



Miltenyi Biotec

Products for mouse cell research



- Cell separation
- Cell detection
- Molecular analysis

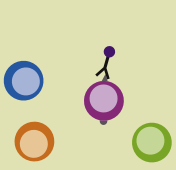
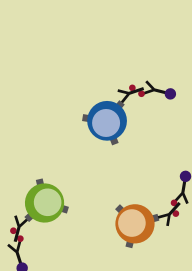
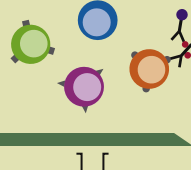
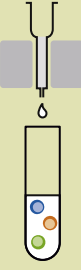
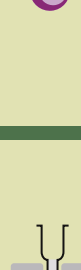

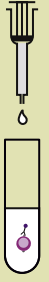
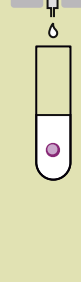

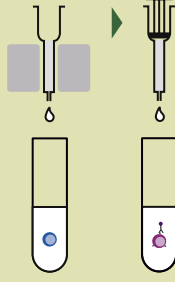
Make cell isolation the easy part of your experiment

The mouse model is the experimental animal model of choice for the majority of studies in basic research. Findings from this field have led to tremendous insights into the mechanisms of the human immune system. MACS® Technology provides different strategies for the efficient isolation of cell

populations and cell subsets from more frequent cell types like T cells or B cells to rare and difficult to isolate cell types like antigen-specific T cells or distinct subsets of dendritic cells. Target cells can either be directly isolated by positive selection with MACS MicroBeads or

indirectly by depletion of unwanted cells with MACS Cell Isolation Kits to obtain untouched target cells. Additionally, these two separation strategies can easily be combined providing a great flexibility for the isolation of certain cell subsets.

MACS® Separation Strategies

<p>Positive selection strategy Positive selection means that the desired target cells are magnetically labeled and isolated as the magnetically retained cell fraction. Positive selection is the most direct and specific way to isolate the target cells from a heterogeneous cell suspension. Binding of antibodies (which are part of the MicroBeads) to the cell surface does not affect viability or function of the cells. Both fractions, labeled and unlabeled, can be recovered and used.</p>	<p>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-magnetic, untouched cell fraction contains the target cells. For many different cell types Miltenyi Biotec offers optimized MACS® Cell Isolation Kits containing pre-titrated cocktails of antibodies directed against non-target cells.</p>	<p>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. This strategy is useful if undesired cells in the cell suspension express the same antigen that is used for positive selection of the target cells. For isolation of extremely rare cells, it also can be useful first to deplete non-target cells from the suspension. Positive selection can then be carried out with the pre-enriched fraction to obtain very pure cells.</p>
<p>Magnetic labeling Cells of interest are magnetically labeled with MACS® MicroBeads.</p> 	<p>Magnetic labeling Non-target cells are magnetically labeled with a biotinylated antibody cocktail and Anti-Biotin MicroBeads.</p> 	<p>1st magnetic labeling Non-target cells are magnetically labeled with a biotinylated antibody cocktail and Anti-Biotin MicroBeads.</p> 
<p>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.</p> 	<p>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.</p> 	<p>1st magnetic separation Undesired cells are retained in a MACS® Column placed in a MACS Separator while the unlabeled cells pass through.</p> 
<p>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.</p> 	<p>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.</p> 	<p>2nd magnetic labeling Target cells are magnetically labeled with MicroBeads according to a subset marker.</p>  <p>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.</p> 

How to choose the right MACS Separation Strategy?

A positive selection strategy should be considered:

- for most specific labeling,
- for a fast performance with best recovery, or
- if no subsequent separation step is needed.

An untouched isolation strategy should be considered:

- for removal of unwanted cells,
- if isolated cells are to be separated according to a second marker, or
- if binding of an antibody to target cells is not desired.

MACS Benefits

MACS Technology

- Optimal recovery and best purity with MACS Columns
- Easy separation of large cell numbers or rare cells
- Fast (less than 1 hour), convenient, and absolutely reliable
- Gentle to cells
- Automated cell separation with autoMACS™ Separator or autoMACS Pro Separator
- Flow cytometry-compatible

MACS MicroBeads

- Highly specific monoclonal antibody conjugates
- Colloidal, for easy handling and short incubation times (15 minutes)
- Small (50 nm), non-toxic, biodegradable
- So small that detaching is not required for downstream experiments

Stem and progenitor cells

Miltenyi Biotec offers a variety of products for the isolation and characterization of mouse stem cells.

The Lineage Cell Depletion Kit has been optimized for the pre-enrichment of stem and progenitor cells from bone marrow (BM) by depleting mature and committed hematopoietic cells (HSCs). Hematopoietic stem cells from bone marrow are defined as Sca-1⁺, CD117 (c-kit)⁺, CD90^{low/+}, and lineage marker-negative (lin⁻). Furthermore, the expression of CD105 on Sca-1⁺ cells from bone marrow is highly increased in HSCs with long-term reconstituting ability (LT-HSCs).^{1,2,3} The Lineage Cell Depletion Kit has also been used to investigate the development of cancer stem cells (CSCs).⁴

Sca-1⁺CD117⁺lin⁻ cells possess the capacity to differentiate into nonhematopoietic (NH) cells such as muscle cells^{5,6}, endothelial cells⁵, hepatocytes⁷, and cells of the neural system⁸. Additionally, CD117⁺ cells from BM show the potential to differentiate into cardiac cell lineages⁹ and contribute to angiogenesis¹⁰. CD117⁺ cells, isolated from cultured amniotic fluid, possess a multipotent differentiation capacity and express adult and embryonic stem cell markers.¹¹

Sca-1 is expressed on circulating endothelial progenitor cells¹² and also on a broad range of stem and progenitor cells that are

specific for certain tissues such as kidney¹³, mammary gland¹⁴, heart¹⁵, liver¹⁶, prostatic¹⁷, and muscle tissue¹⁸.

Prominin-1, the murine ortholog of CD133, was originally identified in mouse neuroepithelial stem cells.¹⁹ Multipotent neural stem cells in the postnatal cerebellum can be isolated based on their expression of prominin-1 in conjunction with the lack of lineage-indicative markers (PSA-NCAM⁻, TAPA⁻, O4⁻).

For the dissociation of neural tissue, papain- or trypsin-based enzyme mixes are available: the Neural Tissue Dissociation Kit (Papain), order no. 130-092-628, and the Neural Tissue Dissociation Kit (Trypsin), order no. 130-093-231.

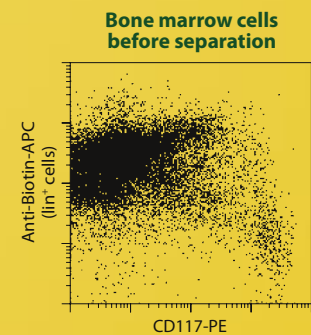
Purified prominin-1⁺/lin⁻ cells form self-renewing neurospheres and can differentiate into neurons, astrocytes, and oligodendrocytes *in vitro* and *in vivo*.²⁰ Prominin-1 expression has been further demonstrated on cells of different tissues, including epithelia²⁰, kidney tubules²⁰, pancreas, and skin.

References:

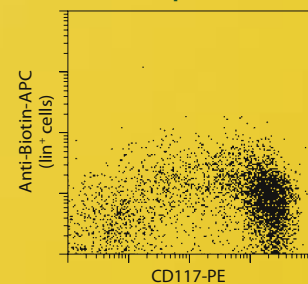
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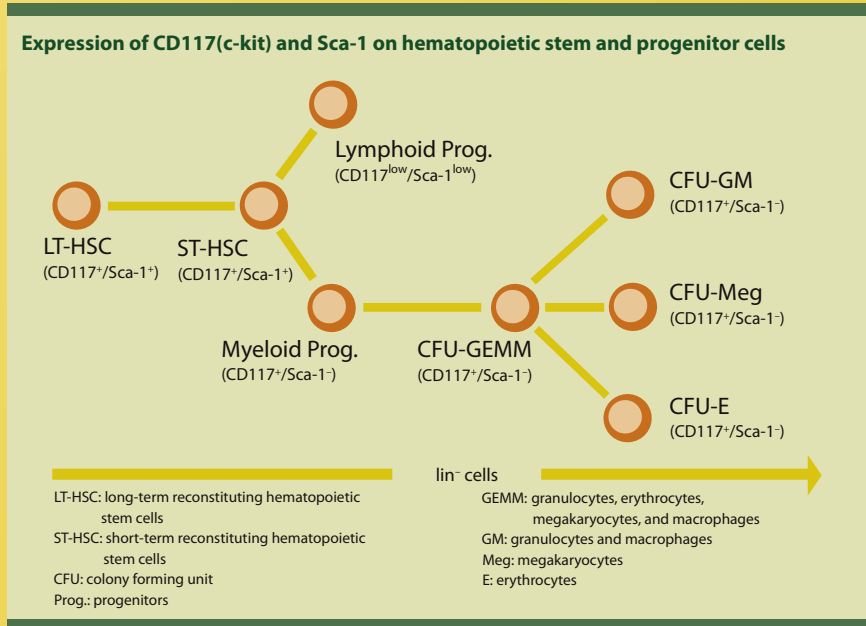
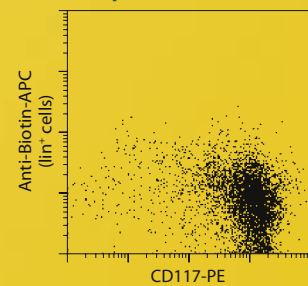
Example for the isolation of lin⁻ CD117⁺ cells from mouse bone marrow.



Pre-enriched lin⁻ cells after depletion of lin⁺ cells with the Lineage Cell Depletion Kit



CD117⁺ cells isolated from the lin⁻ cell-depleted cell fraction



The Anti-Sca-1 MicroBead Kit (FITC) is used for the isolation of stem cells and early progenitor cells. CD117 MicroBeads are used for the isolation of early and late stem and progenitor cells.

Target cells	MACS® Product	Separation strategy	Order no.
Long-term reconstituting hematopoietic stem cells	CD105 MultiSort Kit (PE)	Positive selection	130-092-924
Early and late stem and progenitor cells	CD117 MicroBeads	Positive selection	130-091-224
Neuronal stem cells	Anti-PSA-NCAM MicroBeads	Positive selection	130-092-966
Early stem and progenitor cells	Anti-Sca-1 MicroBead Kit (FITC)	Positive selection	130-092-529
Lin ⁻ cells from bone marrow	Lineage Cell Depletion Kit	Untouched isolation	130-090-858
Neuroepithelial stem cells	Anti-Prominin-1 MicroBeads	Positive selection	130-092-333



Dendritic cells and subsets

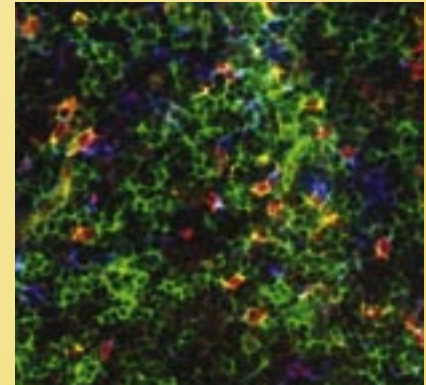
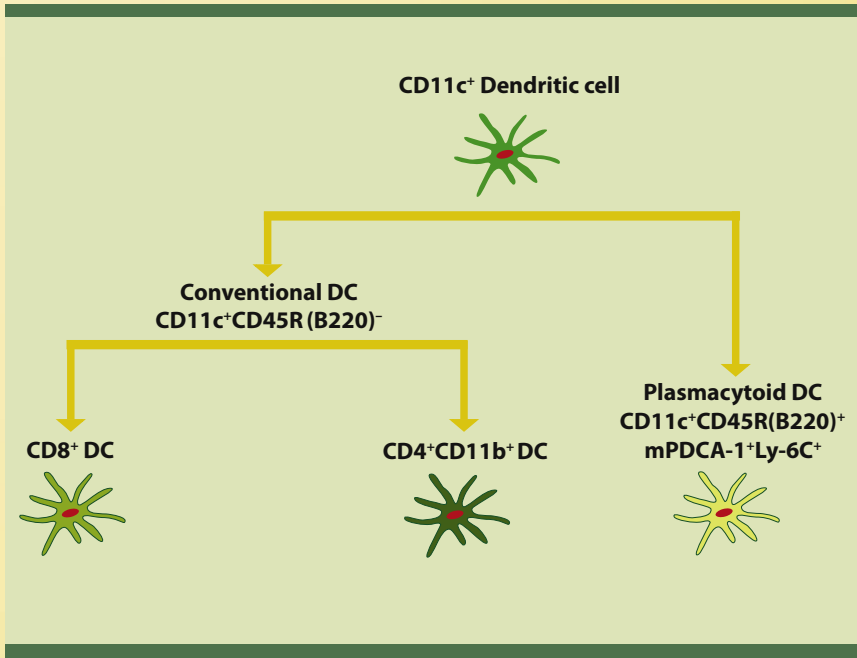
Dendritic cells (DCs) are a heterogeneous population of hematopoietic cells comprising distinct DC subsets differing in phenotype and function. So far, all defined mouse DC subsets specifically express the CD11c antigen, although at different levels. With CD11c MicroBeads or Pan DC MicroBeads, DCs can be directly isolated from all lymphoid and a great variety of non-lymphoid tissues, e.g., liver, lung, skin, and brain. One major DC subtype, mouse plasmacytoid dendritic cells (PDCs), has been identified in all lymphoid organs. Their identification was based on a combination of three antibodies: CD11c, CD45R (B220),

and Ly-6C. A monoclonal antibody that specifically recognizes mPDCA-1 (murine plasmacytoid dendritic cell antigen-1), an antigen exclusively expressed on mouse PDCs, was generated at Miltenyi Biotec. Recently, mPDCA-1 has been identified as bone marrow stromal antigen 2 (BST2).¹ This new antibody, termed Anti-mPDCA-1, allows direct identification of PDCs by single-color staining. The new product line based on this antibody comprises fluorochrome- and biotin-conjugated antibodies as well as pure antibodies for immunohistochemical staining or *in vivo* depletion of PDCs. For specific isolation of PDCs, Anti-mPDCA-1 MicroBeads

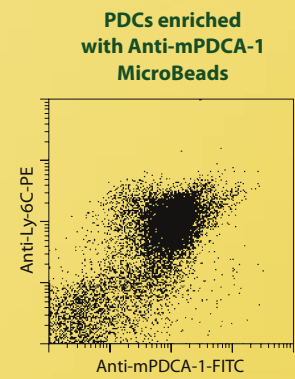
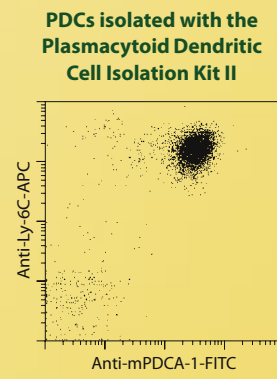
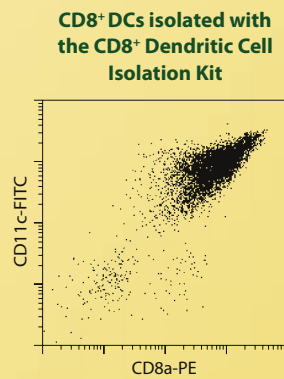
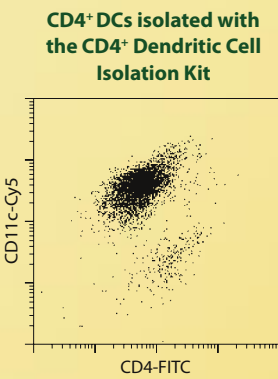
and the Plasmacytoid Dendritic Cell Isolation Kit are available. Using Anti-mPDCA-1 MicroBeads, PDCs can be directly isolated through positive selection. Untouched PDCs can be obtained using the Plasmacytoid Dendritic Cell Isolation Kit II. Apart from PDCs, distinct subsets of conventional DCs have been described in lymphoid organs. MACS® Technology provides two special kits for the isolation of the main subsets: the CD8⁺ Dendritic Cell Isolation Kit and the CD4⁺ Dendritic Cell Isolation Kit.

References:

1. Blasius *et al.* (2006) *J. Immunol.* 177: 3260–3265. [9172]
2. Krug *et al.* (2004) *Immunity* 21: 107–119. [4201]
3. Yoneyama *et al.* (2005) *J. Exp. Med.* 202: 425–435. [7569]
4. Kuwajima *et al.* (2006) *Nat. Immunol.* 7: 740–746. [8806]



Immunohistochemical staining of cryosections with Anti-mPDCA-1. Acetone-fixed cryosections from murine lymph nodes were stained with Anti-mPDCA-1-Biotin and Streptavidin-Cy3 (red), followed by counter-stainings with Anti-Ly-6C-FITC (green) and CD11c-APC (blue). (Courtesy of Drs. L. Ohl and R. Förster, Hannover, Germany)



Target cells	MACS® Product	Separation strategy	Order no.
All DCs	CD11c MicroBeads	Positive selection	130-052-001
	Pan DC MicroBeads	Positive selection	130-092-465
Plasmacytoid DCs	Anti-mPDCA-1 MicroBeads	Positive selection	130-091-965
	Plasmacytoid Dendritic Cell Isolation Kit II	Untouched isolation	130-092-786
CD4 ⁺ CD11b ⁺ DCs	CD4 ⁺ Dendritic Cell Isolation Kit	Depletion + positive selection	130-091-262
CD8 ⁺ DCs	CD8 ⁺ Dendritic Cell Isolation Kit	Depletion + positive selection	130-091-169

Note: A large panel of fluorochrome-conjugated, biotin-conjugated, or pure antibodies is available for evaluation of MACS Separations, subset-specific identification, or further analysis of DCs. For additional information, please refer to page 9.

T cells and subsets

T cells are key regulators and effectors of the adaptive immune system. They promote growth and differentiation of other cells but also exert suppressive activity and down-regulate immune reactions. Particular subsets of the T cell compartment have cytotoxic activity to malignant or virus-infected cells. With MACS® Technology, T cells can be separated either by positive selection using direct labeling of target cells with MACS MicroBeads or by untouched isolation with MACS Cell Isolation Kits. For isolation of distinct T cell subsets both strategies can be easily combined.

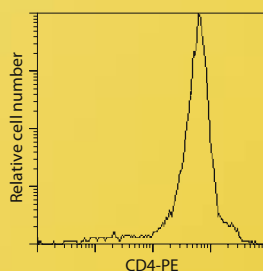
Magnetic cell isolation using MACS Technology has been established as a standard procedure for the isolation of T cells from different tissues.

T cells were then used for, for example:

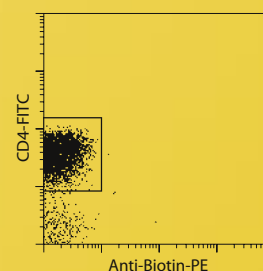
- adoptive transfer experiments into immunodeficient^{1,2,3,11}, knock-out⁴, parasite-infected⁵, or tumor-bearing mice⁶;
- evaluation of T cell chemotaxis in airway inflammation⁷ or imaging of T cell/DC interactions by two-photon microscopy⁸;
- transfer of UV-induced hapten-specific immunological tolerance⁹; and
- priming of DCs for tolerance induction¹⁰.



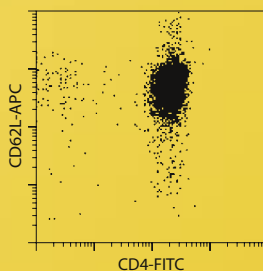
CD4⁺ T_H cells isolated with CD4 MicroBeads



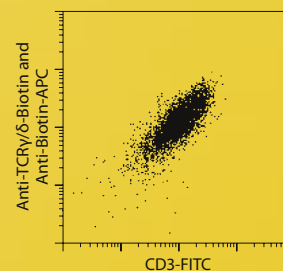
CD4⁺ T_H cells isolated with the CD4⁺ T Cell Isolation Kit



Naive CD4⁺ T_H cells isolated with the CD4⁺CD62L⁺ T Cell Isolation Kit



γ/δ T cells isolated with the TCRγ/δ⁺ T Cell Isolation Kit



References:

1. Trembleau *et al.* (1995) *J. Exp. Med.* 181: 817. [353]
2. Hoerauf *et al.* (1996) *Int. Immunol.* 8: 1569. [329]
3. Johansen *et al.* (2004) *Eur. J. Immunol.* 34: 91. [3934]
4. Soroosh *et al.* (2006) *J. Immunol.* 176: 5975. [8674]
5. Schmitz *et al.* (1994) *J. Exp. Med.* 179: 1349. [109]
6. Khan and Kasper (1996) *J. Immunol.* 157: 2103. [350]
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8. Chvatchko *et al.* (2003) *J. Immunol.* 171: 5498. [6160]
9. Miller *et al.* (2004) *Proc. Natl. Acad. Sci. USA* 101: 998. [3907]
10. Schwarz *et al.* (2004) *J. Immunol.* 172: 1036. [3791]
11. Fallarino *et al.* (2003) *Nat. Immunol.* 4(12): 1206. [3982]

Target cells	MACS Product	Separation strategy	Order no.
T cells	CD90 MicroBeads	Positive selection	130-049-101
	Pan T Cell Isolation Kit	Untouched isolation	130-090-861
CD4 ⁺ T _H cells	CD4 MicroBeads	Positive selection	130-049-201
	CD4 ⁺ T Cell Isolation Kit	Untouched isolation	130-090-860
CD4 ⁺ CD25 ⁺ Treg cells	CD4 ⁺ CD25 ⁺ Regulatory T Cell Isolation Kit	Depletion + positive selection	130-091-041
Naive CD4 ⁺ T _H cells	CD4 ⁺ CD62L ⁺ T Cell Isolation Kit II	Depletion + positive selection	130-093-227
Effector/memory CD4 ⁺ T _H cells	CD4 ⁺ T Cell Isolation Kit + CD62L MicroBeads	Untouched isolation	130-090-860 130-049-701
CD8 ⁺ T _c cells	CD8a MicroBeads	Positive selection	130-049-401
	CD8a ⁺ T Cell Isolation Kit	Untouched isolation	130-090-859
Naive CD8 ⁺ T _c cells	CD8a ⁺ T Cell Isolation Kit + CD62L MicroBeads	Depletion + positive selection	130-090-859 130-049-701
Effector/memory CD8 ⁺ T _c cells	CD8a ⁺ T Cell Isolation Kit + CD62L MicroBeads	Untouched isolation	130-090-859 130-049-701
γ/δ T cells	TCRγ/δ ⁺ T Cell Isolation Kit	Depletion + positive selection	130-092-125

Note: A large panel of fluorochrome- or biotin-conjugated antibodies for evaluation of MACS Separations and further analysis of T cells is available. For additional information, please refer to page 9.

Special T cell subsets—regulatory T cells

Findings from CD4⁺CD25⁺ regulatory T (Treg) cell research have generated widespread interest over the last years. However, many aspects of their biological properties remain to be elucidated. The CD4⁺CD25⁺ Regulatory T Cell Isolation Kit allows an efficient and convenient isolation of CD4⁺CD25⁺ Treg cells

from spleen and lymph nodes in just two steps. First, CD4⁺ T cells are pre-enriched by magnetic labeling and depletion of non-CD4⁺ T cells with an optimized cocktail of biotinylated antibodies and Anti-Biotin MicroBeads. Subsequently, CD4⁺CD25⁺ Treg cells are labeled with CD25-PE and Anti-PE

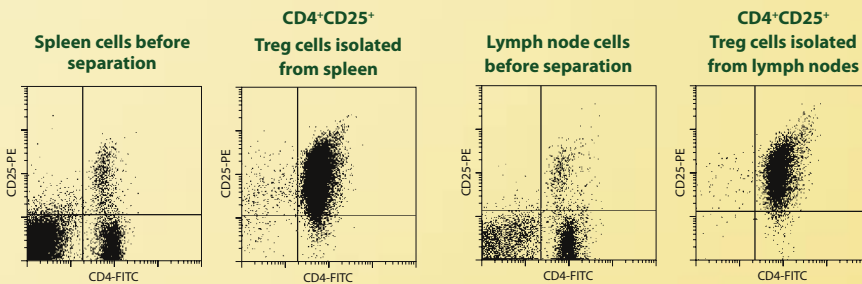
MicroBeads to be positively selected. By adding CD25-PE during the first labeling step, aliquots of cells can be directly analyzed by flow cytometry to check the isolation efficiency.

CD4⁺CD25⁺ Treg cells isolated with the CD4⁺CD25⁺ Regulatory T Cell Isolation Kit were used for, for example:

- coculture experiments to study priming of DCs for tolerance induction¹ or *in vitro* suppression assays²
- adoptive transfer of Treg cells^{3,4}.

References:

1. Fallarino *et al.* (2003) *Nat. Immunol.* 4: 1206–12. [3982]
2. Kashiwada *et al.* (2006) *J. Immunol.* 176: 3958–3965 [8594]
3. Schwarz *et al.* (2004) *J. Immunol.* 172: 1036–1043. [3791]
4. Gangi *et al.* (2005) *J. Immunol.* 174: 7006–7013 [7184]



Special T cell subsets—antigen-specific T cells

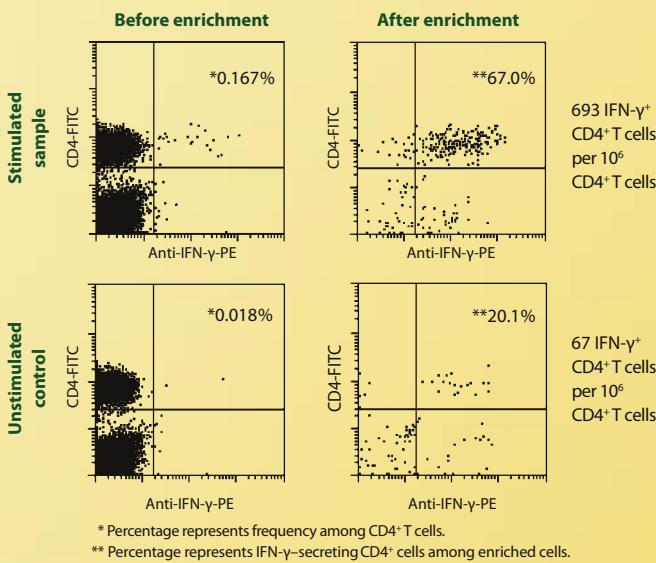
MACS[®] Cytokine Secretion Assays were developed for highly sensitive analysis and efficient magnetic isolation of rare antigen-specific T cells. The technology is based on the activation of T cells with antigen. Cytokines secreted by the activated T cells are then captured directly on the T cell surface. Antigen-specific T cells can be analyzed by flow cytometry providing unmatched sensitivity of detection of one cell in a million. The cells can also be isolated by magnetic cell separation. Because their viability and functionality is not

affected, they can be used for downstream applications, e.g., cytotoxicity assays or adoptive transfer experiments. Additionally, the unique versatility of the Cytokine Secretion Assays allows the detection of cytokine coexpression and their combination with peptide-MHC multimer stainings. The assay has been used for enrichment and/or analysis of cytokine-producing Th2 cells¹, splenic DCs², T cells from bronchioalveolar lavages³, NKT cells⁴, tumor-reactive T cells⁵, and intrahepatic mononuclear cells⁶. Antigen-specific CD4⁺

T cells can also be detected or isolated in a cytokine-independent way based on the expression of CD154.⁷

References:

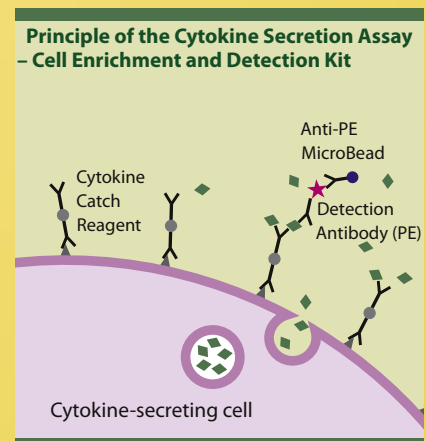
1. Löhning *et al.* (2003) *Proc. Natl. Acad. Sci. USA* 100: 12307. [3067]
2. Edwards *et al.* (2002) *J. Immunol.* 169: 3652. [2687]
3. McAllister *et al.* (2004) *J. Immunol.* 172: 1132. [3147]
4. Yang *et al.* (2003) *J. Immunol.* 171: 2142. [3097]
5. Becker *et al.* (2001) *Nature Med.* 7: 1159. [1207]
6. Berenzon *et al.* (2003) *J. Immunol.* 171: 2024. [4338]
7. Frensch *et al.* (2005) *Nat. Med.* 11: 1118. [7713]



In this example, BALB/c mice were immunized i.p. with HEL (henn eggwhite lysozyme) in incomplete Freund's adjuvant and pertussis toxin. On day 21 after immunization, mouse spleen cells were restimulated *in vitro* with HEL for 15 hours. The responding cells were stained and enriched according to secretion of IFN- γ using the Mouse IFN- γ Secretion Assay – Cell Enrichment and Detection Kit.

In the stimulated sample, 693 IFN- γ -secreting CD4⁺ T cells were enriched per 10⁶ CD4⁺ T cells using MS Columns and a MiniMACS Separator. In the unstimulated control sample, only 67 IFN- γ -secreting CD4⁺ T cells were enriched per 10⁶ CD4⁺ T cells.

Cytokine-secreting cells	Mouse Cytokine Secretion Assay	Cell Enrichment and Detection Kit	Detection Kit
T cells	Mouse IL-2 Secretion Assay	(PE) 130-090-492	(PE) 130-090-491 (APC) 130-090-987
Th2 cells, NK cells	Mouse IL-4 Secretion Assay	(PE) 130-090-515	(PE) 130-090-479
Th2 cells	Mouse IL-5 Secretion Assay	(PE) 130-091-175	(PE) 130-091-166 (APC) 130-091-174
T cells, DCs, macrophages	Mouse IL-10 Secretion Assay	(PE) 130-090-490	(PE) 130-090-489 (APC) 130-090-939
Th1 cells, NK cells, NKT cells	Mouse IFN- γ Secretion Assay	(PE) 130-090-517	(PE) 130-090-516 (APC) 130-090-984
CD154 ⁺ CD4 ⁺ Th cells	CD154 Enrichment and Detection Kit	(PE) 130-093-129	(PE) 130-093-084 (APC) 130-093-083



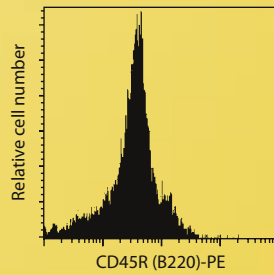
B cells and subsets

B cells are the humoral arm of the adaptive immune system. They also act as antigen-presenting cells, thereby, inducing and modulating T cell responses.

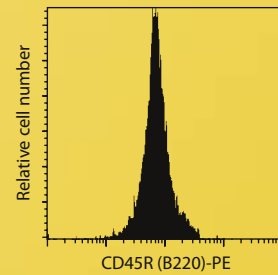
MACS® Technology offers a unique product portfolio for the isolation of B cells and B cell subsets. B cells isolated with MACS MicroBeads or with special MACS Cell Isolation Kits were used for, for example:

- *in vitro* analyses of antibody class switching¹ and B cell receptor signal transduction²;
- studies on accessibility of enhancer elements during B cell development by *in vivo* footprinting³;
- isolation of mRNA for microarray analyses to quantify transcription factor expression during B cell development⁴.

Splenic B cells isolated with CD45R (B220) MicroBeads



Splenic B cells isolated with the B Cell Isolation Kit



- studies on chemokine receptor expression⁵
- *in vitro* proliferation assays⁶

References:

1. Hein *et al.* (1998) *J. Exp. Med.* 188: 2369. [523]

2. Xu *et al.* (2000) *Int. Immunol.* 12: 397. [1674]

3. Shaffer *et al.* (1997) *Immunity* 6: 131. [362]

4. Portis and Longnecker (2003) *J. Virol.* 77:105. [2569]

5. Piovani *et al.* (2005) *Blood* 105: 931. [6713]

6. Nagai *et al.* (2005) *J. Immunol.* 174: 7043. [7185]

Target cells	MACS Product	Separation strategy	Order no.
B cells	CD19 MicroBeads	Positive selection	130-052-201
B cells	CD45R(B220) MicroBeads	Positive selection	130-049-501
Resting B cells	B Cell Isolation Kit	Untouched isolation	130-090-862
Resting B cells	CD43 MicroBeads	Untouched isolation	130-049-801
IgG ⁺ memory B cells	Rat Anti-Mouse IgG1 MicroBeads	Positive selection	130-047-101
IgG ⁺ memory B cells	Rat Anti-Mouse IgG2a+b MicroBeads	Positive selection	130-047-201
B-1a cell subset	CD90 MicroBeads CD5 MicroBeads	Depletion + positive selection	130-049-101 130-049-301
B-2 cell subset	CD5 MicroBeads CD19 MicroBeads	Depletion + positive selection	130-049-301 130-052-201
Plasma cells	CD138 ⁺ Plasma Cell Isolation Kit	Depletion + positive selection	130-092-530

NK cells

Natural killer (NK) cells are innate effector lymphocytes with cytotoxic activity against stressed, microbe-infected, virus-infected, or malignant cells. They can be directly isolated by positive selection with CD49b (DX5) MicroBeads or by depletion of unwanted cells (untouched isolation) with the NK Cell Isolation Kit. NK cells isolated with MACS Technology were used for evaluation of NK cell cytotoxicity *in vitro*¹ or after adoptive transfer *in vivo*². Furthermore, isolated NK

cells were analyzed, e.g., in mouse models of immune-mediated liver injury³ or in chronic infections with parasitic helminths⁴. Moreover, the interaction of isolated NK cells with cytotoxic T cells was investigated.⁵

References:

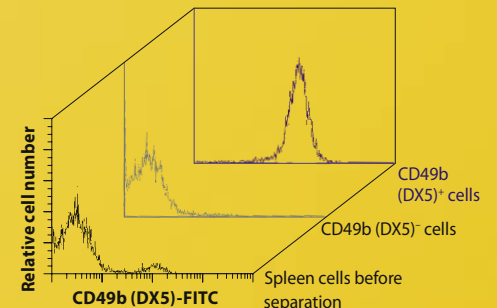
1. Tomasello *et al.* (2000) *Immunity* 13: 335. [945]

2. Shi *et al.* (2000) *J. Immunol.* 165: 3099. [1021]

3. Mühlen *et al.* (2004) *J. Immunol.* 172: 3034. [4274]

4. Hsieh *et al.* (2004) *J. Immunol.* 173: 2699. [4275]

5. Fan *et al.* (2006) *Blood* 107: 1342. [8423]

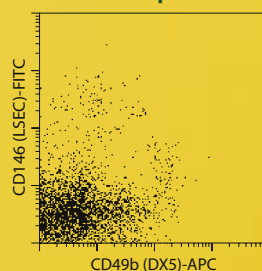


Target cells	MACS Product	Separation strategy	Order no.
Lineage NK cells	CD49b (DX5) MicroBeads	Positive selection	130-052-501
Lineage NK cells	NK Cell Isolation Kit	Untouched isolation	130-090-864

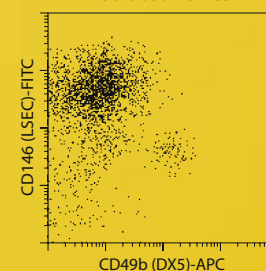
Endothelial cells

CD146 is expressed on smooth muscle cells (SMCs), endothelial cells (ECs), and liver sinusoidal endothelial cells (LSECs). LSECs are microvascular endothelial cells lining the hepatic wall. Their strategic positioning favors a tight interaction with lymphocytes migrating through the liver. LSECs are supposed to mainly contribute to the control of immune responses against circulating soluble antigens in the liver. With Anti-LSEC MicroBeads highly pure mouse LSECs can be isolated in just one step.

Mouse liver cells before separation



Isolated LSECs



Target cells	MACS Product	Separation strategy	Order no.
LSECs, ECs, SMCs	CD146 (LSEC) MicroBeads	Positive selection	130-092-007
ECs	CD105 MultiSort Kit (PE)	Positive selection	130-092-924

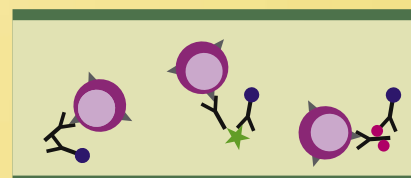
... and more cell types

Target cells	MACS Product	Separation strategy	Order no.
Neutrophils	Anti-Ly-6G MicroBead Kit	Positive selection	130-092-332
Antigen-presenting cells	Anti-MHC Class II (Ia) MicroBeads	Positive selection	130-052-401
Monocytes, macrophages	CD11b (Mac-1) MicroBeads	Positive selection	130-049-601
Leukocytes	CD45 MicroBeads	Positive selection	130-052-301
Erythrocytes	Anti-Ter-119 MicroBeads	Positive selection	130-049-901

MACS® MicroBeads for indirect magnetic labeling

For maximum flexibility, indirect magnetic labeling with MACS® MicroBeads allows the use of virtually any primary antibody for the isolation of particular target cells. The monoclonal or polyclonal primary antibodies can be either unconjugated, biotinylated, or fluorochrome-conjugated.

Furthermore, MACS MicroBeads for indirect magnetic labeling are the ideal tool for the isolation of untouched cells in combination with antibody cocktails that are specifically designed by the user.



MACS Product	Target
Anti-Fluorochrome MicroBeads	FITC, PE, APC, Cy5/Alexa Fluor 647, Cy7
Anti-Fluorochrome MultiSort Kit	FITC, PE, APC
Anti-Biotin MicroBeads or MultiSort Kit	Biotinylated antibodies
Streptavidin MicroBeads	Biotinylated antibodies
Anti-Immunoglobulin MicroBeads	Unconjugated monoclonal and polyclonal antibodies

8



Innovative approaches for molecular biology research

The MACSmolecular product portfolio facilitates molecular analyses—from highly specific molecule isolation and processing to gene expression profiling.

One-step mRNA isolation and in-column cDNA synthesis

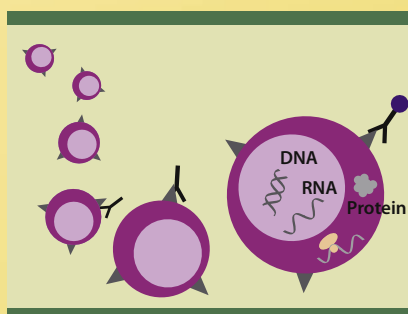
Premium mRNA is isolated in 15 minutes directly from cells, tissue, or blood. The μ MACS™ One-step cDNA Kit combines efficient magnetic isolation of mRNA with revolutionary in-column cDNA synthesis. Purified cDNA is generated from just a few cells to as many as 10^7 cells.

Fast and specific protein isolation from any cell

Any protein can be magnetically labeled with μ MACS MicroBeads, if an epitope tag such as His, HA, c-myc, GST or GFP, or a specific antibody is available. Magnetic labeling enables in-column protein assays and analytical-scale purification. Analyses of interacting proteins like transcription factors or molecular complexes as well as display technologies are significantly accelerated.

MultiMACS™ Separator for 96-well format biomolecule purification

Up to 96 samples can be processed in parallel with this semi-automated benchtop instrument: highly pure molecules such as mRNA, proteins, as well as viable HIV



particles can be isolated for molecular research.

SuperAmp™ System—gene expression profiling from a few cells only

Starting with even a few cells, minute tissue or blood samples, microarray experiments can be performed with the SuperAmp™ Amplification System. As a service, detailed documentation comprises all experimental steps and interpreted results, leading to ready-to-publish data.

Focused gene expression analysis with PIQOR™ Microarrays

The unique bioinformatics selection strategy of cDNA fragments and the precise production of PIQOR Microarrays are the prerequisite for reliable results. Custom or topic-defined microarrays, like the PIQOR™ Immunology Microarrays, PIQOR Cytokines

& Receptors Microarrays, or PIQOR Stem Cell Microarrays target the particular field of interest.

PIQOR Microarray gene lists can be downloaded from the webpage: www.miltenyibiotec.com
Please contact us for more information.

Complete gene expression profiling services

Starting with cell, tissue, or blood samples, microarray experiments are performed based on broad expression profiling expertise. The service includes whole genome, topic-defined, or custom microarrays. Detailed documentation comprises all experimental steps and interpreted results and leads to ready-to-publish data. Save time and resources with the complete service.

Comprehensive bioinformatics services

Experienced bioinformatics specialists perform the biological interpretation of gene expression data based on extensive cluster and pathway analyses. Custom bioinformatics analysis reports present the most significant biological findings and applied methods.

Note: PIQOR™ Microarray Kits are available in Europe only.

MACS® Cell Analysis—unique antibodies and new technologies

MACS® Antibodies are optimized for the evaluation of MACS Separations (MACS Control). The convenient procedure allows staining of cells during or after the magnetic cell isolation.

MACS Products for cell analysis also include

innovative and unique tools for detection or *in vivo* depletion of rare cell subsets.

Applications:

- Identification and enumeration of cells
- MACS Control
- Detection or *in vivo* depletion of rare cells

– Detection of cells according to secreted

- cytokines or intracellular antigens
- Fluorescence signal amplification
- Fixation and dead cell discrimination

Antibodies for identification, analysis, and *in vivo* depletion of mouse cells

MACS Antibody	Cell types expressing the antigen	Available format
CD3ε	T cells, NKT cells	FITC, PE, APC
CD4	T _H cells, DC subset	FITC, PE, APC
CD8a	T _C cells, DC subsets	FITC, PE, APC
CD11b	Macrophages, granulocytes, DCs, NK cells	FITC, PE, APC
CD11c	DCs	FITC, PE, APC
CD19	B cells	FITC, PE, APC
CD25	Treg cells, activated T and B cells, DCs	PE
CD40	Activated DCs, B cells, macrophages	FITC, PE, APC, pure
CD43	Leukocytes, except naive B cells	PE, APC
CD45	Leukocytes	FITC, PE, APC
CD45R(B220)	B cells, PDCs	FITC, PE, APC
CD49b(DX5)	NK cells	FITC, PE, APC
CD62L	Naive T _H and T _C cells, Treg cells, T _{CM} cells, DCs	FITC, PE, APC
CD90	T cells	FITC, PE, APC
CD117	Early stem and progenitor cells	PE, APC
CD146 (LSEC)	ECs, LSECs	FITC, biotin
CD154	Activated T _H cells	PE, APC, biotin
CD205 (DEC205)	DCs	FITC, PE, APC, biotin
Anti-H-2K ^b	MHC class I ⁺ cells	FITC
Anti-Gr-1	Granulocytes, PDCs	FITC, PE, APC, biotin
Anti-GITR	Treg cells, activated T cells	FITC, PE, APC, functional grade
Anti-Ly-6C	PDCs, subsets of T cells, monocytes, macrophages	FITC, PE, APC
Anti-MHC Class II	APCs	FITC, PE, APC
Anti-mPDCA-1	PDCs	FITC, PE, APC, biotin, pure, functional grade
Anti-Ter-119	Erythrocytes	FITC, PE, APC
Anti-Prominin-1	Neuroepithelial stem cells	PE, APC
Anti-Sca-1	Stem cells and early progenitor cells	FITC, PE, APC
Lineage Cell Detection Cocktail-Biotin	Lineage-committed, late hematopoietic progenitor cells	Biotin
Anti-FoxP3	Treg cells	PE, APC (for intracellular staining)
Anti-IL-2	T cells	PE, APC (for intracellular staining)
Anti-INF-γ	T cells, NK cells	PE, APC (for intracellular staining)
Anti-TNF-α	T cells, DCs, macrophages	FITC, PE (for intracellular staining)

Indirect labeling



Anti-Biotin
 FITC #130-090-857
 PE #130-090-756
 APC #130-090-856

Fluorescence amplification



FASER Kit
 FITC #130-091-763
 PE #130-091-764
 APC #130-091-762

Dead cell staining



Fixation and Dead Cell Discrimination Kit
 #130-091-163

Intracellular staining

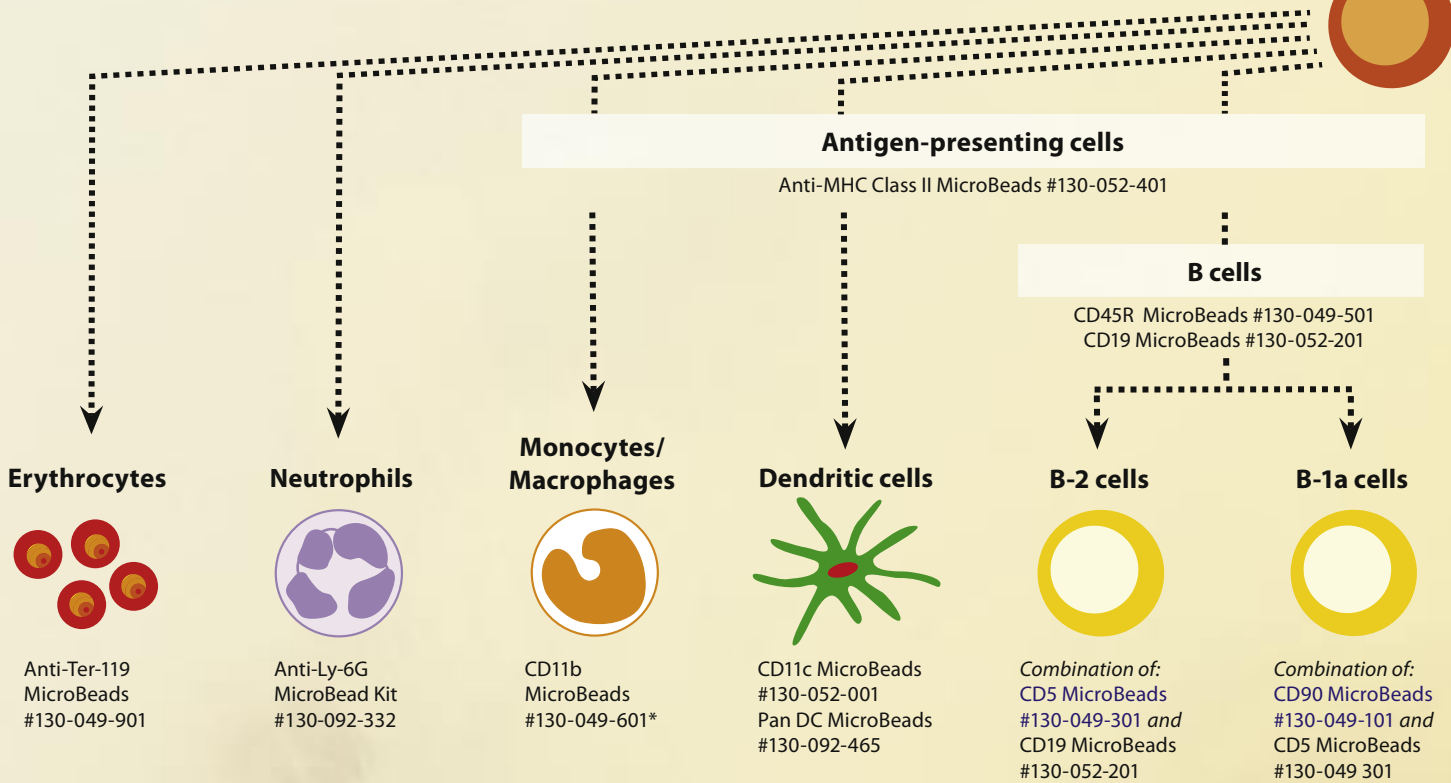


Inside Stain Kit
 #130-090-477

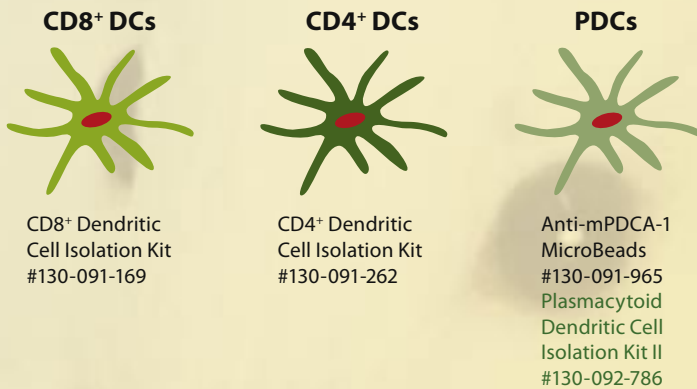
Mouse cell isolation



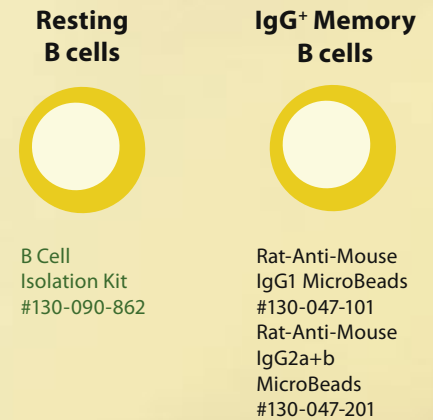
Stem and progenitor



Dendritic cell subsets



B-2 cell subsets



Leukocytes

CD45 MicroBeads #130-052-301

Endothelial cell



CD146 (LSEC) MicroBeads #130-092-007

Plasma cells



CD138⁺ Plasma Cell Isolation Kit #130-092-530

cells

CD117 MicroBeads	#130-091-224	CD105 MultiSort Kit (PE)	#130-092-924
Anti-Sca-1 MicroBead Kit	#130-092-529	Lineage Cell Depletion Kit	#130-090-858
Anti-Prominin-1 MicroBeads	#130-092-333		

T cells

CD90 MicroBeads #130-049-101
 CD5 MicroBeads #130-049-301**
 Pan T Cell Isolation Kit # 130-090-861

TH cells



CD4 MicroBeads
 #130-049-201
 CD4⁺T Cell
 Isolation
 Kit #130-090-860

Tc cells



CD8a MicroBeads
 #130-049-401
 CD8⁺T Cell
 Isolation
 Kit #130-090-859

Treg cells



CD4⁺CD25⁺
 Regulatory
 T Cell Isolation
 Kit #130-091-041

γ/δ T cells



TCRγ/δ⁺ T Cell
 Isolation Kit
 #130-092-125

NK cells



CD49b (DX5)
 MicroBeads
 #130-052-501
 NK Cell
 Isolation Kit
 #130-090-864

T cell subsets

**Naive
T cells**



CD62L
 MicroBeads
 #130-049-701
 CD4⁺CD62L⁺
 T Cell Isolation Kit II
 #130-093-227

**Effector/Memory
T cells**



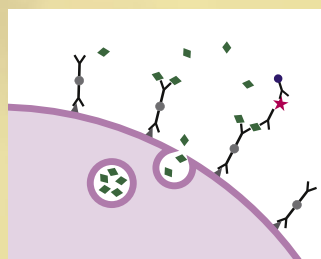
CD62L
 MicroBeads
 #130-049-701

**Activated
T cells**



CD25 MicroBead Kit
 #130-091-072
 CD154 Enrichment
 and Detection Kit
 #130-093-129

Pre-selection with:
 CD4⁺ or CD8⁺ T Cell Isolation Kit



Cytokine-secreting leukocytes

Cytokine Secretion Assay –
 Cell Enrichment and Detection Kits

IFN-γ Secretion Assay	#130-090-517
IL-2 Secretion Assay	#130-090-492
IL-4 Secretion Assay	#130-090-515
IL-5 Secretion Assay	#130-091-175
IL-10 Secretion Assay	#130-090-490

These kits are also available for detection only.

**Color code for the use of
MACS® MicroBeads and Kits**

- Positive selection (labeling of target cells)
- Depletion (labeling for removal of an unwanted cell type)
- Isolation of untouched cells using a depletion cocktail

Antigen also expressed on:

- * NK cells, granulocytes, B-1 cells, DCs
- ** B-1a cells
- *** T cell subset
- **** NK cell subset



Special protocols for preparation of single-cell suspensions from different mouse lymphoid and non-lymphoid tissues can be downloaded from our website. Furthermore, lists of scientific publications describing a wide range of downstream applications for cells isolated by MACS® Technology are available.

New application protocols, customer reports, or recent reports from the R&D department of Miltenyi Biotec are regularly published in our newsletter MACS&more.

For further information, please contact the Miltenyi Biotec specialists in your country or the technical support team at macstec@miltenyibiotec.de



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