

Abstract organization and material parts in ALife and synthetic biology

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Two decades after the initial steps of ALife another field, Synthetic Biology (SynBio), defends the need of synthetic methodologies in the life sciences. Both have used similar arguments: the epistemological principle that to understand how something works, we must know how to build it, and the instrumental goal of producing useful things. But they come from different traditions and constitute different scientific communities; probably ALife's closest ancestor is cybernetics, whereas SynBio's is molecular biology.

In the case of ALife, the main goal is to study living organization. For Langton (1996 *Artificial Life*, MIT Press.), synthesis makes possible to explore life-as-it-could-be in order to understand the necessary and the contingent of living organization in principle in a materiality different from the carbon-based. For others, the stress is in characterising life as an autonomous organization. ALife, like SynBio, is very diverse, and although it has predominantly pursued to create "life-like behaviours within computers and other artificial media", occasionally ALife models have been developed in vitro with biochemical components. Also, although the main goal was to construct new forms of life, in practice the field has produced more models (with scientific purposes) and tools (with instrumental purposes) than real instantiations.

In SynBio, however, the goal is not organisation, but design. The field intends to construct engineered organisms (biofacts) out of the components of existing life, by changing specific parts. Like ALife, SynBio is very diverse; O'Malley et al. (2008, *BioEssays*, 30, p. 57) have distinguished three different approaches: DNA-based device construction, genome-driven cell engineering, and protocell creation. Because it is difficult to see what they have in common, we may consider that the first is the most characteristic so far, or at least we could say that it is the one sharing less with ALife (whereas there is certainly some overlapping in the case of the third).

This paper intends to analyse some epistemological similarities and differences of both fields, especially in what concerns their views on living organization and the importance of materiality. In what concerns the first, in ALife living organization has been considered as an invariant to be found/constructed, whereas in SynBio, the goal is to engineer or to create life (sometimes close to the field of the origins of life). One idea has been that "nature is imperfect and should and can be revised and improved" (cited in Morange, 2008, Unpublished manuscript on Synthetic Biology). In what concerns the second, ALife aims to understand parts, composition and function as emerging properties, thus avoids fixed parts and aims at construction; in contrast, SynBio uses existing parts to change the design of life (one major effort is to build an open-access library of presynthesized biological parts and devices, the *Registry of Standard Biological Parts*), aiming at intervention.