Synthetic Biology as Open Science: Sharing tools and Making Communities

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Synthetic biology, and particularly the so-called 'BioBricks' school (also known as 'parts based'), is often referred to as a paradigmatic case of open science. There have been previous instances in which the 'open' circulation of data and tools has been key to the development of research fields and communities. The development of climate change global models and the IPCC research program is but one such instance (Edwards, 2010). Another interesting case was the rapid advancement of developmental biology through the production of knowledge, tools and standards, to characterize the drosophila fly as a model organism. Such cooperative work ended up producing a scientific community (widely known as the drosophila community). In both instances, the exchange and sharing of knowledge was subject to certain internal and external norms, a political and a moral economy of the property and proprietary co‐existing (Kelty, 2012).

As for other emerging technosciences such as geoengineering and nanotechnology, in synthetic biology, digital design software and platforms for storing and sharing data are increasingly becoming key research tools and infrastructures. A (relative) technical openness comes together with the use of new digital technologies for research in these emerging fields. However, perhaps a specificity of the parts based synthetic biology is that it repeatedly announces itself as a program to "make biology easy to engineer" (Endy, 2005), and therefore potentially accessible to many. Beyond (and together with) technical openness, the need for sharing and for cooperative work is often invoked. An analogy to the decentralized development of computing science and the Internet is often mobilized to indicate the promise of synthetic biology. Cooperative and horizontally organized work is put forward as key for the production of innovation in biology. In a quite particular way, open designs and tools in synthetic biology are informed by a combination of an engineering ethos of making things and making them easy with a sort of a 'hackers ethics'. Nevertheless, in practice, 'openness' in synthetic biology is articulated in a number of different settings, resulting in not one, but diverse forms of 'openness', such as 1) Institutionalized 'biohacking' in leading institutions such as MIT, 2) Subversive hacking out of the institutions and in the form of citizen science (DIYbio), 3) As 'industrial' hacking in biotech companies such as Ginkgo Bioworks.

Institutionalized biohacking, DIYbio and 'industrial' hacking rely on technical openness –of different sorts; they differ in terms of political and moral economy. This paper aims at providing some clues on how synthetic biology might be articulating itself as 'open' science. It looks at how 'openness' configures itself through practices of sharing and owning (or: property?) in those three different settings. It will do so by reporting on empirical materials from: 1) The 'biostrike' series of workshops organized by DIYbio groups in Europe. This included the recent publication of a 'Biocommons White Paper"; 2) The development of SBOL (Synthetic Biology Open Language), a large technical infrastructure for enhancing data sharing and digital design in synthetic biology (Galdzicki et al., 2014); 3) Introducing Ginkgo Bioworks, an innovative synthetic biology company and its 'open' biological designs. What forms of communities are

being envisioned and enacted through sharing and owning practices in those different settings? This is the question that this paper aims to address.

References:

Endy D, 2005, "Foundations for engineering biology" *Nature 438*(24) 449-453. Edwards, P. N. (2010) A Vast Machine. Computer Models, Climate Data and the Politics of Global Warming. Cambridge, Massachusetts: MIT Press.

Galdzicki et al., 2014, "The Synthetic Biology Open Language (SBOL) provides community standards for communicating in synthetic biology" *Nature Biotechnology 32*(6) 545-550.

Kelty, C. M, 2012, "This is not an article: Model organism newsletters and the question of 'open science'" *Bio Societies 7*(2) 140-168