



## ABSTRACT

The WCM CLC Flow Cytometry Core Facility offers state-of-the-art fluorescence activated cell sorting (FACS) instruments and services, and expertise in their applications, to the Weill Cornell Medicine (WCM) community and to outside investigators. Services include support for cell counting, cell sorting, biomarker detection, and protein engineering projects. The facility also provides consultation on project design and data analysis, and offers educational workshops, seminars and training.

## OVERVIEW

**Background:** Flow cytometry is a laser- or impedance-based, biophysical technology employed in cell counting, cell sorting, biomarker detection and protein engineering (to help identify cell surface protein variants). Cell components are fluorescently labeled, suspended in a stream of fluid, and then excited by a laser to emit light at varying wavelengths while passing by an electronic detection apparatus. This allows simultaneous multi-parametric analysis of the physical and chemical characteristics of up to thousands of cells (or other particles) per second. Examples of the cell properties measured include relative granularity, size and fluorescence intensity and internal complexity. A common flow cytometry application is to physically sort cells based on their properties, so as to purify populations of interest.

**History:** The Flow Cytometry Core Facility was established in 2012 by the Department of Pathology and became part of the institutional WCM Core Laboratories Center (CLC) in 2015. The facility expanded into a multi-institutional core in 2016 as part of a collaboration between Weill Cornell Medicine (WCM) and the Hospital for Special Surgery (HSS).

**Location:** The core is located on the 6<sup>th</sup> floor of the "A" building and the sub-basement level of the "E" building, Weill Cornell Medicine, 1300 York Avenue, New York, NY.

**WCM Core Laboratories Center (CLC):** The WCM CLC was established in 2015. In addition to flow cytometry, the CLC includes core facilities that offer resources and services in genomics and epigenomics, proteomics and metabolomics, synthetic and analytical chemistry, NMR, imaging (optical and electron microscopy, high content screening) CBIC (MRI, PET/CT, and ultrasound), biorepository, bioinformatics, and advanced technology assessment.

**Services:** The WCM CLC Flow Cytometry Core Facility provides full service (i.e., assisted use) for a wide variety of fluorescence activated cell sorting (FACS) applications, including sorting and analysis of cell surface markers, analysis of expression of intracellular proteins and separation of cell suspensions into sub-groups or single cells. Flow cytometry applications are optimized in close collaboration with investigators and with the staff of the CLC genomics and epigenomics, proteomics and metabolomics, and imaging core facilities, to achieve best possible materials for subsequent study. The Flow Core Facility also offers training in all aspects of flow cytometry, including hands-on use of sorters and analyzers. Soon to be implemented: investigators will be able to use selected instrumentation in the core facility 24/7 without staff assistance (i.e., unassisted use) after training and certification by core staff.

**Administration:** The Flow Cytometry Core Facility is administered by the Weill Cornell Medicine (WCM) Core Laboratories Center (CLC).

**Open to all:** The resources and services of the core facility are open to all investigators at Weill Cornell Medicine, Cornell University and Cornell-affiliated institutions, and at the Hospital for Special Surgery. The facility also provides services to external investigators at both academic institutions and commercial enterprises.

## RESOURCES

**Cell Sorters:** BD FACSAria II SORP (available now) and BD Influx (available July 2016). BD Fusion expected later this year.

**Analytical Cytometers:** Cytex FACSCalibur DXP 11 and BD FACScan (both available July 2016). BD LSR Fortessa X-20 expected later this year.

**Data Analysis:** Site license for FlowJo analysis software.



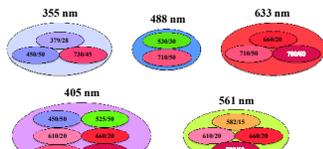
## Cell Sorter

### BD FACSAria II SORP



- Fully enclosed in BSL-2 rated hood (not shown)
- 355, 405, 488, 561, and 640 laser lines
- 18 fluorescence detectors
- Sorts cell sizes 1-35 microns
- Sorts into tubes, plates, and custom collection vessels
- 4-way simultaneous sorting
- Self-serve operation for trained core users

### Lasers and Detectors



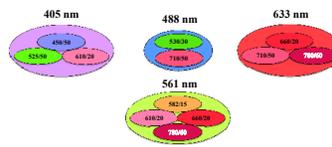
## Analytical Cytometer

### Cytex FACSCalibur DXP 11



- 405, 488, 561, and 640 laser lines
- 11 fluorescence detectors
- Analysis from single tubes, tube carousel, and 96-well plates
- Self-serve operation for trained core users

### Lasers and Detectors



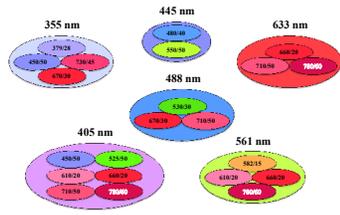
## Cell Sorter

### BD Influx



- Fully enclosed in BSL-2 rated hood
- 355, 405, 445, 488, 561, and 640 laser lines
- 22 fluorescence detectors
- Sorts cell sizes 1-50 microns
- Sorts into tubes, plates, and custom collection vessels
- 6-way simultaneous sorting (tubes only)
- Customizable fluids accommodate sensitive cells

### Lasers and Detectors



## Analytical Cytometer

### FACScan



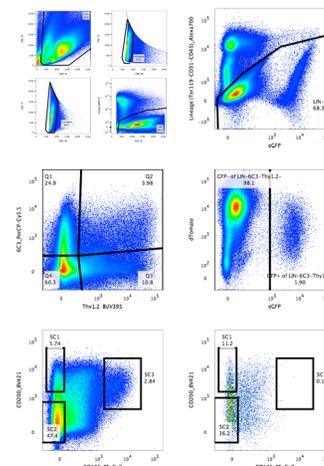
- 488 and 640 laser lines (Cytex upgrade)
- 4 fluorescence detectors
- Analysis from single tubes
- Self-serve operation for trained core users

### Lasers and Detectors



## Data Analysis

### Example of Results:



**Stem Cell Sorting:** The flow cytometry core advised investigators in design of an eight-antibody staining panel, including a dead-cell exclusion stain, to identify and characterize multiple stem cell subsets in primary tissue already expressing high levels of dTomato and/or eGFP. Fluorochromes used were Alexa 700, APC, BV421, BV510, BV680, DAPI, PerCP-Cy5.5, and PE-Cy7. Plots below were made with FlowJo software to illustrate gating strategy used for sorting. FlowJo was also used to generate frequencies for all combinations of antibodies for comparison with Drop-seq analysis data.

Gates SC1, SC2, and SC3 were sorted on the FACSAria II SORP instrument. Sorted cells were used for genomic analysis by the CLC Genomics and Epigenomics Core Facility, image analysis by the CLC Imaging Core Facility, and *in vivo* transplantation / reconstitution experiments were done by the investigator.

## Consultation, Workshops, and Training

Consultation on project design and data analysis.

Educational workshops and hands-on training on data analysis.

Seminars on emerging flow cytometry technologies and applications.

Coordinated project design consultation and data analysis support available with the CLC genomics and epigenomics, proteomics and metabolomics, synthetic and analytical chemistry, NMR, imaging (e.g., optical and multiphoton microscopy, high content screening, MRI, PET/CT, and high resolution ultrasound) biorepository, bioinformatics, and advanced technology assessment core facilities.

## Contact Information

### Flow Cytometry Core Facility

Jason McCormick, Core Manager  
jam2073@med.cornell.edu

For questions about the WCM Core Laboratories Center please contact George Grills at gg2016@med.cornell.edu