Homework 08

Due Date: 5:00PM on May 17nd

Design a piece of open hardware for biology.

Answer the following questions about your design:

1) What unmet need is your piece of hardware/device answering?

2) Will it be open source? What is the advantage/disadvantage in this case for it to be open source? What are the ethical implications of this decision?

3) Describe in technical detail the device. You can hand draw sketches, use/annotate images, and/or draft a 2D or 3D model. Include as much detail as possible, including measurements, power requirements, biological components.

CAD design software suggestion:

Fusion360 (free academic version)
https://www.autodesk.com/products/fusion-360/students-teachers-educators

EXTRA CREDIT: make the device. If you need access to 3D printers, we have reserved space at the 3D Printing Hackathon this weekend! Email Elizabeth for more info at elizabeth.m.henaff@gmail.com

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There are many areas where hardware interfaces with synthetic biology and biological construction. Here is a (non-exclusive) list of project area suggestions:

Experiment Execution. Throughput and reproducibility are key limits to what can be accomplished in synthetic biology. Any hardware that accelerates the design, test, build, and learn cycle and/or makes experimental results more reliable and reproducible will have a significant impact on synthetic biology.

Sensors. Data acquisition for biological measurement—from optical density to fluorescence measurements—require sensors. Projects based on novel sensing technologies, or innovative remixes of current sensors, are welcome topics.

Microscopy. The ability to visualize biological systems is one of the most critical enabling technologies for biology. In class, we've learned about a variety of imaging techniques that can enable, for example, expansion microscopy and FISSEQ.

Liquid Handling. We exist in the pipette era of biology. Fluidic machines—from microfluidics to liquid handling robots—can help us realize the longstanding vision of an automated biological future.

Complexity Management. Synthetic biologists constantly manage complexity, from sample tracking to running multiple parallel experiments. Great hardware can help organize and systematize without scaling up confusion.

Bioreactors. Engineered organisms typically require culturing in an in vitro environment. Great hardware can help organisms grow according to experimental parameters and execute their engineered functions.

Bio-printing. We have learned in class about ways to work with biological materials to create structures. From inkjets to larger deposition systems, hardware is critical for precisely spatially orienting bio-materials.

Bio-Made Hardware. Hardware can help synthetic biologists engineer biology, but biology can also be used to engineer hardware. Consider also projects that use genetically engineered machines to create structures, mechanisms, and other devices.

Reading

Lab Making | The Book: HackteriaLab 2014 - Yogyakarta, by Urs Gaudenz, Sachiko Hirosue http://hackteria.org/wp-content/uploads/2015/09/LabMaking_HLab14book-Sep10-Pages-59-61.pdf

Open Source Generic Lab Equipement and Scientific Devices http://de.slideshare.net/mrgaudi/open-source-generic-lab-equipement-gaudilabs?ref=http://hackteria.org/wiki/Generic_Lab_Equipment

Beyond Black Boxes: Bringing Transparency and Aesthetics Back to Scientific Investigationhttp://hackteria.org/wiki/Syntheses_of_%22Beyond_Black_Boxes%22

Overview on Generic Lab Equipment http://hackteria.org/wiki/Generic_Lab_Equipment

Open Source microfluidics designs:
http://metafluidics.org/