

open hardware

DropBot: an open-source platform for lab automation

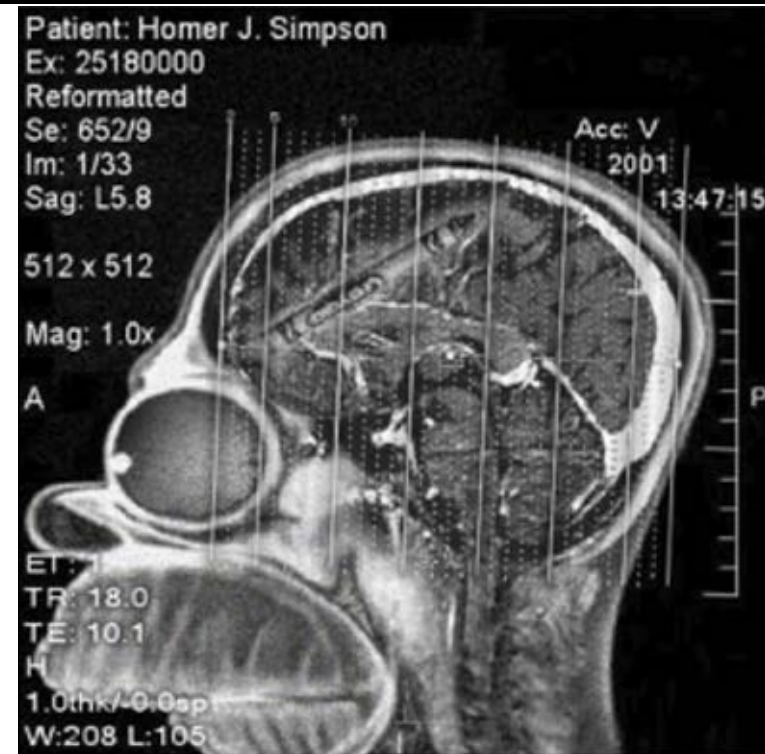
Ryan Fobel

I: How did I end up here???

II: DMF and the DropBot

III: General insights

MASc in Imaging physics

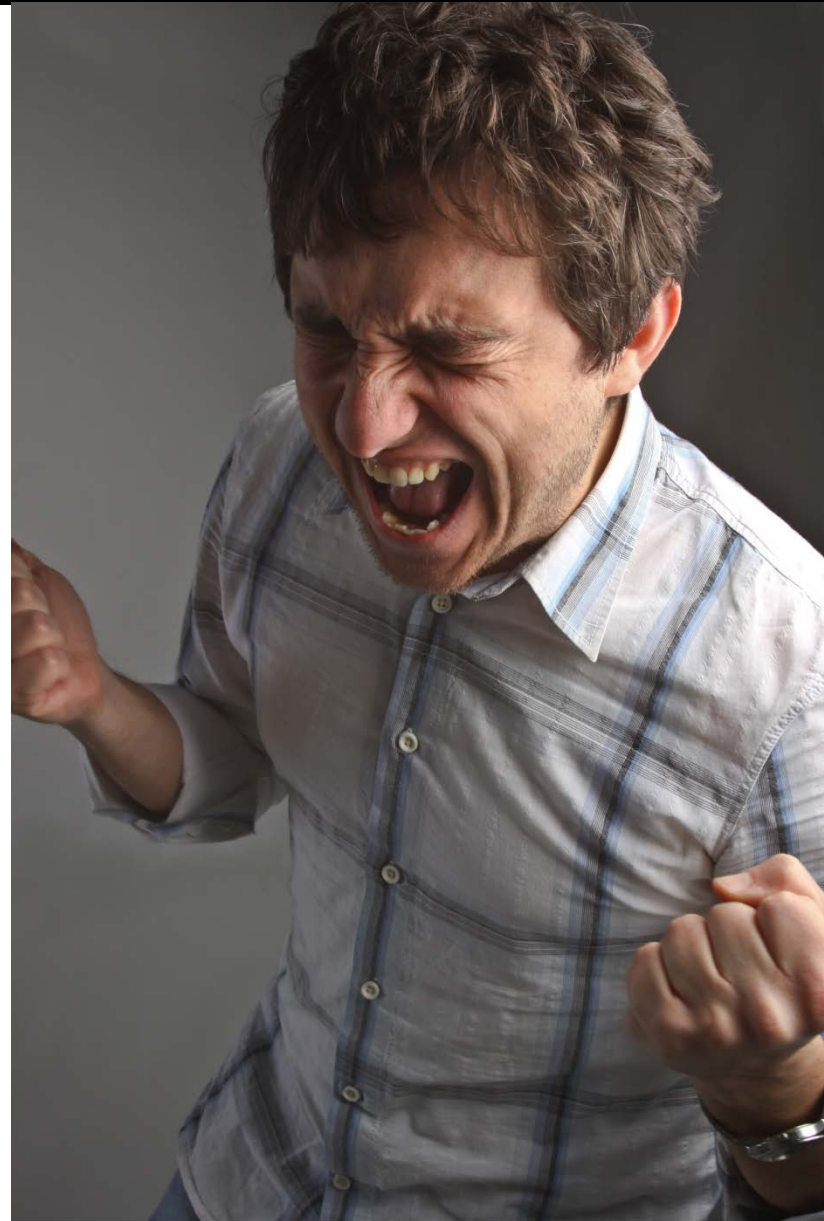


- got to play with super cool million dollar gadgets
- take pictures of my friends' brains
- chance to positively impact health care



Reality is frustrating

- incremental advances
- no culture of sharing (few exceptions)
- reinventing the wheel
- trying to reverse engineer a black box
- boss is not happy if you want to take apart magnet



Science needs open technology
platforms, not appliances.

- Jordan Miller, OHS 2012

My introduction to hardware

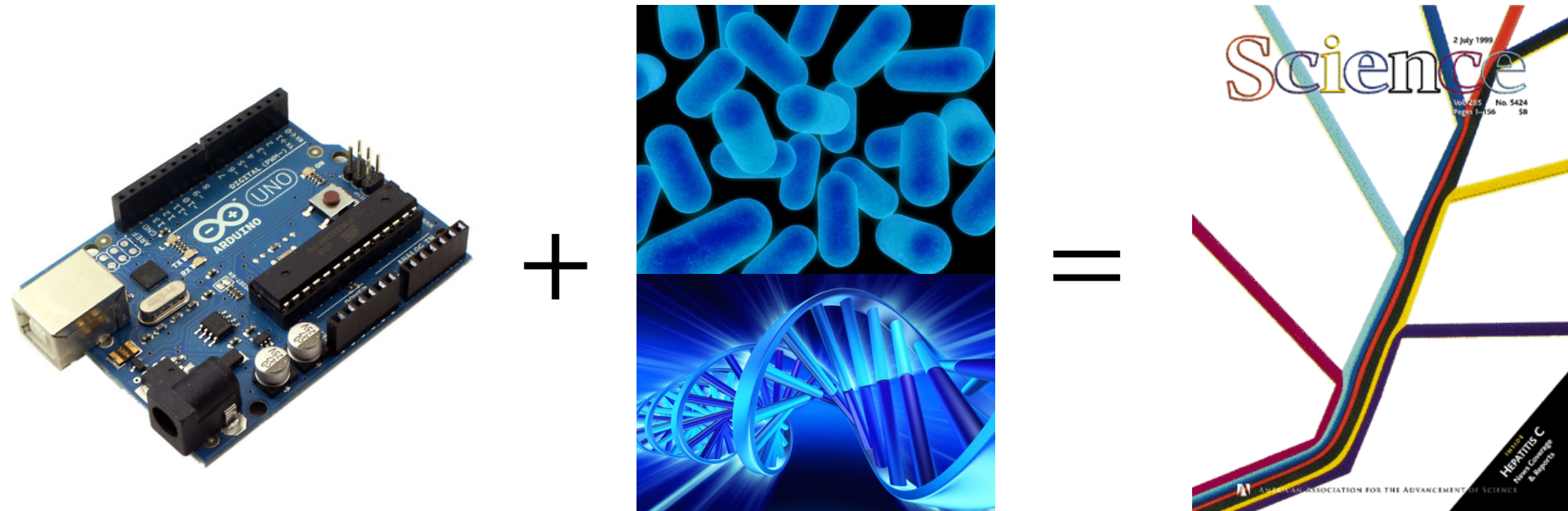


I: How did I end up here???

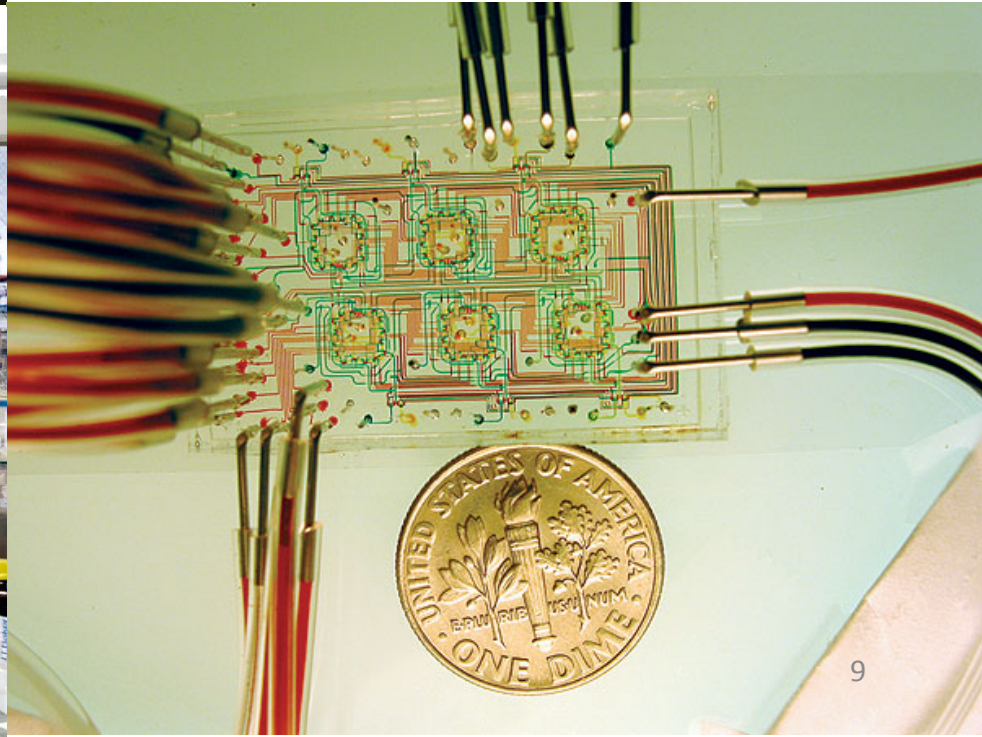
II: DMF and the DropBot

III: General insights

Hello Microfluidics



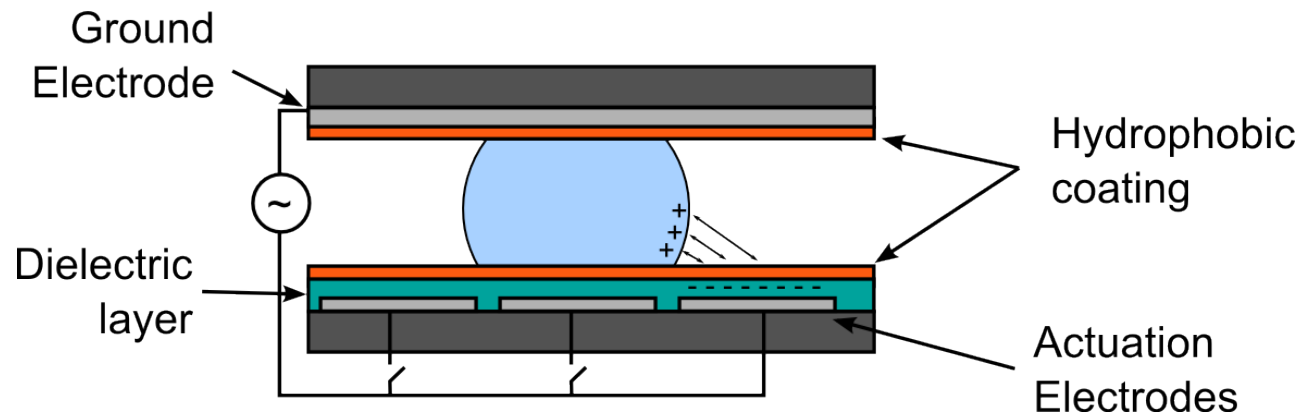
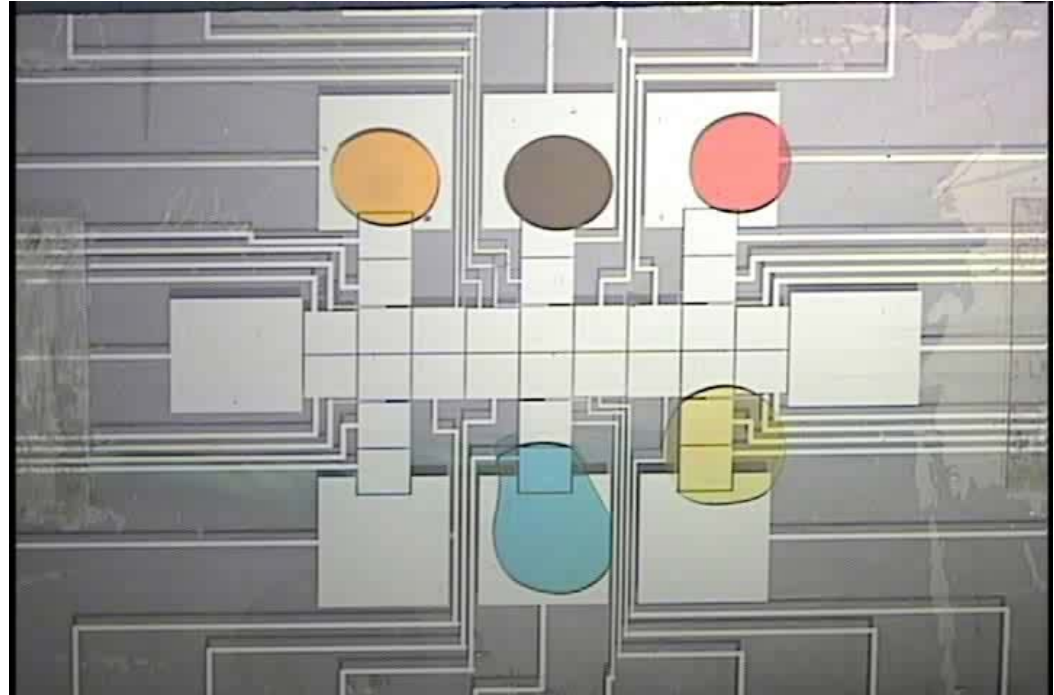
Kenis et al.,
Science, 1999
285 83-85



Digital Microfluidics (DMF)

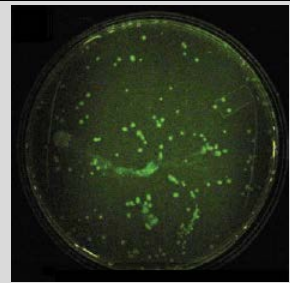


Prof. Aaron Wheeler
University of Toronto

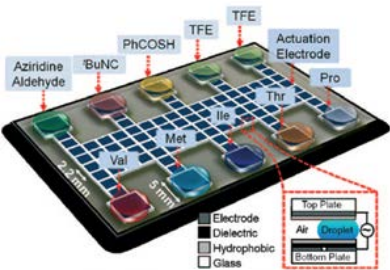


Sample applications

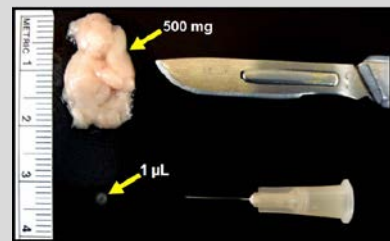
Cell culture and biological assays



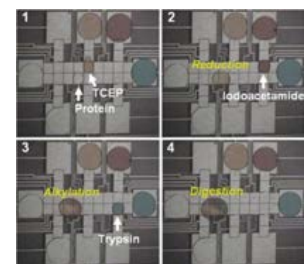
Chemical synthesis



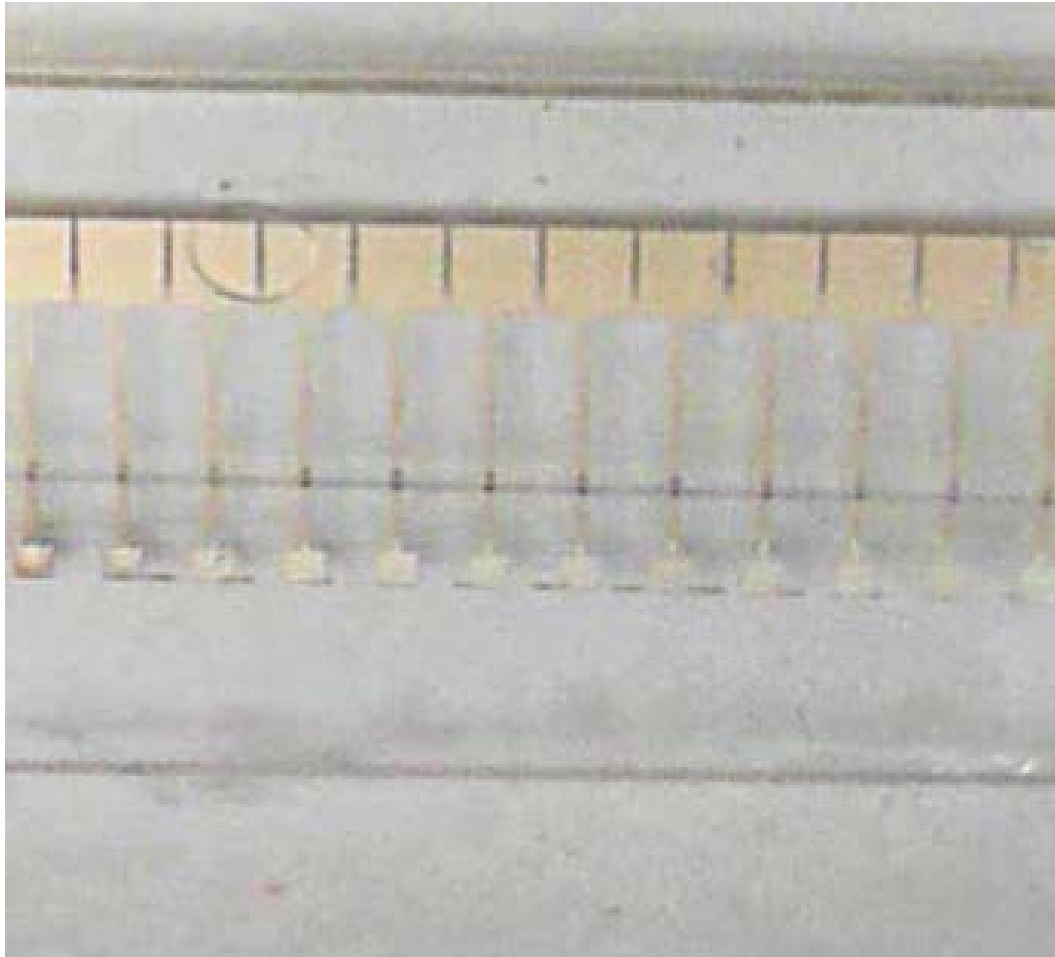
Diagnostics



Proteomics

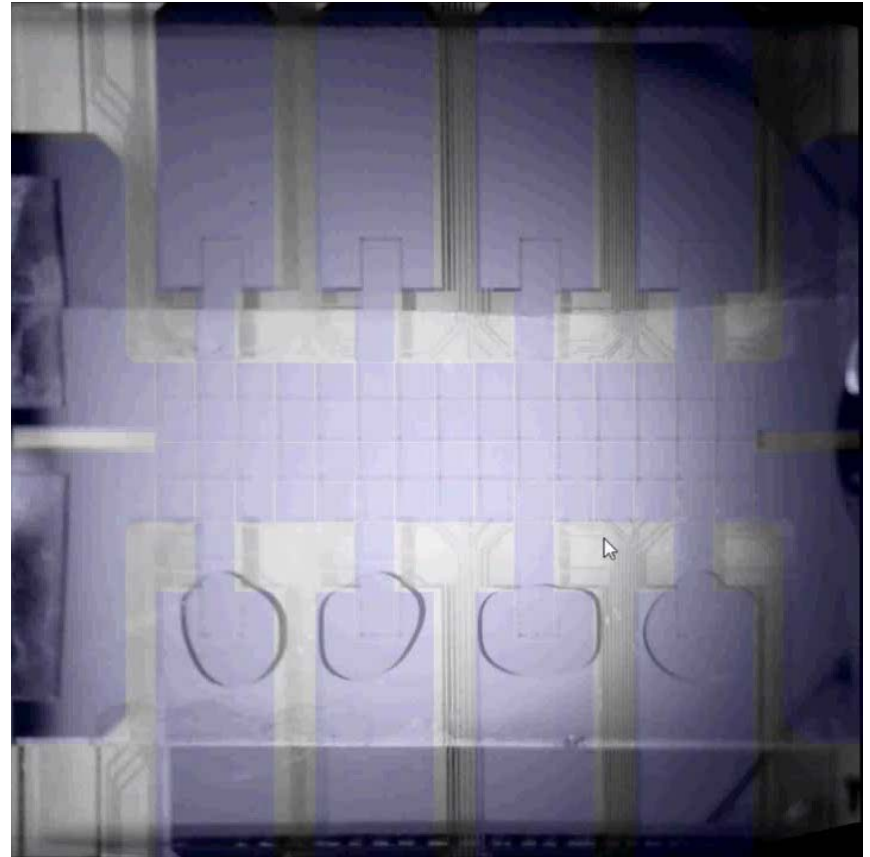
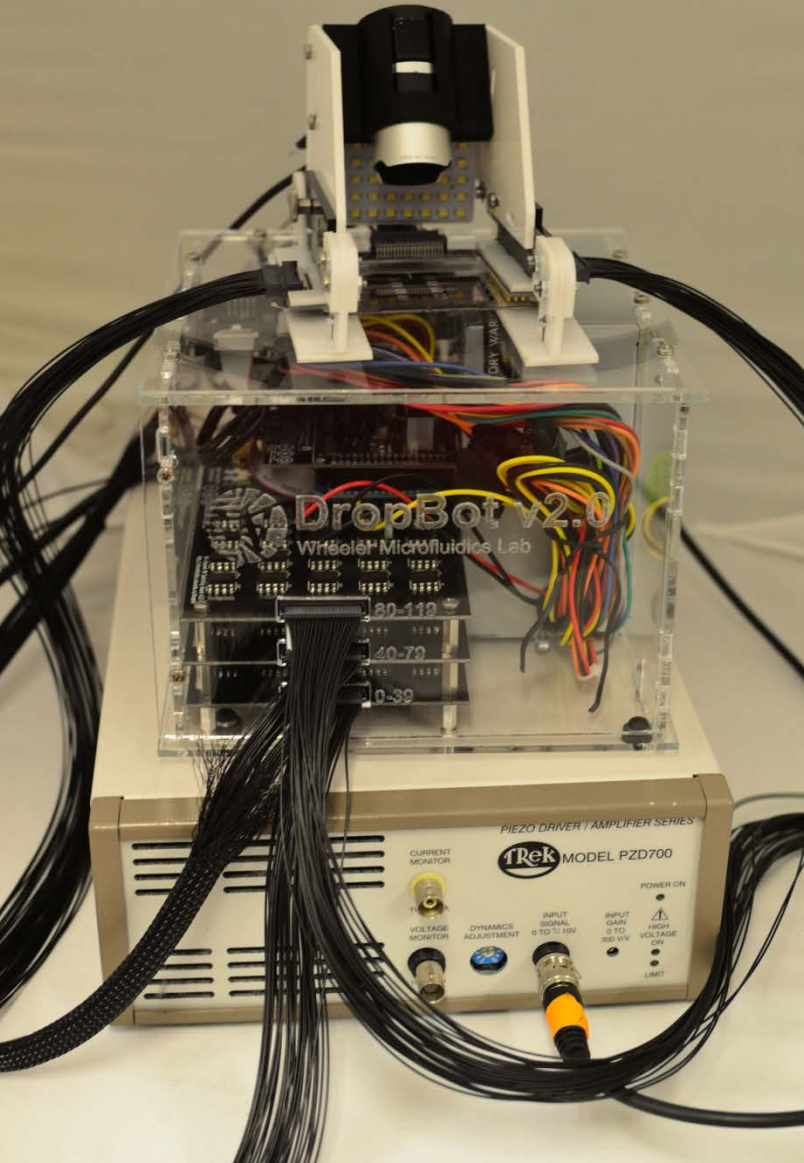


2009



DropBot



Fobel et al., *Appl. Phys. Lett.* 2013, 102, 193513



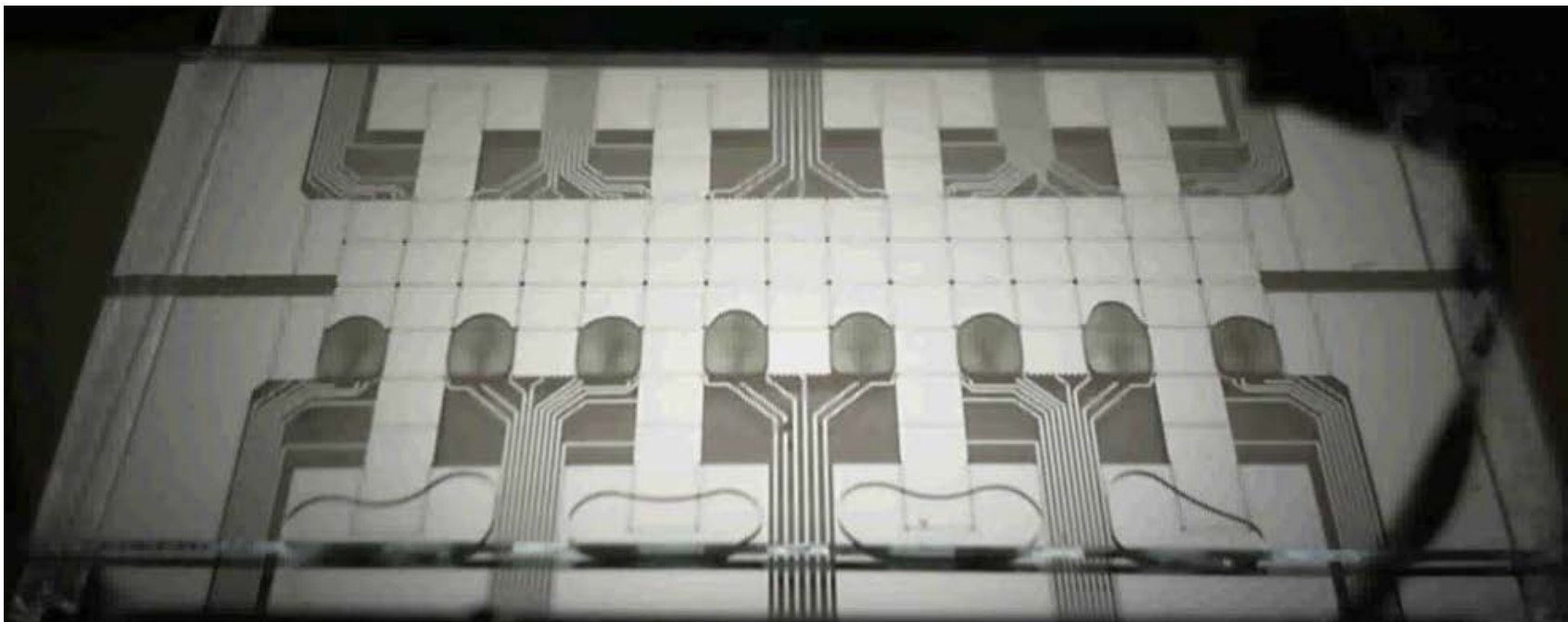
Christian Fobel

Maximum flexibility, easy to extend

- modular/decoupled hardware (40 to >1000 channels)

-  and  pythonTM based
- software plugin architecture
- I²C/power (+/-12V, +5V, +3.3V) breakouts (i.e., to add sensors/actuators)

Example plugin: magnetic separations



Choi & Ng et al. *Anal Chem* (2013). doi:10.1021/ac401847x.

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Open hardware risks/rewards are different for scientists vs entrepreneurs

Advantages (relative to entrepreneurs):

- don't need to be profitable (increased visibility/citations/opportunities for collaboration)
- get paid (research grants) even though you're giving it away
- get help improving the tools you need for your experiments

Disadvantages:

- not always possible (university may own your IP)
- hard to develop in the open (want to keep things secret until paper is published)
- stigma against application-based vs hypothesis-driven research

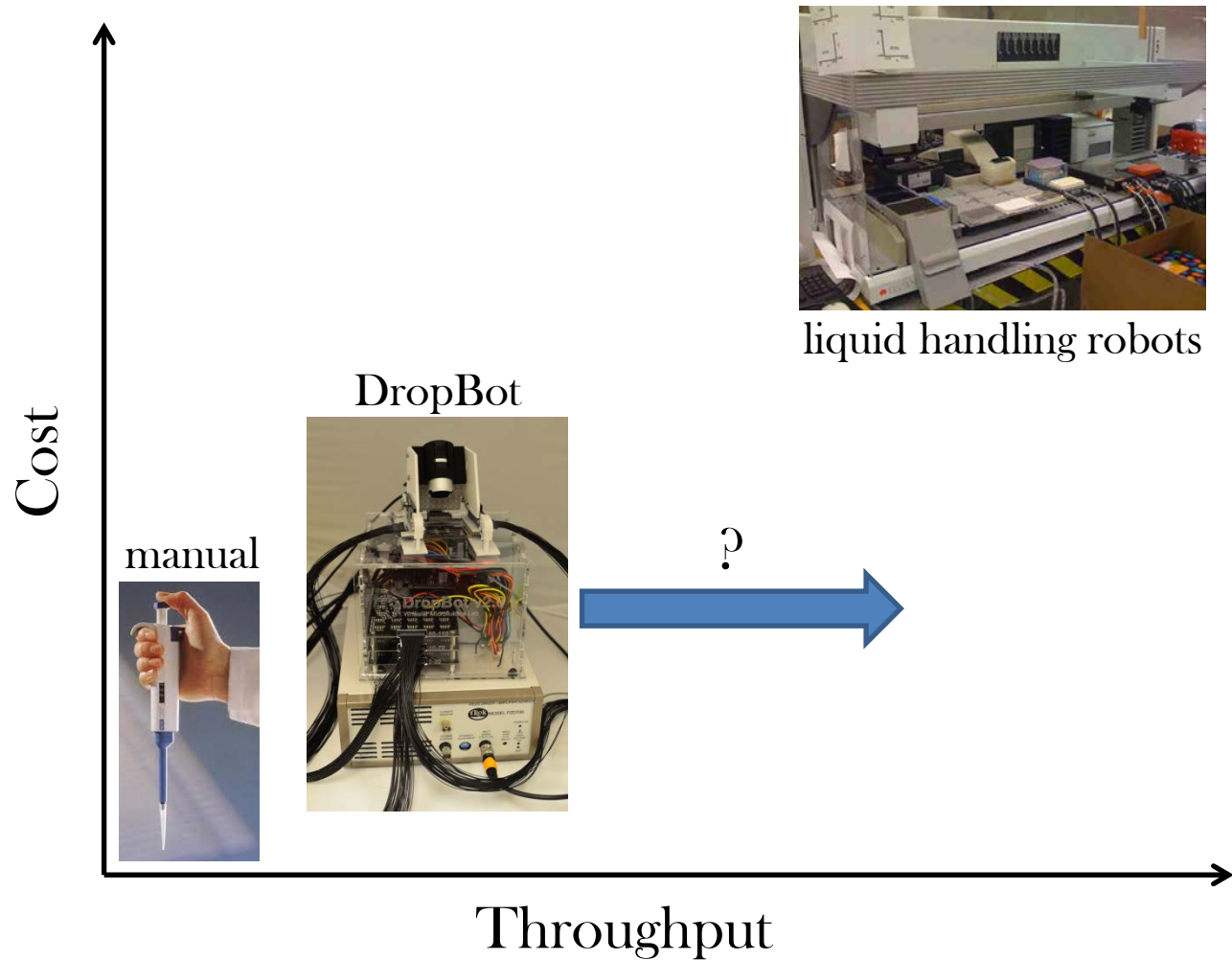
Consumers want appliances:
just work and easy to use

Scientists want open platforms

Consumers want appliances:
just work and easy to use

Scientists want open platforms (that feel like
appliances)

Generalized liquid-handling platform on every bench?



Thank you!

- Aaron Wheeler
- Christian Fobel
- Wheeler Lab

