

Valerie Racine's Commentary on "DIY Biology and the Case of the Glowing Plants"

Commentary On

Case: DIY Biology and the Case of the Glowing Plants

Projects within DIY biology are often thought to be part of a political movement that represents “a material re-distribution, a democratization, and an alternative to established, technoscience” (Meyer 2012). The very politics of transparency and accessibility of the DIY biology movement is what generates many ethical, social, and environmental concerns about biosafety and biosecurity (e.g. bioterrorism). The movement also invokes larger questions about governance and the regulation of scientific research.

Bioengineering research and development outside of academic and research institutions raise concerns about the potential release of harmful biological materials into the environment, and its potential effects on human health. The challenges of assessing and managing risks in this area are even greater given our current limited knowledge about complex adaptive systems, from microorganisms to ecosystems. That level of uncertainty and unpredictability poses serious concerns: “Experimentation with living organisms [...] is problematic because they are self-replicating and transmissible, so they pose many hazards that one would not encounter in many other types of do-it-yourself science” (Wolinsky 2009).

However, many projects in bioengineering, including projects in DIY biology, promise beneficial applications of the new biotechnologies and the new modified organisms. For example, members in the DIY biology community have made efforts to develop biosensors and biomarkers, such as DNA bar coding, intended to improve food safety (Landrain *et al.* 2013). Critics of the Glowing Plant Project argue that it has no purported benefits of improving human health, safety, or the environment, whereas its promise of distributing genetically modified seeds to its supporters presents a potential risk to the environment. Supporters of the project have responded by

claiming that basic scientific research motivated by pure curiosity often leads to beneficial applications down the road. The CEO of the project, Antony Evans, suggested that a future goal of the project could be the development of a biotechnology that could replace street lamps with glowing trees, which might help to reduce carbon dioxide emissions and the modified glowing trees would last longer than most current street lamps.

The issue of balancing potential risks and benefits in the development of this new biotechnology invokes a larger ethical issue. The main concern isn't solely about the potential release of harmful biological materials into the environment, but rather about the lack of regulatory oversight that might set dangerous precedents for future projects. Given these concerns, questions arise about what kinds of oversight agents or bodies should regulate citizen-science movements, such as DIY biology, and the extent to which these projects ought to be regulated.

Currently, the DIY biology community is self-regulated (Wolinsky 2009; Landrain *et al.* 2013). In the case of the Glowing Plant Project, the modified plants are beyond the jurisdiction of the Animal and Plant Health Inspection Service (APHIS), an agency of the US Department of Agriculture (USDA), because the agency only regulates genetically modified plants if plant pathogens are part of the process. A common method to produce genetically modified plants makes use of a plant pathogen, *Agrobacterium*, to transfect foreign genes into new host cells. But, the scientists at the Glowing Plant Project sidestepped this method by using a gene gun instead, and dodged the legal and regulatory oversight of the APHIS. Because of that, detractors have also criticized the project for capitalizing on a regulatory loophole.

Despite that criticism, the DIY biology community has considered some of the worries about the release of harmful biological material. They have taken a "bottom-up" approach to self-governance by drafting a code of ethics and by encouraging transparency and collaborations with public authorities (Landrain *et al.* 2013). However, the extent to which members of the community follow this code remains questionable (Evans & Selgelid 2014).

An additional challenge for DIY biology is how potentially beneficial innovations, if and when they are developed, will fit into current social institutions and economic and political arrangements. Take the case of drug development as an example. There is much more to that process than developing a new drug to which a current disease has no resistance (Evans & Selgelid 2014). There needs to be knowledge

about how and when to use the drug correctly, about drug resistance, and about the manufacturing and distribution processes, which invoke many economic and sometimes political challenges (Evans & Selgelid 2014). Thus, as Evans and Selgelid have argued, any benefits that come out of DIY biology efforts will be “contingent on the performance of other institutions, including but not limited to health and security establishments” (Evans & Selgelid 2014, 1076).

Lastly, a difficult question regarding governance and the regulation of DIY biology concerns finding the right scope and balance of regulation. On the one hand, ensuring global and national biosecurity and biosafety, and protecting the environment, are paramount. On the other hand, too much regulation may lead to underground operations that are more difficult to track and might pose a greater risk (Wolinsky 2009). Landrain *et al.* sum up the challenge accordingly:

“The regulation and governance of DIY biology calls for a balancing act: to collectively set ethical standards without alienating individuals, to establish a global set of principles that makes sense in local contexts, to be close enough to authorities, yet far enough to avoid losing the counter-cultural and innovative edge that DIYbio stands for” (Landrain *et al.* 2013).