Nanotechnology Risk Perception and Public Participation Research as a Template for Synthetic Biology

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Synthetic biology has already emerged with a large red flag for potential risk perception amplification and regulatory challenge (e.g., IRGC 2008; FOE 2010). Indeed, the potential for synthetic biology's rapid scale up and commercialization around the globe appears to far exceed that realized thus far for nanotechnology; and yet as with nanotechnologies, this will likely be accompanied by very high levels of lack of knowledge among publics in many countries (cf. Satterfield et al. 2009). In this short piece, I would like to suggest the most salient aspects of nanotech risk perception and public deliberation work that synthetic biology funders should consider and incorporate in building future research initiatives with societal components if their aim is responsible innovation and development.

Risk perception and decision risk research are well-established fields, based on cognitive and affective theories and well-validated methods, approaches, and tools. In particular their ability to theorize and assess the construction of preference and preference reversals is critical to issues of public acceptance that have preoccupied nanotechnology funders and industry . In addition to providing a rigorous approach to understanding public perceptions, the field also has long scrutinized the nature and distribution of points of connection and disconnection between publics and experts, in particular, and between different kinds of 'situated' or 'affiliative' knowledges more broadly. Work based on these approaches at CNS-UCSB has added value to the nano initiative at NSF by helping characterize and disentangle the multiple factors that operate on upstream benefit and risk perception (Pidgeon et al. 2009; Pidgeon, Harthorn & Satterfield 2011).

Government agencies in the US have widely adopted multi-stakeholder approaches to engagement, yet these activities are often conducted without knowledge of or reference to evidence of such perceptions among participants. They also tend to be shaped around incorporation of leading upstream actors at the cost of public involvement, which is viewed as more appropriate downstream (thus removing precaution from dialogue). And they tend to shape participant composition according to intuitive ideas rather than informed evidence-based knowledge of constituents views and preferences. In addition, the skilled analysis of the effects of such power and perspective differentials is a critical and frequently ignored dimension.

Public participation is widely mandated across numerous governmental institutions for input in science and technology policy decision making. Yet methods for its implementation are largely unspecified, ad hoc, and often performed with a 'check the box' approach that limits their impact and violates normative ethics. Engagement in the context of high scientific uncertainty about risks and widespread lack of knowledge as has been the case with nanotechnologies has added yet further complexities. But research in a number of countries has demonstrated that such upstream and anticipatory engagement can indeed be performed, assessed and found to be effective in achieving its goals (Corner & Pidgeon

2012). Our work has also found US participants to be strongly supportive of public deliberation as a vital, though excessively unfamiliar, approach. It has also found pervasive public ambivalence about societal implications of science and engineering development (cf. Harthorn, Shearer & Rogers 2011), particularly around issues of trust, institutional recreancy, and procedural and distributive justice. These seem likely to be yet more extensive in the synthetic biology case.

Responsible risk communication, a widely mandated and ethically requisite element of governance in the US, needs to include a comprehensive approach across agencies that is currently faulty or absent entirely. The science of risk communication also demonstrates the importance of tailoring risk messages to specific audiences, of integrating different levels of risk governance into them, and of basing them on evidence-based rather than intuitive understandings of multi-stakeholder risk and benefit perceptions. Nano has provoked great advances in empirical evidence on diverse stakeholders, yet comprehensive risk communication has not (yet) arisen; synthetic biology could benefit from and extend this evidence base. In the event of likely risk amplification in synthetic biology, this is a vital area of research focus for responsible development. Nanotech has also provided an excellent case study for showing the limits of traditional quantitative risk assessment to resolve safety questions ahead of innovation and development, and hence has demonstrated the limits of regulation based on risk assessment alone.

Finally, both societal nano focused centers in the US at UCSB and ASU have succeeding in producing the requisite social and intellectual chemistry for innovating new modes of integration of science and society of which syn bio should take sharp notice—the large center context that has produced these is not incidental to their development and should be examined as a model for syn bio development.

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