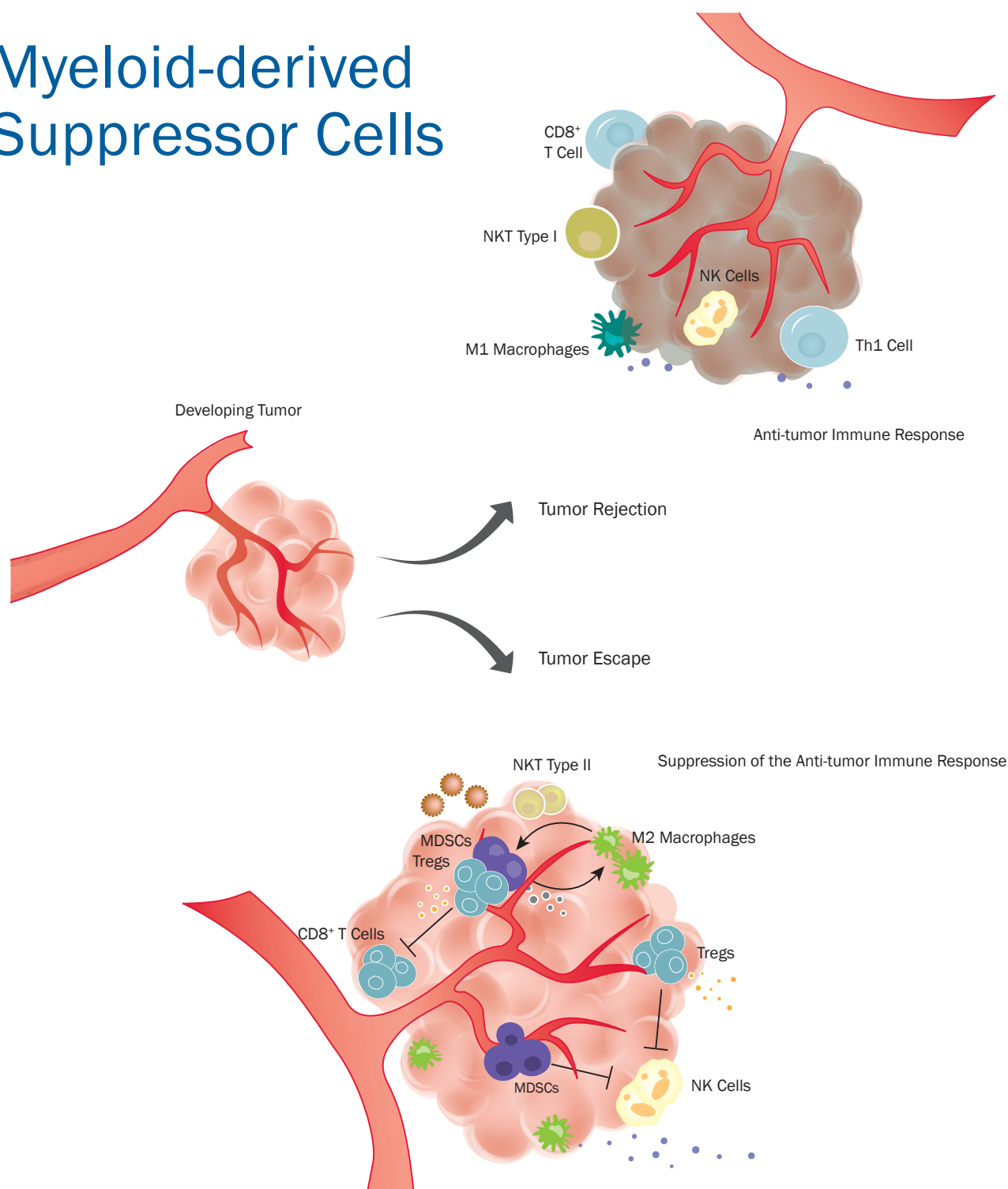


Myeloid-derived Suppressor Cells

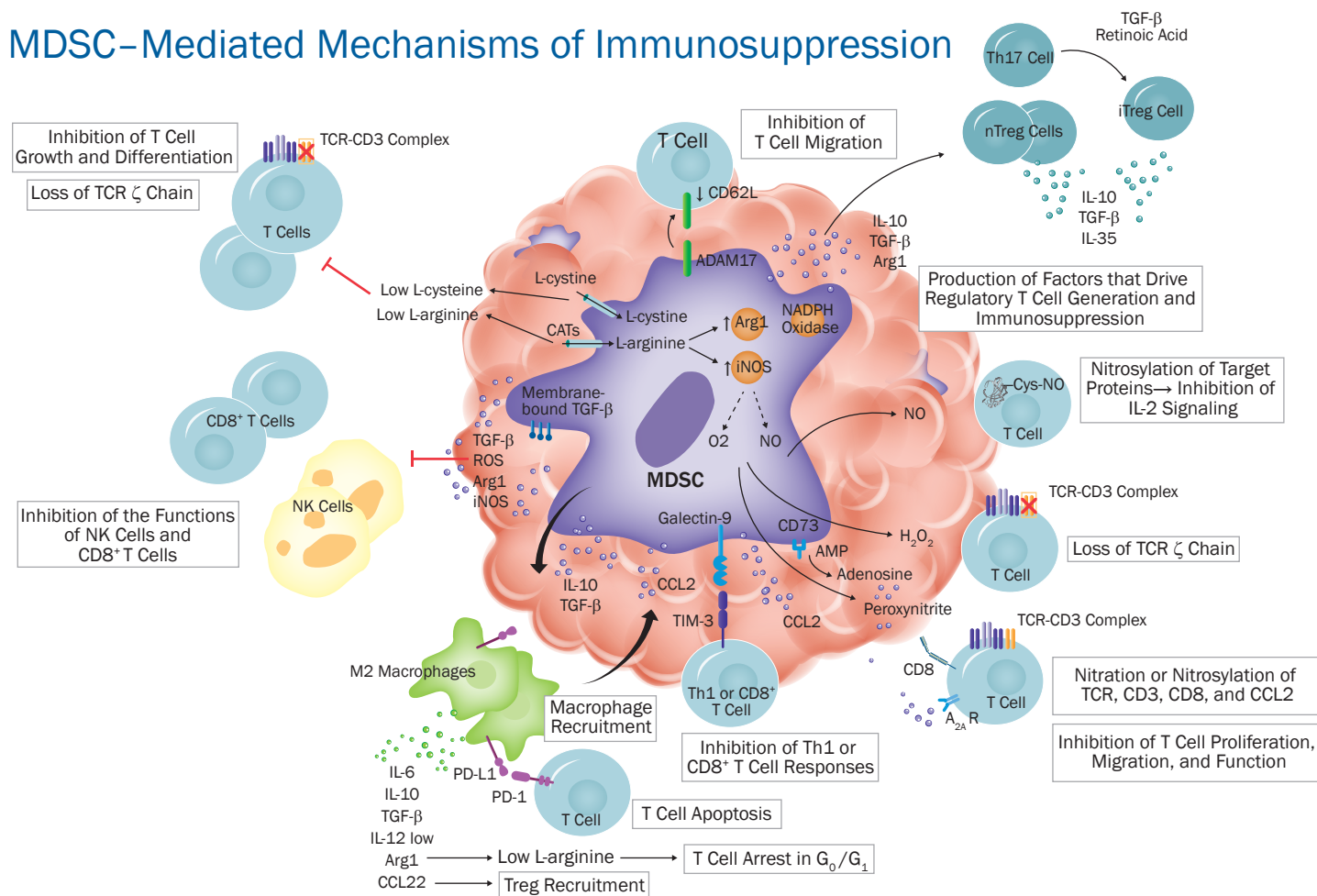


Myeloid-derived Suppressor Cells

Myeloid-derived suppressor cells (MDSCs) are a heterogeneous population of immature myeloid progenitor cells that fail to differentiate into granulocytes, macrophages, and 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

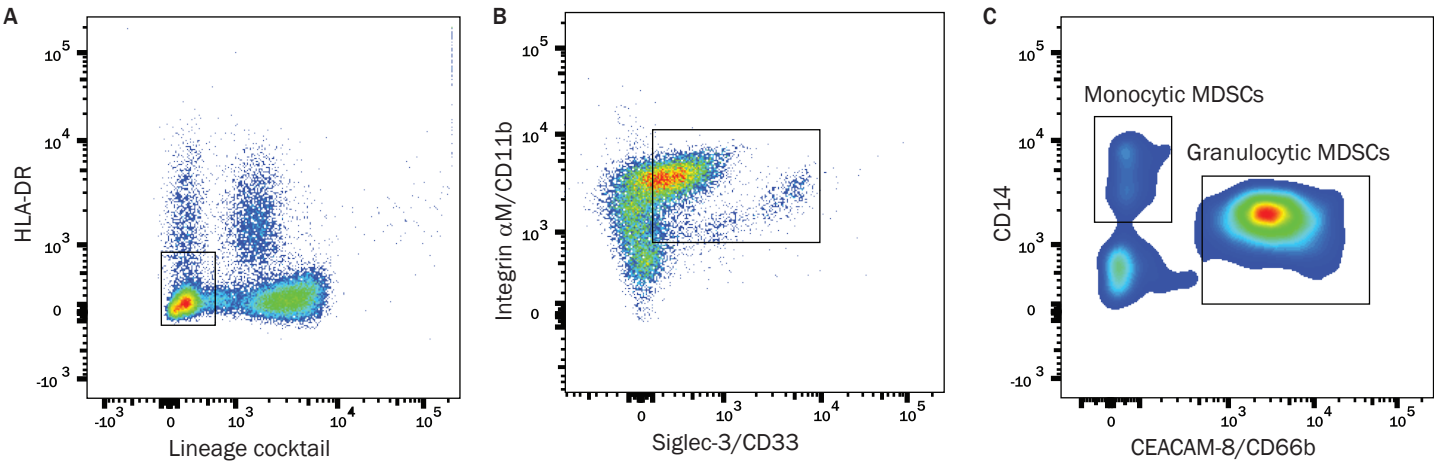


Mouse Markers		
	Granulocytic MDSCs	Monocytic MDSCs
CD11b/Integrin α M	+	+
Gr-1/Ly-6G	+	-
Ly-6C	-	+

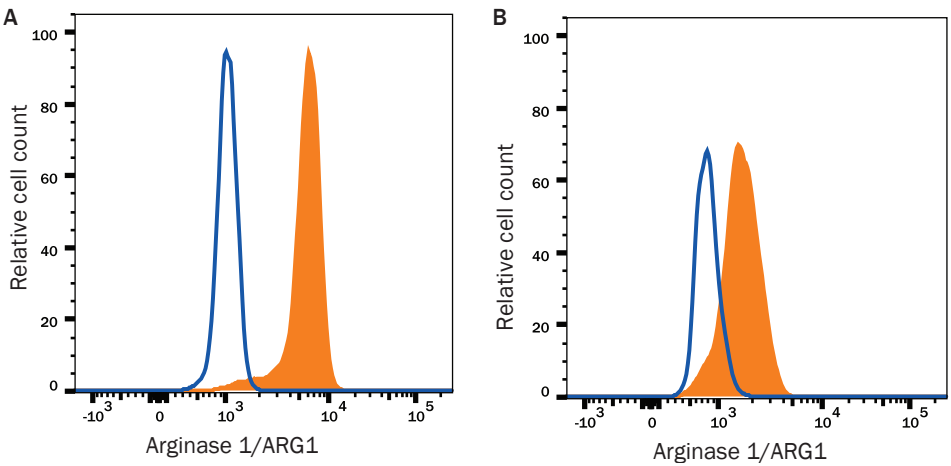
Human Markers		
	Granulocytic MDSCs	Monocytic MDSCs
Lin	-	-
CD11b/Integrin α M	+	+
CD33	+	+
HLA-DR	-	-

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

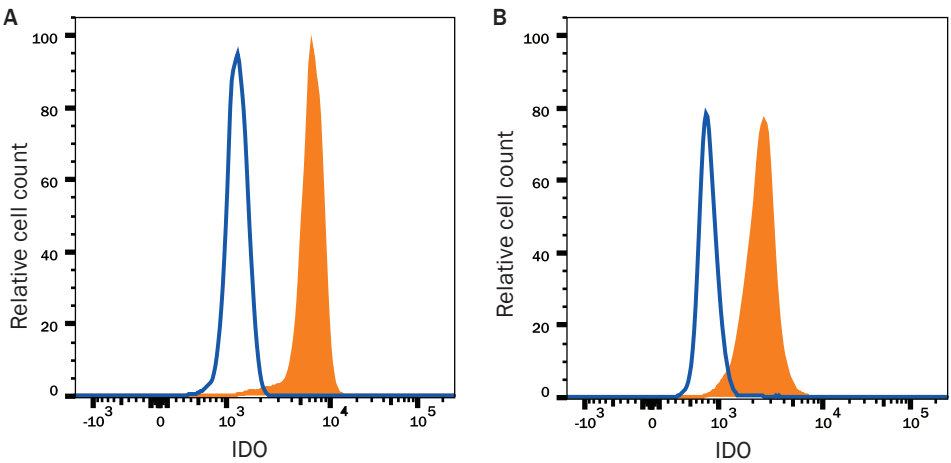
Analysis of Human Granulocytic and Monocytic MDSCs by Flow Cytometry



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 CD3 ϵ 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 α M/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).

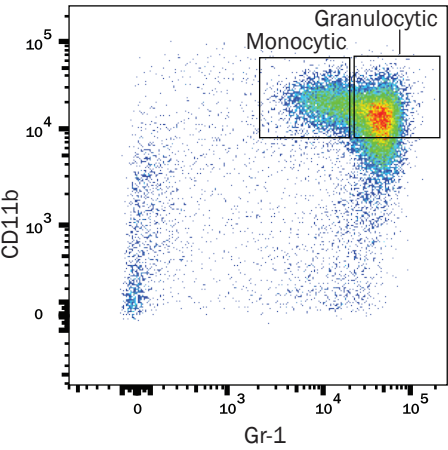


Detection of Arginase 1 Expression in Human Granulocytic and Monocytic Myeloid-derived Suppressor Cells by Flow Cytometry. Following identification of myeloid-derived suppressor cells (MDSCs) by flow cytometry, expression of Arginase 1 in the gated (A) granulocytic (Lin⁻/CD11b⁺/CD14⁻/CD33⁺/CEACAM-8⁺/HLA-DR⁻) and (B) monocytic (Lin⁻/CD11b⁺/CD14⁺/CD33⁺/CEACAM-8⁺/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 (Lin⁻/CD11b⁺/CD14⁻/CD33⁺/CEACAM-8⁺/HLA-DR⁻) and (B) monocytic (Lin⁻/CD11b⁺/CD14⁺/CD33⁺/CEACAM-8⁺/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											
Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							Unconjugated Antibodies (Applications)	
			APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates		
							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	FAB4841C	FAB4841G	FAB4841N	FAB4841V/FAB4841T/ FAB4841R/FAB4841S	MAB4841 (FA, FC, ICC/IF, IHC, IP)
		Mouse	145-2C11	NBP2-30149APC		NBP2-30149PE	NBP2-30149PCP	FAB484G	FAB484N	FAB484U/FAB484V/ FAB484T/FAB484R/ FAB484S	NBP2-30151 (FC) MAB484 (Depl, FA, FC, IP)
	CD14	Human	134620	FAB3832A	FAB3832F	FAB3832P	FAB3832C		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	ICRF29-2	FAB7368A				FAB7368G			MAB7368 (FC)
	CEACAM-8/ CD66b	Human	913542	FAB4246A		FAB4246P					MAB4246 (FC, WB)
		Human	G10F5	NB100-77808APC	NB100-77809	NB100-77808PE	NB100-77808PCP	NB100-77808AF488	NB100-77808AF700	NB100-77808AF405/ NB100-77808AF647	NB100-77808 (FC, IHC)
	Gr-1/Ly-6G	Mouse	RB6-8C5	FAB1037A	FAB1037F	FAB1037P	FAB1037C		FAB1037N	FAB1037V	MAB1037 (FC, ICC/IF, IHC, IP)
	HLA-DR	Human	L203	FAB4869A	FAB4869F	FAB4869P	FAB4869C		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	FAB1699A		FAB1699P		FAB1699G			MAB1699 (FC, ICC/IF, IHC)
			238446	FAB16991A		FAB16991P	FAB16991C	FAB16991G	FAB16991N	FAB16991V/ FAB16991T/ FAB16991R/FAB16991S	MAB16991 (FC, ICC/IF)
		Mouse	M1/70	FAB1124A	FAB1124F	FAB1124P	FAB1124C		FAB1124N	FAB1124V/FAB1124T/ FAB1124R/FAB1124S	MAB1124 (FC, ICC/IF, IHC, IP)
	Siglec-3/CD33	Human	6C5/2	FAB1137A	FAB1137F	FAB1137P					MAB1137 (FC, WB)

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization											
	Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							Unconjugated Antibodies (Applications)
				APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	
								488	700		
	5' Nucleotid-ase/CD73	Human	606112	FAB5795A		FAB5795P					MAB5795 (FC)
		Human	AD2	NBP2-00297	NBP2-22353	NBP2-22354					
		Mouse	496406	FAB4488A	FAB4488F	FAB4488P					MAB4488 (FC)
	ADAM17/TACE	Human	111633		FAB9301F	FAB9301P					MAB9301 (FC, IP, WB)
	2B4/CD244/SLAMF4	Human	Poly-clonal		FAB1039F	FAB1039P					AF1039 (E, FA, FC, IHC, WB)
		Mouse	Poly-clonal								AF1050 (FC, IHC, WB)
	Aminopepti-dase N/CD13	Human	WM-15	FAB8284A				FAB8284G	FAB8284N		
		Mouse	Poly-clonal								AF2335 (FC, ICC/IF, IP, WB)
	Arginase 1/ARG1	Human	658922	IC8026A		IC8026P	IC8026C	IC8026G	IC8026N		MAB58681 (FC)
		Human/Mouse	Poly-clonal	IC5868A	IC5868F	IC5868P					
	B7-2/CD86	Human	37301	FAB141A	FAB141F	FAB141P	FAB141C		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	Poly-clonal	FAB1019A	FAB1019F						AF1019 (FC, IHC, WB)
	CCR2	Human	48607	FAB151A		FAB151P	FAB151C	FAB151G	FAB151N		MAB150 (FC, IHC)
		Mouse	475301	FAB5538A	FAB5538F	FAB5538P			FAB5538N	FAB5538T/FAB5538R/FAB5538S	
	CX3CR1	Mouse	Poly-clonal	FAB5825A		FAB5825P		FAB5825G			AF5825 (FC, WB)
	CXCR2/IL-8 RB	Human	48311	FAB331A	FAB331F	FAB331P	FAB331C		FAB331N		MAB331 (B/N, FC, IHC)
		Mouse	242216	FAB2164A		FAB2164P	FAB2164C				MAB2164 (B/N, FC)
	CXCR4	Human	12G5	FAB170A	FAB170F	FAB170P	FAB170C	FAB170G	FAB170N		MAB170 (B/N)
		Human	44717	FAB173A		FAB173P	FAB173C	FAB173G	FAB173N		MAB173 (B/N, FC)
		Mouse	247506	FAB21651A	FAB21651F	FAB21651P	FAB21651C				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)
	CD19	Human	4G7-2E3	FAB4867A	FAB4867F	FAB4867P	FAB4867C		FAB4867N	FAB4867T/FAB4867R/FAB4867S	MAB4867 (FC)
		Human	LT19	NB500-338APC	NB100-63513	NB500-338PE	NB500-338PCP	NB500-338AF488	NB500-338AF700	NB500-338AF405/NB500-338AF647	NB500-338 (FC, IP)
			CB19	NBP2-25196APC	NBP2-26643	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	FAB6874A				FAB6874G			MAB3628 (FC)
	CD34	Human	QBEnd10	FAB7227A		FAB7227P		FAB7227G			
		Human	756510			FAB72271P		FAB72271G			MAB72271 (FC, ICC/IF)
	CD39/ENTPD1	Human	498403	FAB4397A	FAB4397F	FAB4397P					MAB4397 (FC)
		Mouse	495826	FAB4398A	FAB4398F	FAB4398P					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

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

Antibodies Against Other Cell Surface & Intracellular Markers used for MDSC Identification or Characterization											
	Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							Unconjugated Antibodies (Applications)
				APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	
								488	700		
	CD45	Human	2D1	FAB1430A		FAB1430P	FAB1430C	FAB1430G	FAB1430N		MAB1430 (FC, ICC,/IF
		Mouse	30-F11	FAB114A	FAB114F	FAB114P	FAB114C			FAB114V/FAB114R	MAB114 (FA, FC, IHC, IP)
	CD117/c-kit	Human	47233	FAB332A		FAB332P	FAB332C				MAB332 (B/N, E, FC, WB)
		Human/ Mouse	2B8	NB100-77477APC	NBP1-43974	NB100-77477PE	NB100-77477PCP	NB100-77477AF488	NB100-77477AF700	NB100-77477AF405/ NB100-77477AF647	NB100-77477 (FC, IHC, IP)
		Human/ Mouse	104D2	NB600-765APC		NB600-765PE	NB600-765PCP	NB600-765AF488	NB600-765AF700	NB600-765AF405/ NB600-765AF647	NB600-765 (FC, ICC,/IF)
		Mouse	180627	FAB1356A		FAB1356P					MAB1356 (FC, IHC, WB)
	F4/80/EMR1	Human/ Mouse	BM8		NB100-77700	NBP2-22134					NBP1-60140 (FC, IHC, WB)
		Mouse	521204	FAB5580A		FAB5580P	FAB5580C				MAB5580 (FC, ICC,/IF)
		Mouse	CI-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		FAB2546N		MAB2546 (FC)
		Mouse	275003	FAB19601A	FAB19601F	FAB19601P	FAB19601C		FAB19601N		MAB19601 (FC)
	Galectin-9	Mouse	766428					IC3535G			MAB3535 (FC, IHC)
	GM-CSF Rα	Human	31916	FAB706A		FAB706P					MAB706 (FC, WB)
		Mouse	698423	FAB6130A		FAB6130P		FAB6130G	FAB6130N		MAB6130 (B/N, FC, ICC,/IF)
	ICAM-1/CD54	Mouse	166623	FAB796A	FAB796F	FAB796P					MAB796 (E, WB)
	IFN-γ RI/CD119	Human	92101		FAB673F	FAB673P					MAB6731 (B/N, FC, WB)
		Mouse	2E2.4			FAB1026P					MAB1026 (WB)
	IL-4 Rα/CD124	Human	25463	FAB230A	FAB230F	FAB230P	FAB230C		FAB230N		MAB230 (B/N, FC, IHC, WB)
		Mouse	Poly-clonal		FAB530F	FAB530P					AF530 (FC, WB)
	Indoleamine 2,3-dioxygenase/IDO	Human	700838	IC6030A		IC6030P	IC6030C	IC6030G	IC6030N		MAB6030 (FC, ICC,/IF)
	Integrin α4/CD49d	Human	7.2R	FAB1354A		FAB1354P	FAB1354C	FAB1354G			MAB1354 (FC, ICC,/IF)
		Mouse	265329	FAB2450A		FAB2450P					MAB2450 (FC)
	L-Selectin/CD62L	Human	4G8		BBA33						BBA24 (E, FC)
		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	FAB5761P					MAB5761 (FC)
		Mouse	MEL-14	NBP1-28010	NBP1-28007	NB100-63971					NBP2-00260 (FC, IHC, IP)
	M-CSF R/CD115	Human	61708	FAB329A	FAB329F	FAB329P			FAB329N		MAB329 (FC)
		Mouse	460615	FAB3818A		FAB3818P	FAB3818C				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										
Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							Unconjugated Antibodies (Applications)
			APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	
							488	700		
NCAM-1/CD56	Human	301040	FAB2408A		FAB2408P					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			MAB7820 (FC, WB)
STAT1	Human	246523	IC1490A				IC1490G			MAB1490 (FC, ICC/IF)
STAT3	Human/ Mouse	232209		IC1799F	IC1799P					MAB1799 (FC, ICC/IF, IP, WB)
VEGF R1/Flt-1	Human	49560	FAB321A		FAB321P					MAB321 (FC, WB)
	Mouse	141522	FAB4711A		FAB4711P		FAB4711G	FAB4711N		MAB4711 (FC, WB)



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.

Select Recombinant Proteins for Inducing MDSC-like Cells <i>in vitro</i>		
Molecule	Species	Catalog #
G-CSF	Human	214-CS
	Mouse	414-CS
GM-CSF	Human	215-GM
	Mouse	415-ML
IL-4	Human	204-IL
	Mouse	404-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 Recombinant Proteins for Inducing MDSC-like Cells <i>in vitro</i>		
Molecule	Species	Catalog #
IL-6	Human	206-IL
	Mouse	406-ML
IL-13	Human	213-ILB
	Mouse	413-ML



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	DIF50	DY285
	Mouse	MIF00	DY485
IL-1β	Human	DLB50	DY201
	Mouse	MLB00C	DY401
IL-4	Human	D4050	DY204
	Mouse	M4000B	DY404
IL-6	Human	D6050	DY206
	Mouse	M6000B	DY406

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 #
IL-10	Human	D1000B	DY217B
	Mouse	M1000B	DY417
IL-13	Human	D1300B	DY213
	Mouse	M1300CB	DY413
TGF-β1	Human	DB100B	DY240
	Mouse	MB100B	DY1679
TNF-α	Human	DTA00C	DY210
	Mouse	MTA00	DY410
VEGF	Human	DVE00	DY293B
	Mouse	MMV00	DY4893

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 # ARY022) 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.

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.

Tocris Small Molecules for Myeloid-Derived Suppressor Cell Research			
Reported Activity on MDSCs*	Product Name	Catalog #	Product Description
Promote MDSC Differentiation	AM 580	0760	Retinoic acid analog; RAR α agonist
	Calcipotriol	2700	Analog of Vitamin D ₃
	Calcitriol	2551	Vitamin D receptor (VDR) agonist
	Retinoic Acid/ATRA	0695	Endogenous retinoic acid receptor agonist
	Vitamin D ₃	4156	Naturally occurring from of vitamin D
Decrease MDSC Levels	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, PDGFR β , 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
	NCX 4040	4531	NO-donating aspirin; anti-inflammatory
	NS 398	0942	COX-2 inhibitor
	SB 225002	2725***	Potent and selective CXCR2 antagonist
	Sildenafil	3784	Orally active, potent PDE5 inhibitor
	T 0156	1676	Highly potent, selective 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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