ELSI Pilot: Assessing and Mitigating the Risks of Large-Scale Metabolic Engineering

Geller, J.,[1] Lee, S.,[1] Tarjan, D.,[1] Wu, C.,[1] Torok, T.,[1] Hazen, T.C.,[1]
Arkin, A.P.,[1,2,3] and **Hillson, N.J.**[1,2]* (njhillson@lbl.gov)

[1]Lawrence Berkeley National Laboratory, Berkeley, CA;
[2]Joint Bioenergy Institute, Emeryville, CA; and [3]University of California, Berkeley

Project Goals: Establish methodologies for assessing and mitigating the risks of future large-scale metabolic engineering microbial projects, including those extending beyond the bioreactor.

The DOE EERE-funded Advanced Biofuel Process Development Unit (ABPDU) houses two 300 liter microbial fermentation tanks. In the extremely unlikely event that the ABPDU's post-fermentation microbicidal protocol (e.g. base treatment and neutralization) should catastrophically fail, broth harboring viable genetically engineered micro-organisms could be purged directly to downstream waste-water treatment processes. This Ethical, Legal and Social Implications (ELSI) pilot study seeks to quantitate the risks associated with this scenario, by measuring the viability of the engineered microbes (and perhaps more importantly, their embedded genes) in mock sewage reactors that mimic the conditions and microbial communities found in real-world waste water treatment plants. Furthermore, investigation of how differential genetic backgrounds (e.g. gene deletions) impact survival and gene transmission to sewage sludge communities will guide subsequent forward-engineering efforts to further reduce risk. This pilot study establishes methodologies (leveraging only recently available technologies) for assessing and mitigating the risks of future large-scale metabolic engineering microbial projects, including those extending beyond the bioreactor.