

Product Brochure

# Scepter™ 2.0 Cell Counter

Precise, handheld cell counting



## What people are saying...

"At last, an alternative to lining up for the Coulter Counter®, and far easier than sweating over fragile hemocytometers."

AMY A. CAUDY is a Lewis-Sigler Fellow at Princeton University's Lewis-Sigler Institute for Integrative Genomics

*The Scientist*, Dec. 2010.  
Top Ten Innovations of 2010.

"Cell counting is normally a very tedious process and usually only provides minimal information on the cell population. This instrument, which is only slightly larger than an automatic pipette, allows you to count cells in your tissue-culture hood, simplifies the procedure, and provides much useful data, such as the fraction of intact cells."

H. STEVEN WILEY is a lead biologist at the Environmental Molecular Sciences Laboratory at the Pacific Northwest National Laboratory

*The Scientist*, Dec. 2010.  
Top Ten Innovations of 2010.

## Scepter™ 2.0 – Precise, handheld cell counting

Scepter™ 2.0 is your portable cell counter. While other automated counters consume bench space and rely on object recognition software, manual focusing, and clumsy loading chambers, the Scepter™ cell counter provides true automation without the error that accompanies vision-based systems. With its microfabricated, precision-engineered sensor, the Scepter™ cell counter does all the work and delivers accurate and reliable cell counts in less than 30 seconds.

### Scepter™ 2.0 marks the next generation in Scepter™ technology, highlighted by:

#### Compatibility with More Cell Types

The Scepter™ cell counter is the only one on the market to accurately count particles as small as 3 µm in diameter

#### Increased Cell Concentration Range

The new 40 µm sensor can count samples with concentrations as high as 1,500,000 cells/mL

#### Powerful Software for Complex, Effortless Cell Analysis

- Compare sample sets side by side using histogram overlay and multiparametric data table
- Create and save gating templates
- Generate reports, graphs and tables

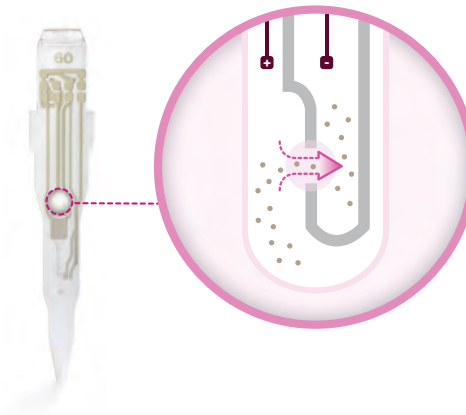
## ■ The power of precision

Trust Scepter™ counting with your most valuable samples to get reproducible and reliable counts. The reliability of Scepter™ counting is particularly apparent with smaller cell types. Because the Scepter™ cell counter measures volume using the Coulter Principle, it can quantify cells based on size and will discriminate larger cells from smaller debris, unlike vision based techniques, which rely on object recognition software and cannot reliably detect small cells.

## Scepter™ sensor technology

Compatible with 60 µm and 40 µm sensors, the Scepter™ 2.0 cell counter can meet even more of your cell- and particle-counting needs. Use the 60 µm sensor for particles between 6 and 36 µm. Use the 40 µm sensor for particles between 3 and 17 µm.

- Precise volumes are drawn into the Scepter™ sensor.
- As cells flow through the aperture in the sensor, resistance increases. This increase in resistance causes a subsequent increase in voltage.
- Voltage changes are recorded as spikes with each passing cell.
- Spikes of the same size are bucketed into a histogram and counted. This histogram gives you quantitative data on cell morphology that can be used to examine the quality and health of your cell culture.



**Figure 1.** Particles are detected by Ohm's Law  $V=IR$  ( $V$ =voltage,  $I$ =current, and  $R$ =resistance)

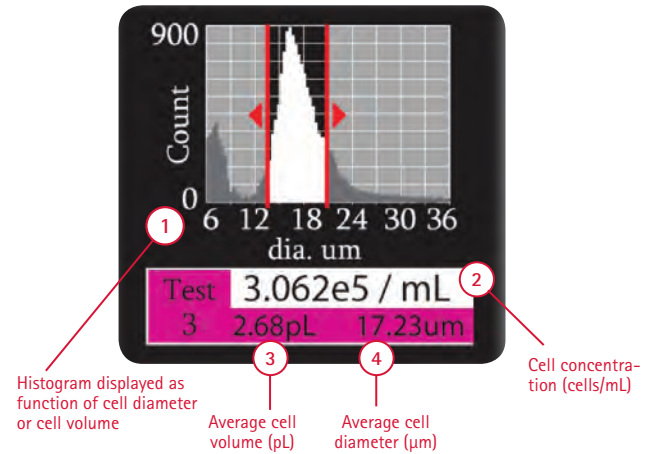
Cell Type	Measured size (µm)	40 µm sensor	60 µm sensor
2102 Ep	15-19		
454 beads			
A172	15		
A253	14-18		
A375	16		
A431	15-17		
A549			
Algae (various)	7-9		
B35	13-16		
B Cells	6-11		
C2C12	12		
C305	12-14		
C6	12-13		
CA46	10-12		
Caco-2	17		
CHO	14-17		
COS-1	12		
Cos-7	15		
D283	12		
Daudi	10-12		
DU-145	15-17		
Epithelia	14-15		
HCT-116	10		
HEK293	11-15		
HeLa	12-14		
HepG2	12		
HFF	18-20		
Hs27	14		
HT-1080	14-16		
HT-29	11		
HUH7- Hepatoma line			
Human ES Cells	9-12		
HUVEC	14-15		
IMR-32	12-14		
IMR-90	15		
Jurkat	13		
K562	22		
KB	14		
KG-1	10-13		
L6	14-16		
LNCaP	15-16		
Luminex® beads	5-6		
MCF7	15-17		
MDCK	13-15		
Meg-01	16-17		
MG-63	15-17		
Mouse ES Cell	5-13		
Mesenchymal Stem Cell	15-16		
MRC-5			
NCI-H146	10-13		
NIH 3T3	15		
NTERA2, clone D1	13		
OK	17-18		
PBMCs	7-12		
PC12	9-13		
Primary Astrocytes	7		
Primary Neuronal Cell			
Raji	12-15		
Ramos	11-12		
Rat Dorsal Root Ganglion Cells	7		
Rat Whole Blood	4.6		
Red Blood Cells	5-7		
Rat Neural Stem Cell	11-13		
RAW 264.7	12-15		
RBL	11-13		
RIN-mF5	13-14		
SF9	13		
SH-SY5Y	12		
Sk-Br-3	15-20		
SK-MEL-28	17-19		
SK-N-MC	14-15		
SK-N-SH	14-15		
Splenocytes	7-9		
SW-480	15		
SW-620	13-14		
T84	14-18		
T98G	17		
TF-1	13-14		
U251	16-20		
U20S	16-19		
U266	12		
U87-Human Glioblastoma cell line	12-14		
U937	11-13		
WI-38	12-15		
Y79	13-14		
Yeast- <i>Pichia Pastoris</i>	5		
Yeast- <i>S.cerevisiae</i>	6		

■ Recommended based on size   ■ EMD Millipore Validated   ■ Customer Validated

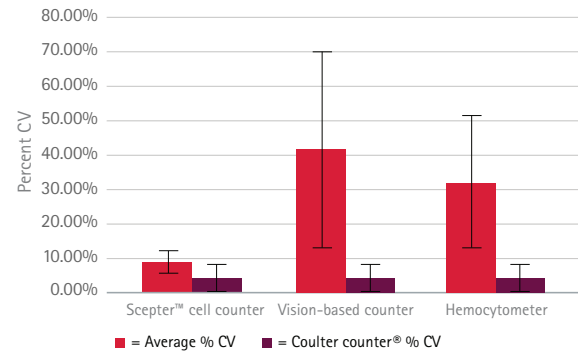
**Table 1.** Cell types validated with the Scepter™ cell counter and the recommended Scepter™ sensor.

## ■ Scepter™ counting delivers precision

There is no need to subjectively determine cell counts, as required by vision-based counting methods. The Scepter™ cell counter detects every cell and displays the population as a histogram of cell size distributions. From the histogram, count all the cells or use the gating function to count a chosen subpopulation. By monitoring changes in your histogram, you can gain insight into the health and quality of your cell culture from one experiment to the next.



**Figure 2.** The average percent coefficient of variation (CV) for each counting method shown was calculated using cell concentration measurements at 50,000 cells/mL samples of 19 different cell lines. The Scepter™ cell counter is more precise than vision-based counting and hemocytometry, and approaches the precision of the Coulter Counter® standard (maroon bars). Error bars represent standard deviation.



	Format	Counting methods	Sample volume needed	Sample volume counted	Cells counted in a 100,000 cell/mL sample	Average % CV
Hemocytometer	Slide and microscope	Manual, vision-based	10 µL	.1 µL / square	10/square	41.8
Brand L	Benchtop	Automated vision-based system	10 µL	.4 µL	40	32.1
Scepter™ Cell Counter	Handheld	Impedance-based cell detection	100 µL	50 µL	5000	9.1

## ■ As easy as pipetting

### Prepare the sample:

Start with a single-cell suspension, diluted to a total volume of 100 µL (recommended) in phosphate buffered saline (such as EmbryoMax® 1x DPBS) to 10,000-500,000 cells/mL (operating range for 60 µm sensor) in a 1.5 mL microcentrifuge tube.

### Perform cell count:

- Turn on the Scepter™ cytometer by pressing the toggle on the back of the instrument and wait for on-screen instructions to appear.

- When prompted, attach a sensor to the end of the Scepter™ unit with the electrode sensing panel facing toward the front of the instrument, and you'll see detailed instructions for each step of the counting process.
- Pipette once to draw sample into the sensor. 50 µL of your cell suspension is drawn into the microfabricated, precision-engineered channel embedded in the sensor. The cell sensing zone detects each cell drawn into the sensor and thus cell concentration is calculated.
- The sensing zone also measures cell sizes and cell volumes with sub-micron and sub-picoliter resolution, enabling the Scepter™ cytometer to display a histogram distribution of cell size or cell volume.

# Intuitive analysis software

From simple counts to complex volume measurements used to assess cell health parameters, Scepter™ Software Pro provides an intuitive, intelligent platform to perform high-level cell analysis based on the size measurements captured with the Scepter™ cell counter.

## A VIEW OF SCEPTER™ SOFTWARE PRO

**DATA:** data files from your Scepter™ cell counter

**CURRENT PLOT:** working plot and data file

**GROUP STATS:** customizable statistics from your selected data files

**MULTIFUNCTIONAL PLOT:** multiple data sets/histogram overlays

**REPORTS:** export, print selected graphs/files, cut and paste

**ANALYSIS TEMPLATES:** saved gating parameters

File Name	Dilution Factor	Original Volume (mL)	Original Conc. (Count/mL)
Copy_Sn_A700m3_Test 03d	10.00	1.00	3.87e+09
Copy_Sn_A700m3_Test 04c	10.00	10.00	3.87e+09
Copy_Sn_A700m3_Test 05c	10.00	10.00	3.87e+09
Copy_Sn_A700m3_Test 05b - Nov 1	1.00	1.00	3.87e+09
SN_A700m3_Test 02c - Nov 1	1.00	1.00	3.44e+09
SN_A700m3_Test 02a - Nov 1	1.00	1.00	2.73e+09
SN_A700m3_Test 02b - Nov 1	1.00	1.00	2.68e+09
SN_A700m3_Test 02d - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02e - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02f - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02g - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02h - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02i - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02j - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02k - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02l - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02m - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02n - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02o - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02p - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02q - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02r - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02s - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02t - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02u - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02v - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02w - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02x - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02y - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 02z - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03a - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03b - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03c - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03d - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03e - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03f - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03g - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03h - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03i - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03j - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03k - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03l - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03m - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03n - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03o - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03p - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03q - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03r - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03s - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03t - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03u - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03v - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03w - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03x - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03y - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 03z - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04a - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04b - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04c - Nov 1	1.00	1.00	3.78e+09
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SN_A700m3_Test 04g - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04h - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04i - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04j - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04k - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04l - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04m - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04n - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04o - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04p - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04q - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04r - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04s - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04t - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04u - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04v - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04w - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04x - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04y - Nov 1	1.00	1.00	3.78e+09
SN_A700m3_Test 04z - Nov 1	1.00	1.00	3.78e+09

## Using the Scepter™ Software Pro on your computer, you can:

- Compare several samples and data sets side by side using histogram overlay and multiparametric tables
- Create and save gates to be used from one experiment to the next
- Create attractive graphical presentations and reports with your data



- Hold down the plunger to begin

60µm tip attached  
Ready...
- Submerge the sensor

Release plunger  
60µm sensor attached
- Keep sensor submerged

100%

Click to cancel  
loading sample ...

WAIT...
- Sample Loaded

Remove sensor from sample  
sample loaded.
- Counting

900  
Count

0 6 12 18 24 30 36  
dia. µm

Please wait ....  
calculating ....

WAIT...
- Counting

900  
Count

0 6 12 18 24 30 36  
dia. µm

Please wait ....  
saving .....

WAIT...
- Count Complete.

Please remove sensor and discard.

REMOVE SENSOR

Please wait ....  
Jun 11 20:45:13

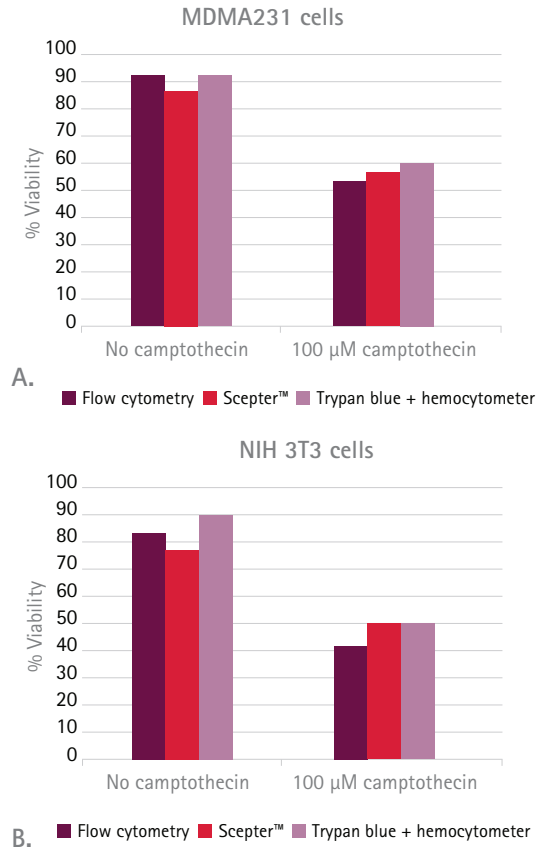
## APPLICATIONS

EMD Millipore continues to expand the capabilities of Scepter™ technology. And the latest generation, Scepter™ 2.0, features enhanced analytical powers, enabling you to count even more cell types and sizes.

### Scepter™ 2.0 for cell health

Instantly gauge the health of your cell cultures without even leaving the culture hood. Because the Scepter™ cell counter displays high-resolution histograms of entire cell populations, you can differentiate live cells from dead cells and debris by simply gating on the histogram peak corresponding to larger-diameter cells. No staining is required! The resulting calculation for % viable cells agrees with viability calculations obtained using flow cytometry (ViaCount® reagent) and Trypan blue staining/hemocytometry (shown here with MDMA231 and NIH 3T3 cells).

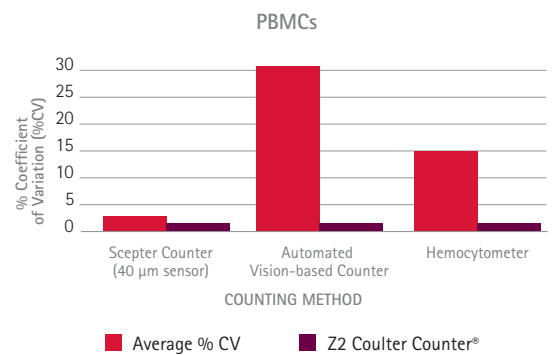
**Figure 3.** Rapid cell analysis using the Scepter™ 2.0 device provides reliable assessments of cell viability compared to flow cytometry (ViaCount® assay) and hemocytometry (using Trypan blue staining). MDMA231 cells (A) and NIH 3T3 cells (B) were treated with camptothecin 24 hours prior to analysis.



### Scepter™ 2.0 for counting heterogeneous cell populations

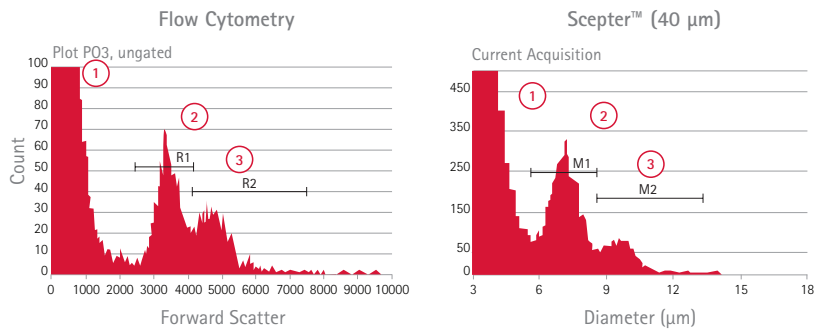
Count blood cells and other cells with small diameters with the highest precision. Biological samples such as primary isolates or cultured cells are often heterogeneous mixtures of cells that differ by type and/or function. Such differences in cellular attributes are most commonly determined by multicolor fluorescent antibody detection of cell type specific surface marker(s) using flow cytometry. Notably, in addition to variations in protein expression, many cell types and physiological states are also uniquely distinguishable on the basis of size alone. The ability to identify population subsets on the basis of phenotypic differences and further determine their relative frequencies (and concentrations) is critical to many aspects of research.

**Distinguishing lymphocytes from monocytes in freshly isolated PBMCs.** The assessment of immune profiles of the various immune cell subsets can help identify molecular signatures that may facilitate research. The Scepter™ cell counter, when used in combination with Scepter™ Software Pro, provides a tool for rapid determination of lymphocyte and monocyte concentrations as well as the relative frequency of these cell types in PBMC isolates.



**Figure 4.** The Scepter™ 2.0 cell counter counts PBMCs with greater precision than other counting methods, as reflected by low coefficients of variation. % CVs were calculated using average cell counts of four replicate samples.





**Figure 5.** Representative comparison of histogram plots for human PBMC samples acquired on the Scepter™ cell counter (diameter histogram on right) and guava easyCyte™ flow cytometry (forward scatter histogram on left) platforms. Analysis plots derived from both platforms demonstrate three distinct peaks corresponding to 1) dead cell/debris, 2) lymphocyte and 3) monocyte fractions. The difference in counts displayed (Y-axis) is due to differences in sample dilution between the guava easyCyte™ flow cytometer and the Scepter™ cell counter.

Test	Cell Fraction	Scepter™ <sup>1</sup>	Forward Scatter <sup>2</sup>	Staining <sup>3</sup>
1	Lymphocyte	58	65	63
	Monocyte	42	35	37
2	Lymphocyte	68	72	71
	Monocyte	32	28	29
3	Lymphocyte	66	69	71
	Monocyte	34	31	29

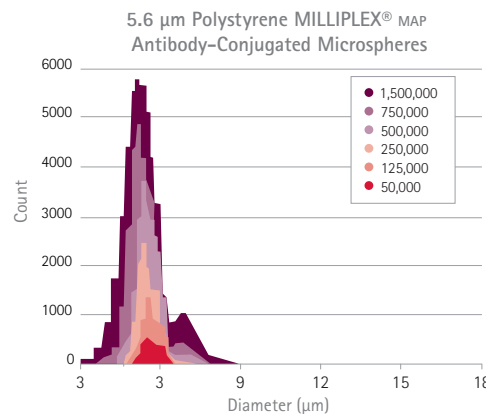
**Table 2.** Lymphocyte and monocyte subset frequencies from three individual PBMC samples. Aliquots from each sample were analyzed using the guava easyCyte™ flow cytometry and Scepter™ platforms. <sup>1</sup>Values were derived from the diameter histogram plot. <sup>2</sup>Values were derived from the forward scatter histogram plot based on total events measured on guava easyCyte™ flow cytometry platform. <sup>3</sup>Staining frequencies derived as follows: % Lymphocytes = (% CD3+ T cells) + (%CD16/56+ NK cells) + (%CD19+ B cells); % Monocytes = % CD14+ cells

## Precise and accurate bead counting with Scepter™ 2.0

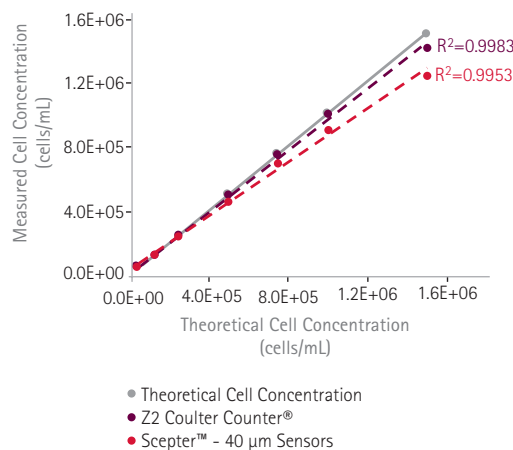
Micron-sized beads are used in a variety of biological applications, ranging from daily validation of flow cytometer performance to purification of fusion protein constructs from cell lysates. Accurate determination of bead counts at the onset of each assay allows for standardization of bead concentrations across multiple samples and minimizes errors and variation in downstream results. The Scepter™ cell counter is well suited for precise counting for beads of numerous types and can improve reproducibility of bead-based assays, such as immunoprecipitation and multiplexed detection.

## Scepter™ counting can facilitate yeast cell counting for brewing and wine industries

Introduction of a consistent yeast cell concentration is required for successful beer and wine fermentation as well as to maintain batch-to-batch reproducibility and ensures consistent fermentation over many cycles. Scepter™ counting can be used to monitor yeast size and concentration by yielding interpretable histograms that could be gated to provide this depth of information.



**Figure 6.** Scepter™ Software Pro displays imported size distribution histograms as either a single sample histogram or as overlaid histograms for multiple samples. Shown is an overlaid histogram for serially diluted 5.6 μm MILLIPLEX® MAP microspheres.



**Figure 7.** The Scepter™ cell counter counts yeast cells with good accuracy and linearity. Measured yeast cell concentrations were compared to theoretical concentrations. The solid gray line represents the theoretical values. Dotted lines represent best linear fit to data. Both the Scepter™ and Coulter Counter® platforms show a loss of linearity and accuracy upon an increase in cell concentration.

## Ordering Information

Description	Qty	Catalogue No.
<b>Scepter™ 2.0 Handheld Automated Cell Counter</b>		
with 40 µm Scepter™ Sensors (50 Pack)	1	PHCC20040
with 60 µm Scepter™ Sensors (50 Pack)	1	PHCC20060
<b>Includes:</b>		
Scepter™ Cell Counter	1	
Downloadable Scepter™ Software	1	
O-Rings	2	
Scepter™ Test Beads	1	PHCCBEADS
Scepter™ USB Cable	1	PHCCCABLE
Scepter™ Sensors, 60 µm	50	PHCC60050
	500	PHCC60500
Scepter™ Sensors, 40 µm	50	PHCC40050
	500	PHCC40500
Universal Power Adapter	1	PHCCPOWER
Scepter™ O-Ring Kit, includes 2 O-rings and 1 filter cover	1	PHCCOCLIP

Are you an existing Scepter™ user interested in upgrading your device to Scepter™ 2.0? It's easy. Visit [www.millipore.com/scepterupgrade](http://www.millipore.com/scepterupgrade) to upgrade your Scepter™ today!



For technical assistance, contact Millipore:  
1-800-MILLIPORE (1-800-645-5476)  
E-mail: [tech\\_service@millipore.com](mailto:tech_service@millipore.com)  
[www.emdmillipore.com](http://www.emdmillipore.com)



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**In Canada:**  
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To fax an order, use 1-800-463-2996.  
To order online: [www.fishersci.ca](http://www.fishersci.ca)