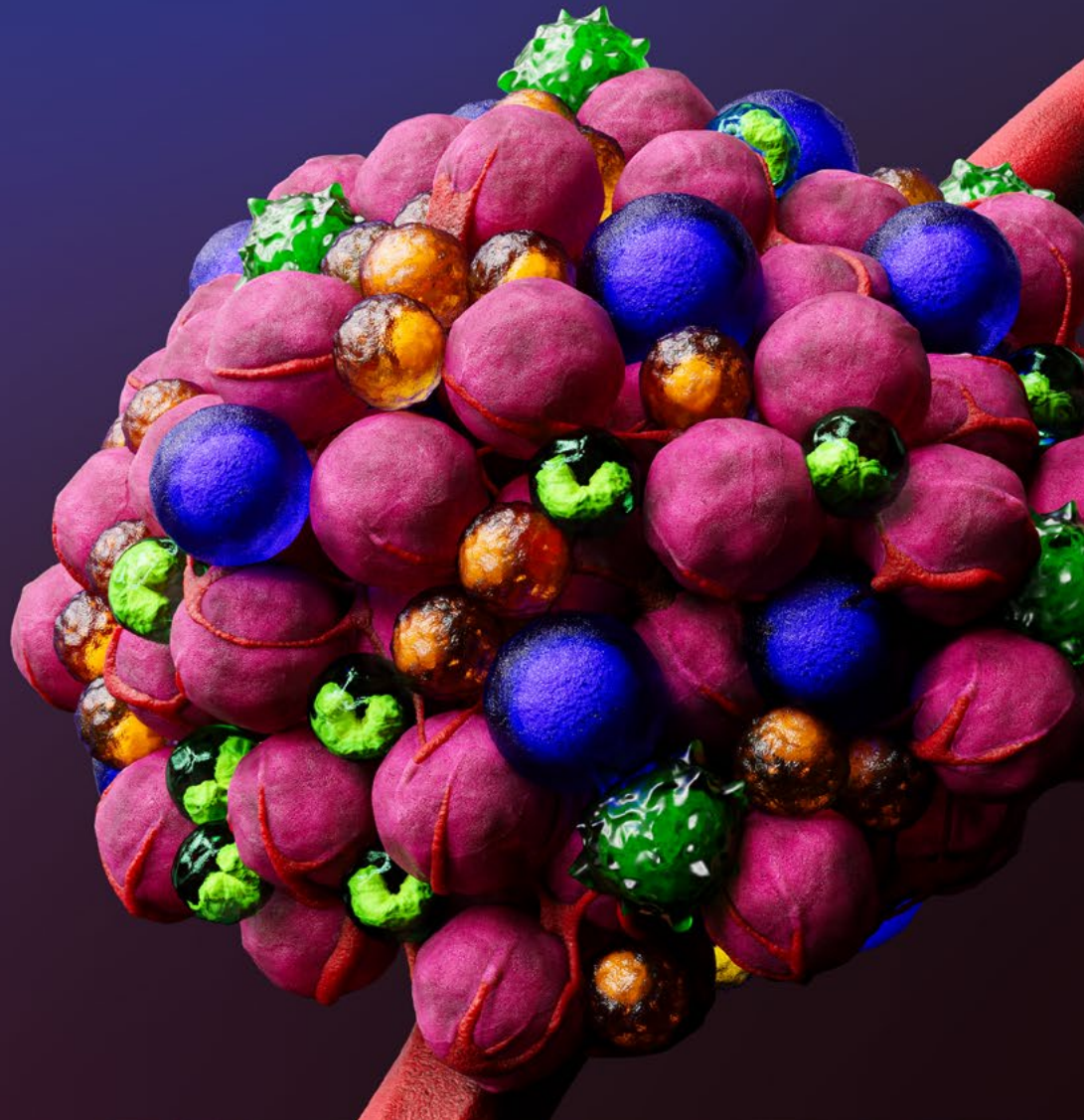


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Myeloid-derived Suppressor Cells

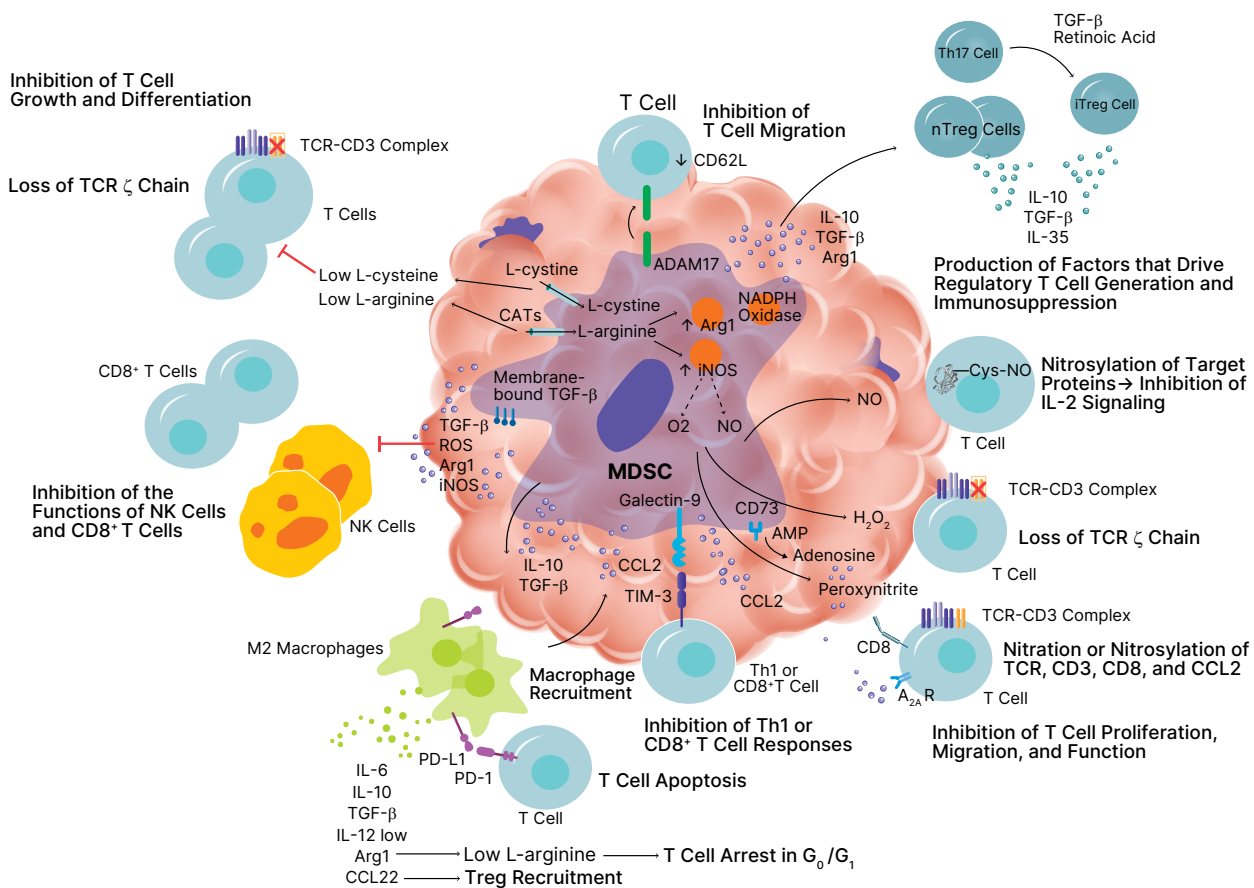


Myeloid-derived Suppressor Cells

Myeloid-derived suppressor cells (MDSCs) are a heterogeneous population of immature myeloid progenitor cells that fail to differentiate into granulocytes, macrophages, or dendritic cells. These immature cells have the capacity to suppress immune responses mediated by natural killer cells, CD8⁺ and CD4⁺ T cells. MDSCs accumulate in the blood, bone marrow, and secondary lymphoid organs of tumor-bearing mice and cancer patients, where circulating levels of MDSCs have been shown to correlate with clinical stage, metastatic burden, and chemoresistance. As a result, these cells have been suggested to have a causative role in promoting tumor-associated immunosuppression. In mouse, MDSCs are broadly defined as CD11b⁺ Gr-1⁺ cells, but the relative expression levels of Ly-6G and Ly-6C define two specific subsets known as granulocytic and monocytic MDSCs. Mouse granulocytic MDSCs are CD11b⁺ Gr-1/Ly-6G^{high} Ly-6C^{low}, while monocytic MDSCs are CD11b⁺ Gr-1/Ly-6G^{low} Ly-6C^{high}. Human MDSCs also commonly express CD11b along with Siglec-3/CD33 and lack HLA-DR and the lineage markers CD3, CD14, CD19, and CD56. Similar to mouse, human granulocytic (Lin⁻ CD11b⁺ CD14⁻ CD15⁺ CD33⁺ CD66b⁺ HLA-DR⁻) and monocytic (Lin⁻ CD11b⁺ CD14⁺ CD15⁻ CD33⁺ CD66b⁻ HLA-DR⁻) subsets have been identified, but they are based on the differential expression of CD14, CD15, and CD66b/CEACAM-8.

MDSCs are of great interest due to their immunosuppressive properties. While the mechanism by which MDSCs inhibit NK cells is currently not well-understood, multiple pathways are responsible for MDSC-mediated T cell suppression including production of arginase 1/ARG1 and upregulation of nitric oxide synthase 2 (iNOS). ARG1 and iNOS metabolize L-arginine and either together, or separately, cause the loss of the TCR zeta chain, promote nitration or nitrosylation of TCR, CD3, CD8, and CCL2, disrupt IL-2 signaling, and inhibit T cell proliferation. Additionally, MDSCs secrete immunosuppressive cytokines and induce regulatory T cell development. Although it is now evident that MDSCs are a major obstacle for immunotherapy, further characterization is necessary to determine how MDSCs accumulate, how they function, and mechanisms by which they can be inhibited. [R&D Systems](#), [Novus Biologicals](#), and [Tocris Biosciences](#) together offer a wide range of products for characterizing MDSCs and studying their functions.

MDSC-Mediated Mechanisms of Immunosuppression



Mouse Markers

	Granulocytic MDSCs	Monocytic MDSCs
CD11b/ Integrin α M	+	+
Gr-1/Ly-6G	+	-
Ly-6C	-	+

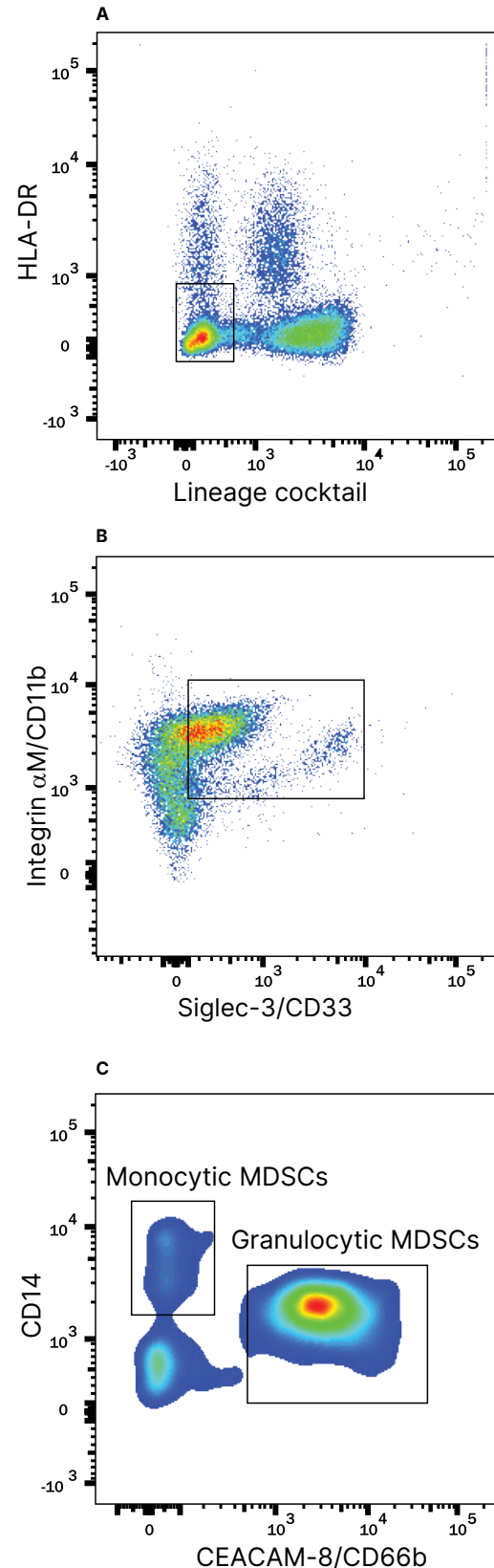
Human Markers

	Granulocytic MDSCs	Monocytic MDSCs
Lin	-	-
CD11b/ Integrin α M	+	+
CD33	+	+
HLA-DR	-	-

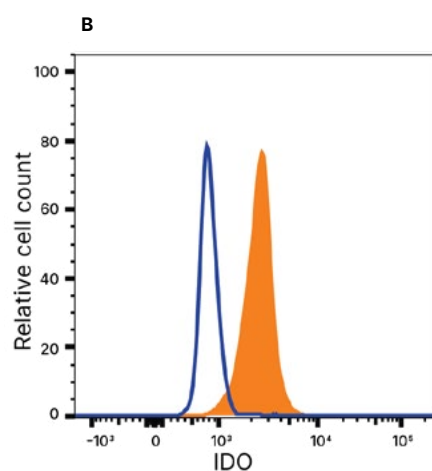
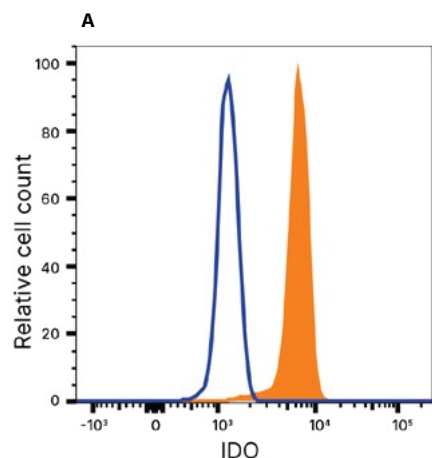
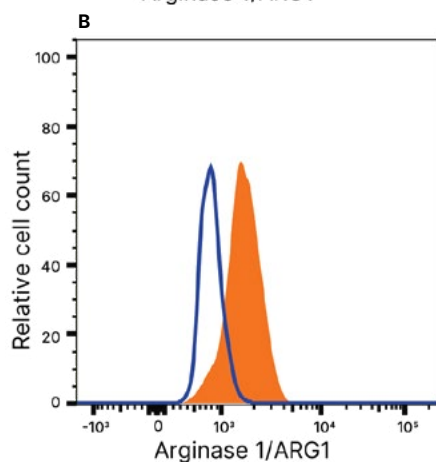
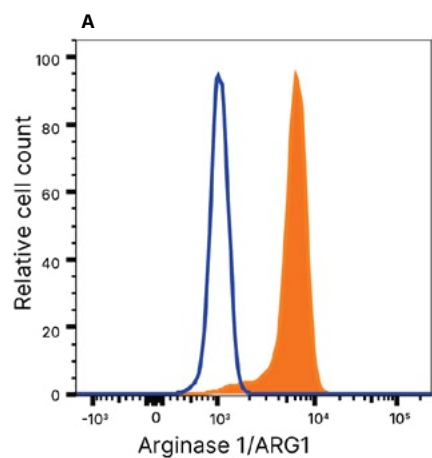
	Granulocytic MDSCs	Monocytic MDSCs
CD14	-	+
CD15	+	-
CD66b/ CEACAM-8	+	-

Analysis of Human Granulocytic and Monocytic MDSCs by Flow Cytometry

Identification of Human Granulocytic and Monocytic Myeloid-derived Suppressor Cells by Flow Cytometry. (A) Lin⁻/HLA-DR⁻ cells were detected in human peripheral blood mononuclear cells by staining with a lineage cocktail containing Alexa Fluor® 700-conjugated Mouse Anti-Human CD3ε and CD19 Monoclonal Antibodies (R&D Systems, Catalog # FAB100N and # FAB4867N, respectively) and an Alexa Fluor 750-conjugated Mouse Anti-Human HLA-DR Monoclonal Antibody (R&D Systems, Catalog # FAB4869S). Lin⁻/HLA-DR⁻ cells were gated. (B) CD11b⁺/CD33⁺ cells were detected in the Lin⁻/HLA-DR⁻ cell population by staining with an APC-conjugated Mouse Anti-Human Siglec-3/CD33 Monoclonal Antibody (R&D Systems, Catalog # FAB1137A) and an Alexa Fluor 405-conjugated Mouse Anti-Human Integrin αM/CD11b Monoclonal Antibody (R&D Systems, Catalog # FAB16991V). CD11b⁺/CD33⁺ cells were gated. (C) Human granulocytic myeloid-derived suppressor cells (Lin⁻/CD11b⁺/CD14⁻/CD33⁻/CEACAM-8⁺/HLA-DR⁻) and monocytic myeloid-derived suppressor cells (Lin⁻/CD11b⁺/CD14⁺/CD33⁺/CEACAM-8⁻/HLA-DR⁻) were detected in the Lin⁻/HLA-DR⁻/CD11b⁺/CD33⁺ cell population by staining with a PE-conjugated Mouse Anti-Human CEACAM-8/CD66b Monoclonal Antibody (R&D Systems, Catalog # FAB4246P) and a PerCP-conjugated Mouse Anti-Human CD14 Monoclonal Antibody (R&D Systems, Catalog # FAB3832C).



Alexa Fluor® is a registered trademark of Molecular Probes, Inc., Eugene, OR.



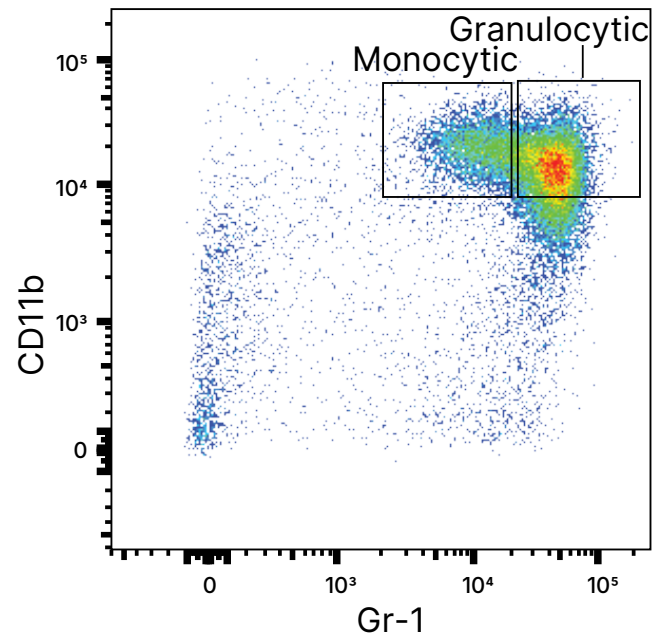
Detection of Arginase 1 Expression in Human Granulocytic and Monocytic Myeloid-derived Suppressor Cells by Flow Cytometry.

Following identification of myeloid-derived suppressor cells (MDSCs) by flow cytometry, expression of Arginase 1 in the gated **(A)** granulocytic ($\text{Lin}^-/\text{CD11b}^+/\text{CD14}^-/\text{CD33}^+/\text{CEACAM-8}^+/\text{HLA-DR}^-$) and **(B)** monocytic ($\text{Lin}^-/\text{CD11b}^+/\text{CD14}^+/\text{CD33}^+/\text{CEACAM-8}^-/\text{HLA-DR}^-$) MDSC populations was determined by staining with an Alexa Fluor 488-conjugated Mouse Anti-Human Arginase 1/ARG1 Monoclonal Antibody (R&D Systems, Catalog # IC8026G; filled histograms) or an Alexa Fluor 488-conjugated Mouse IgG_{2B} Isotype Control (R&D Systems, Catalog # IC0041G; open histograms).

Detection of IDO in Human Granulocytic and Monocytic Myeloid-derived Suppressor Cells by Flow Cytometry.

Following identification of myeloid-derived suppressor cells (MDSCs) by flow cytometry, expression of Indoleamine 2,3-dioxygenase/IDO in the gated **(A)** granulocytic ($\text{Lin}^-/\text{CD11b}^+/\text{CD14}^-/\text{CD33}^+/\text{CEACAM-8}^+/\text{HLA-DR}^-$) and **(B)** monocytic ($\text{Lin}^-/\text{CD11b}^+/\text{CD14}^+/\text{CD33}^+/\text{CEACAM-8}^-/\text{HLA-DR}^-$) MDSC populations was determined by staining with an Alexa Fluor 488-conjugated Mouse Anti-Human Indoleamine 2,3-dioxygenase/IDO Monoclonal Antibody (R&D Systems, Catalog # IC6030G; filled histograms) or an Alexa Fluor 488-conjugated Mouse IgG₁ Isotype Control (R&D Systems, Catalog # IC002G; open histograms).

Analysis of Mouse Granulocytic and Monocytic MDSCs by Flow Cytometry



Identification of Mouse Monocytic and Granulocytic Myeloid-derived Suppressor Cells by Flow Cytometry.

Mouse monocytic (CD11b⁺/Gr-1^{low/mid}/Ly6C⁺) and granulocytic (CD11b⁺/Gr-1^{high}/Ly6C⁻) myeloid-derived suppressor cells (MDSCs) from C57BL/6 mouse bone marrow cells were identified by staining with an APC-conjugated Rat Anti-Mouse Gr-1/Ly-6G Monoclonal Antibody (R&D Systems, Catalog # FAB1037A) and a PE-conjugated Rat Anti-Mouse Integrin α M/CD11b Monoclonal Antibody (R&D Systems, Catalog # FAB1124P). CD11b⁺/Gr-1^{low/mid} and CD11b⁺/Gr-1^{high} cells were gated to show the two populations of MDSCs.

Fluorochrome-conjugated & Unlabeled Antibodies from R&D Systems and Novus Biologicals

R&D Systems and Novus Biologicals offer a wide selection of unlabeled and fluorochrome-conjugated antibodies for the identification and characterization of mouse and human MDSCs.

Antibodies for Select Positive and Negative Markers used to Identify Granulocytic and Monocytic MDSCs by Flow Cytometry

Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)										
Molecule	Species	Clone					Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
			APC	Fluorescein	PE	PerCP	488	700		
									350/405/594/647/750	
CD3	Human	UCHT1	FAB100A	FAB100F	FAB100P	FAB100C	FAB100G	FAB100N	FAB100V/ FAB100T/ FAB100R/ FAB100S	MAB100 (FA, FC, ICC/IF, IP)
	Mouse	17A2	FAB4841A	FAB4841F	FAB4841P	FAB4841AC	FAB4841G	FAB4841N	FAB4841V/ FAB4841T/ FAB4841R/ FAB4841S	MAB4841 (FA, FC, ICC/IF, IHC, IP)
	Mouse	145-2C11					FAB484G	FAB484N	FAB484U/ FAB484V/ FAB484T/ FAB484R/ FAB484S	MAB484 (Depl, FA, FC, IP)
CD14	Human	134620	FAB3832A	FAB3832F	FAB3832P	FAB3832C	FAB3832G	FAB3832N	FAB3832V/ FAB3832T/ FAB3832R/ FAB3832S	MAB3832 (B/N, FC, WB)
	Human	M5E2	NB100-77758APC	NB100-77759	NB100-77758PE	NB100-77758PCP	NB100-77758AF488	NB100-77758AF700	NB100-77758AF405/ NB100-77758AF647	NB100-77758 (FC, ICC/IF, IHC)
CD15/Lewis X	Human	ICRF 29-2					FAB7368G	FAB7368N	FAB7368U/ FAB7368V/ FAB7368T/ FAB7368R/ FAB7368S	MAB7368 (FC)
CEACAM-8/CD66b	Human	913542					FAB4246G	FAB4246N	FAB4246V/ FAB4246T/ FAB4246R/ FAB4246S	MAB4246 (FC, WB)
Gr-1/Ly-6G	Mouse	RB6-8C5	FAB1037A	FAB1037F	FAB1037P	FAB1037C	FAB1037G	FAB1037N	FAB1037V/ FAB1037R/ FAB1037S	MAB1037 (FC, ICC/IF, IHC, IP)
HLA-DR	Human	L203	FAB4869A		FAB4869P	FAB4869C	FAB4869G	FAB4869N	FAB4869V/ FAB4869T/ FAB4869R/ FAB4869S	MAB4869 (FC)
	Human	L243	NB100-77855APC	NB100-77856	NB100-77855PE	NB100-77855PCP	NB100-77855AF488	NB100-77855AF700	NB100-77855AF405/ NB100-77855AF647	NB100-77855 (FC, IHC, IP, WB)
Ly-6C	Mouse	HK1.4	NBP1-28046APC	NBP1-28047	NBP1-28046PE	NBP1-28046PCP	NBP1-28046AF488	NBP1-28046AF700	NBP1-28046AF405/ NBP1-28046AF647	NBP1-28046 (FC, IV)
Integrin αM/CD11b	Human	ICRF44					FAB1699G	FAB1699N	FAB1699U/ FAB1699V/ FAB1699T/ FAB1699R/ FAB1699S	MAB1699 (FC, ICC/IF, IHC)
		238446					FAB16991G	FAB16991N	FAB16991V/ FAB16991T/ FAB16991R/ FAB16991S	MAB16991 (FC, ICC/IF)
	Mouse	M1/70	FAB1124A	FAB1124F	FAB1124P		FAB1124G	FAB1124N	FAB1124V/ FAB1124T/ FAB1124R/ FAB1124S	MAB1124 (FC, ICC/IF, IHC, IP)
Siglec-3/CD33	Human	6C5/2	FAB1137A		FAB1137P		FAB1137G	FAB1137N	FAB1137U/ FAB1137V/ FAB1137T/ FAB1137R/ FAB1137S	MAB1137 (FC, WB)

Application Key: B/N Blocking/Neutralization ChIP Chromatin Immunoprecipitation Depl Depletion E ELISA FA Functional Assay FC Flow Cytometry ICC/IF Immunocytochemistry/Immunofluorescence IHC Immunohistochemistry IV In vitro IP Immunoprecipitation WB Western Blot

- R&D Systems product
- Novus Biologicals product

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization

Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)										
Molecule	Species	Clone	APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
							488	700		
5' Nucleotidase/CD73	Human	606112	FAB5795A		FAB5795P		FAB5795G	FAB5795N	FAB5795V/ FAB5895T/ FAB5795R/ FAB5795S	MAB5795 (FC) NBP2-48480 (FC, IHC)
	Human	AD2	NBP2-48480APC	NBP2-48480F	NBP2-48480PE		NBP2-48480AF488	NBP2-48480AF700	NBP2-48480AF405/ NBP2-48480AF594/ NBP2-48480AF647/ NBP2-48480AF750	
	Mouse	496406		FAB4488F			FAB4488G	FAB4488N	FAB4488V/ FAB4488T/ FAB4488R/ FAB4488S	MAB4488 (FC)
ADAM17/TACE	Human	11633			FAB9301P		FAB9301G	FAB9301N	FAB9301V/ FAB9301T/ FAB9301R/ FAB9301S	MAB9301 (FC, IP, WB)
2B4/CD244/SLAMF4	Human	999602					FAB10393G	FAB10393N	FAB10393V/ FAB10393T/ FAB10393R/ FAB10393S	MAB10393 (B/N, FC)
	Mouse	Polyclonal								AF1050 (FC, IHC, WB)
Aminopeptidase N/CD13	Human	WM-15						FAB8284N		
	Mouse	Polyclonal								AF2335 (FC, ICC/IF, IP, WB)
Arginase 1/ARG1	Human	658922	IC8026A		IC8026P	IC8026C	IC8026G	IC8026N		MAB58681 (FC)
	Human/ Mouse	Polyclonal	IC5868A	IC5868F	IC5868P			IC5868N		
B7-2/CD86	Human	37301	FAB141A	FAB141F	FAB141P			FAB141N	FAB141T/ FAB141R	MAB141 (B/N, FC, WB)
B7-H1/PD-L1	Human	130021	FAB1561A		FAB1561P	FAB1561C	FAB1561G	FAB1561N	FAB1561V/ FAB1561T/ FAB1561R	MAB1561 (FC, IHC)
	Mouse	Polyclonal	FAB1019A							AF1019 (FC, IHC, WB)
CCR2	Human	48607	FAB151A		FAB151P	FAB151C	FAB151G	FAB151N		MAB150 (FC, IHC)
	Mouse	475301	FAB5538A	FAB5538F	FAB5538P		FAB5538G	FAB5538N	FAB5538T/ FAB5538R/ FAB5538S	
CX3CR1	Mouse	Polyclonal	FAB5825A		FAB5825P		FAB5825G			AF5825 (FC, WB)
CXCR2/IL-8 RB	Human	48311	FAB331A	FAB331F	FAB331P		FAB331G	FAB331N	FAB331V/ FAB331T/ FAB331R/ FAB331S	MAB331 (B/N, FC, IHC)
	Mouse	242216	FAB2164A		FAB2164P		FAB2164G	FAB2164N	FAB2164V/ FAB2164T/ FAB2164R/ FAB2164S	MAB2164 (B/N, FC)
CXCR4	Human	12G5	FAB170A	FAB170F	FAB170P		FAB170G		FAB170T/ FAB170R/ FAB170S	MAB170 (B/N)
	Human	44717	FAB173A		FAB173P		FAB173G	FAB173N	FAB173V/ FAB173T/ FAB173R/ FAB173S	MAB173 (B/N, FC)
	Mouse	247506	FAB21651A	FAB21651F	FAB21651P		FAB21651G	FAB21651N	FAB21651V/ FAB21651T/ FAB21651R/ FAB21651S	MAB21651 (B/N, FC, ICC/IF, IHC)
CD1d	Mouse	1B1	NBP1-43461APC		NBP1-43461PE	NBP1-43461PCP	NBP1-43461AF488	NBP1-43461AF700	NBP1-43461AF405/ NBP1-43461AF647	NBP1-43461 (FC, IHC, IP)

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization (cont.)

Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)										
Molecule	Species	Clone	APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
							488	700		
									405/594/647/750	
CD19	Human	4G7-2E3	FAB4867A	FAB4867F	FAB4867P	FAB4867C	FAB4867G	FAB4867N	FAB4867T/ FAB4867R/ FAB4867S	MAB4867 (FC)
	Human	CB19	NBP2-25196APC	NBP2-25196F	NBP2-26646	NBP2-25196PCP	NBP2-25196AF488	NBP2-25196AF700	NBP2-25196AF405/ NBP2-25196AF647	NBP2-25196 (FC, ICC/IF, IHC, IV, WB)
	Mouse	1D3	NBP2-24968	NBP2-24967	NBP2-24966	NBP2-24965PCP	NBP2-24965AF488	NBP2-24965AF700	NBP2-24965AF405/ NBP2-24965AF647	NBP2-24965 (FC)
CD31/PECAM-1	Mouse	693102				FAB6874G			MAB3628 (FC)	
CD34	Human	QBEnd10	FAB7227A		FAB7227P		FAB7227G	FAB7227N	FAB7227V/ FAB7227T/ FAB7227R/ FAB7227S	
	Human	756510					FAB72271G	FAB72271N	FAB72271V/ FAB72271T/ FAB72271R/ FAB72271S	MAB72271 (FC, ICC/IF)
CD39/ENTPD1	Human	498403	FAB4397A				FAB4397G	FAB4397N	FAB4397V/ FAB4397T/ FAB4397R/ FAB4397S	MAB4397 (FC)
	Mouse	495826	FAB4398A				FAB4398G	FAB4398N	FAB4398V/ FAB4398T/ FAB4398R/ FAB4398S	MAB4398 (FC, IP, WB)

Application Key: B/N Blocking/Neutralization ChiP Chromatin Immunoprecipitation Depl Depletion
 E ELISA FA Functional Assay FC Flow Cytometry ICC/IF Immunocytochemistry/Immunofluorescence
 IHC Immunohistochemistry IV *In vitro* IP Immunoprecipitation WB Western Blot

- R&D Systems product
- Novus Biologicals product

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization

Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)										
Molecule	Species	Clone					Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
			APC	Fluorescein	PE	PerCP	488	700	405/594/647/750	
CD45	Human	2D1	FAB1430A		FAB1430P	FAB1430C	FAB1430G	FAB1430N	FAB1430V/FAB1430T/ FAB1430R/FAB1430S	MAB1430 (FC, ICC/IF)
	Mouse	30-F11	FAB114A	FAB114F			FAB114G	FAB114N	FAB114V/FAB114R	MAB114 (FA, FC, IHC, IP)
CD117/c-kit	Human	47233	FAB332A		FAB332P		FAB332G	FAB332N		MAB332 (B/N, E, FC, WB)
	Human/ Mouse	2B8	NB100-7747APC	NB100-77477F	NB100-77477PE	NB100-77477PCP	NB100-77477AF488	NB100-77477AF700	NB100-77477AF405/ NB100-77477AF647	NB100-77477 (FC, IHC, IP)
	Mouse	180627	FAB1356A		FAB1356P		FAB1356G	FAB1356N	FAB1356V/FAB1356T/ FAB1356R/FAB1356S	MAB1356 (FC, IHC, WB)
F4/80/EMR1	Mouse	521204	FAB5580A		FAB5580P		FAB5580G	FAB5580N	FAB5580V/ FAB5580T/ FAB5580R/FAB5580S	MAB5580 (FC, ICC/IF)
	Mouse	Cl-A3-1	NB600-404APC		NB600-404PE	NB600-404PCP	NB600-404AF488	NB600-404AF700	NB600-404AF405/ NB600-404AF647	NB600-404 (FC, ICC/IF, IHC, WB)
Fcγ RIII/CD16	Human	245536	FAB2546A	FAB2546F	FAB2546P	FAB2546C	FAB2546G	FAB2546N	FAB2546V/ FAB2546T/ FAB2546R/FAB2546S	MAB2546 (FC)
	Mouse	275003	FAB19601A	FAB19601F	FAB19601P	FAB19601C	FAB19601G	FAB19601N	FAB19601V/ FAB19601T/ FAB19601R/ FAB19601S	MAB19601 (FC)
Galectin-9	Mouse	766428					IC3535G	IC3535N	IC3535V/IC3535T/ IC3535R/IC3535S	MAB3535 (FC, IHC)
GM-CSF Rα	Human	31916	FAB706A				FAB706G	FAB706N	FAB706V/FAB706T/ FAB706R/FAB706S	MAB706 (FC, WB)
	Mouse	698423	FAB6130A		FAB6130P		FAB6130G	FAB6130N	FAB6130V/FAB6130T/ FAB6130R/FAB6130S	MAB6130 (B/N, FC, ICC/IF)
ICAM-1/CD54	Mouse	166623			FAB796P					MAB796 (E, WB)
IFN-γ RI/CD119	Human	92101		FAB673F	FAB673P					MAB6731 (B/N, FC, WB)
IL-4 Rα/CD124	Human	25463	FAB230A		FAB230P		FAB230G	FAB230N	FAB230V/FAB230T/ FAB230R/FAB230S	MAB230 (B/N, FC, IHC, WB)
	Mouse	Polyclonal			FAB530P					AF530 (FC, WB)
Indoleamine 2,3-dioxygenase/IDO	Human	700838	IC6030A		IC6030P	IC6030C	IC6030G		IC6030V/IC6030T/ IC6030R/IC6030S	MAB6030 (FC, ICC/IF)
Integrin α4/CD49d	Human	7.2R			FAB1354P		FAB1354G	FAB1354N	FAB1354V/FAB1354T/ FAB1354R/FAB1354S	MAB1354 (FC, ICC/IF)
L-Selectin/CD62L	Human	DREG56	NBP1-42795APC	NBP1-42791	NBP1-42795PE	NBP1-42795PCP	NBP1-42795AF488	NBP1-42795AF700	NBP1-42795AF405/ NBP1-42795AF647	NBP1-42795 (FA, FC, IHC, IP, WB)
	Mouse	95218		FAB5761F			FAB5761G	FAB5761N	FAB5761V/FAB5761T/ FAB5761R/FAB5761S	MAB5761 (FC)
M-CSF R/CD115	Human	61708	FAB329A		FAB329P		FAB329G	FAB329N	FAB329V/FAB329T/ FAB329R/FAB329S	MAB329 (FC)
	Mouse	460615	FAB3818A		FAB3818P		FAB3818G	FAB3818N	FAB3818V/FAB3818T/ FAB3818R/FAB3818S	MAB3818 (FC)
	Mouse	AFS98	NBP1-43363APC		NBP1-43363PE	NBP1-43363PCP	NBP1-43363AF488	NBP1-43363AF700	NBP1-43363AF405/ NBP1-43363AF647	NBP1-43363 (B/N, FA, FC, IHC, WB)

Application Key: B/N Blocking/Neutralization **ChiP** Chromatin Immunoprecipitation **Depl** Depletion
E ELISA **FA** Functional Assay **FC** Flow Cytometry **ICC/IF** Immunocytochemistry/Immunofluorescence
IHC Immunohistochemistry **IV** *In vitro* **IP** Immunoprecipitation **WB** Western Blot

● R&D Systems product
● Novus Biologicals product

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization

Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)										
Molecule	Species	Clone	APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
							488	700		
NCAM-1/CD56	Human	301040	FAB2408A		FAB2408P		FAB2408G	FAB2408N	FAB2408V/ FAB2408T/ FAB2408R/ FAB2408S	MAB2408 (E, FC, WB)
	Human	123C3	NBP2-33132APC		NBP2-33132PE	NBP2-33132PCP	NBP2-33132AF488	NBP2-33132AF700	NBP2-33132AF405/ NBP2-33132AF647	NBP2-15184 (E, FC, ICC/IF, IHC, IP, WB)
	Mouse	809220	FAB7820A		FAB7820P		FAB7820G	FAB7820N	FAB7820V/ FAB7820T/ FAB7820R/ FAB7820S	MAB7820 (FC, WB)
STAT1	Human	246523	IC1490A				IC1490G	IC1490N	IC1490V/ IC1490T/ IC1490R/ IC1490S	MAB1490 (FC, ICC/IF)
STAT3	Human/ Mouse	232209		IC1799F	IC1799P		IC1799G	IC1799N	IC1799V/ IC1799T/ IC1799R/ IC1799S	MAB1799 (FC, ICC/IF, IP, WB)
VEGFR1/Flt-1	Human	49560	FAB321A		FAB321P		FAB321G	FAB321N	FAB321V/ FAB321T/ FAB321R/ FAB321S	MAB321 (FC, WB)
	Mouse	141522	FAB4711A		FAB4711P		FAB4711G	FAB4711N	FAB4711V/ FAB4711T/ FAB4711R/ FAB4711S	MAB4711 (FC, WB)

Select Recombinant Proteins for Inducing MDSC-like Cells *in vitro*

Recombinant Proteins & ELISA Kits from R&D Systems

R&D Systems portfolio includes recombinant proteins for generating MDSC-like cells from bone marrow-derived cells and ELISA Kits for detecting molecules that affect MDSC proliferation or promote immunosuppression.

Molecule	Species	Catalog#
G-CSF	Human	214-CS
	Mouse	414-CS
GM-CSF	Human	215-GM
	Mouse	415-ML
IL-4	Human	BT-004
	Mouse	404-ML
IL-6	Human	206-IL
	Mouse	406-ML
IL-13	Human	213-ILB
	Mouse	413-ML

* Recombinant Human G-CSF, GM-CSF, IL-4, and IL-6 are also available as Animal-Free™ proteins and GMP-grade proteins with the exception of G-CSF.

Select ELISAs for Detecting Molecules Secreted by MDSCs or Molecules in the Tumor Microenvironment that Affect MDSCs

Molecule	Species	Quantikine® ELISA Catalog #	DuoSet® ELISA Catalog #
G-CSF	Human	DCS50	DY214
	Mouse	MCS00	DY414
GM-CSF	Human	DGM00	DY215
	Mouse	MGM00	DY415
IFN-γ	Human	DIF50C	DY285B
	Mouse	MIF00	DY485
IL-1β	Human	DLB50	DY201
	Mouse	MLB00C	DY401
IL-4	Human	D4050	DY204
	Mouse	M4000B	DY404
IL-6	Human	D6050B	DY206
	Mouse	M6000B	DY406
IL-10	Human	D1000B	DY217B
	Mouse	M1000B	DY417
IL-13	Human	D1300B	DY240
	Mouse	M1300CB	DY413
TGF-β1	Human	DB100C	DY240
	Mouse		DY1679
TNF-α	Human	DTA00D	DY210
	Mouse	MTA00B	DY410
VEGF	Human	DVE00	DY293B
	Mouse	MMV00	DY493

In addition to the single analyte ELISAs listed above, we also offer the membrane-based Proteome Profiler™ Human XL Cytokine Array (R&D Systems, Catalog # ARY022B) and Mouse XL Cytokine Array (R&D Systems, Catalog # ARY028), as well as bead-based Luminex® Screening and Performance Assays, which can be used to simultaneously detect most or all of these analytes.

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Tocris Small Molecules for Myeloid-derived Suppressor Cell Research

Tocris Biosciences offers a large selection of small molecules that can be used to study MDSC functions.

Reported Activity on MDSCs*	Product Name	Catalog#	Product Description
Promote MDSC Differentiation	AM 580	0760	Retinoic acid analog; RARα agonist
	Calcipotriol	2700	Analog of Vitamin D ₃
	Calcitriol	2551	Vitamin D receptor (VDR) agonist
Decrease MDSC Levels	Retinoic Acid/ ATRA	0695	Endogenous retinoic acid receptor agonist
	Axitinib	4350	Potent inhibitor of VEGF R2, R3, and R1
	Docetaxel	4056	Leads to cell cycle arrest; exhibits cytotoxic activity
	5-Fluorouracil	3257	Inhibits RNA and DNA synthesis; cytotoxic
	Gemcitabine	3259	Deoxycytidine analog that inhibits DNA synthesis
	Sunitinib	3768	Potent VEGFR, PDGFRβ, and KIT Inhibitor
Inhibit MDSC Function	AMD 3100	3299**	Highly selective CXCR4 antagonist
	CDDO Im	4737	Nrf signaling inhibitor; immunomodulator
	Celecoxib	3786	Selective COX-2 inhibitor
	NS 398	0942	COX-2 inhibitor
	SB 225002	2725***	Potent and selective CXCR2 antagonist
Sildenafil	3784	Orally active, potent PDE5 inhibitor	

The reported activity on MDSCs is based on a publication by Najjar, Y.G. & J.H. Finke (2013) *Front. Oncol.* **3**:49., except where indicated. ** Grabner B. *et al.* (2015) *Nat. Commun.* **6**:6285. *** Talmadge J.E. & D.I. Gabrilovich (2013) *Nat. Rev. Cancer* **10**:739.

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