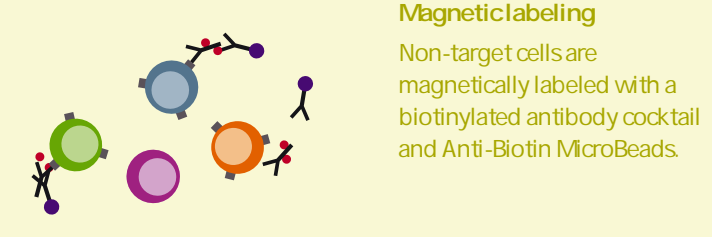
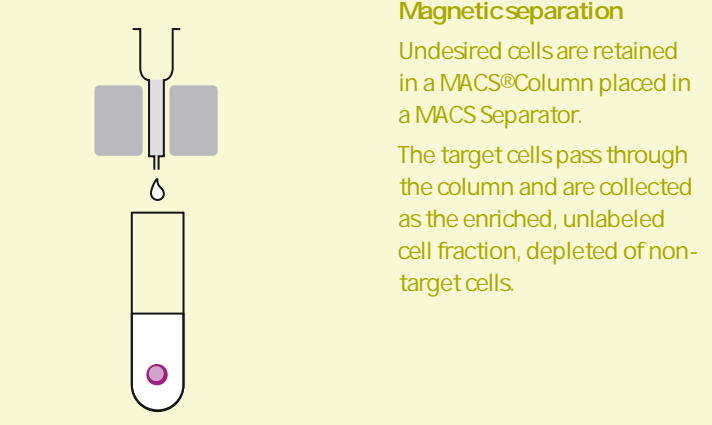


Untouched isolation

- Untouched isolation is performed by depletion of undesired cells
- Non-target cells are magnetically labeled and eliminated from the cell mixture
- The non-labeled, untouched cell fraction contains the target cells. Optionally, magnetically labeled cells can be eluted.
- For many different cell types MACS® Cell Isolation Kits for depletion of non-target cells are available



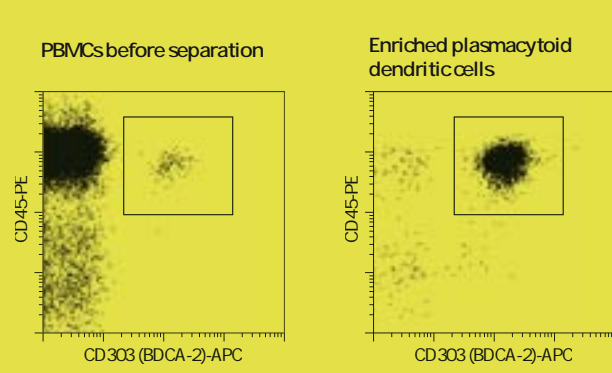
Magnetic labeling
Non-target cells are magnetically labeled with a biotinylated antibody cocktail and Anti-Biotin MicroBeads.



Magnetic separation
Undesired cells are retained in a MACS® Column placed in a MACS Separator. The target cells pass through the column and are collected as the enriched, unlabeled cell fraction, depleted of non-target cells.

Untouched isolation should be considered

- for removal of unwanted cells,
- if no specific antibody is available for target cells,
- if binding of the antibody to the target cells is not desired, or
- for subsequent isolation of a cell subset by means of positive selection.



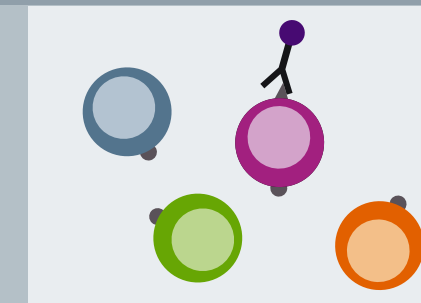
Isolation of human plasmacytoid dendritic cells from PBMCs by using the Plasmacytoid Dendritic Cell Isolation Kit, an LD Column, and a MiniMACS® Separator.

MACS® Technology—the gold standard in cell separation

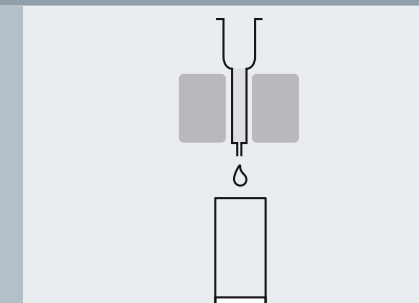
MACS® Technology has become the standard method for cell separation. Numerous publications have proven its versatility for multiple applications: cell separations with consistent high-quality results from lab bench to clinical applications, from small scale to large scale separations, from frequently occurring cells to rare cells and sophisticated subsets. More than 200 MACS Cell Separation Reagents are available for the efficient separation of virtually any cell type.

particles, which are only 50 nanometer in size. Cells labeled with MACS MicroBeads are retained in the magnetic field within a MACS Column placed in a MACS Separator, allowing fast and efficient separation. Separated cells—the positively labeled fraction as well as the non-labeled fraction—can directly be used for downstream applications, such as cell analysis, further expansion, or functional assays. MACS MicroBeads are extremely small and biodegradable and the whole separation procedure is fast and gentle. Thus, the separated cells remain viable and their functionality is not impaired.

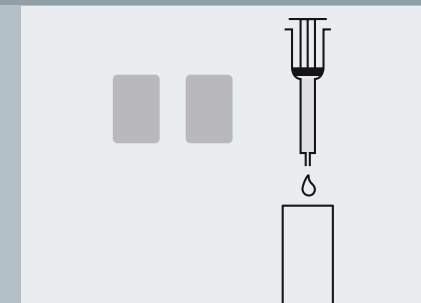
MACS Cell Separation is based on MACS MicroBeads, specific monoclonal antibodies conjugated to superparamagnetic



Magnetic labeling
Cells are magnetically labeled with MACS® MicroBeads in a short incubation step.



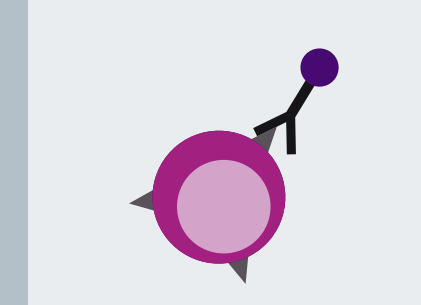
Magnetic separation
Cells are separated on a MACS Column placed in a MACS Separator. The flow-through can be collected as negative fraction depleted of the labeled cells.



Elution of the labeled cell fraction
The MACS Column is removed from the magnetic field. The magnetically retained cells are flushed out as positively selected cells.

- Excellent purity, recovery, and viability of separated cells
- Efficient separation of frequently occurring cells as well as rare cells
- Flexible separation strategies: positive selection, untouched isolation, or sequential sorting
- From small-scale to large-scale cell separation
- Manual or automated separation

MACS® MicroBeads



MACS® MicroBeads are superparamagnetic particles that bind to specific antigens on the cell surface and magnetically label these cells. The MicroBeads do not alter structure, function, or activity status of labeled cells.

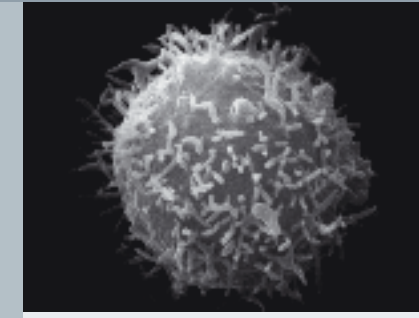


Image Courtesy of Prof. Groscurth/Zürich/Switzerland

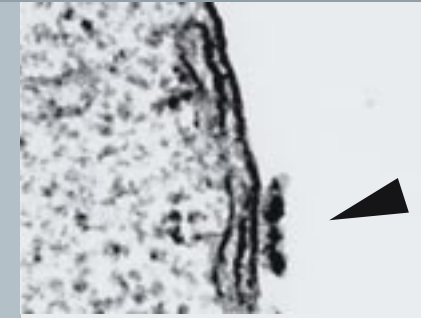
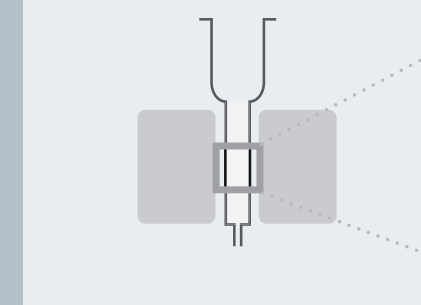


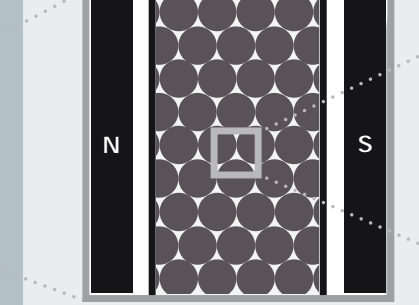
Image Courtesy of Prof. Groscurth/Zürich/Switzerland

- Small (50 nm) superparamagnetic particles coupled to highly specific antibodies
- Short incubation times (5 minutes)
- Non-toxic and biodegradable
- No bead detachment required: Labeled cells can go straight to flow cytometric analysis, cell culture, or other downstream applications

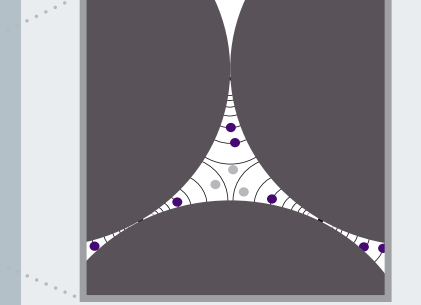
MACS® Columns and Separators



MACS® Columns and MACS Separators are designed for fast and easy cell separation of cells which are labeled with MACS MicroBeads. MACS Separators consist of strong permanent magnets.



MACS Columns are composed of a spherical steel matrix. When a column is placed in a MACS Separator, a high-gradient magnetic field is induced within the column.



The high-gradient magnetic field efficiently retains the cells that are magnetically labeled with minimal amounts of MACS MicroBeads.

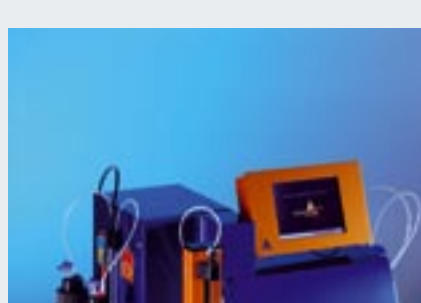
- Gentle to cells
- Thorough rinsing procedure
- Convenient for working under sterile conditions



A MiniMACS™ Separation Unit holds one 15 mL Column.



A MidiMACS™ Separation Unit shown with an LD Column.



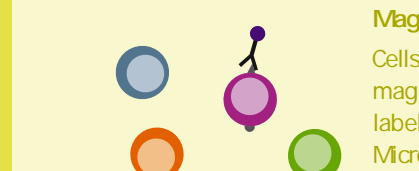
The autoMACS™ Pro Separator allows walk-away cell sorting of multiple samples, even directly from whole blood and bone marrow.

The QuadroMACS™ Separation Unit attached to a MACS® MultiStand and shown with LS Columns and the MACS® 15 mL Tube Rack.

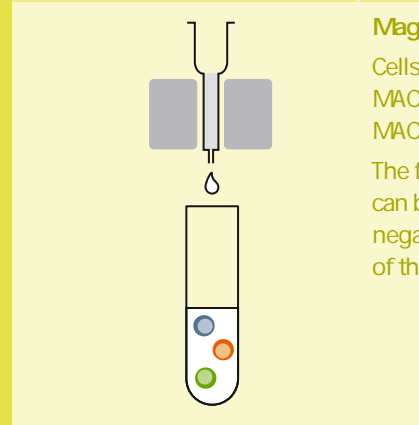
MACS® Separators are available for manual and automated cell separation. The MACS Separator portfolio allows the convenient processing of a wide range of sample sizes and cell numbers.

Positive selection

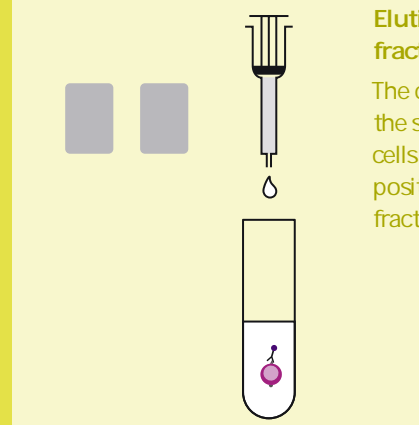
- Most direct and specific way to isolate cells
- For isolation and depletion of cell subsets
- Cells of interest are magnetically labeled with MACS® MicroBeads
- Binding of MACS MicroBeads to the cell surface does not affect viability or function of the cells
- After separation, both fractions—labeled and unlabeled—can be recovered and used for downstream applications
- MACS MicroBeads are biodegradable and typically disappear after a few days in culture



Magnetic labeling
Cells of interest are magnetically labeled with MACS® MicroBeads.



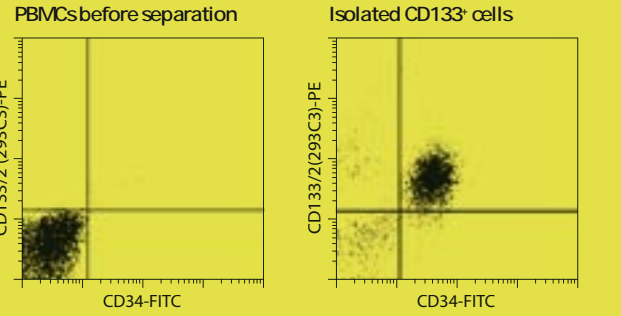
Magnetic separation
Cells are separated in a MACS Column placed in a MACS Separator. The flow-through fraction can be collected as negative fraction depleted of the labeled cells.



Elution of the labeled cell fraction
The column is removed from the separator. The retained cells are eluted as the enriched, positively selected cell fraction.

The positive selection strategy should be considered for

- excellent purity—even from rare cells,
- excellent recovery, and
- fast results.

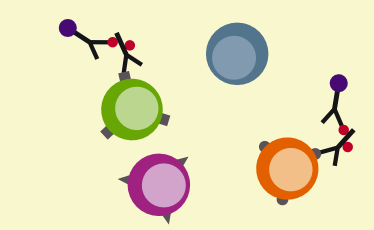


Isolation of CD133+ cells from human PBMCs using the CD133 MicroBead Kit, two MS Columns, and a MiniMACS® Separator.

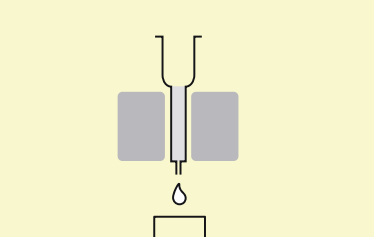
Sequential sorting

Depletion followed by positive selection

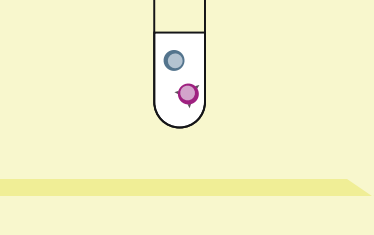
- Cell subsets can be isolated by first depleting the non-target cells and then positively selecting the cell subsets of interest



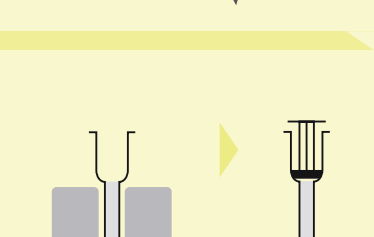
1st magnetic labeling
Non-target cells are magnetically labeled with a biotinylated antibody cocktail and Anti-Biotin MicroBeads.



1st magnetic separation
Undesired cells are retained in a MACS® Column placed in a MACS Separator while the unlabeled cells pass through.



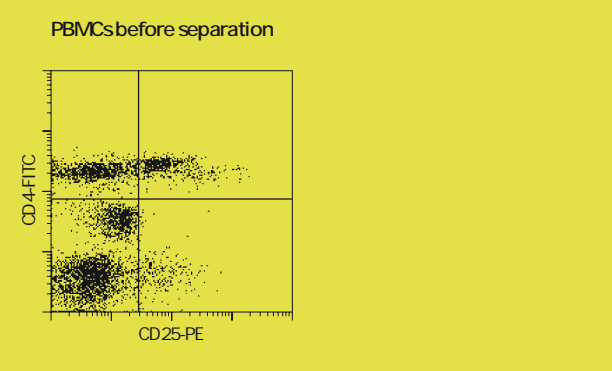
2nd magnetic labeling
Target cells are magnetically labeled with MicroBeads according to a subset marker.



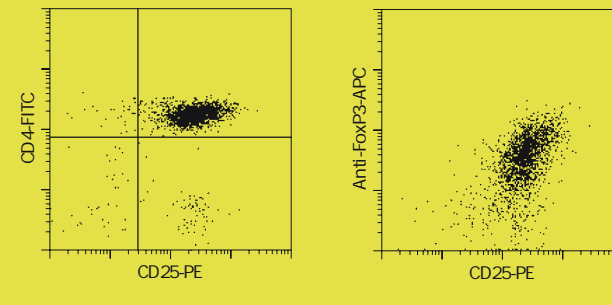
2nd magnetic separation
Target cells are retained in the column while unlabeled cells pass through. After the column is removed from the separator, the target cells are eluted as the enriched, positively selected cell fraction.

Depletion followed by positive selection should be considered

- if undesired cells in the cell suspension express the same antigen which is used for positive selection of the target cells.
- for isolation of extremely rare cells, it also can be useful to deplete non-target cells from the suspension prior to positive selection to obtain very pure cells, e.g., the isolation of human plasmacytoid dendritic cells using the Diamond Plasmacytoid Dendritic Cell Isolation Kit.



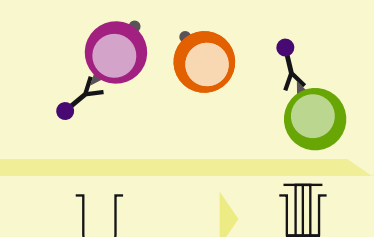
Isolated CD4+CD25+ regulatory T cells



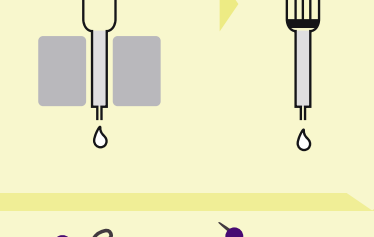
Isolation of human peripheral blood CD4+CD25+ regulatory T cells using the CD4+CD25+ Regulatory T Cell Isolation Kit. Cells were stained with CD4-FITC, CD25-PE, and intracellularly with ANI-FoxP3-APC.

MultiSort strategy

- Sequential sorting with MACS® MultiSort Kits allows consecutive positive selections of cells
- Even rare cells can be enriched in a time-efficient way



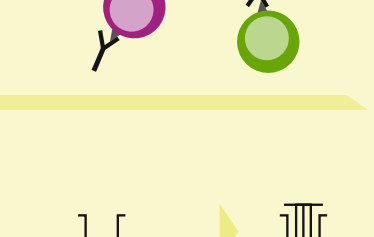
1st magnetic labeling
Cells of interest are magnetically labeled with MultiSort MicroBeads.



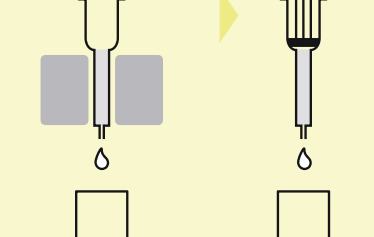
1st magnetic separation
Target cells are magnetically isolated by positive selection.



Release of magnetic particles
MultiSort MicroBeads are enzymatically released.



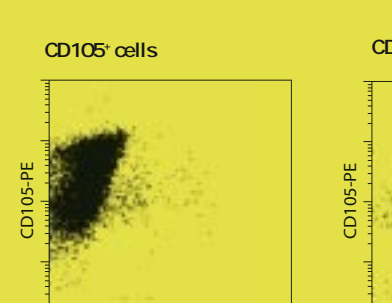
2nd magnetic labeling
Cell subset of interest is labeled with MACS® MicroBeads according to a second marker.



2nd magnetic separation
Target cells are separated.

MACS MultiSort strategy should be considered for

- isolation of cells which are characterized by multiple cell surface markers



Separation of CD105+ Sca-1+ cells from mouse bone marrow using the CD105 MultiSort Kit (PE), mouse, and two LS Columns for the first positive selection followed by the Anti-Sca-1 MicroBead Kit (FITC), mouse, and two MS Columns in the second positive selection step.

MACS® Labeling Strategies

Direct magnetic cell labeling

- Fast way of magnetic labeling
- Requires only one labeling step
- Specific antibody is directly coupled to the magnetic particle
- Reduces the number of washing steps and avoids unnecessary cell loss
- Available for many different surface markers of cells from various species



Indirect magnetic cell labeling

- For virtually any cell type from virtually any species
- If no direct MicroBeads for the cell type of interest are available
- Labeling of the cells with a primary antibody of choice followed by magnetic labeling with Anti-Fluorochrome, Anti-Biotin, Streptavidin, or Anti-Immunoglobulin MicroBeads
- For virtually any monoclonal or polyclonal primary antibody
- Method of choice for magnetic separation according to dimly expressed antigens

