Controlling Life? Implications of the mathematisation of biology & other topics

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Background

Research at University of Sheffield on the social study of synthetic biology – using primarily STS[1] approaches - began in 2007. Based in the sociology department, a programme of work was developed out of existing interests on the dynamics of techno-scientific communities, with a particular empirical focus on physical sciences and engineering fields. Most of our sociological research so far has focussed on understanding different aspects of scientific field development e.g. how new scientists are trained; how new scientific communities are formed from existing interests; how attempts to generate knowledge production in inter-disciplinary settings are organized etc. Yet we have barely scratched the surface of several key sociological research questions. The long term engagement with particular science and engineering research groups is central to our research programme and we have gained funding to work on several collaborative projects. It is from this context that the following ideas emerge.

Some research areas, challenges and questions

- Implications of the mathematisation of bioscience

While aspects of computing, systems engineering, control sciences and mathematics are central to the ideal-type processes and the goals of synthetic biology, these engineering and mathematical fields are not only playing a role in the development of synbio but currently impacting in many other areas of bioscientific work. As a result, it may not be wise to separate out (completely) synbio from other trends and developments in bioscience and a sociological research agenda should perhaps not confine itself to synthetic biology (as it is currently defined). We need to understand the ongoing drive to quantify / mathematise /automate the biological sciences and what falls out from that. The translation of the biorealm through, not only quantification, but a mathematical worldview, has practical and epistemological implications that are currently unexplored.

- The practical accomplishment of synbio as an interdisciplinary field

Synbio lays claim to multiple disciplines in pursuit of its goals. Yet it is well known that inter-disciplinary research can be challenging. Is synbio getting it right or not? If it is, what lessons may work for other areas of research and other emerging fields? Are we sure we know what success looks like in interdisciplinary research?

- Industry-academia relations in synbio

In the UK, as elsewhere, synbio appears to be playing a particular kind of economic role. The prospect of economic returns, jobs etc is regularly mobilised to justify continued public investment. This can only be brought about however by bridging an 'innovation gap' (or crossing the dramatic 'valley of death'). Hence the role of industry is

[1] STS – Science and Technology Studies

perceived as key to the success of the synbio endeavour. Realising this vision of industry – academic relations is not necessarily straightforward and it is not yet clear what appropriate forms of relation might emerge between public and private sectors, nor (again) how 'success' might be recognised.

- Expanding current notions of social study of science

The practice of synbio as an everyday science remains elusive. Whether the field will ever stabilise remains an open question. This means that the terrain that STS would like to explore is ever-changing and the ethical landscape is evolving. Alongside, it also provides an opportunity for the co-development of research agendas across disparate research areas. We need to broaden our notions of what social and humanist study of synbio may involve and we need to develop our repertoire of resources (conceptual, theoretical and practical) to analyse and explain and to inform policy and practice.

- Training (who, what, when)

To what extent does training of the technically competent need to include development of competency in the social dimensions of the field (the politics, economics, sociological, ethical etc), If responsible research and innovation is important, then whose notions of 'responsibility' will count? We also have to consider the training of social scientists, to ensure the ongoing analysis of this technical domain (& subsequent emerging technologies yet to be envisaged). Can we experiment with joint training?

- The problem with the term 'social acceptance'

What would be a better concept than 'social acceptance'? Acceptance is a problematic notion for a number of reasons and there is sufficient STS knowledge available to counter the utility of the idea. What sociologically-acceptable ideas could replace it?

- Equity and access

What do emerging technologies in emerging economies look like? Who are the winners and losers as time goes on? Science is a global activity but do we have the capacity to comprehend implications on global scales? Do we have the sociological apparatus to handle uncomfortable questions around equity and economics?

- Open and closed innovation

What are the implications of parallel developments in synbio of open source and closed (IP protected) approaches to the field? Do we assume a mixed economy will ensue and what might the interplay be? How may open-source be policed? Should it be?

- Collaborative experimentation

Synbio has offered intriguing possibilities for collaboration across social and technical communities. We need to get beyond simplistic ideas of what makes interdisciplinary research hard e.g. language, and reach to deeper concerns of an epistemological nature in exploring new forms of knowledge generation. Could we mess with institutional boundaries in relation to synbio in ways not available in other domains? How can social science participate in these experiments? Will participation be possible without sacrificing key parts of disciplinary integrity, our promotion prospects & our need to fulfil institutional success metrics?