

# **WORKSHOP TO ESTABLISH UK EAST AFRICAN COLLABORATIONS IN PRACTICAL SYNTHETIC BIOLOGY**

**LAICO HOTEL**

LOITA STREET / UHURU HIGHWAY  
P.O BOX 57549-00200  
NAIROBI, KENYA

**15th-17th March 2017**

**W O R K S H O P**

## WORKSHOP INTRODUCTION

# Professor Paul Freemont (Imperial College London) and Dr Benson Kinyagia (NACOSTI)



## Scoping Meeting to establish UK-East African collaborations in Practical Synthetic Biology: Health (Human and livestock), Industry, Environment and Innovation

15th-17th March 2017 – Nairobi, Kenya

## WORKSHOP INTRODUCTION

### Aims of the meeting

The concept of manipulating the biological machinery of nature for the benefits of mankind is nothing new. In the 1970s there was a rapid expansion with the development of recombinant DNA technology which led to the growth of new Biotechnology companies and industries that primarily used engineered cells to manufacture high-value products. New developments in gene therapy and genetic engineering in the 1990s accelerated these developments and in the 21st century we have seen a plethora of new advances and technologies including gene editing. In particular, the ability to read DNA through sequencing, including the genomes of humans, many microbes, animals and plants, is now being driven forward by the ability to write DNA through chemical synthesis.

The field of synthetic biology aims to define a framework and global community for accelerating the engineering of biological systems and cells for useful applications as well as furthering our fundamental understanding of living systems. Synthetic biology adopts an engineering approach for the systematic design and construction of new biological systems and cells at the genetic level and is inherently interdisciplinary bringing together biologists, engineers, computer scientists, social scientists, designers and artists.

Whilst many developed countries are instigating strategies and investment to establish synthetic biology research and commercialization, many low income and middle income countries have little awareness of the opportunities and potential of synthetic biology and as such are at a significant disadvantage in establishing policies and research agendas in the area and also more broadly in biotechnology. There is a need to ensure that synthetic biology including training and education becomes accessible to a developing global community such that major challenges like disease, food and energy production, clean water and waste management can be addressed using practical synthetic biology technologies.

The Practical Synthetic Biology Workshop will bring together researchers and policymakers from East Africa with academics and entrepreneurs from Imperial

College London, University of Cambridge, University of Edinburgh and the John Innes Centre. The workshop will explore potential E. African application areas for practical synthetic biology including disease detection, agri-technology, environment, industrial processes as well as policy, IP and commercialization opportunities. The overall aim is to identify specific challenge areas that would benefit from applying practical synthetic biology technologies including teaching, training, required infrastructure and capacity building.

### Objectives of the meeting

The objectives of the workshop are:

- 1) Develop Programs on Synthetic Biology research and Training
- 2) Identify Practical Applications for Synthetic Biology solutions and Biotechnologies
- 3) Establish networks and collaborations on Synthetic Biology between Eastern African & UK researchers
- 4) Facilitate Communication, Information Exchange and Education on Synthetic Biology

The UK government has recently established the Global Challenges Research Fund (GCRF) which is a £1.5 billion fund to support cutting-edge research that addresses the challenges faced by developing countries through: (1) Challenge-led disciplinary and interdisciplinary research; (2) Strengthening capacity for research and innovation within both the UK and developing countries; (3) Providing an agile response to emergencies where there is an urgent research need.

This meeting is financially supported by UK Research and Innovation (UKRI) and specifically the Biotechnology and Biological Sciences Research Council (BBSRC) as part of on-going efforts to interact and inform upcoming UKRI funding calls. There are substantial opportunities for potential collaborations between UK and East African partners.

## WORKSHOP INTRODUCTION

### Global Challenge Research Fund Themes

The GCRF has established a number of focus areas and research objectives which are given below:

- 1) Secure and resilient food systems supported by sustainable agriculture
- 2) Sustainable health and well-being
- 3) Inclusive and equitable quality education
- 4) Clean air, water and sanitation
- 5) Renewable energy and materials
- 6) Sustainable livelihoods supported by strong foundations for inclusive economic growth and innovation
- 7) Resilience and action on short-term environmental shocks and long-term environmental change
- 8) Sustainable cities and communities
- 9) Understand and effectively respond to forced displacement and multiple refugee crises
- 10) Reduce conflict and promote peace, justice and humanitarian action
- 11) Reduce poverty and inequality, including gender inequalities

This first UK-East Africa scoping meeting on practical synthetic biology aims to identify applications for near-term practical synthetic biology solutions and biotechnologies. The meeting also aims to seed the development of synthetic biology research and training in Kenya and E. Africa through academic/student exchanges, collaboration and open sharing of teaching and technology resources. This meeting will also lead to the establishment of a UK-Kenyan/E. African synthetic biology research network and the establishment of potential research collaborations focused around the identified application areas that could be eligible for GCRF funding.

### Meeting Themes

The meeting has seven major themes with speakers from both the UK and E. Africa

#### Enabling practical synthetic biology- Foundational tools and technologies

The aim of this theme is to discuss current biotechnology capabilities in E. Africa against the new and emerging foundational tools and technologies required for practical synthetic biology. Tools and technologies such as DNA synthesis, DNA assembly, characterization of engineered organisms and computer aided tools to enable the synthetic biology design cycle will be discussed. The outcome of this theme will allow an assessment of what infrastructure might be required in E. Africa taken into account the emergence of low-cost approaches like cell-free in vitro systems and DIY-bio instruments and kits.

#### Healthcare (animal and human)

The aim of this theme is to discuss some of the challenges and needs for animal and human healthcare in E. Africa. There will be a particular focus on cell-free low cost biosensors comprising synthetic DNA encoded modular that functions in microbial cell extracts. Exemplars of such biosensors to detect bacterial pathogens and parasites as well as disease biomarkers will be discussed. The advantages of in vitro biosensors are ease of use and the ability to freeze dry onto different surfaces including paper avoiding cold-storage chains. The outcome of this theme is to identify and prioritize key application areas which would benefit from practical synthetic biology developments.

#### Environment and Biodiversity

The aim of this theme is to discuss the opportunities for practical synthetic biology technologies as applied to environmental and biodiversity issues in E. Africa. An exemplar of a synthetic biology arsenic biosensor for use in monitoring drinking water will be presented. There will also be a focus on global policies around biodiversity including the Nagoya protocol and also a discussion about whether a repository of biological resources and genetic parts from E. Africa is needed. The outcome of this theme is to identify and prioritize key

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areas which would benefit from practical synthetic biology developments and also establish how global policies like Nagoya could impact on synthetic biology collaborations between E. Africa and the UK.

#### Agritechnology

The aim of this theme is to identify the challenges and opportunities for agritechnology development in an E. African context. An exemplar of measuring soil nutrient availability for crops will be presented showing how a research tool can be commercialised. There will also be a discussion on policies and legislation in E. Africa which may impact on the development of practical synthetic biology tools for agritechnology applications. The outcome of this theme is to identify and prioritize key application areas which would benefit from practical synthetic biology developments and whether there are any regulatory or societal issues that would impede the application of synthetic biology agritechnologies in E. Africa.

#### Industrial Biotechnology and Synthetic Biology

The aim of this theme is to explore the current capabilities and challenges of industrial biotechnology in E. Africa. Exemplars of how synthetic biology can enable industrial biotechnology will be presented from both E. Africa and the UK. The outcome of this theme is to identify and prioritize key industrial application areas which would benefit from practical synthetic biology developments and whether there are any regulatory or societal barriers to applying synthetic biology technologies in industry in E. Africa.

#### Teaching and Training

The aim of this theme to explore the teaching and training opportunities in E. Africa for synthetic biology in relation to the current training environment. Exemplars of teaching synthetic biology to UK undergraduate and postgraduate students will be presented as will the role of the global student competition iGEM. Experiences with E. African regional centres and capacity development for new technologies will also be presented and discussed. The outcome of this theme is to identify and share best practice/resources for teaching and training a future generation of synthetic biologists in the context of current E. Africa educational programs.

#### GM, Safety and Responsible Research and Innovation

The aim of this theme is to explore specific challenges and regulations in GM and safety in E. Africa in the context of establishing a synthetic research base. The role of Responsible Research and Innovation in the UK as a mechanism for developing synthetic biology technologies and applications in the UK will be presented. Issues around IP and innovation will also be presented from an E. African perspective. The outcome of this theme is to identify societal/regulatory barriers to developing synthetic biology research and applications in E. Africa.

#### Commercialization and translation of synthetic biology research

The aim of this theme is to explore the different approaches to commercialization and translation of biotechnologies both in the UK and E. Africa. The current start-up innovation ecosystem in E. Africa will be presented to explore whether this could be extended to biotechnology and synthetic biology. The UK commercialization and translation initiative for synthetic biology will be presented as will UK policy and strategy for synthetic biology. The outcome of this theme is to identify key issues around how potential biotechnology research in E. Africa could be commercialized and how the UK national centre SynbiCITE could collaborate.





**PROGRAMME DAY 1 – WEDNESDAY 15TH MARCH**

Time	Session	Facilitator
	<b>Program Coordinator Dr Benson Kinyagia and Prof Paul Freemont.</b>	
<b>15th March</b>	<b>Chair; Prof Ogoyi/ Rapporteur: Jane Omari</b>	
8.30 – 9.00am	Arrival and registration of Participants	Secretariat
9.00– 9.15	Introduction to the UK Governments Global Challenge Research Fund and overall aims of the workshop	Dr. Benson Kinyagia and Prof Paul Freemont,
9.15-9.30	Opening remarks	Dr. Moses Rugutt, Director General, NACOSTI Dr Julia Kemp DFID
	<b>Session 1 – What is synthetic biology and context to the workshop</b>	
9.30 – 10.00	What is Synthetic Biology?	Professor Paul Freemont (Imperial College)
10.00-10.15	The UK Synthetic Biology Scene	Professor Richard Kitney (Imperial College)
10.15-10.30	The E. African Biotechnology Scene	Dr Roy Mugira (NACOSTI)
10.30 – 11.00	<b>Open Discussion</b>	
<b>11.00-11.30</b>	<b>COFFEE break and networking</b>	
	<b>Session 2 – Enabling practical synthetic biology - Foundational tools and technologies</b>	
11.30-11.50	Current Biotechnology research capabilities in E. Africa	Dr Charles Mugoya (Uganda)
11.50-12.10	Foundational tools and technologies - 1	Dr Geoff Baldwin (Imperial College)
12.10-12.30	Foundational tools and technologies -2	Dr Guy Bart Stan (Imperial College)
12.30 – 1.00	<b>Open Discussion</b>	
<b>1.00-2.00</b>	<b>LUNCH and networking</b>	
	<b>Session 3 – Healthcare (animal and human)</b>	
2.00-2.30	Challenges and needs for animal and human healthcare in E. Africa with research exemplars	Dr Hasting Ozwara (Institute of Primate Research, Kenya)
2.30-2.50	Whole cell biosensors for low coast diagnostics	Dr Jim Ajioka (University of Cambridge)
2.50-3.10	Cell free biosensors for low coast diagnostics	Prof. Paul Freemont (Imperial College)
3.10-4.00	<b>Open Discussion</b>	
<b>4.00-4.30</b>	<b>COFFEE break and networking</b>	
<b>4.30</b>	<b>Departure for Local Delegates</b>	

**PROGRAMME DAY 2 – THURSDAY 16TH MARCH**

Time	Session	Facilitator
<b>16th March</b>	<b>DAY 2 Chair Dr Karembu/ Dr Kimani Rapporteur: Rose Nyaga/ Julius Mwangi</b>	
9.00-9.05	Welcoming comments and summary of Day One	Jane Omari-NACOSTI
	<b>Session 4 – Environment and Biodiversity</b>	
9.05-9.35	Challenges and Opportunities for the environment and biodiversity in E. Africa	Dr Flora Ismail (Commission for Science and Technology-COSTECH, Tanzania)
9.35-9.55	Policy and the Nagoya protocol – what does this mean for international research collaborations?	Prof Hamadi Boga (Acting VC, Taita Taveta University-Kenya)
9.55-10.15	Environmental applications – water contamination	Dr Lalitha Sundaram (University of Cambridge)
10.15-10.30	A repository of E. African biological resources and genetic parts?	Dr Nyamongo (KALRO- Genetic Resources Research Institute)
10.30 – 11.00	<b>Open Discussion</b>	
<b>11.00-11.30</b>	<b>COFFEE break and networking</b>	
	<b>Session 5 – Agritechnology</b>	
11.30- 11.50	Current challenges and opportunities for agri-technology development with Exemplars in E. Africa	Dr. Catherine Taracha (Kenya Agriculture and Livestock Research Organization)
11.50-12.10	Measuring soil nutrient availability for crops- from a research tool to commercial development	Dr Anthony Miller (John Innes Centre)
12.10-12.30	Products development through Biotechnology and Synthetic Biology in E. Africa	Prof Mulaa (UON)
12.30 -1.00	<b>Open Discussion</b>	
<b>1.00-2.00</b>	<b>LUNCH break and networking</b>	
	<b>Session 6 – Industrial Biotechnology and Synthetic Biology</b>	
2.-2.30	What are the current capabilities and challenges in E. Africa?	Dr Geletu Kassahun Tesfaye (Director Ethiopian Biotechnology Institute, MST, Addis Abba, Ethiopia)
2.30-2.50	Synthetic Biology and working with industry and University of Edinburgh perspective.	Prof. Susan Rosser (University of Edinburgh)
3.10-3.30	How can synthetic biology contribute to biochemical engineering process development?	Dr Karen Polizzi (Imperial College)
3.30-4.00	<b>Open Discussion</b>	
<b>4.00-4.30</b>	<b>COFFEE break, networking</b>	
<b>4.30</b>	<b>Departure for Local Delegates</b>	

**PROGRAMME** **DAY 3 – FRIDAY 17TH MARCH**

Time	Session	Facilitator
<b>17th March</b>	<b>DAY 3 Chair Dr Langat/ Dr Njumbi Rapporteur: Dr Njiiru</b>	
9.00-9.05	Welcoming comments and summary of Day Two	Jane Omari-NACOSTI
	<b>Session 7 – Teaching and Training</b>	
9.05-9.35	The current teaching and training environment in E. Africa – successes and challenges	Dr. Douglas Watuku Miano (University of Nairobi)
9.35-9.55	Teaching synthetic biology at UG and PG level	Dr Geoff Baldwin (Imperial College)
9.55-10.15	iGEM competition	Dr Karen Polizzi and Dr Guy Bart Stan (Imperial College)
10.15-10.30	Effective science communication on emerging technologies	Dr. Margaret Karembu ISAAA AfriCenter
10.30 -11.00	<b>Open Discussion</b>	
<b>11.00-11.30</b>	<b>COFFEE break and networking</b>	
	<b>Session 8 – GM, Safety and Responsible Research and Innovation</b>	
11.30-11.50	Current GM safety regulations in E. Africa- are there specific challenges?	Mr Emmanuel Kabera (Environmental Management Authority, Rwanda)
11.50-12.10	What is Responsible Research and Innovation and is it relevant in an E. African context?	Dr Lalitha Sundaram (University of Cambridge)
12.10-12.30	IP regimes in innovations and start-up in Eastern African	Dr Julius Ecuru (African Centre for Technology Studies, Uganda)
12.30 -1.00	<b>Open Discussion</b>	
<b>1.00-2.00</b>	<b>LUNCH break and networking</b>	
	<b>Session 9 – Commercialization and translation of synthetic biology research</b>	
2.00-2.30	Innovation and start-ups in E. Africa – could this extend to biotech and synthetic biology?	Dr Samuel Muiruri (IITA, Kenya)
2.30-2.50	The UK national commercialization and translation centre for synthetic biology SynbiCITE	Dr Stephen Chambers (SynbiCITE)
2.50-3.10	The UK policy and strategy for Synthetic Biology	Prof. Richard Kitney (Imperial College)
3.10-4.00	<b>Open Discussion</b>	
4.00-14.30	Conclusion and the Way Forward	Dr Edwardina Dhine HOD Biological Sciences, NACOSTI
16.15-16.30	Closing Remarks	Dr. S. Karimi, DAQA, NACOSTI
<b>16.30-17.00</b>	<b>Coffee / Tea Break</b>	
<b>17.00</b>	<b>Departure End of Meeting</b>	

**LOCAL ORGANIZING COMMITTEE****Professor Paul Freemont**

Professor Paul Freemont is co-director and co-founder of the Centre for Synthetic Biology and Innovation (since 2009) and the National UK Innovation and Knowledge Centre for Synthetic Biology (SynbiCITE; since 2013) at Imperial College London.

He is also currently Head of the new Section of Structural Biology in the Department of Medicine at Imperial. His research interests span from understanding the molecular mechanisms of human diseases and infection to applying synthetic biology tools as novel biosensors and is the author of over 200 scientific publications. He is a member of European Molecular Biology Organisation and Fellow of the Royal Society of Biology and Royal Society of Medicine. He was a co-author of the British Government's UK Synthetic Biology Roadmap and participated as a technical expert in the United Nations Convention for Biological Diversity and Biological Weapons Convention. He has appeared regularly on radio and television broadcasts on the subject of synthetic biology.

[www.imperial.ac.uk/people/p.freemont](http://www.imperial.ac.uk/people/p.freemont)

**Dr. Benson Mburu Kinyagia**

Dr Benson Mburu Kinyagia is a Principal Scientist at the National Commission for Science, Technology and Innovation (NACOSTI) in the Agriculture and Natural Resources Division.

He has a wide experience in Policy, legal and regulatory frameworks in the area of Biosciences.. Dr Benson Mburu has been part of the Kenyan Delegation to the Conference of Parties to the Convention on Biological Diversity (CBD) and is a member the Ad Hoc Technical Expert Group (AHTEG) representing the East and Central African Region. He holds a PhD in Pesticide Science from South China University of Agriculture.



**LOCAL ORGANIZING COMMITTEE**



**Dr. Moses K.  
Rugutt**



**Dr. Roy Mugira**

**Dr Moses K. Rugutt is the Director General of the National Commission for Science, Technology and Innovation (NACOSTI).**

He has previously worked at the Directorate of Research Management (DMRD) in the Ministry of Education and at the Kenya Agricultural and Livestock Research Organization (KALRO). He has wide experience in the Management of Research, Science, Technology and Innovation and as a researcher in the area of Veterinary Sciences. Holds a PhD in Veterinary Parasitology and has been awarded by the President of the Republic of Kenya the Head of State Commendation (HSC) and the Order of the Grand Warrior (OGW).

**Dr. Roy Mugira is the Director, Technical Services at the National Commission for Science, Technology and Innovation.**

He holds a Ph.D in diagnosis of plant viral infections based on the alignment of their DNA sequences and cloning gene silencing vectors. Previously, he served as a Senior Assistant Director of Research at the Directorate of Research Management (DMRD) in the Ministry of Education. He is widely experienced in the area of Biosafety legal and regulatory framework.

**LOCAL ORGANIZING COMMITTEE**



**Prof. Dorington  
O. Ogoyi**



**Dr. Margaret  
Karembu**

**Prof. Dorington O. Ogoyi is the Director of Technical Services at the National Biosafety Authority since February, 2012.**

Prof. Ogoyi was an Associate Professor at the Department of Biochemistry and Biotechnology Technical University of Kenya (TUK). He has wide experience in research in Molecular Biology and Proteomics. Prof. Ogoyi is currently the National Focal point for the Biosafety Clearing House, a member of the Advisory Adhoc Committee on Biosafety Clearing House and represents the African region in the Compliance committee of the Cartagena Protocol on Biosafety. He holds a Ph.D (Biochemistry) from the University of Nairobi.

**Dr. Margaret Karembu is Director, ISAAA AfriCenter [www.africenter.org](http://www.africenter.org) based in Kenya.**

She is actively involved in strengthening capacity on biosciences communication and policy outreach for informed choices on modern agricultural biotechnology in Africa. A science-communication trainer, Margaret holds a Ph.D degree in Environmental Science Education from Kenyatta University, where she taught for more than 10 years prior to joining ISAAA.





## LOCAL ORGANIZING COMMITTEE



**Dr. Douglas  
Miano**



**Dr Joseph  
Kagunda  
Kimani**

**Dr. Douglas Miano is a Senior Lecturer at the Department of Plant Science and Crop Protection, University of Nairobi, Kenya.**

He is a plant pathologist specializing in plant virology and biotechnology and is involved in research in cassava, maize and sweetpotato virus diagnostics, characterization and management. Dr. Miano has wide experience in product development and biosafety regulations of genetically modified crops. He holds a Ph.D in Plant Virology from Louisiana State University, USA.

**Dr Joseph Kagunda Kimani, PhD Human Genetics, Zhejiang University and has 17years experience in forensic DNA analysis at the Government Chemist, Ministry of health, Kenya.**

He has specialized in human identification using DNA for DVI case and published papers on human DNA variants.

## LOCAL ORGANIZING COMMITTEE



**Ms. Jane A.  
Otadoh**

**Ms. Jane A. Otadoh is an Assistant Director of Agriculture in the Ministry of Agriculture, Livestock and Fisheries.**

She holds a Master of Science (Plant Biotechnology) degree from the University of Nairobi. and a Bachelor of Science in Agriculture from Andrews University (Michigan, USA). She has worked for the ministry for the last 32 years in areas of extension and regulating biotechnology and Biosafety. She has participated in the development of agriculture and biotechnology policy documents.



**Ms Jane Omari**

**Ms Jane Omari is a Principal Scientist at the National Commission for Science Technology and Innovation.**

She holds a Master of Science in Zoology, majoring in Immunology from Kenyatta University and a Bachelor of Education from the same institution. She was involved in the Development of the National Biosafety Act and the National Biotechnology Development Policy.



## LOCAL ORGANIZING COMMITTEE



**Dr. Edwardina Ndhine**



**Dr. Joshua Mugendi Njiru**

**Dr. Edwardina Ndhine is Principal Scientist, working at the Biological and Health Sciences Schedule, National Commission for Science, Technology and Innovation (NACOSTI), Kenya.**

She is the coordinator of National Public Education and Awareness about biotechnology applications, use, products and issues of concern to enable informed decision making. Dr. Ndhine holds a Ph.D degree in Zoology (Animal Physiology) from Makerere University, Uganda and MSc (Animal Physiology, Cellular and Molecular Biology) from University of Nairobi, Kenya with previous 8 years teaching and research experience.

**Dr. Joshua Mugendi Njiru is an assistant manager at Kenya Bureau of Standards (KEBS) testing services department.**

He has vast experience in biotechnology and molecular biology. Joshua holds a Ph.D in Biotechnology from Kenyatta University.

## UK SPEAKERS



**Dr Karen Polizzi**



**Dr Steven Chambers**

**Dr Karen Polizzi is a Senior Lecturer in Department of Life Sciences. She joined Imperial College in 2008 as an RCUK Fellow in Biopharmaceutical Processing.**

Her lab is interested in the development of biosensors to monitor metabolism of cells during manufacturing. Karen received her PhD in Chemical & Biomolecular Engineering from the Georgia Institute of Technology in the field of protein engineering.

[www.imperial.ac.uk/people/k.polizzi](http://www.imperial.ac.uk/people/k.polizzi)

**Dr Stephen Chambers is CEO at SynbiCITE, the Innovation and Knowledge Centre for Synthetic Biology.**

He has extensive entrepreneurial experience with start-ups, and was a founding scientist at Vertex Pharmaceuticals and a co-founder of Abpro. Dr Chambers is also the lead teaching faculty for the Lean LaunchPad for Synthetic Biology at Imperial College London.

[www.synbicite.com/about-us/our-team/stephen-chambers/](http://www.synbicite.com/about-us/our-team/stephen-chambers/)

[www.imperial.ac.uk/people/s.chambers](http://www.imperial.ac.uk/people/s.chambers)





## UK SPEAKERS



**Dr Guy-  
Bart Stan**

Dr Guy-Bart Stan is a Reader (equiv. Associate Professor) in Engineering Design for Synthetic Biology, the head of the "Control Engineering Synthetic Biology" group at the Department of Bioengineering, and a member of the Faculty of Engineering Research Committee at Imperial College London, U.K.

His group is exploring the mathematical aspects of modelling, analysis and control of biological systems and their applications in systems and synthetic biology (<http://www.bg.ic.ac.uk/research/g.stan/group/>). In particular, their focus is on the study of core engineering design principles of biological systems with a particular interest in the analysis, design and in vivo implementation of biomolecular feedback control mechanisms for the robust and efficient control of natural and synthetic biology systems, including gene regulatory networks and metabolic pathways, with a view to their applications for biotechnology, biosynthesis, advanced cell-based medicine and healthcare.

<http://www.bg.ic.ac.uk/research/g.stan/>

<http://www.bg.ic.ac.uk/research/g.stan/group/>



**Professor  
Richard Kitney**

Professor Richard Kitney is Professor of Biomedical Systems Engineering, Chairman of the Institute of Systems and Synthetic Biology, and Co-Director and Co-Founder of the Imperial College Centre for Synthetic Biology and Innovation.

He chaired the Royal Academy of Engineering Inquiry into Synthetic Biology and is a member of the Ministerial Leadership Council for Synthetic Biology. Prof Kitney is recognised as a leading research worker in the field of synthetic biology and, with Professor Paul Freemont, has been responsible for developing the Imperial College Hub for Synthetic Biology - which is now recognised as one of the leading international centres in the field. In 2013, they were successful in winning the national competition to establish the UK national industrial translation centre for synthetic biology - SynbiCITE. Prof Kitney has published over 300 papers in the fields of synthetic biology, mathematical modelling, biomedical information systems, and medical imaging and has worked extensively in and with industry and was made a Fellow of the World Technology Network in 1999 for his innovative work in the fields of health and medicine.

He was made an Academician of the International Academy of BioMedical Engineering in September 2003 (this is the highest honour bestowed by the International Federation of BioMedical Engineering Societies). He is also a Fellow of AIMBE, the America Academy of BioMedical Engineering. In 2006 he was made an Honorary Fellow of both The Royal College of Physicians and The Royal College of Surgeons. In March 2016 Prof Kitney was made a Fellow of The Royal Society of Edinburgh.

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## UK SPEAKERS



**Dr. Geoff  
Baldwin**

Dr. Baldwin is a Reader in Biochemistry in the Department of Life Sciences and Centre for Synthetic Biology and Innovation (CSynBI) at Imperial College London.

He has spent his career at the interface of the physical and life sciences. Having done an undergraduate degree in Chemistry, he moved into biochemistry for his PhD working on DNA-protein interactions and subsequently DNA repair. More recent interests have seen him cross the boundary to engineering in the field of synthetic biology, where his quantitative approach to studying biological systems at the molecular level has found a new application space. He has been one of the advisors of the very successful Imperial College iGEM teams over the last few years. He has also been responsible for developing the training pipeline of synthetic biologists at Imperial College, having established the final year undergraduate module that is taught across the Life Science and Bioengineering Departments, and being Director of the MRes in Systems and Synthetic biology. He has been involved with setting up the Centre for Synthetic Biology and Innovation where he has an active programme of research in DNA assembly, part characterisation, circuit design and implementation.

These are being applied to in vivo approaches to directed evolution for the creation of new specificity and functionality for biosynthetic pathway optimisation. He also has an active programme of research and commercialisation around the use of protein nanocages as drug delivery vectors.

<https://www.imperial.ac.uk/people/g.baldwin>



**Professor  
Susan Rosser**

Professor Susan Rosser holds a Chair in Synthetic Biology at the University of Edinburgh. She is Director of the UK Mammalian Synthetic Biology Research Centre, Co-director of the Edinburgh Genome Foundry for synthetic DNA synthesis and assembly.

She also holds a prestigious EPSRC Leadership Fellowship in Synthetic Biology. Her research focuses on developing tools for synthetic biology approaches for pathway and genome engineering in bacteria, yeast and mammalian cell systems. The applications of her work include rapid strain engineering for production of high value secondary metabolites, cell lines for protein production, engineering bacteria to generate electricity and developing genetic tools for bio-computation: engineering cells to sense, process and memorise information.

Previously Susan was a lecturer in Biotechnology at the Institute of Molecular, Cell and Systems Biology at the University of Glasgow before being promoted to Professor in 2012. Susan studied microbiology and genetics at the University of Dundee before doing a PhD on the mechanisms of multiple antibiotic resistance. She then moved to the Institute of Biotechnology at the University of Cambridge to work on the biotransformation of cocaine and high explosives

<http://rosser.bio.ed.ac.uk/professor-susan-rosser>

## UK SPEAKERS



**Tony Miller**

**Tony Miller, Senior Scientist at the John Innes Centre (JIC), Norwich, UK.**

Plant scientist with over 25 years of experience in crop nutrition with specialist knowledge in membrane transporters. Editorial duties for several high impact journals he has written reviews on plant nitrogen biochemistry, physiology and transport, with over 130 research publications on nutrition that cover a broad range from molecular to whole plant and soil/root physiology. Research interests: Nutrient acquisition by roots, membrane transporter families for N, P and K., rhizosphere nutrient cycling processes, Calcium channels and signalling, metal transporters and vacuolar proton pumps. Transport processes can limit nutrient acquisition, crop yield and quality. Uptake is also an important step in the efficient use of fertilizer. Collaborations with Chinese scientists and UK agronomists have led to the development of soil sensors and transgenic rice with much improved yield and nitrogen use efficiency.

**JIC webpage:**  
<https://www.jic.ac.uk/directory/tony-miller/>

**Researcher ID**  
<http://www.researcherid.com/rid/B-5139-2008>

**Researchgate profile**  
[https://www.researchgate.net/profile/Anthony\\_Miller/?ev=hdr\\_xprf](https://www.researchgate.net/profile/Anthony_Miller/?ev=hdr_xprf)



**Lalitha Sundaram**

**Lalitha Sundaram's primary introduction to synthetic biology was with the University of Cambridge and Edinburgh's Arsenic Biosensor Collaboration which devised a bacterial biosensor to detect groundwater arsenic in Nepal and Bangladesh.**

Lalitha developed strategy to take this novel synthetic biology product from bench to field, focusing on the international regulatory landscape and Responsible Research and Innovation. Lalitha was subsequently awarded a Postdoctoral Research Project Fellowship at King's College London, where she investigated the opportunities and challenges facing emerging biotechnologies in global health more broadly.

Since completing this Fellowship, she has taken up a post at the University of Cambridge's Centre for the Study of Existential Risk, where her portfolio includes investigating biorisks such as engineered pathogens, DIY-bio and gene synthesis as well as the risks posed by not exploiting emerging biotechnologies to tackle emerging concerns. Lalitha's PhD research, also at the University of Cambridge, used a combination of bioinformatic, next-generation sequencing and molecular biology tools to explore host-cell metabolic and microRNA changes following infection by the pathogenic parasite *Toxoplasma gondii*.

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## UK SPEAKERS



**Jim Ajioka**

**Jim Ajioka, Senior Lecturer, Department of Pathology, University of Cambridge**

Jim Ajioka is a Senior Lecturer in the Department of Pathology, Fellow of Jesus College, Cambridge and co-Director of the Cambridge Synthetic Biology Strategic Research Initiative.. He also teaches Synthetic Biology and Bioengineering in the Departments of Biochemistry and Engineering. His current research directions are: i) investigating host-intracellular pathogen interactions and the population structure/evolution of the protozoan parasite *Toxoplasma gondii* and ii) developing Synthetic Biology methods for the construction of genetic systems in microbes.

Current projects include: analysis of host cell response to toxoplasma infection; hierarchical network analysis of large transcriptomic data sets (*B. subtilis*); developing methods for genetic part/device characterisation; constructing a whole-cell arsenic biosensor for field use.



## ABOUT SYNBI CITE

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SynbiCITE is a pioneering Innovation and Knowledge Centre (IKC) dedicated to promoting the adoption and use of synthetic biology by industry.

The IKC is an internationally recognised lead centre in industrialising synthetic biology research giving the UK a globally renowned national resource of interacting partners from across the UK's leading academic institutions, industry and business.

SynbiCITE is focused at Imperial College London and is, with our partners, accelerating the commercialisation of world-class science and the emerging technologies encompassed by synthetic biology into new products, tools, processes and services. Our overall aim is to grow UK industry in the sector and improve synthetic biology, using industry to achieve significant economic impact, generate wealth for the companies, generate skilled workers and create jobs.

## ABOUT CSYNBI

### Centre for Synthetic Biology and Innovation

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The Centre for Synthetic Biology and Innovation at Imperial College was the first UK Centre to be established in synthetic biology. Funded by a Science and Innovation award from the Engineering and Physical Sciences Research Council (EPSRC), CSynBI now comprises around 80 researchers and students and 10 PI's plus 15 associated research groups within Imperial. The Centre is inherently interdisciplinary and brings together researchers in Bioengineering, Life Sciences, Medicine, Mathematics, Chemistry and Chemical Engineering.

CSynBI has a number of research themes which include, foundational tools, pathway engineering, biosensors, bioprocessing, artificial cells, genome engineering and systematic biodesign. CSynBI also coordinates undergraduate and postgraduate teaching and training including the iGEM team within Imperial and is seen as one of the leading centres in Europe.

## ABOUT NACOSTI

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The National Commission for Science, Technology and Innovation (NACOSTI), is established under the Science, Technology and Innovation Act, 2013. It is mandated to develop, in consultation with stakeholders, the priorities in scientific, technological and innovation activities in Kenya, advice on science education and innovation at both basic and advanced levels and promote increased awareness, knowledge and information of research system, regulate and license all research activities in the Country both at National and County level.

