The Study of Chemical Biology and Molecular Biology

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Description

Much of the discussion surrounding synthetic biology involves some degree of speculation about the future. This paper reports on two workshops we held with the aim of 'opening up' and exploring possible futures for synthetic biology, one at the synthetic biology 4.0 conference and the other at the bio sys bio meeting.

We developed an interactive 'causes and consequences' exercise for these workshops, with the aim of creating a space for members of the synthetic biology community to discuss issues about the future of the field that they might not regularly explore in their daily work. We analyse the outputs and discussions from these workshops in the light of three key themes: the connections between social and technical issues in synthetic biology, the roles and responsibilities of synthetic biologists in shaping possible futures for the field, and the suitability of this method for opening up discussions about the future. Synthetic biology is often described as a project that applies rational design methods to the organic world. Although humans have influenced organic lineages in many ways, it is nonetheless reasonable to place synthetic biology towards one end of a continuum between purely 'blind' processes of organic modification at one extreme, and wholly rational, design-led processes at the other. An example from evolutionary electronics illustrates some of the constraints imposed by the rational design methodology itself. These constraints reinforce the limitations of the synthetic biology ideal, limitations that are often freely acknowledged by synthetic biology's own practitioners. The synthetic biology methodology reflects a series of constraints imposed on finite human designers who wish, as far as is practicable, to communicate with each other and to intervene in nature in reasonably targeted and well-understood ways. This is better understood as indicative of an underlying awareness of human limitations, rather than as expressive of an objectionable impulse to mastery over nature.

Molecular Biology

A commitment to 'making' creating or producing things can shape scientific and technological fields in important ways. This article demonstrates this by exploring synthetic biology, a field committed to making use of advanced techniques from molecular biology in order to make with living matter (and for some, to engineer living matter). Synthetic biologists' ambition to make helps determine how their field demarcates itself, sets appropriate methods and practices, construes the purpose and character of knowledge, and views the things of the living world. Using empirical data from extensive ethnographic and interview-based research, I discuss the importance of seemingly simple and unimportant commitments in this case, a focus on the making of things rather than the production of knowledge claims. I conclude by examining the ramifications of this line of research for studies of science and technology.

As extensively stressed by Weyl and van Fraassen, XXth century physics has been substituting to the concept of law that of symmetry. Thus, this concept may be "considered the principal means of access to the world we create in theories". Along these lines, one of the major challenges for a (theoretical) physicist is to invent the pertinent space or, more precisely, to construct a mathematical space which contains all the required ingredients for describing the phenomena and to understand the determination of its trajectory, if any. So, Newton's analysis of trajectories was embedded in a Cartesian space, a "condition of possibility".

Chemical Biology

Chemical biology and the techniques the field encompasses provide scientists with the means to address biological questions in ever-evolving and technically sophisticated ways. They facilitate the dissection of molecular mechanisms of cell phenomena on timescales not achievable by other means. Libraries of small molecules, bio-orthogonal chemistries and technical advances in mass-spectrometry techniques enable the modern chemical biologist to tackle even the most difficult of biological questions. It is because of their broad applicability that these approaches are well suited to systems less tractable to more classical genetic methods. As such, the parasite community has embraced them with great success. Some of these successes and the continuing evolution of chemical biology applied to apicomplexans will be discussed.

It is then possible to give a broader sense to the notion of phase space. For thermodynamics, say, boyle, carnot and gay-lussac decided to focus on pressure, volume and temperature, as the relevant observables: the phase space for the thermodynamic cycle (the interesting "trajectory") was chosen in view of its pertinence, totally disregarding the fact that gases are made out of particles. Boltzmann later unified the principles of thermodynamics to a particle's viewpoint and later to Newtonian trajectories by adding the ergodic hypothesis. Statistical mechanics thus, is not a reduction of thermodynamics to Newtonian trajectories, rather an "asymptotic" unification.

At the infinite time limit of the thermodynamic integral, under the novel assumption of "molecular chaos" (ergodicity). In statistical mechanics, ensembles of random objects are considered as the pertinent objects, and observables are derived as aspects of their (parameterized) statistics.