

# Synthetic Biology: on the feasibility of anticipating future dynamics in Complex Systems using Technology Assessment

The symbolic distinction between what is considered alive and therefore natural, and what is considered artificial and therefore technical, is eroding rapidly. Although still categorized as technologies, Artificial Intelligence, Neurotechnology and Synthetic Biology require a critical reflection on what is commonly perceived as technology, and to what extent this categorization might hide certain underlying complexities. Furthermore, positioning these technologies in the same category as the internet, railroads and microscopes might reduce our ability to anticipate their future impacts.

According to systems biology, anticipation in the broadest sense is not a strictly human affair: biological life has been able to sustain itself on earth without human interference for at least 3.5 billion years through various forms of anticipation. Forming a model to anticipate the future and subsequently acting accordingly to what was predicted made it possible for living systems to persist on earth despite constant entropy (Friston, 2013)<sup>1</sup>. Modifying living, and thus self-preserving systems through the use of Synthetic Biology might introduce future dynamics that require an entirely different approach to anticipation than used in the past. Those involved in Anticipatory Studies might even consider to what extent *any* approach is equipped to anticipate future dynamics in highly complex systems such as those emerging from, for instance, Synthetic Biology. To provide a partial answer to this question, I will investigate to what extent a commonly used approach, Technology Assessment (TA), is equipped to anticipate the future dynamics within complex systems such as those emerging from Synthetic Biology. My current hypothesis is that TA is unequipped to sufficiently anticipate the future dynamics of complex systems, and therefore it needs to be extended or replaced by a different approach altogether.

To answer the research question, I will survey Synthetic Biology literature to gain a better understanding of the methods and technologies used during the development and engineering process. Survey both Complex Systems and Systems Biology literature to gain a better understanding of the dynamics in play with regards to the hybrid systems emerging from Synthetic Biology. As well as Technology Assessment literature on complex systems and how they relate to Synthetic Biology. I will identify relevant concepts, issues, and theories found in the field of Anticipatory Studies (and related areas). Finally, I will offer suggestions based on Anticipation Studies that might be useful to elaborate alternative approaches to Technology Assessment (or alternative<sup>2</sup> TA methods) better suited to anticipate future dynamics in complex systems. That is to say: approaches that result in scenarios that describe future dynamics closer to how these dynamics eventually unfold. For the sake of discussion, one might wonder if anticipation should remain a human affair, or if it might be desirable to embed a form of anticipatory algorithms into the complex systems themselves. Furthermore, the distinction between anticipation as a human act, versus anticipation as a quality of biological systems should be discussed, as the line between both forms of anticipation becomes potentially blurred when dealing with synthetic biology.

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<sup>1</sup> Friston, K. (2013). Life as we know it. *Journal of the Royal Society Interface*, 10(86), 20130475.

<sup>2</sup> Schmidt, J. C. (2016). *Prospective Technology Assessment of Synthetic Biology*.