SynBioNT background

The overarching aim of this network is to generate new vigorous interactions between the disciplines that impinge on (and contribute to) Synthetic Biology by supporting a range of community building activities. These activities are centred on the specific technical goal of achieving programmable interactions between biological and synthetic chemical cells (chells), inspired by an ‘imitation game’ which proposes a Turing test-like method to determine the “aliveness” of chells.

Chells such as polymersomes have applications as nanoreactors and drug delivery vectors which we can model and simulate using Dissipative Particle Dynamics (DPD). Conversely, we are using P systems to model bacterial colonies and prototype in silico gene regulatory networks that produce emergent patterns of expression in bacterial colonies which are being implemented in vivo.

The overall intellectual and experimental challenges of implementing artificial life remain long-term goals.

Network outputs

SynBioNT has 90 members who together have produced, for example, the following:

- Peer-reviewed papers (selection)

- Books
  - Balmer AS & Herreman C. Craig Venter and the Re-programming of Life: How metaphors shape and perform ethical discourses in the media presentation of synthetic biology. (chapter)

- Reports

- Funded Grants
  - The Logistics of Small Things (EP/H024905/1)
  - The CHELL: A Bottom-Up approach to in vitro and in silico Minimal Life-like Constructs (EP/G042462/1)
  - Paving the Way for Future Emerging DNA-based Technologies: Computer-Aided Design and Manufacturing of DNA libraries. (ICT-7th framework)

Public engagement activities

A public dialogue meeting titled “Should we create synthetic life?” was held at the Broadway Cinema on Sunday 21st March. This attracted over 30 members of the public from various sectors of society and was attended by 10 scientists and 5 social scientists involved in the Challenges in Top-Down, Bottom-Up and Computational Approaches to Synthetic Biology meeting held at the University of Nottingham.

The Broadway Cinema was chosen as it is a central location in Nottingham City Centre and is well-known as a place for cultural discussion. Holding the event on a Sunday afternoon at lunchtime meant that we attracted participants that might otherwise have been unavailable, providing us with a broad mix from school children to retirees, professionals to career seekers, and persons from a variety of faiths.

The event was an integral part of the scientific meeting and attracted participation from leading biological and computer scientists, and social scientists from Nottingham, Edinburgh, London, and Sheffield.

The agenda for the meeting covered a range of issues:

- Are scientists ‘playing God’?
- Can synthetic biology help prevent climate change and produce a greener future?
- Will synthetic biology be used for biological warfare?
- Who should decide what research is done and how it is controlled?

Short elevator talks were given by Miguel Camara, Natalio Krasnogor, Jennifer Hallinan and James King that helped spur a debate between the members of the public, the scientists and the social scientists. Following this group debate the room was split into two smaller groups that allowed everyone to voice their opinion on what they had heard, ask questions of the scientists and social scientists and to speculate about where they thought synthetic biology should go. The two groups were brought back together for a closing plenary with some further discussion and feedback. Lunch was provided after the event with all the public members mingling with the academic attendees, producing a convivial break out of individual discussions and debates, with many people staying for hours afterwards. Feedback of the event was extremely positive and we hope to test the model again in the future to explore how the emerging relationships between synthetic biologists and sociologists can be best utilised to promote engagement that goes beyond the didactic interactions so common in traditional public talks.

A particular highlight of the event was the screening of James King’s film Cellularity, which proposes ‘the cellularity scale’ to measure the “aliveness” of chells.

Cellularity has been also exhibited publicly at AltenNature, Cheltenham Science Festival, Natural History Museum, EPSRC Impact - Royal College of Art, Alife XII, New Directions in Synthetic Biology Symposium, Wyss Institute at Harvard, Cambridge.

On-going public engagement activities

- Writing grants with Science and Technology Studies components, e.g. RoadBlock
- Network members proactively promoting the various flavours of Synthetic Biology represented in SynBioNT, through social media (e.g. YouTube, SlideShare) to reach the widest possible audience, and the SynBioNT wiki to announce events:

In addition, Paul Martin has played a leading role in establishing a national network (led by Jane Calvert, University of Edinburgh) of social scientists and ethicists concerned with the ELSIs raised by synthetic biology. This has formed the basis for a successful bid for an ESRC funded seminar series on Synthetic biology and the Social Sciences. The 2nd meeting of this series will be held in Nottingham.
Reflections on the Synthetic Biology Dialogue

Jonathan Blakes, Brigitte Nerlich, James King, Paul Martin, Andrew Balmer, Cameron Alexander and Natalio Krasnogor

To stimulate reflection on the dialogue among SynBioNT members we asked:
What aspects of Synthetic Biology Public Engagement and ELSI aspects do you consider more critical, important or problematic?
What approaches can you suggest to address it?

Andrew Balmer – Post-doctoral Researcher in Science and Technology Studies
“There remain difficult questions about the practice of public engagement as a mode of democratic governance of science. For instance, to what degree should public(s) ‘unease’ about a particular sociotechnical project be influential in determining its direction, funding and applications? Or, does dialogue about science at early stages of engagement really satisfy the perceived requirement to ‘involve’ the public? What kinds of mechanisms should we use to engage with each other, and how do we understand success in this context? Second, within the context of synthetic biology specifically, I think we need to explore how the epistemological distinctions are being made between the different realms of synbio (i.e. between top-down and bottom-up, chells and minimal cells, BioBricks, etc) in order to understand the ‘cognitive frames’ that will be used to develop applications. This more fundamental understanding of the processes of synthetic biology work should form part of engagement practices, not simply as a background to ‘how science works’ but to evidence how science is plural and in motion, and thus open to contestation and consensus building.

We need to build more understanding, in greater depth and with greater numbers of scientists about the practices of STS and the practices of scientists themselves. This will be a starting point to help shift the motivation and understanding of scientists who are increasingly required to ‘engage’ and have ‘impact’. This deeper collaboration can help produce a more nuanced understanding of science as complicated, contested, professional, human, limited, conflicted, etcetera, which will help to undermine the cycle of risk-vs-benefit thinking that dominates engagement and public consultation. Existing strategies are moving in the right direction, however more needs to be done to consolidate existing relationships between STS and synbio, to ensure that long-term collaborations can be fostered that have the freedom to explore novel and exciting directions for engagement and reflexivity.

James King – Speculative Designer
“Design is integral to synthetic biology - a field in which researchers quite literally design the objects of their study. In this respect, designers might have something to contribute in an analogous way to the scientists who have been pivotal in shaping the field so far. My suggestion would be to involve designers in the research process from the start, to reflect on possible applications, challenge the assumptions of its potential impact and to act as a conduit between the researchers and the public - in both directions.”

“I have worked with the SynBioNT network and collaborated with the researchers on the Chell project to design a response to their research. This project, titled Cellularity, reflected upon the ways in which our understanding of life could be changed by an attempt to build chemical cells. As well as having potential technological applications, chells could lead to a new understanding of how living and non-living things differ from one another. To explore these impacts, I have imagined how chells could develop as a pharmaceutical technology and have designed The Cellularity Scale – a speculative definition of life that is applicable in a future where we no longer ask whether something is dead or alive, but how alive it is. “Synthetic Biology may never become a consumer-facing technology, but it will affect the material world in numerous ways. Designing objects for use by real people is a difficult and problematic task because the ways that they will be used, and the environments they will be used in are never ideal and can never be predicted. Products that seem to make perfect sense on the drawing board can fail once they enter the real world. Designing applications for synthetic biology will face all of the same challenges of designing with a well understood technology and more. The challenge to the engineer is to make the internal workings of the cellless mysterious, more malleable and more predictable. The challenge for the designer is to bridge the gap between the molecular and human scales and align the external facets of synthetic biology with the needs of people in their everyday lives.”

Brigitte Nerlich – Professor of Science, Language and Society
“With public engagement one should not only invest in ‘upstream’ engagement, but also in along-stream engagement, that is, it’s not enough to engage people with something which is some way off in the future, but you have to continue to do so when things actually come downstream and become reality. This is something that is, I think, a bit missing in nanotechnology for example (where the nano-revolution has been replaced by what one of my colleagues calls ‘nanocreep’). This needs continuous monitoring of what’s coming downstream and continuous investment in engagement. The problem in nanotech is that all sorts of things are on the market that contain nanotech components but nobody knows or bothers to know about it.”

Future directions and planned public engagement activities:

• We are interested in exploring the possibility of engaging secondary school and sixth form pupils in the dialogue, by presenting SynBioNT members research and encouraging students to explore the themes and issues raised by synthetic biology and its potential impacts through artistic media such as creative writing, e.g. science fiction, and art.
• Two inter-disciplinary grants arising from SynBioNT and under review from the EPSRC explicit include ELsI in work packages and through co-investigators: RoadBlock involves chemical engineering, molecular biology, science and technology studies, and computer science from Sheffield, Nottingham and Warwick.
• Audacious involves molecular biology, chemistry, computer science and science and technology studies.
• A national meeting on the themes of collaboration between social science, ethicists and natural scientists/engineers around the ELsIs on synthetic biology will take place in Nottingham in June 2011.

Paul Martin – Professor in Science and Technology Studies
“I agree with many of the points Andy make, although trying to achieve this practically will be a major challenge. However, the points I think need more consideration are the broader framing of ‘public engagement’ and ‘ELSI’ activities. In particular, there are two dimensions that need further elaboration. Firstly, what role do PE/ELSI play in the creation of expectations - either negative or positive - about the potential of SB? Is it possible to undertake this sort of work in a way that is more realistic about the timelines and potential impact of the technology? Secondly, can we think about engagement as a form of technology assessment or social steering of innovation? This would encourage much more explicit consideration of the direction, benefits and risks of innovation at an early stage and could be used to ensure technologies were developed that had much greater levels of public support. In other words gaining support would be built into the process of innovation from the start.

“There have been experiments in so called Constructive Technology Assessment (CTA) that seek to bring stakeholders together to consider which options for the application of the science/technology should be pursued and which should be abandoned/ or pursued. A CTA approach would challenge a number of the assumptions that currently underpin established PE/ELSi activities in the UK and fundamentally change the relationship between publics and researchers to make it much more two-way.”

Jonathan Blakes – PhD student in computational systems and synthetic biology
“I was curious to see how the language used in the dialogue had changed over the time the synthetic biology networks had been in existence, so I choose three similarly themed publications from 2008, 2009 and 2010 (the BBSRC Synthetic Biology Dialogue) – and ran their contents through wordle.net) which makes beautiful word clouds using word frequencies to determine relative size. I think that the results demonstrate the beginnings of a deeper, more thoughtful dialogue starting to appear. While the term “synthetic biology” is rightly prominent in each clouds, the relative size diminishes over time. It isn’t hard to notice a movement away from words aligned with novelty in 2008 to an emphasis on engagement and to applications and concerns in 2010 as greater consideration was given to the downstream and continuous investment in engagement. The problem in nanotech is that all

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