

## **London Open Biology Forum – 17 November 2016**

SCI sponsored the 1<sup>st</sup> London Open Biology Forum which took place at the Space Centre in Hackney on the 17 November 2016.

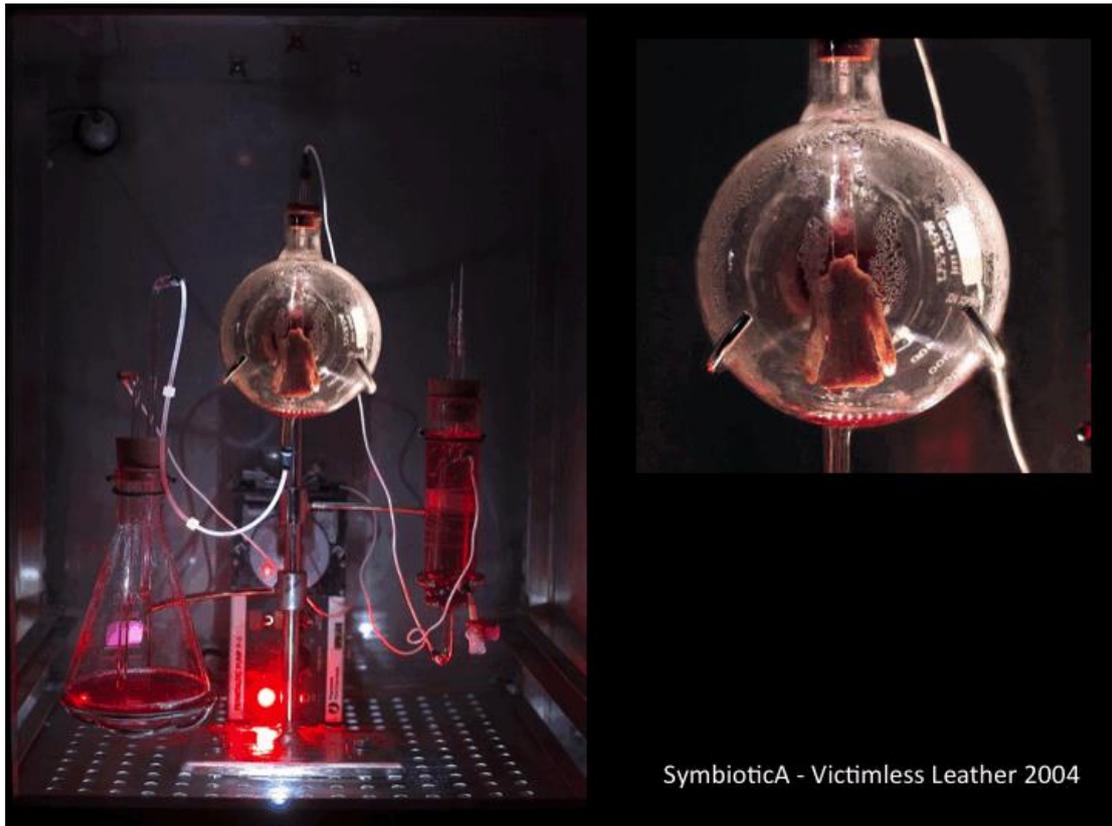


*Heather Barnett speaking at The Open Biology Forum*

The meeting, was attended by about 30 participants and began with a short introduction by Ilya Levantis, Conference Organiser and Director of the London Biohackspace who introduced the purpose of the meeting; to enable representatives of the open biology movement to share their approaches and experiences in developing innovative bioscience projects. Open Biology aims to make available biological systems and tools to non-biologists and to encourage enthusiastic amateurs and professionals with backgrounds in a broad mix of professions such as artists, engineers, biologists and programmers to employ bioscience in their projects. Public engagement, open workshops and the provision of hackspace would allow the development of low-cost bioscience tools. Ilya emphasised enthusiasm and playfulness as key elements in their development.

The first presentation was by Oron Catts, director of SymbioticA, the Centre for Excellence in Biological Arts at the University of Western Australia and professor at Large at The Royal College of Arts, London. His work explores the cultural, ethical and aesthetic implications of the life sciences. With his collaborator Ionat Zurr, he was the first to grow in-vitro meat and leather and is perhaps best known for his work “Victimless Leather” an experiment shown at the Museum of Modern Art (MoMA) in New York in 2008.

Oron pointed out that Technology is becoming more Life-like – think driverless cars - and Life, more Technology-like – think synthetic biology. Our political and cultural systems evolved in their present form from, and during, the Industrial Revolution. Do they now appear to be broken and can they survive unchanged with the advent of biotechnology and artificial intelligence?



***Oron Catts - Victimless Leather.***

Oron emphasised that the underpinning ideas of synthetic biology are by no means new. Jacques Loeb (1859-1924) wanted biology, which at the time was strongly classificatory and analytical, to become an engineering and constructive discipline. Loeb, whilst working at Woods Hole Marine Biology Laboratory, discovered Artificial Parthenogenesis in which the eggs of the sea-urchin were induced to develop not by fertilization but by chemical and physical means. It was heralded at the time as "The Creation of Life. Lower Animals Produced by Chemical Means" and Loeb himself often referred to the "artificial production of living matter". Compare Craig Venter's claim to have created a synthetic life form in 2010 which is "...a living species now, part of our planet's inventory of life..."



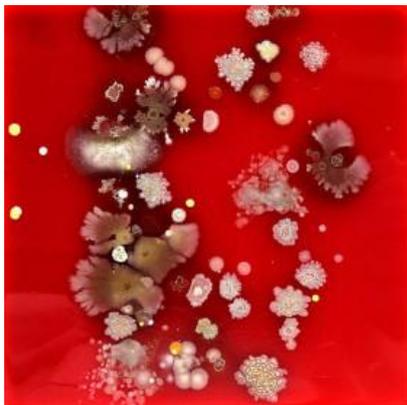
***Jacques Loeb***

Oron mentioned the public impact (fetish?) of Dolly the Sheep, the first mammal cloned from an adult somatic cell, by fusion of an enucleated egg cell with a mammary gland cell and hence named after Dolly Parton. After death she was displayed at the National Museum of Scotland and became one of their most popular exhibits. Photographs of Dolly's droppings can be bought for upwards of £10 depending on the intended use.



*Dolly the Sheep.*

As biology becomes more an engineering discipline life is becoming more like a raw material. Their research in art and design explores the construction of non-utilitarian working prototypes to stimulate cultural conversation. In vitro-meat was presented as a “solution” but, Oron said, it is acutely more of a symptom, as it does not address issues of over consumption and access to resources as the future is not evenly distributed and is controversial. Today CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology offers the possibility of cut and paste genetic engineering. However, DNA is part of a complex system and control cannot be total – we either relinquish control or allow disorder. Catts & Zurr’s design projects go beyond the usual limits of art; inspiring innovations in materials, textiles, architecture, ethics, fiction, and food.



*Sarah Craske – Biological Hermeneutics  
MA Art and Science, Central Saint Martins*

Oron Catts presentation was followed by Heather Barnett, Lecturer on the MA Arts and Science course at Central Saint Martins (University of the Arts London). As an

artist Heather has worked with microbial portraiture, cellular wallpapers, and has an ongoing 'collaboration' with an intelligent slime mould, *Physarum polycephalum*. Here she talked about the growing role of biology within the Art School. The Arts and Science course began in 2010, and takes students from a wide range of backgrounds offering the opportunity to explore the creative relationships between art and science and how they can be communicated. Outputs might include, for example, paintings inspired by particle physics, sculpture exploring complex systems or works engaging directly with biological systems, for example representing a de-cellularised pig heart. One graduate, Sarah Craske, recently won the Mullen-Lowe award for her Biological Hermeneutics project working in collaboration with microbiologist Dr Simon Park and science historian Dr Charlotte Sleigh. Working with an 18th Century copy of Ovid's *Metamorphoses* the project explored the microbial history of the text from multiple disciplines. Recent years have seen a great increase in the presence of biology in degree shows across the whole range of Central Saint Martin's courses and the college is now pursuing the development of a lab for biological investigations embedded within art and design practices. A mixed group of students from MA Art and Science and MA Material Futures will also be participating next year in the international competition Biodesign Challenge, which offers art and design students the opportunity to envision future applications of biotechnology.

The next speaker was Carl Gombrich (Programme Director of Arts and Sciences at University College London) and Brenda Parker (Lecturer in Biochemical Engineering at UCL) who talked about UCL's interdisciplinary Arts and Sciences (BASc) degrees. The course was launched in 2012 with the aim of educating students capable of working in a cross disciplinary way. Students choose major and minor pathways selected from Cultures, Societies, Health and Environment and Science and Engineering. Students majoring in arts based pathways (Cultures and Societies) must minor in a science based pathway and vice versa. In addition, the degree contains a suite of core modules which teach qualitative and quantitative methods as well as modules which are explicitly inter-, cross- or post-disciplinary. Many of these core modules take a problem-based approach to learning and are inspired by UCL's Grand Challenges in Human Wellbeing, Intercultural Interaction, Sustainable Cities and Global Health. However as yet the Biology modules offered on the programme are quite traditional and do not connect across the disciplines as well as some others such as those offered in Engineering. The talk was continued by Brenda Parker who highlighted two of the more innovative BASc modules incorporating ideas from Biology: Open Source Synthetic Biology and Citizen Science for Radical Change. Brenda also questioned what we might consider in designing a new 'Biology 101' course for an interdisciplinary Arts and Sciences degree.



### ***BentoLab***

Bethan Wolfenden entrepreneur and co-founder (with Philipp Boeing) of Bento Bioworks spoke about the latest developments around Bento Lab – a complete DNA lab with an A4 footprint and weighing 3 Kg that enables users to extract, copy and visualize DNA. The device consists of a centrifuge for DNA extraction, a thermocycler for PCR (Polymerase Chain Reaction for DNA amplification) and a gel electrophoresis unit with a blue LED transilluminator for the analysis. This allows users whether hobbyists or educators to perform basic DNA analysis to compare species or different versions of a gene. The idea developed out of their time as undergraduates at UCL and the first prototype was constructed in UCL’s makespace – The Institute of Making. Supporters have included UCL Advances, Synbicate and the Royal Academy of Engineering. Recently Bentobio raised significant funding using crowdsourcing (Kickstarter) to enable the first production run of the machine which will begin to ship early next year. Currently they are developing an ecosystem of on-line researchers to better understand the potential applications and develop an infrastructure of support to make application easier. Bentolab has been used for extracting sequences from Fungi for sequencing and identification, analysis of the genetics of yeast in craft beers connected to flavour and educational applications in schools. Applications to the analysis of SNPs (Single Nucleotide Polymorphisms) are under development.



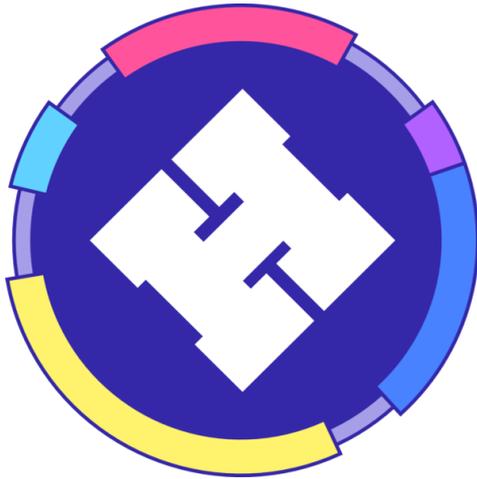
### ***Former MRC Building Cambridge University***

Bethan was followed by Jenny Molloy of the Cambridge Biomakespace which aims to build on the success of The Cambridge Makespace; a community-run enterprise providing tools and equipment for manufacture and prototyping. Its origins and support lie in the University of Cambridge Synthetic Biology Strategic Research Initiative (SynBio SRI) and the Cambridge ideaSpace. It aims to develop a community of scientists, engineers and others to develop ideas in a less formal setting than is available within an institution. The current focus is on plant synthetic biology and is based on an open source innovation model. It is a non-profit company and as such its aims had to be carefully defined since it can only spend on the company's stated objectives. Jenny described this as an IP-Free space since in a community space and for health and safety reasons confidentiality would be both difficult to guarantee and burdensome. However this is not to say that projects leading to IP cannot be pursued. Cambridge University has provided 3 laboratories and a social area with a total of 50 m<sup>2</sup> of space in the former MRC building near Addenbrooke's Hospital. The Biomakespace will have a strong public engagement focus; providing training and networking events. Because of space constraints and organism conflicts initial projects will focus on the common liverwort *Marchantia polymorpha* which has advantages of culture simplicity, a growing suite of genomic tools and a streamlined genome. The Cambridge Biomakespace will open in January 2017.



***Marchantia polymorpha***

Ilya Levantis gave a presentation on the London Biohackspace which is housed in the London Hackspace located in the London borough of Hackney (no pun intended). This is a large (600 m<sup>2</sup>) community run makerspace which provides access to a wide variety of tools including, cutters, etching stations, mills and 3D printers for use in projects ranging from costume to robotics. The Biohackspace consists of a small (20 m<sup>2</sup>) laboratory containing basic equipment for bio-based projects; centrifuges, incubators, electroporator and electrophoresis kit some of which is DIY and the rest second hand. The lab is an HSE approved Containment Level 1 facility – the first such facility outside academia and industry in the UK to get this approval. They have a published code of ethics based on the DIYbio code of ethics which contains a section on Modesty – Know you don't know everything, which, Ilya observed, could usefully be included in more professional codes of ethics (see - <https://diybio.org/>).



### ***London Biohackspace Logo***

The London biohackspace entered the iGEM competition (The International Genetically Engineered Machine (iGEM) Foundation a non-profit organisation spun out from MIT) in 2014 as a community lab funded by UCL with a 3D printing project called “Juicyprint” that used light to control the production of a bacterial cellulase to develop the print. They entered again in 2015 with the “SynBio Brewery” project to develop tools for creating designer yeast strains to produce beers with novel flavours, scents, or colours. They are committed to public engagement and have presented several workshops on aspects of DIY biology. Ilya pointed out that this public engagement is very different from the norm where public engagement means simply “telling people”. Here public engagement involves the public getting actively engaged with the science.

The final session was presented by Brenda Parker and reviewed UCL’s plans for UCL East; a new campus to be built on the former Olympic site in East London. It aims to innovate in the area of teaching and learning and community interaction by breaking down the barriers between teaching, research, enterprise and community participation,

The meeting was followed by a lively networking session.

### **Further Reading**

Bioart. Yetisen A.K., Davis J., Coskun A. F., Church G. M., and Yun S.H. TIBTech 33, 724-734 (2015). <http://dx.doi.org/10.1016/j.tibtech.2015.09.011>

European do-it-yourself (DIY) biology: Beyond the hope, hype and horror. Seyfried G., Pei L., and Schmidt M. Bioessays 36: 548–551, (2014). DOI 10.1002/bies.201300149