demand. Although boosting productivity is a challenge in agricultural research, one straightforward approach is to enhance the efficiency of photosynthesis and thus the amount of fixed carbon. In C3 plants, photorespiration reduces the photosynthetic efficiency. Thus, reducing photorespiration should increase carbon-use efficiency, promote growth and increase the yield. We have developed a novel method to enhance photosynthetic carbon fixation in potato, based on expression of a polyprotein comprising all three subunits of bacterial glycolate dehydrogenase. The recombinant DEFp was active *in-planta*, leading to significant improvement of tuber yield in greenhouse as well as controlled field experiment. This approach has the potential to increase biomass and yield of diverse crops. CONFIRMED: **Greta Nölke, Group Head, Metabolic Engineering, Department Plant Biotechnology, Fraunhofer Institute for Molecular Biology and Applied Ecology, Germany**
14.15-14.40	**Regulating with RNA in Bacteria** We propose a forward engineering approach to dissect the roles of different forms of RNA could play in genome function. Current computational tools for secondary prediction allows us the development of an algorithm to design novel RNA regulatory circuits based on the stability of RNA molecules, their interactions and strand displacement reactions. We take advantage of available RNA domains with known function and structure (such as ribosome-biding sites, transcription terminators, or ribozymes) to use them as interchangeable and switchable modules in our circuits. We exemplify the methodology by engineering novel behaviours for RNA molecules that only where believed to occur in proteins, such as cooperative regulation or a two-component signal transduction system. We also show the engineering of the first known RNA-RNA cascade in living cells by imposing a hierarchical activation of functional RNA modules. We characterize our circuits in E. coli by external forcing using custom microfluidics chips and measuring the responses at the single-cell level. CONFIRMED: **Alfonso Jaramillo, Professor of Synthetic Biology, School of Life Sciences, University of Warwick , UK**	**Title to be Confirmed** CONFIRMED: **James Locke, Research Group Leader, Sainsbury Laboratory, University of Cambridge, UK**

	Track 1 - Synthetic Biology in Healthcare	Track 2 - Plant Synthetic Biology
14.40-15.05	**Advanced Concepts in Drug Bioproduction from Microorganisms** Co-regulated genes tend to locate at periodical or proximal positions along the chromosome. This specific genome layout is interpreted as a means to cluster co-regulated genes in space through the appropriate folding and conformation of chromosomes. To improve our capacity in designing genomes for bioproduction, an important issue is whether gene position matters for its expression level in a rationalizable way. Such appears to be the case, based on genome profiling of responsiveness to a given transcription factor. This periodical genome layout is found, not only in eubacteria, but also in eukaryotic yeast, meaning that the workhorses of drug bioproduction share this feature. CONFIRMED: **François Kepes, Research Director, institute of Systems and Synthetic Biology, Genopole, CNRS, France**	**Redirection of the Carotenoid Pathway for the Production of Taxanes in Tomato Fruit** The taxane, paclitaxel, is an important cancer chemotherapy agent for which a commercially viable fully synthetic rout does not currently exist. We have redirected geranylgeranyl diphosphate (GGPP) from the tomato fruit carotenoid biosynthetic pathway for the production of high levels of taxadiene. We have used this taxadiene for in vitro chemical conversion to downstream metabolites, and in the process have gained insight into the possible mode of action of the endogenous plant enzymes. We also show that the first three enzymes in the paclitaxel biosynthetic pathway are located in different sub-cellular compartments, a finding that may restrict the ability to reconstruct the pathway in micro organisms. CONFIRMED: **Rupert Fray, Associate Professor, Plant Molecular Biology, University of Nottingham, UK**
15.05-15.35	**Afternoon Refreshments & Poster Presentation Sessions**	
15.35-16.00	**LINuS: A Light-Inducible Nuclear Localization Signal for Precise Spatiotemporal Control of Protein Dynamics in Living Cells** An optogenetic tool (LINuS) for regulating protein nuclear import with blue light is presented -LINuS is a single, small protein tag, genetically encoded, that does not need externally supplied chromophores and can be tuned by mutations or by selecting different light regimes - LINuS can be fused to any protein of interest, provided the endogenous regulation of import/export can be knocked out (via mutations) We showcase the applicability of LINuS for cell biology by controlling gene expression and mitotic entry with light. CONFIRMED: **Barbara Di Ventura, Group Leader Synthetic Biology, Heidelberg University, Germany**	**Production of Citrus Compounds by Synthetic Biology** • Plants produce many high value compounds. For example, Citrus fruits such as lemon, orange and grapefruit produce a number of monoterpenes, sesquiterpenes and flavonoids that have an industrial application. Traditionally these are produced by distillation and extraction from Citrus fruit waste products. • By introducing biosynthetic pathways from plants into microbes, we create alternative sources of plant high value compounds. The identification of the pathways will be highlighted in this presentation. • By engineering the metabolic chassis of the microbe, we truly integrate the plant pathway into the microbial host, and tailor microbial production systems for production of plant compounds. Examples for microbial production of Citrus compounds will be presented. CONFIRMED: **Jules Beekwilder, Senior Scientist, Plant Research International, Wageningen University, The Netherlands**
16.00-16.25	**Precise Genome Editing in the Moss, Physcomitrella Patens, for Production of High-Value Plant Natural Products** Moss is unique among plants in its native ability for efficient DNA repair using homologous recombination. This facilitates targeted gene knockouts and introduction of heterologous genes. In addition to precise genetic editing tools, the moss Physcomitrella patens has a fully sequenced genome. The combination of molecular editing tools and a known genomic landscape makes moss an attractive platform for heterologous assembly of complex biosynthetic pathways from higher plants, leading to production of valuable natural products such as terpenoids for bio-based pharmaceuticals. Moss is an exciting alternative to microbial systems for the reconstruction of plant natural product pathways and plant synthetic biology. CONFIRMED: **Brian King, Post Doc, Department of Plant and Environmental Sciences, University of Copenhagen, Denmark**	
	Chairman's Closing Remarks and Conference Close	

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