

**Social sciences and the emergence of Synthetic Biology – The need to think out of the
(black) box**
Pierre-Benoit Joly, Directeur de recherche, INRA and IFRIS Paris

The contribution of social sciences in the governance of emerging sciences and technologies has been the focus of much attention over the last few years. The usual narrative suggests that the contribution of social sciences may be identified as an overlapping sequence of three waves: analysis of ethical legal and social implications (ELSI), contribution to democratization of choices through public engagement, and more recently integration of social scientists in research laboratories in order to perform real time assessment and foster reflexivity. Programs for ‘anticipatory governance’ performed at ASU, ‘human practices’ at SynbERC, ‘constructive Technology Assessment’ in the Netherlands, or collaborative projects in the UK are among the most prominent examples of this third wave. In this short note, I argue that this later form of contribution of social sciences has serious limitations. To put it in a nutshell, such an engagement in local forms of co-production overlooks key transformations in the regime of production of knowledge that go along with the emergence of SB. To support this argument, I start by referring to an analysis of the current emergence of SB (Raimbault et al. 2014) and then turn to more general analytical questions.

Although SB is still an emerging field, we used a delineation strategy to identify 3000 scientific papers published until end 2013. Most of the 10 000 authors that appear in the corpus only appear once. We identify a core set of about 300 researchers and a smaller set of less than a dozen Institutional Entrepreneurs that both play a key role in the construction of the cognitive dimensions (they have published in the top 100 highly cited papers of the corpus) and in the social dimensions (they are involved in institutional setting) of the field. The high rate of self-references (most of top papers cited by the corpus belong to the corpus) is a good indicator of the growing level of autonomy of the field. Members of the core group formulate a scientific promise that plays a key role for mobilizing resources and attracting researchers. They also play a key role in shaping a local order that involves *inter alia* communication channels, training, social norms of behavior, etc. The definition of standards of proof is crucial and this involves both cognitive and social dimensions. We call this dynamics –which is internal to the scientific field – the "credibility circle".

Our analysis also shows the central role of applications in the dynamic of the field, which leads us to characterize it as a techno-scientific field (TSF). Co-word mapping allows us to identify three clusters of research organized around applications: medical applications; biofuels; and tools for engineering biology. Thus, the dynamic of the field is not only related to credibility circles but also to external forms of valuation of the relevance of the research. The crucial point for a TSF lies in the translation of the scientific promise into promises of application. This is instrumental for building the legitimacy of the emerging field and gaining public support. This public support may translate into additional resources (through specific public programs for

research and/or innovation) and may reinforce expectations and hence attract researchers and companies into the field. We call this dynamic the "legitimacy circle".

Our claim is that the coupling of the credibility and the legitimacy circles plays a key role in the emergence of a TSF. Within the core group, Institutional Entrepreneurs are crucial for such coupling. They span boundaries not only across scientific disciplines but also across social worlds. Hence, they play a key role in translating the scientific promise into promises of application, in constructing the image of synthetic biology in the public sphere to gain public support, and so on. Therefore, they not only act within the scientific world but also construct the conditions of emergence of the new specialty through the making of its socio-political environment. Overall, synthetic biology exemplifies what we have called a regime of techno-scientific promises (Joly 2010).

Our empirical work and analysis of the emergence of SB as a techno-scientific field that contributes to a regime of techno-scientific promises, and of the important role of credibility and legitimacy circles, has important implications for research agendas for social sciences. Social scientists are well placed to ask important questions such as: what are the type of relations between science and society within such regimes? What are the processes of techno-scientific promise making? What is valued and how –and how does it affect research agendas? What does it mean to govern through promises?

Social scientists can also contribute to debates around the growing reference to responsibility. What are the implications on research objectives and laboratory practices? Is it mainly a way to ensure self-regulation of the field and prevent external forms of compulsory control? What does it mean to be responsible and reflexive in a regime of techno-scientific promises? What is the expected role of social sciences in this context? Is it just about fostering acceptability?

References

Joly, P.B. (2010). « On the Economics of Techno-scientific Promises », in Akrich, M., Barthe, Y., Muniesa, F., Mustar, P. (eds.) *Débordements. Mélanges offerts à Michel Callon*, Paris: Presse des Mines, pp.203-222.

Raimbault, B., Cointet, J.P., Joly, P.B. (2014). "On the emergence of techno-scientific fields: The case of Synthetic Biology" (Submitted)