

Product survey: Cell sorting

Lab Cinderellas

Sorting cells from body fluids, tissue cultures or other multicellular sources is routine in many cell biology laboratories. Most researchers rely on magnetic or electrical fields to guide the cells into the proper containers.

Though centrifugation-based cell separation, such as differential and density gradient centrifugation, are still in use and in many cases a prerequisite for further separation steps, Fluorescent activated cell sorting (FACS) and Magnetic activated cell sorting (MACS) are currently the two most popular cell sorting techniques.

Fluorescence-activated cell analysis is usually done with flow cytometers. As with many techniques in biochemistry and molecular biology, the basic principles of FACS analysis are rather simple, the obstacles to implement the technique into a functional device, however, are complicated. Hence, flow cytometers are sophisticated and pretty expensive instruments that are usually operated by experts. Producing a constant stream of single, cell enclosing droplets with a stable size and distance between each other, is at the heart of any flow cytometer. This sounds easy to accomplish at first sight, since every kid can generate droplets by ejecting a stream of water into the air with a water pistol. The droplets coming out of a water pistol's tip, however, are very erratic in size and distance. To stabilise the droplets coming out of the flow cytometer's nozzle, engineers have invented an ingenious trick: a stationary wave of vibration is applied to the fluid stream passing the nozzle to produce droplets that eject one-by-one out of the nozzle, at fixed distances.

The cells are scanned on their way through the nozzle by a laser beam to obtain some information about their number and their size. This is simply done by measuring the light scattering, induced by cells passing the laser beam. Cell size and number are, however, not the main interests of most cell biologists when using a FACS machine; they rather aim at separating subpopulations of cells. To this end, additional laser beams are used to excite fluorescence-dye-



Positive magnetic selection at the scrap yard.

coupled antibodies targeted against particular cells. Once an antibody-labelled cell passes the laser beam, it emits a fluorescence signal that is detected by a photomultiplier and sent to the cell sorter unit, which collects the charged cell droplet shortly after its passage through a deflecting electrical field.

Prices for flow cytometers may easily exceed €100,000 making them unaffordable for many research groups. But that's no reason to worry, since low priced magnetic activated cell sorting kits are an equal alternative to flow cytometers.

Though slight variations amongst MACS kits exist, the underlying principle is always the same. Super-paramagnetic beads, which only exhibit magnetic properties when placed in a magnetic field, are coated with antibodies or other ligands that specifically bind to the desired cells. Beads and cells are mixed in appropriate tubes and the resulting cells-bead complexes are separated from unmarked cells by placing the tube in a magnetic field. Magnetic cell sorting can be accomplished to negatively or positively select cells, which actually follows the same principle used at the scrap yard to separate iron from non-magnetic materials. In the first case, unwanted cells are tagged and removed with the magnet, in the latter case the cells of interest are marked and pulled out of the 'trash'. Since negative selection leaves the designated cells free from perturbing antibodies or magnetic particles, negative selection beads are usually much larger than the tiny beads applied for positive selection, having diameters of just 50 nanometres.

In the meantime, some companies also offer kits which may be used for both negative and positive selection and the choices of magnetic beads with different coatings is all but endless.

HARALD ZÄHRINGER

Cell Sorting				
Company	Name of Product	Short description	Miscellaneous, Specialities, Generally	Price [EUR]
Active Motif Rixensart, Belgium www.activemotif.com Contact: Phone: +32 2653 0001 eurotech@activemotif.com	LavaCell	LavaCell is a small fluorescent compound that rapidly diffuses in living cells where it stains the plasma and internal membranes.	<ul style="list-style-type: none"> ■ Cellular counter-stain ■ No washing steps needed ■ No effect on cell growth or viability ■ Fluorescence upon binding to primary amino-groups ■ Multiplex with blue, green or yellow emitting probes 	235,- (200 µg)
	Chromoex fluorescent dyes	A series of effective fluorescent label for bioanalysis.	<ul style="list-style-type: none"> ■ Superior fluorescent properties ■ High fluorescence intensity ■ Low background ■ High stability 	205,- (1 mg reactive Dye, NHS ester)
	Chromoex fluorescent secondary antibody conjugates	Offer an improved method of detection of your primary antibody.	<ul style="list-style-type: none"> ■ Optimized for target binding ■ High fluorescence intensity ■ Low background ■ High stability 	150,- (1 mg)
Ambion (Europe) Applied Biosystems Huntingdon, United Kingdom www.ambion.com Contact: Claudia Matz Phone: +44 1480303020 eurotech@ambion.com	LCM Staining kit	Allows identification of target cells without compromising RNA quality or LCM efficiency. Includes a stain that clearly shows cell distribution.	<ul style="list-style-type: none"> ■ Ideal for cases where tissue morphology has been disrupted ■ Maintenance of RNA integrity ■ Use for gene expression analysis 	252,-
Amsbio Abingdon, United Kingdom www.amsbio.com Contact: Phillip Pridham Phone: +44 1235 828200 phillipp@amsbio.com	FACSmax Cell Dissociation Solution 100 ml	Gentle and highly effective cell dissociation solution, disaggregation with maximum cell viability.	<ul style="list-style-type: none"> ■ Dissociates clumped cells in minutes 	100,-
	FACSmax Cell Dissociation Solution 10 x 100 ml	Gentle and highly effective cell dissociation solution, disaggregation with maximum cell viability.	<ul style="list-style-type: none"> ■ Dissociates clumped cells in minutes 	710,-
Beckman Coulter Krefeld, Germany www.beckmancoulter.com Contact: Michael Braun Phone: +49 2151/333-788 or +49 171/304 9823 mbraun@beckmancoulter.com	MoFlo XDP Cell Sorter	High viability, yield, and purity with sort rates of up to 70,000 events per second are standard.	<ul style="list-style-type: none"> ■ >100,000 events per second acquisition ■ >1 billion event listmode files ■ Unmatched linearity ■ Touch screen operation ■ 32 bit, 100 MHz resolution 	On request (dep. on configuration)
	MoFlo Astrios Cell Sorter	With 7 spatially separated lasers and 49 PMTs it is designed for researchers who desire high productivity combined with state-of-the-art biosafety solutions.	<ul style="list-style-type: none"> ■ In addition to MoFlo XDP: 7 Pinholes, 7 Lasers, 49 PMTs 	On request (dep. on configuration)
BioCat Heidelberg, Germany www.biocat.com Contact: Elke Gamer Phone: +49 6221-7141516 gamer@biocat.com	FACSmax Cell Dissociation Solution	Gentle and highly effective cell dissociation solution. Highly effective in creating single cell suspensions from clumped cell cultures for accurate cell counting, flow cytometry, viral transfection assays, cell sorting, and bioreactor scale-up.	<ul style="list-style-type: none"> ■ Dissociates clumped cells in minutes ■ Results in homogeneous single cell suspension ■ Gentle cell disaggregation for maximum cell viability ■ Yields accurate, reproducible cell counts ■ Saves time. No need for extra PBS washing steps 	115,- (100 ml)
	Blue, Cyan, Green, Yellow, Red, and Far-Red Fluorescent Protein Expression Vectors	Broad spectrum of fluorescent proteins to be used as in vivo marker for cell sorting.	<ul style="list-style-type: none"> ■ Superbright fluorescence ■ High pH- and photostability ■ Fast maturation 	400,- (20 µg vector DNA)
	Adembeads	Superparamagnetic nanoparticles conjugated to monoclonal mouse antibodies like anti-human CD4, CD8 or CD14 for isolation of CD4+, CD8+ or CD14+ cells. Adembeads are also available with functional group for conjugation to the antibody specific for your protein of interest.	<ul style="list-style-type: none"> ■ High magnetic content, uniform particle size, excellent mono-dispersion properties, and high surface area ■ Beads do not sediment on standing and can be applied in suspension – no columns ■ Weak magnetic field sufficient – no stress for cells ■ Compatible with subsequent analysis tools like flow cytometry etc. 	Depending on conjugate and pack size

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Carl Roth Karlsruhe, Germany www.carlroth.com Contact: Stefanie Seipp Phone: +49-721-5606-1038 s.seipp@carlroth.de	Roti-MagBeads COOH	Magnetic beads with activated functional groups for binding of your own, cell specific ligand.	<ul style="list-style-type: none"> ■ Highly efficient binding of ligands ■ Separators available ■ Cell sorting without flow cytometers ■ High sedimentation rates <li style="text-align: right;">■ Low costs 	See country specific website
	DAPI	Fluorescent dye (blue) for violet lasers.	<ul style="list-style-type: none"> ■ Specific DNA binding ■ Stable at -20 °C ■ Excitation maximum 359 nm ■ Emission maximum: 461 nm <li style="text-align: right;">■ Low costs 	See country specific website
	Propidium iodide	Fluorescent dye (orange) for blue argon lasers.	<ul style="list-style-type: none"> ■ Specific DNA binding ■ Stable at 4 °C ■ Excitation maximum 535 nm ■ Emission maximum: 617 nm <li style="text-align: right;">■ Low costs 	See country specific website
Carl Zeiss MicroImaging Munich, Germany www.zeiss.de/microdissection Contact: Phone: +49-89/909000800 palm-info@zeiss.de	PALM MicroTweezers	Contact-free manipulation, sorting and isolation of living non-adherent cells such as bacteria or stem cells.	<ul style="list-style-type: none"> ■ Contamination-free isolation ■ Various imaging techniques possible ■ Incubation possible ■ Force measurement capability ■ Upgradeable with PALM MicroBeam 	n.a.
	PALM MicroBeam	Contact-free isolation and recultivation of living cells and stem cells. Isolation of selected cells within tissue sections.	<ul style="list-style-type: none"> ■ Contamination-free isolation ■ Image processing software for automated cell recognition ■ Full incubation possible ■ Sorting under normal cell growth conditions ■ Various imaging techniques possible 	n.a.
Invitrogen Paisley, United Kingdom www.invitrogen.com Contact: Kurt.Gielen@Invitrogen.com	Dynal Negative Isolation Kits	Deplete the unwanted cells with supplied antibody mix, Dynabeads and a magnet for sample preparation.	<ul style="list-style-type: none"> ■ Tube-based, gentle and stress-free method 	See homepage
	Dynabeads FlowComp kits	Positive isolation / enrichment of cells, removal of beads for analysis possible.	<ul style="list-style-type: none"> ■ Minimal stress – least possible interaction with your cells during isolation ■ No columns – Your cells are not being passed through a dense column ■ No immunogens such as iron oxides remain in your sample to influence your results 	See homepage
	Dynabeads FlowComp Flexi	Cell isolation using your own antibody to isolate any cell type from any species.	<ul style="list-style-type: none"> ■ Combine with your own antibody of choice ■ Beads are removed after isolation 	n.a.
	Antibodies for Flow Cytometry	Antibodies binding to surface proteins, can be used in cell sorting.	<ul style="list-style-type: none"> ■ Primary and secondary antibodies, Streptavidin, Biotin, Avidin conjugates 	n.a.
	Vybrant DyeCycle stains	DNA content analysis in living cells, cell sorting based on DNA content.	<ul style="list-style-type: none"> ■ Cell membrane-permeant, DNA-selective stains ■ Fluorescence signal is proportional to DNA mass ■ Fluorescence data can be used to generate a frequency histogram ■ Allows the simultaneous co-staining of the cell population 	n.a.
	PeakFlow reference beads	Dyes that have been carefully selected to produce emission peaks coincident with labeled cells, to calibrate a flow cytometer's laser source, optics, stream flow and cell sorting system.	<ul style="list-style-type: none"> ■ Narrow emission profiles beads are highly uniform with respect to both size and fluorescence intensity ■ Approximate the size, emission wavelength and intensity of many biological samples 	n.a.
Merck Chemicals Calbiochem Novaochem Novagen Nottingham, United Kingdom www.merckbio.eu Contact: Customer.service@merckbio.eu Phone: +44 115 9430 840	Immunomagnetic beads	When coated with primary or secondary antibodies, these beads (approximately 1.3 µm in diameter with a magnetic core and thin polystyrene shell) can be used in cell separation, cell sorting, immunoprecipitation and protein purification.	<ul style="list-style-type: none"> ■ Aqueous dispersion ■ Direct absorption of protein ■ Covalent attachment of ligands via -COOH surface groups 	165,- (2 ml)
	FICOLL 400 Reagent, Molecular Biology Grade	Useful for the separation of lymphocyte subpopulations.	<ul style="list-style-type: none"> ■ No contaminating DNAses, RNAses and proteases 	126,- (25 g) 723,- (250 g)
	Primary and secondary antibodies	Large assortment of primary and secondary antibodies suitable for flow cytometry.	<ul style="list-style-type: none"> ■ Broad range of target proteins 	On request

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Millipore Bioscience Division Schwalbach/Ts, Germany www.millipore.com Contact: technischerservice@millipore.com Phone +49-6196-494-299 (DE) +41-433994049 (CH) +43-820874464 (AT)	Guava PCA Flow Cytometry System	n.a.	<ul style="list-style-type: none"> ■ Efficient separations ■ Flexible separation strategies ■ From small-scale to large-scale cell separation 	On request	
	Guava PCA-96 Flow Cytometry System	n.a.	<ul style="list-style-type: none"> ■ Automated sample tray for 96-well microplate or 10 sample tubes ■ Green (532nm) excitation laser ■ Two-color / yellow and red) fluorescence detection ■ Single sample analysis with manual loading ■ Absolute cell counts - no need of reference beads ■ Microcapillary fluidics - no sheath fluid required 	On request	
	Guava EasyCyte Mini Flow Cytometry System	n.a.	<ul style="list-style-type: none"> ■ Three fluorescent parameters allow simultaneous multicolor detection ■ Forward scatter and optional side scatter ■ Absolute cell counts - no need of reference beads ■ Microcapillary fluidics - no sheath fluid required 	On request	
	Guava EasyCyte Plus Flow Cytometry System	n.a.	<ul style="list-style-type: none"> ■ Three fluorescent parameters allow simultaneous multicolor detection ■ Forward scatter and optional side scatter ■ Fourth color option enables six parameter detection ■ Absolute cell counts - no need of reference beads ■ Microcapillary fluidics - no sheath fluid required 	On request	
	Guava easyCyte 8HT Flow Cytometry System	n.a.	<ul style="list-style-type: none"> ■ Blue and red excitation lasers provide simultaneous detection of 6 fluorescent colors, plus forward and side scatter ■ Automated sample tray for 96-well microplate or 10 sample tubes ■ Microcapillary fluidics - no sheath fluid required 	On request	
	Guava Tunel Assay	Quantitates cells at mid-to late-stage apoptosis, when DNA degradation is occurring.	n.a.		380,- (100 tests / Kit)
	Guava Cell Toxicity Assay	Assay uses two dyes: a cell permeant painting dye and a cell impermeant DNA binding dye.	n.a.		380,- (200 tests / Kit)
	Guava ViaVount Assay	Distinguishes between viable and non-viable cells based on the differential permeability of DNA-binding dyes in the ViaCount Reagent.	n.a.		280,- (100 tests / Kit)
	Guava Mitochondrial Depolarization Assay	Mix and read multiparametric assay to measure mitochondrial membrane potential and apoptosis.		<ul style="list-style-type: none"> ■ 100 tests / Kit 	n.a.
	Guava Cell Growth Assay	Uses two dyes, a cell permeant painting dye and a cell impermeant DNA binding dye, to distinguish live or dead proliferated cells.	n.a.		150,- (200 tests / Kit)
	FlowCollect Stem Cell Characterization Kits	Available for FlowCytometry based detection of human and mouse nuclear or surface embryonic stem cell markers.		<ul style="list-style-type: none"> ■ 25 test / kit 	On request
	FlowCollect Chemokine Receptor Surface Expression Quantification Kits	Quantitative identification of chemokine receptor surface expression.		<ul style="list-style-type: none"> ■ 100 tests / Kit 	On request
	FlowCollect Multi-STAT Activation Profiling Kit	Designed to simultaneously detect the phosphorylation of the most commonly studied STAT proteins.	n.a.		449,- (25 tests / Kit)
	FlowCollect PI3K-mTOR Signaling Cascade Kit	Includes two directly conjugated phospho-specific signaling antibodies which are optimized for multi-color flow cytometry applications to analyze the mTOR pathway.	n.a.		300,- (25 tests / Kit)
	FlowCollect PI3K/MAPK Dual Pathway Activation and Cancer Marker Detection kit	Designed to examine cross-talk in a multiparametric fashion by providing three fully validated and optimized antibody biomarkers.	n.a.		449,- (25 tests / Kit)

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Miltenyi Biotec Bergisch Gladbach, Germany www.miltenyibiotec.de Contact: macs@miltenyibiotec.de	autoMACS Pro Separator	Automated sorting of virtually any cell type from any species is possible. Prior to cell sorting there is the option to perform manual or automated cell labeling using a wide variety of MACS Reagents.	<ul style="list-style-type: none"> ■ Green (532 nm) excitation laser ■ Two-color/yellow and red) fluorescence detection ■ Single sample analysis with manual loading ■ Absolute cell counts – no need of reference beads ■ Microcapillary fluidics – no sheath fluid required 	On request
	MACS Separators for manual cell separation: MiniMACS Separator, MidiMACS Separator, QuadroMACS Separator, OctoMACS Separator, MAC-SiMAG Separator	Designed for the fast and easy cell separation in combination with MACS Columns and MACS MicroBeads. MACS Separators are strong permanent magnets that induce a high-gradient magnetic field within the MACS Column.	<ul style="list-style-type: none"> ■ High-performance immunomagnetic cell sorting ■ Fully automated labeling of multiple samples ■ Chill racks maintain sample integrity ■ Highly reproducible results ■ Intuitive touchscreen interface 	On request
Partec Münster, Germany www.partec.com Contact: Phone +49 2534 80080 science@partec.com	CyFlow Sorter	Piezo-driven cell sorter for high purity sorting Easy handling without need for a professional operator.	<ul style="list-style-type: none"> ■ Non-destructive, cell-protecting sorting ■ Easy and robust system ■ Non-hazardous for the operator ■ Closed fluidic system ■ Monitoring of sorting by CCD camera 	34.130,- (Flow cytometer not included)
pluriSelect Leipzig, Germany www.pluriselect.de Contact: Phone +49 341 97 15 887 info@pluriselect.de	pluriBead whole blood	Fast and simple cell separation whole blood, cord blood or bone marrow. Pure cell population in 10 to 30 minutes.	<ul style="list-style-type: none"> ■ Cells in < 15 min for RT-PCR ■ Cells in < 1h for experiments ■ No sample pre-treatment necessary ■ Sample volume from 0.3 - 15 ml ■ Up to 98% purity 	Starting from 80,-
	pluriBead depletion	Deplete unwanted cells from your samples or tissue culture.	<ul style="list-style-type: none"> ■ Deplete cells (e.g. granulocytes) from your sample at room temperature or 37°C 	Starting from 80,-
	pluriBead primary cells	Specific cell isolation from tissue such as spleen, bone marrow, lymph node.	<ul style="list-style-type: none"> ■ Isolation of aggregated cell cluster ■ Single cell suspension ■ Isolate at room temperature or 37°C 	Starting from 80,-
	pluriBead cascade	One-step multi-target separation for cells or proteins.	<ul style="list-style-type: none"> ■ Up to 3 targets ■ Use 0.3 ml - 3 ml sample volume ■ Specially for mouse applications 	n.a.
	pluriBead universal	Use your one special catching antibody for your isolation.	<ul style="list-style-type: none"> ■ Use Streptavidin pluriBeads or anti-IgG pluriBeads to couple your own antibodies 	n.a.
Probior Munich, Germany www.probior.com Contact: Brian Caudill Phone +49 89-58 00 81 20	Dojindo HiLyte Fluor Labeling Kit	Kits use a wide range of HiLyte Fluor dyes to prepare fluorescence-labeled proteins for immunostaining and cell sorting.	<ul style="list-style-type: none"> ■ Protein labeling, immunostaining, fluorescence 	On request
	Dojindo Biotin Labeling Kits	Kits can be used to produce biotin-labeled antibodies for cell sorting.	<ul style="list-style-type: none"> ■ Protein labeling, immunosassays, biotin 	On request
Stemcell Technologies Vancouver, Canada www.stemcell.com Contact: Vicki Stronge Phone +1 604-668-0854 vicki.stronge@stemcell.com	RoboSep	True walk-away automation of immunomagnetic cell isolation from virtually any source including whole blood.	<ul style="list-style-type: none"> ■ No Columns ■ Positive and negative selection ■ Fully automated ■ Up to 4 samples simultaneously ■ No cross contamination 	Please inquire
	EasySep	Immunomagnetic cell separation system that combines the specificity of monoclonal antibodies with the simplicity of a column-free magnetic system.	<ul style="list-style-type: none"> ■ No Columns ■ Positive and negative selection ■ Any sample source ■ FACS compatible 	Please inquire
	RosetteSep	The RosetteSep cocktail contains Tetrameric Antibody Complexes that cross link unwanted cells to red blood cells, leaving desired cells as a highly enriched cell population at the interface.	<ul style="list-style-type: none"> ■ No Columns ■ No Magnets ■ Untouched cells ■ One step cell enrichment ■ Performed at room temperature 	Please inquire