2015

**Flow-Cytometry Machine for the Developing World**

Paul Howell  
*Virginia Commonwealth University*

Jewel Nkwocha  
*Virginia Commonwealth University*

Jaynie Laverty  
*Virginia Commonwealth University*

Follow this and additional works at: [http://scholarscompass.vcu.edu/capstone](http://scholarscompass.vcu.edu/capstone)

Part of the [Biomedical Engineering and Bioengineering Commons](http://scholarscompass.vcu.edu/capstone)

© The Author(s)

Downloaded from  
[http://scholarscompass.vcu.edu/capstone/33](http://scholarscompass.vcu.edu/capstone/33)
Flow-Cytometry Machine for the Developing World

**Objective**

To create a flow cytometry machine for the developing world with the ability to count and distinguish cell types as well as detect a fluorophore-marked cell surface epitope. The machine should be low-cost and have streamlined functionality.

**Clinical Significance**

Flow-cytometry provides critical diagnostic, measurement, and research applications across many health and biological disciplines. Its use in the detection of blood-cancers, HIV/AIDS, cell differentiation, and viral detection is unique and unparalleled.

Despite flow-cytometry’s vast array of applications, its use is limited by expense. In addition, flow-cytometry’s high costs create a barrier to its implementation in developing nations. Therefore in order for the dissemination of flow-cytometry’s critical applications, especially to that of the developing world, a new, low-cost, model must be developed.

**Methods**

1. Microfabrication of silicon wafer with μchannel
   - Spun with su-8 2010 and exposed for 3 minutes under mask aligner
2. PDMS μchannel plasma etched onto glass slide
   - Plasma etched for 2 minutes at 100mV and .150 torr
3. Tubing attached via bore holes at ends
   - Hand-drilled with 0.0292in drill bit
4. Syringe driven flow of PBS solution containing μbeads
   - 460/500nm beads as pos. control, 305/380nm beads as neg. control
5. Images captured via Galaxy s5 in custom 3D printed case
   - 495nm longpass filter, 25X objective, and 10X eyepiece attached

**Results**

The prototype flow cytometry machine allows for the counting of individual cells as well as detection of a fluorophore marked epitope. 3D printed casing with attachment of microscope objective, longpass filter, and LED circuitry create a portable and modular device. Figure 3 shows imaging of bead flow through μchannels; emulating detection of HIV/AIDS via CD4 positive lymphocytes.

**Future Considerations**

1. Redesign of μchannel baffle to prevent aggregation of μbeads along flow cell perimeter.
2. Implementation of non-manual flow system
3. Creation of automated cell counting/detection programming

**Acknowledgement**

We would like to thank our advisor, Dr. Christopher A. Lemmon, graduate students Jiten Narang, Lauren Griggs, Tyler Ferro, as well as professors Dr. Hooman V. Tafreshi, Dr. Paul A. Wetzel, and Dr. Russell D. Jamison for all their help.