R&D SYSTEMS a bio-techne brand

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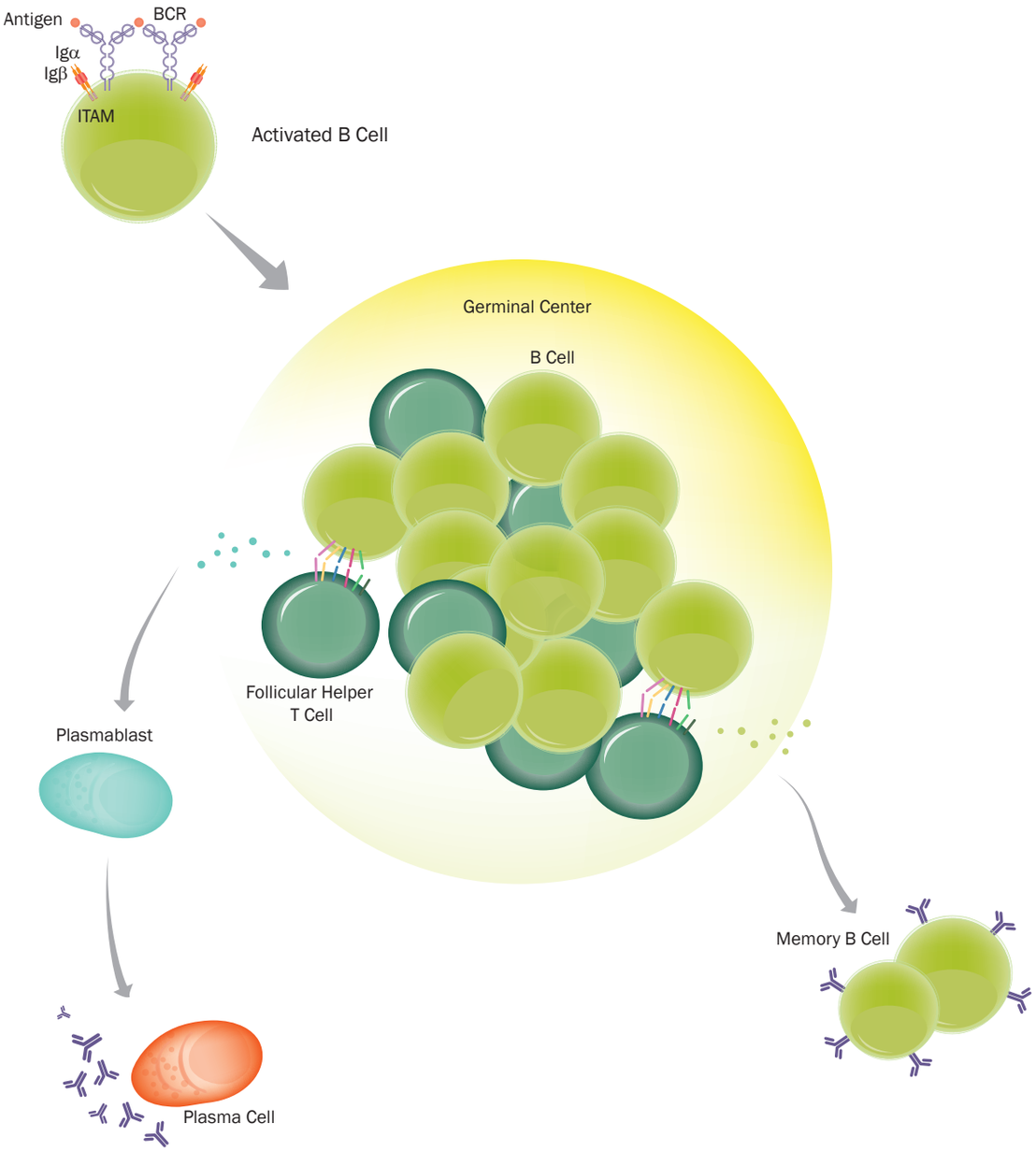
B Cells



B Cells

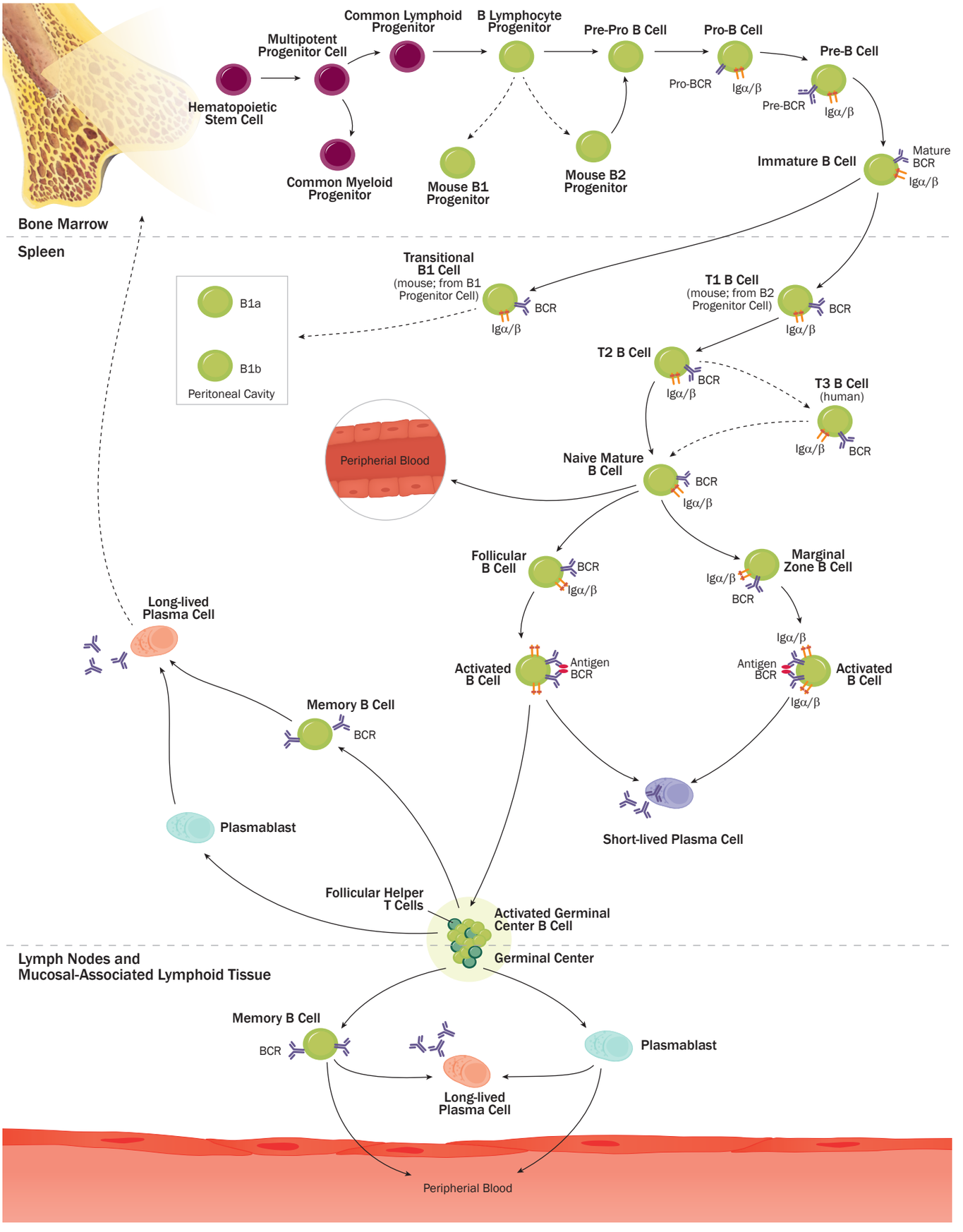
B lymphocytes (B cells) are an integral part of the humoral immune response due to their ability to produce antibodies against foreign antigens. B cells originate from hematopoietic stem cells (HSCs) in the bone marrow, which is seeded during embryonic development by HSCs from the fetal liver. The initial stages of B cell development are antigen-independent and involve the generation of several intermediary precursor cells that arise from B lymphocyte progenitor cells including Pre-pro-B cells, Pro-B cells, and Pre-B cells, which develop into immature B cells. During these stages of development, B cells undergo immunoglobulin gene rearrangement resulting in the expression of a mature B cell receptor (BCR) that is capable of binding to antigen. This is followed by a selection process that involves BCR editing or clonal deletion, designed to eliminate self-reactive immature B cells. The majority of immature B cells that survive this selection process leave the bone marrow and migrate to the spleen where they differentiate into transitional immature B cells that then become immunocompetent naïve mature B cells. Most naïve B cells develop into follicular B cells, while a small population becomes marginal zone B cells (frequently called IgM memory B cells in human). Following antigen-dependent activation, follicular B cells participate in germinal center reactions where they differentiate into memory B cells or long-lived, antibody-secreting plasma cells. While these developmental stages are similar for human B cells and mouse conventional B2 cells, a second mouse cell lineage (B1 cells) has also been described. B1 cells are abundant in the peritoneal cavities and can be further subdivided into B1a and B1b subsets. These along with other B cell precursor cells and functionally distinct subtypes including marginal zone B cells, follicular B cells, memory B cells, plasma cells, and regulatory B cells can be distinguished from each other based on the expression of specific cell surface and intracellular markers. **R&D Systems and Novus Biologicals together offer the widest selection of fluorochrome-conjugated antibodies for detecting human and mouse B cell subsets and further characterizing these cells.**

Cell Surface & Intracellular Markers Expressed at Different Stages of B Cell Development

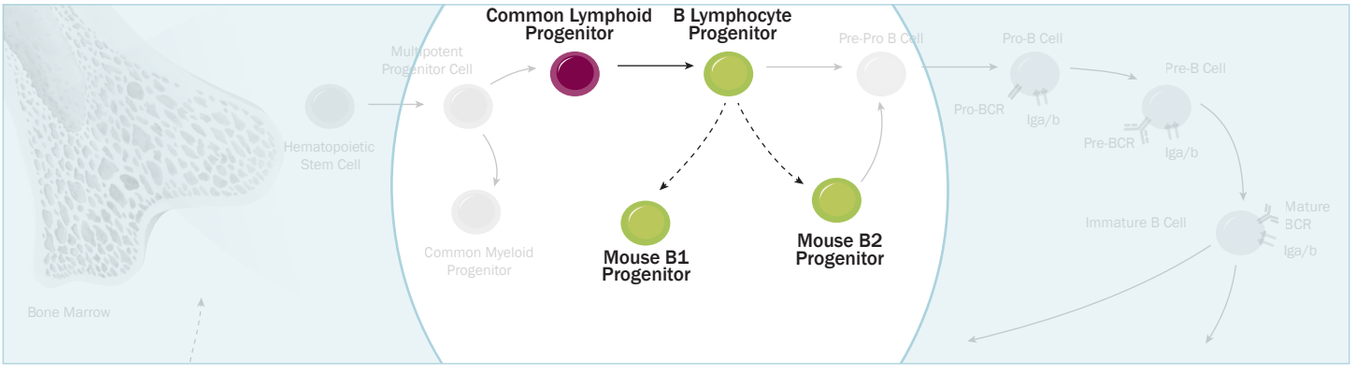
Cell Type	Human Markers	Mouse Markers
Common Lymphoid Progenitor	CD10/Neprilysin$^+$ CD34$^+$ Pax5$^+$	Lin$^-$ CD117/c-kit$^-$ Sca-1/Ly6$^-$ Ly6D$^-$ IL-7 Rα^+ Flt-3/Flk-2$^+$
B Lymphocyte Progenitor	CD10/Neprilysin$^+$ CD34$^+$ Pax5$^+$	Lin$^-$ CD117/c-kit$^-$ Sca-1/Ly6$^-$ Ly6D$^+$ IL-7 Rα^+ Flt-3/Flk-2$^+$
Mouse B1 Progenitor		Lin$^-$ B220/CD45 R^{low} CD19$^+$ C1q R1/CD93$^+$
Mouse B2 Progenitor		Lin$^-$ B220/CD45 R$^+$ CD19$^-$ C1q R1/CD93$^-$
Pre-Pro B Cell	CD117/c-kit^{low} CD10/Neprilysin$^+$ CD34$^+$ CD38$^+$ Pax5$^+$	Lin$^-$ B220/CD45 R$^+$ CD19$^-$ CD24^{low} CD43$^+$ C1q R1/CD93$^+$ CD117/c-kit$^-$ CXCR4$^+$ Flt-3/Flk-2$^+$ IL-7 Rα^+ IgM$^-$
Pro-B Cell	CD117/c-kit^{low} CD10/Neprilysin$^+$ CD19$^+$ CD20/MS4A1$^+$ CD24$^+$ CD34$^+$ CD38$^+$ C1q R1/CD93$^+$ IL-3 R$^+$ IL-7 Rα^+ Pax5$^+$	Lin$^-$ B220/CD45 R$^+$ CD19$^+$ CD24$^+$ CD43$^+$ CD117/c-kit^{low} IL-7 Rα^+ IgM$^-$
Pre-B Cell	CD117/c-kit$^-$ CD10/Neprilysin$^+$ CD19$^+$ CD20/MS4A1$^+$ CD24$^+$ CD34$^-$ CD38$^+$ C1q R1/CD93$^+$ IL-3 R$^+$ IL-4 Rα^+ IL-7 Rα^+ Pax5$^+$	Lin$^-$ B220/CD45 R$^+$ CD19$^+$ CD24$^+$ CD43$^-$ IL-7 Rα^+ IgM$^-$
Immature B Cell	CD117/c-kit$^-$ CD10/Neprilysin$^+$ CD19$^+$ CD20/MS4A1$^+$ CD21$^+$ CD24$^+$ CD27$^-$ CD38$^+$ CD40$^+$ C1q R1/CD93$^+$ IL-4 Rα^+ IL-7 Rα^-	B220/CD45 R$^+$ CD19$^+$ CD23/Fcε RII$^-$ CD24$^+$ CD43$^-$ C1q R1/CD93$^+$ IgD$^-$ IgM$^+$
B1a Cell		CD1d^{mid} CD5$^+$ CD19^{high} CD23/Fcε RII$^-$ CD43$^+$
B1b Cell		CD1d^{mid} CD5$^-$ CD19^{high} CD23/Fcε RII$^-$ CD43$^+$
Transitional B Cell	CD10/Neprilysin^{low} CD5$^+$ CD19$^+$ CD20/MS4A1$^+$ CD21$^+$ CD23/Fcε RII$^+$ CD24$^+$ CD27$^-$ CD38$^+$ C1q R1/CD93$^+$ TACI$^+$	T1: B220/CD45 R$^+$ CD19$^+$ CD24$^+$ CD43$^-$ C1q R1/CD93$^+$ IgM$^+$ IgD^{low}
		T2: B220/CD45 R$^+$ CD19$^+$ CD24$^+$ CD43$^-$ C1q R1/CD93$^+$ IgM$^+$ IgD$^+$
Marginal Zone B Cell	CD1c$^+$ CD19$^+$ CD20/MS4A1$^+$ CD21$^+$ CD27$^+$ FCRL3/FcRH3$^+$ TACI$^+$	B220/CD45 R$^+$ CD1d$^+$ CD19^{mid} CD21^{high} CD23/Fcε RII$^-$ CD43$^-$ C1q R1/CD93$^-$ IgM^{high} IgD^{low}
Follicular B Cell	CD10/Neprilysin$^-$ CD19$^+$ CD20/MS4A1$^+$ CD21$^+$ CD22/Siglec-2$^+$ CD23/Fcε RII$^+$ CD24^{low} CD27$^-$ CD38^{low} CXCR5$^+$ TACI$^+$ MHC class II$^+$	B220/CD45 R$^+$ CD1d^{mid} CD19^{mid} CD21^{low} CD23/Fcε RII$^+$ CD43$^-$ CXCR5$^+$ IgM^{low} IgD^{high}
Activated Germinal Center B Cell	CD19$^+$ CD20/MS4A1$^+$ CD27$^+$ CD38$^+$ CD40$^+$ CD83$^+$ TACI$^+$ MHC class II$^+$	B220/CD45 R$^+$ CD19$^+$ CD40$^+$ MHC class II$^+$
Memory B Cell	CD19$^+$ CD20/MS4A1$^+$ CD21$^+$ CD27$^{mid/+}$ C1q R1/CD93$^-$ TACI$^+$	B220/CD45 R$^+$ CD19$^+$ CD21$^+$ CD27$^{mid/+}$ CD40$^+$ MHC class II$^+$
Plasmablast	BCMA$^+$ CD19^{low} CD27^{high} CD38$^+$ C1q R1/CD93$^+$ Syndecan-1/CD138$^{-/low}$	B220/CD45 R^{low} CD19$^+$ CD27^{high} CD38$^+$ Syndecan-1/CD138$^+$
Plasma Cell	BCMA$^+$ BLIMP1$^+$ CD19^{low} CD20/MS4A1$^{-/low}$ CD27^{high} CD38^{high} Syndecan-1/CD138$^+$ CXCR4$^+$ MHC class II^{low}	B220/CD45 R^{low} BLIMP1$^+$ CD19$^-$ CD27^{high}, CD38^{low} CXCR4^{high} Syndecan-1/CD138$^+$ MHC class II$^{-/low}$
Regulatory B Cell	CD1d$^+$ CD5$^+$ CD19$^+$ CD21$^+$ CD24$^+$ IL-10$^+$ IL-35$^+$ TGF-β^+	CD1d$^+$ CD5$^+$ CD19$^+$ CD23/Fcε RII$^{-/low}$ CD24$^+$ C1q R1/CD93$^{-/low}$ TIM-1$^+$ IL-10$^+$ IL-35$^+$ TGF-β^+

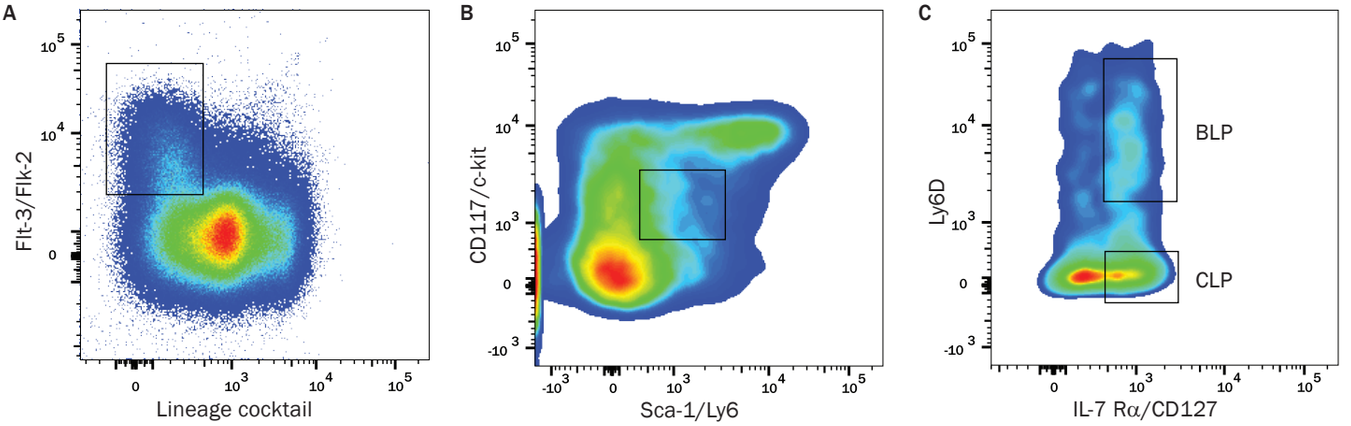
Note: **Lin$^-$ for Mouse CLP, BLP, B1 and B2 Progenitor cells:** CD3$^-$ CD4$^-$ CD8$^-$ Gr-1/Ly-6G$^-$ Integrin αM/CD11b$^-$ TER-119$^-$
Lin$^-$ for Mouse Pre-Pro B, Pro-B, Pre-B cells: CD3$^-$ Gr-1/Ly-6G$^-$ Integrin αM/CD11b$^-$ TER-119$^-$

B Cell Development

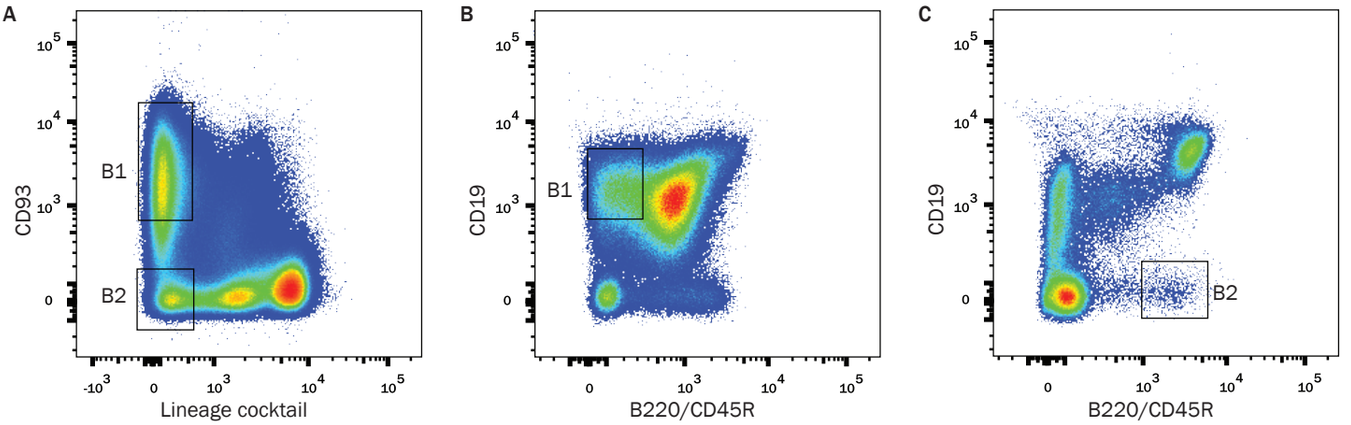


Analysis of Different Stages of B Cell Development in Mouse Bone Marrow by Flow Cytometry

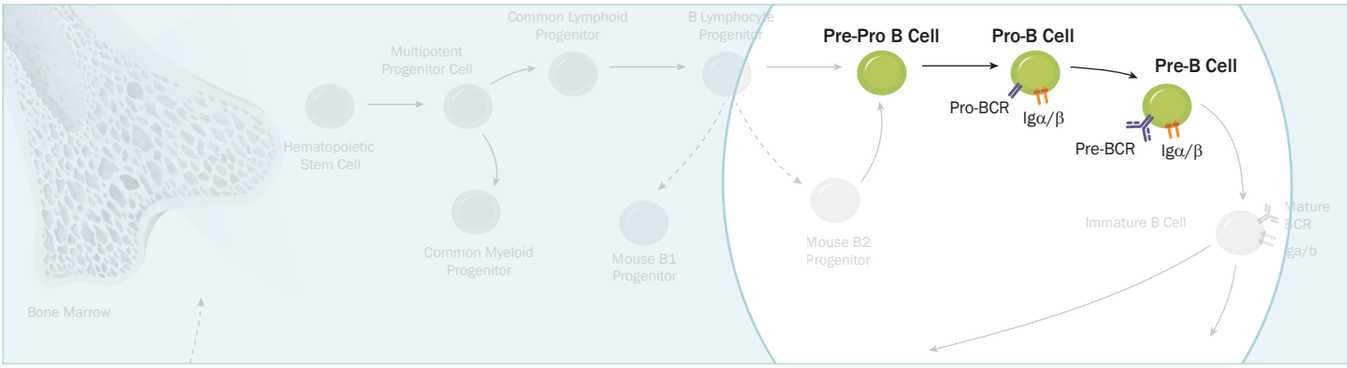


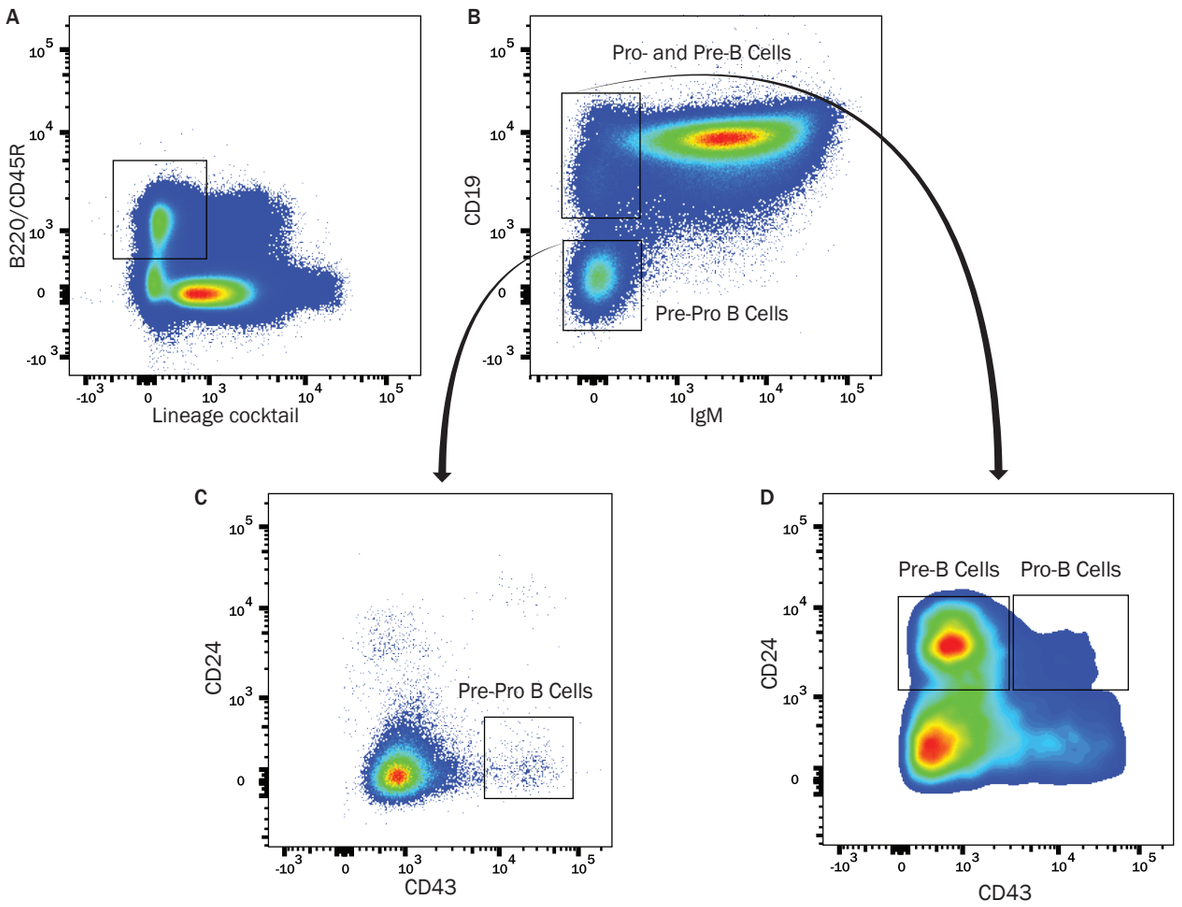


Detection of Common Lymphoid Progenitor Cells (CLPs) and B Lymphocyte Progenitor Cells (BLPs) in Mouse Bone Marrow by Flow Cytometry. C57BL/6 mouse bone marrow cells were depleted of $CD3^+$, $CD4^+$, $CD8^+$, Gr-1^+, CD11b/Integrin αM^+, TER-119^+ cells by staining the cells with Biotinylated Anti-Mouse Monoclonal Antibodies against each of these markers followed by magnetic depletion using streptavidin-coated magnetic beads. Common lymphoid progenitor cells (CLPs: $Lin^-/CD117^{low}/Sca\text{-}1^{low}/Flt\text{-}3^{high}$/IL-7 $R\alpha^+/Ly\text{-}6D^-$) and B lymphocyte progenitor cells (BLPs: $Lin^-/CD117^{low}/Sca\text{-}1^{low}/Flt\text{-}3^{high}$/IL-7 $R\alpha^+/Ly\text{-}6D^+$) in the remaining cell population were detected by staining the cells with (**A**) an Alexa Fluor 405-conjugated lineage cocktail containing Anti-Mouse Monoclonal Antibodies against each of the depletion markers and a PE-conjugated Rat Anti-Mouse Flt-3/Flk-2 Monoclonal Antibody (R&D Systems, Catalog # FAB7681P). $Lin^-/Flt\text{-}3^+$ cells were gated. (**B**) $CD117^{low}/Sca\text{-}1^{low}$ cells in the $Lin^-/Flt\text{-}3^+$ population were detected using an Alexa Fluor 700-conjugated Rat Anti-Mouse Sca-1/Ly6 Monoclonal Antibody (R&D Systems, Catalog # FAB1226N) and an APC-conjugated Rat Anti-Mouse CD117/c-kit Monoclonal Antibody (R&D Systems, Catalog # FAB1356A). (**C**) IL-7 $R\alpha^+/Ly\text{-}6D^-$ cells and IL-7 $R\alpha^+/Ly\text{-}6D^+$ cells were detected in the $Lin^-/Flt\text{-}3^+/CD117^{mid/low}/Sca\text{-}1^{mid/low}$ population using an Alexa Fluor 488-conjugated Rat Anti-Mouse IL-7 Rα/CD127 Monoclonal Antibody (R&D Systems, Catalog # FAB47742G) and a fluorochrome-conjugated rat anti-mouse Ly-6D monoclonal antibody.



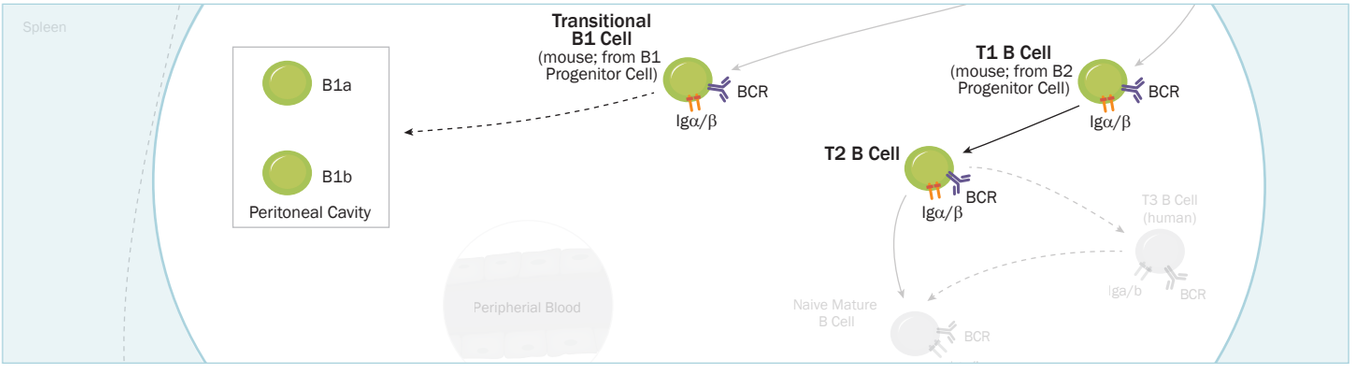
Detection of B1 and B2 Lymphocyte Progenitor Cells in Mouse Bone Marrow by Flow Cytometry. (**A**) $Lin^-/CD93^+$ and $Lin^-/CD93^-$ cells were detected in C57BL/6 mouse bone marrow cells by staining with a lineage cocktail containing Alexa Fluor 405-conjugated Anti-Mouse Monoclonal Antibodies against CD3, CD4, CD8, CD11b/Integrin αM, Gr-1, and TER-119 and an APC-conjugated Rat Anti-Mouse C1q R1/CD93 Monoclonal Antibody (R&D Systems, Catalog # FAB1696A). $Lin^-/CD93^+$ cells and $Lin^-/CD93^-$cells were gated. (**B**) B1 ($Lin^-/CD93^+/B220^{low}/CD19^+$) and (**C**) B2 ($Lin^-/CD93^-/B220^+/CD19^-$) progenitor cells were detected by staining with an Alexa Fluor 488-conjugated Rat Anti-Mouse B220/CD45 R Monoclonal Antibody (R&D Systems, Catalog # FAB1217G) and a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966).

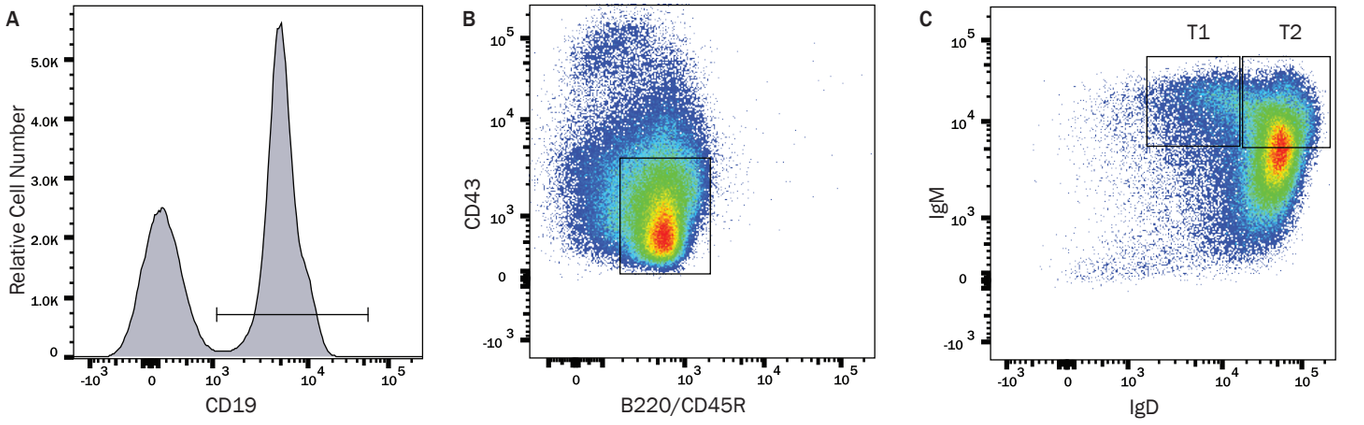




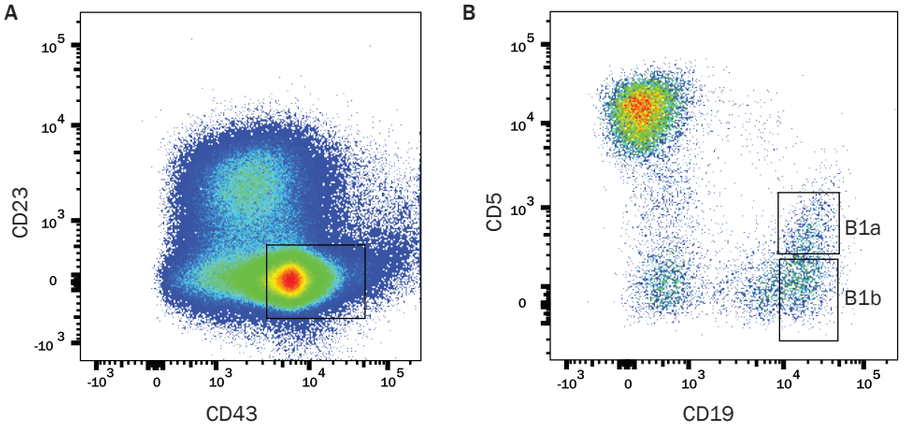
Detection of Pre-Pro-B, Pro-B, and Pre-B Cells in Mouse Bone Marrow by Flow Cytometry. (**A**) $Lin^-/B220^+$ cells were detected in C57BL/6 mouse bone marrow by staining with a lineage cocktail containing Alexa Fluor 405-conjugated Anti-Mouse Monoclonal Antibodies against CD3, CD11b/Integrin αM, Gr-1, and TER-119 and an Alexa Fluor 750-conjugated Rat Anti-Mouse B220/CD45 R Monoclonal Antibody (R&D Systems, Catalog # FAB1217S). (**B**) $IgM^-/CD19^-$ cells (pre-pro-B) and $IgM^-/CD19^+$ cells (pro-B and pre-B) were detected in the $Lin^-/B220^+$ population by staining with a PE-Cy7-conjugated Rat Anti-Mouse IgM Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-42940) and a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966). (**C**) Pre-pro-B cells ($Lin^-/B220^+/CD19^-/CD24^{low}/CD43^+/IgM^-$), (**D**) pro-B cells ($Lin^-/B220^+/CD19^+/CD24^+/CD43^+/IgM^-$) and pre-B cells ($Lin^-/B220^+/CD19^+/CD24^+/CD43^-/IgM^-$) were detected by staining with an Alexa Fluor 488-conjugated Rat Anti-Mouse CD43 Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43413AF488) and an APC-conjugated Rat Anti-Mouse CD24 Monoclonal Antibody (R&D Systems, Catalog # FAB8547A).

Analysis of Different Stages of B Cell Development in Mouse Spleen by Flow Cytometry

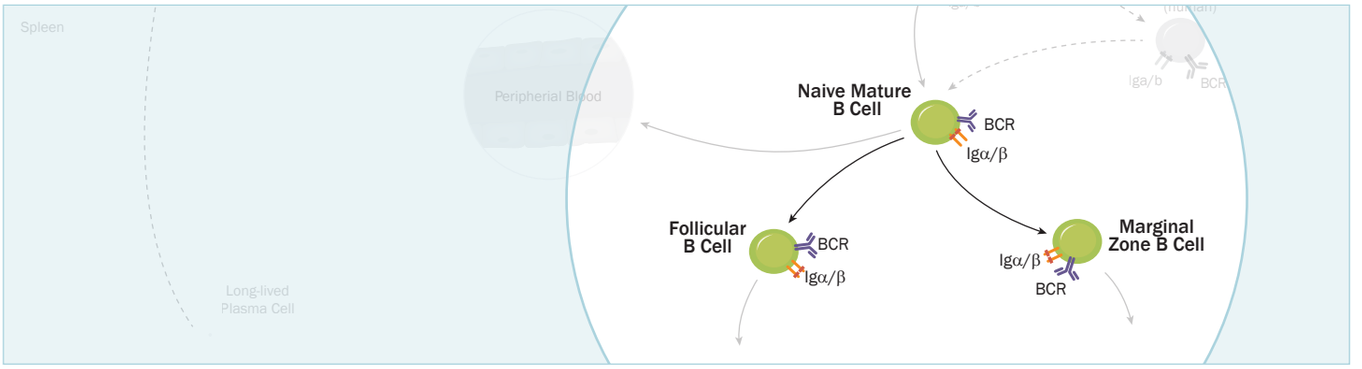


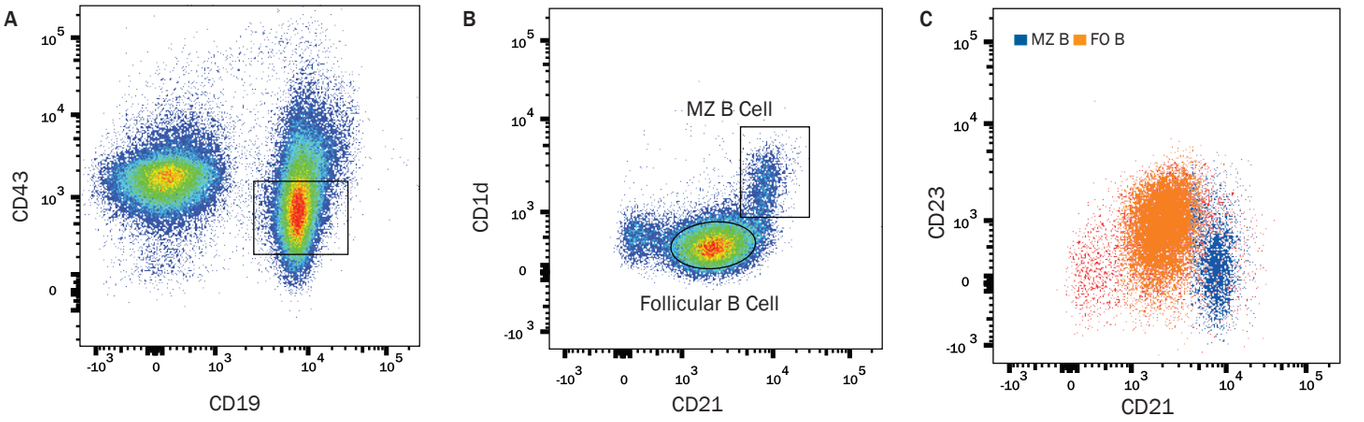


Detection of Transitional 1 (T1) and Transitional 2 (T2) B Cells in Mouse Splenocytes. (**A**) C57BL/6 mouse splenocytes were stained with a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966) and CD19$^+$ cells were gated. (**B**) B220$^+$/CD43$^-$ cells in the CD19$^+$ cell population were detected by staining with an Alexa Fluor 750-conjugated Rat Anti-Mouse B220/CD45 R Monoclonal Antibody (R&D Systems, Catalog # FAB1217S) and an Alexa Fluor 488-conjugated Rat Anti-Mouse CD43 Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43413AF488). (**C**) Transitional 1 (T1) B cells (CD19$^+$/B220$^+$/CD43-/IgM$^+$/IgD^{low}) and transitional 2 (T2) B cells (CD19$^+$/B220$^+$/CD43-/IgM$^+$/IgD$^+$) were detected in the CD19$^+$/B220$^+$/CD43- population by staining with an Alexa Fluor 647-conjugated rat anti-mouse IgD monoclonal antibody and a PE-Cy7-conjugated Rat Anti-Mouse IgM Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-42940).

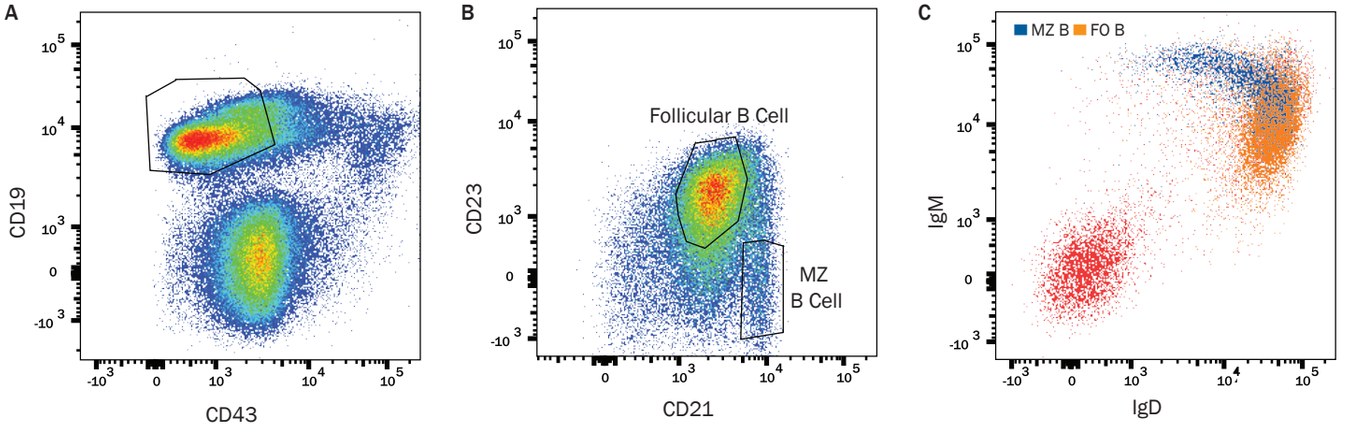


Detection of Transitional B1a and B1b Cells in Mouse Splenocytes. (**A**) C57BL/6 mouse splenocytes were stained with an Alexa Fluor 488-conjugated Rat Anti-Mouse CD43 Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43413AF488) and an Alexa Fluor 594-conjugated Rat Anti-Mouse CD23/Fcε RII Monoclonal Antibody (R&D Systems, Catalog # FAB6900T). CD43$^+$/CD23$^-$ cells were gated. CD1d^{mid} cells in the CD43$^+$/CD23$^-$ population were detected by staining with an Alexa Fluor 700-conjugated Rat Anti-Mouse CD1d Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43461AF700; Data not shown). (**B**) Transitional B1a cells (CD5$^+$/CD19^{high}/CD1d^{mid}/CD23$^-$/CD43$^+$) and transitional B1b cells (CD5$^-$/CD19^{high}/CD1d^{mid}/CD23$^-$/CD43$^+$) were detected in the CD1d^{mid}/CD23$^-$/CD43$^+$ population by staining with a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966) and an APC-conjugated Rat Anti-Mouse CD5 Monoclonal Antibody (R&D Systems, Catalog # FAB115A).



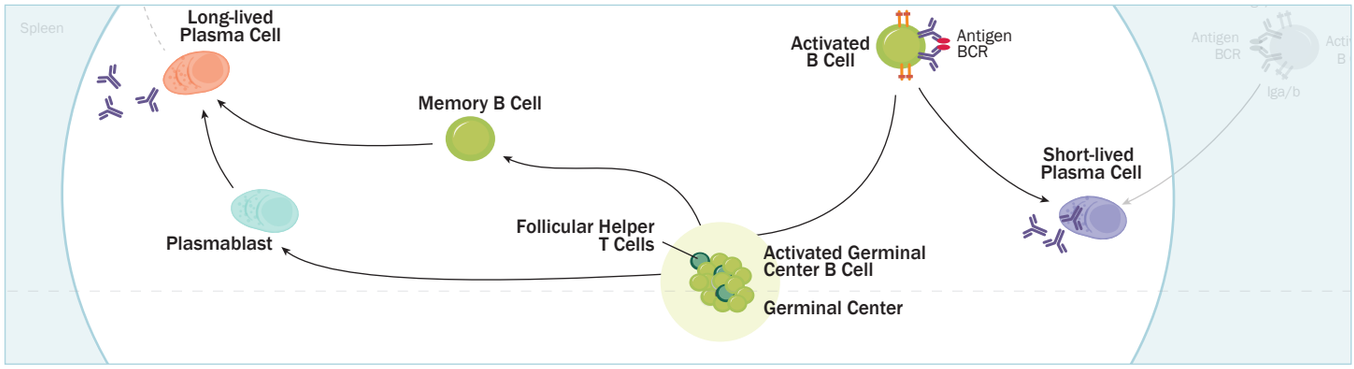


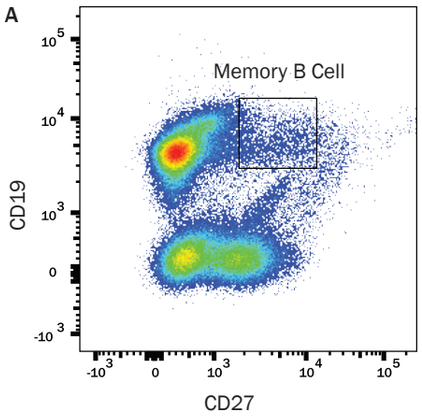
Detection of Marginal Zone and Follicular B-2 Cells in Mouse Splenocytes. (**A**) C57BL/6 mouse splenocytes were stained with a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966) and an Alexa Fluor 488-conjugated Rat Anti-Mouse CD43 Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43413AF488). $CD19^{+}/CD43^{-}$ cells were gated. (**B**) Follicular B-2 cells ($CD19^{mid}/CD1d^{mid}/CD23^{+}/CD21^{low}/CD43^{-}$) and marginal zone B-2 cells ($CD19^{mid}/CD1d^{high}/CD23^{-}/CD21^{high}/CD43^{-}$) were detected in the $CD19^{+}/CD43^{-}$ population by staining with a fluorochrome-conjugated anti-mouse CD21 monoclonal antibody and an Alexa Fluor 700-conjugated Rat Anti-Mouse CD1d Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43461AF700). $CD1d^{mid}/CD21^{low}$ and $CD1d^{high}/CD21^{high}$ cells were gated. (**C**) Follicular B-2 cells ($CD1d^{mid}/CD21^{low}$) and marginal zone B-2 cells ($CD1d^{high}/CD21^{high}$) were stained for CD21 and CD23 using a fluorochrome-conjugated anti-mouse CD21 monoclonal antibody and an Alexa Fluor 594-conjugated Rat Anti-Mouse CD23/Fcε RII Monoclonal Antibody (R&D Systems, Catalog # FAB6900T).

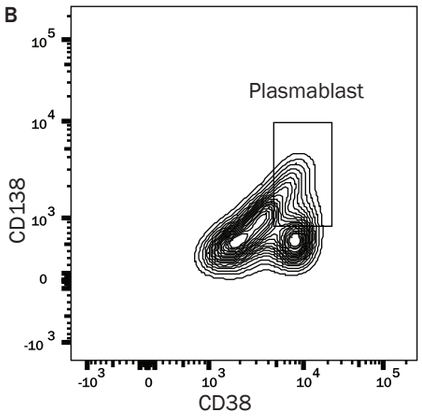


Detection of IgD and IgM on Marginal Zone and Follicular B-2 Cells from Mouse Splenocytes. (**A**) C57BL/6 mouse splenocytes were stained with an Alexa Fluor 488-conjugated Rat Anti-Mouse CD43 Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-43413AF488) and a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966). $CD19^{mid}/CD43^{-}$ cells were gated. (**B**) Follicular B-2 cells ($CD19^{mid}/CD1d^{mid}/CD23^{+}/CD21^{low}/CD43^{-}$) and marginal zone B-2 cells ($CD19^{mid}/CD1d^{high}/CD23^{-}/CD21^{high}/CD43^{-}$) were detected in $CD19^{+}/CD43^{-}$ population by staining with a fluorochrome-conjugated anti-mouse CD21 monoclonal antibody and an Alexa Fluor 594-conjugated Rat Anti-Mouse CD23/Fcε RII Monoclonal Antibody (R&D Systems, Catalog # FAB6900T). $CD21^{low}/CD23^{+}$ and $CD21^{high}/CD23^{-}$ cells were gated. (**C**) Expression of IgM and IgD on follicular B-2 ($CD19^{mid}/CD23^{+}/CD21^{low}/CD43^{-}/IgM^{low}/IgD^{high}$) and marginal zone B-2 ($CD19^{mid}/CD23^{-}/CD21^{high}/CD43^{-}/IgM^{high}/IgD^{low}$) cells was detected using an Alexa Fluor 647-conjugated rat anti-mouse IgD monoclonal antibody and a PE-Cy7-conjugated Rat Anti-Mouse IgM Monoclonal Antibody (Novus Biologicals, Catalog # NBP1-42940).

Analysis of Memory B Cells and Plasmablasts in Mouse Spleen by Flow Cytometry

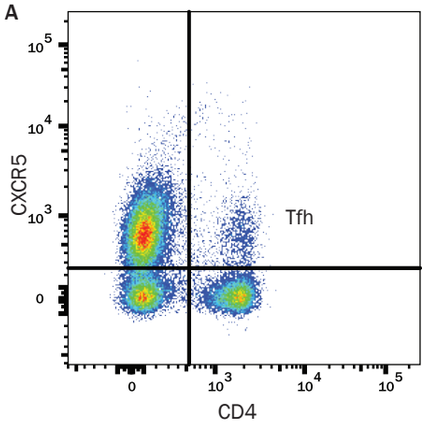


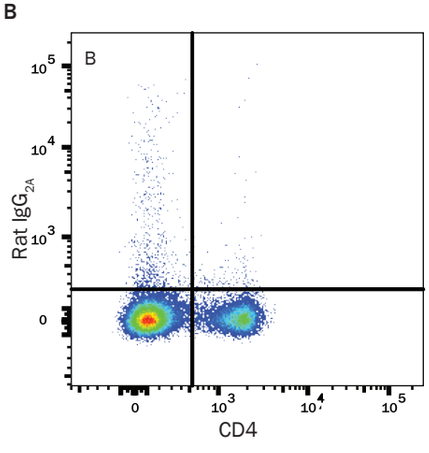




Detection of Memory B Cells and Plasmablasts in Mouse Splenocytes. (**A**) Memory B cells ($CD27^+/CD19^+$) from immunized mouse Balb/c splenocytes were detected by staining with an Alexa Fluor 488-conjugated Rat Anti-Mouse CD27/TNFRSF7 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-11950AF488) and a PE-conjugated Rat Anti-Mouse CD19 Monoclonal Antibody (Novus Biologicals, Catalog # NBP2-24966). $CD27^+/CD19^+$ cells were gated. (**B**) Plasmablasts ($CD19^+/CD27^+/CD38^+/CD138^+$) were detected in the $CD27^+/CD19^+$ population by staining with an Alexa Fluor 700-conjugated Rat Anti-Mouse CD38 Monoclonal Antibody (Novus Biologicals, Catalog # NB100-77405AF700) and an APC-conjugated Rat Anti-Mouse CD138/Syndecan-1 Monoclonal Antibody (R&D Systems, Catalog # FAB2966A).

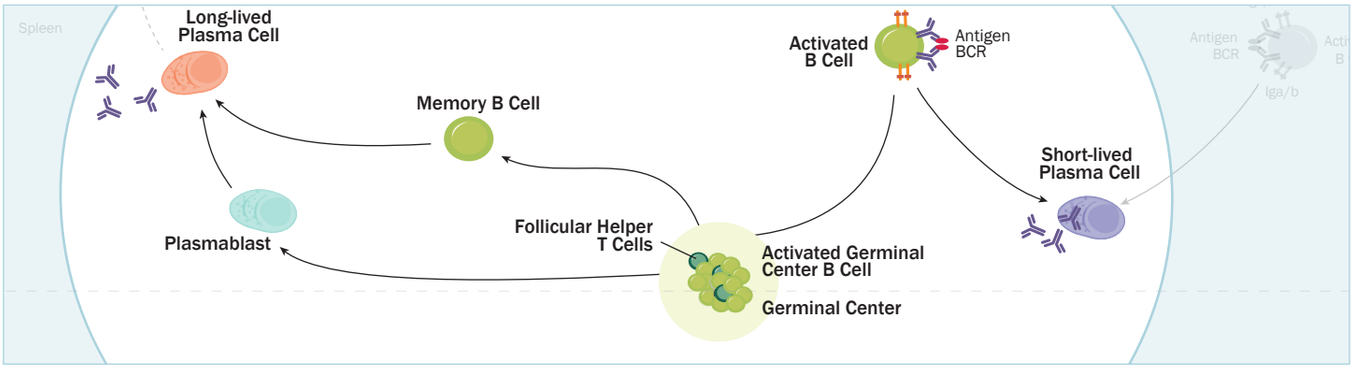
Analysis of Follicular Helper T Cells in Mouse Spleen

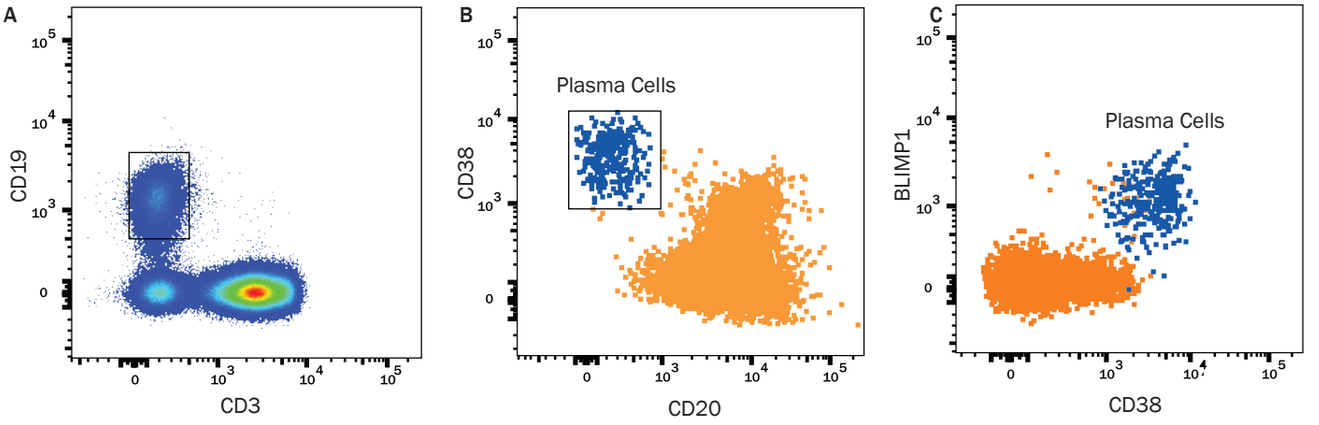


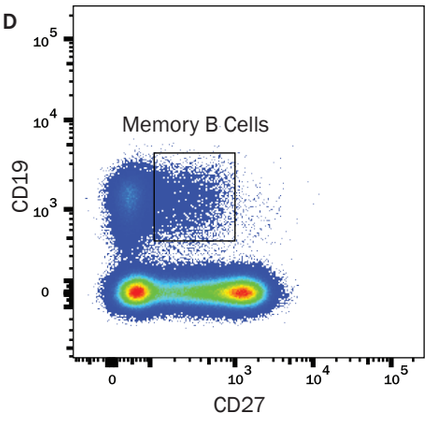


Detection of T Follicular Helper (Tfh) Cells in Mouse Splenocytes. (**A**) Immunized Balb/c mouse splenocytes were stained an Alexa Fluor 405-conjugated Rat Anti-Mouse CD4 Monoclonal Antibody (R&D Systems, Catalog # FAB554V) and either (A) an APC-conjugated Rat Anti-Mouse CXCR5 Monoclonal Antibody (Catalog # FAB6198A) or (**B**) an APC-conjugated Rat IgG_{2A} Isotype Control (Catalog # IC006A).

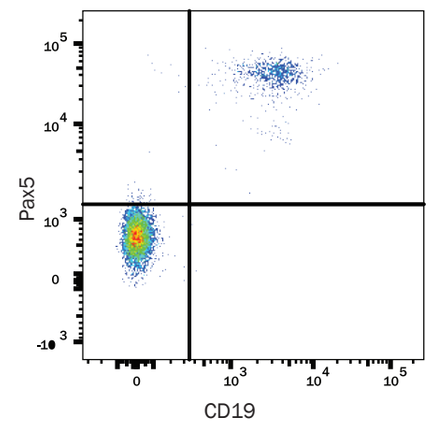
Analysis of Human Plasma Cells and Memory B Cells by Flow Cytometry







Detection of Plasma Cells and Memory B Cells in Human Peripheral Blood Mononuclear Cells by Flow Cytometry. Plasma cells ($CD3^-/CD19^{low}/CD20^{-/low}/CD38^{high}/BLIMP1^+$) in human peripheral blood mononuclear cells were detected by staining with (**A**) an Alexa Fluor 405-conjugated Mouse Anti-Human CD3ε Monoclonal Antibody (R&D Systems, Catalog # FAB100V) and an Alexa Fluor 594-conjugated Mouse Anti-Human CD19 Monoclonal Antibody (R&D Systems, Catalog # FAB4867T). $CD3^-/CD19^+$ cells were gated. (**B**) Expression of CD20/MS4A1 and CD38 on cells in the $CD3^-/CD19^+$ gate was determined by staining with an APC-conjugated Mouse Anti-Human CD20/MS4A1 Monoclonal Antibody (R&D Systems, Catalog # FAB4225A) and a PerCP-conjugated Mouse Anti-Human CD38 Monoclonal Antibody (R&D Systems, Catalog # FAB2404C). $CD20^{-/low}/CD38^+$ cells were gated. (**C**) Expression of BLIMP1 in the $CD20^{-/low}/CD38^+$ cell population was determined by staining with a PerCP-conjugated Mouse Anti-Human CD38 Monoclonal Antibody (R&D Systems, Catalog # FAB2404C) and a PE-conjugated Mouse Anti-Human BLIMP1/PRDM1 Monoclonal Antibody (R&D Systems, Catalog # IC36081P). (**D**) Memory B cells were also detected in the starting population of human peripheral blood mononuclear cells by staining with a Fluorescein-conjugated Mouse Anti-Human CD27/TNFRSF7 Monoclonal Antibody (R&D Systems, Catalog # FAB382F) and an Alexa Fluor 594-conjugated Mouse Anti-Human CD19 Monoclonal Antibody (R&D Systems, Catalog # FAB4867T).



Detection of Pax5 Expression in Human B Cells by Flow Cytometry. Human peripheral blood mononuclear cells were surface stained using an APC-conjugated Mouse Anti-Human CD19 Monoclonal Antibody (R&D Systems, Catalog # FAB4867A). Cells were then fixed and permeabilized and stained intracellularly using a Rabbit Anti-Human Pax5 Monoclonal Antibody (R&D Systems, coming soon) followed by a PE-conjugated Goat Anti-Rabbit Antibody (R&D Systems, Catalog # F0110).

Fluorochrome-conjugated Antibodies for Detecting Different Stages of Human and Mouse B Cell Development

Antibodies for B Cell Lineage Negative Markers used to Enrich for B Cell Progenitors

Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)								
			APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Biotin	Unconjugated Antibodies (Applications)
							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)
CD3	Mouse	17A2	FAB4841A	FAB4841F	FAB4841P	FAB4841C	FAB4841G	FAB4841N	FAB4841V/FAB4841T/ FAB4841R/FAB4841S	BAM4841	MAB4841 (FA, FC, ICC/IF, IHC, IP)
CD3	Mouse	145-2C11	NBP2-30149APC		NBP2-30149PE	NBP2-30149PCP	FAB484G	FAB484N	FAB484U/FAB484V/FAB484T/ FAB484R/FAB484S	NBP2-30149B	NBP2-30151 (FC); MAB484 (Depl, FA, FC, IP)
CD4	Human	11830	FAB3791A	FAB3791F	FAB3791P	FAB3791C	FAB3791G	FAB3791N			
CD4	Human	RPA-T4	NBP2-27245	NBP2-27247	NBP2-27248	NBP2-27216PCP	NBP2-27216AF488	NBP2-27216AF700	NBP2-27216AF405/ NBP2-27216AF647		NBP2-25199 (B/N, FC, IHC, IV)
CD4	Mouse	GK1.5	FAB554A	FAB554F	FAB554P	FAB554C	FAB554G	FAB554N	FAB554V/FAB554T/FAB554R/ FAB554S	BAM554	MAB554 (Depl, FA, FC, IHC, IP)
CD8α	Human	37006	FAB1509A	FAB1509F	FAB1509P	FAB1509C	FAB1509G	FAB1509N	FAB1509V/FAB1509T/ FAB1509R/FAB1509S		MAB1509 (FC, ICC/IF)
CD8α	Human	C8/144B	NBP2-34588APC		NBP2-34588PE	NBP2-34588PCP	NBP2-34588AF488	NBP2-34588AF700	NBP2-34588AF405/ NBP2-34588AF647	NBP2-34588B	NBP2-32836 (FC, ICC/IF, IHC, IP, WB)
CD8α	Human	RPA-T8	NBP2-27246	NBP2-27235	NBP2-27237	NBP2-25195PCP	NBP2-25195AF488	NBP2-25195AF700	NBP2-25195AF405/ NBP2-25195AF647		NBP2-25195 (FC, IHC, IV)
CD8α	Mouse	53-6.7	FAB116A	FAB116F	FAB116P	FAB116C	FAB116G		FAB116V/FAB116T/FAB116R/ FAB116S	BAM116	MAB116 (Depl, FA, FC, ICC/IF, IP)
Integrin αM/CD11b	Human	ICRF44	FAB1699A		FAB1699P		FAB1699G			BAM1699	MAB1699 (FC, ICC/IF, IHC)
Integrin αM/CD11b	Human	238446	FAB16991A		FAB16991P	FAB16991C	FAB16991G	FAB16991N	FAB16991V/FAB16991T/ FAB16991R/FAB16991S		MAB16991 (FC, ICC/IF)
Integrin αM/CD11b	Mouse	M1/70	FAB1124A	FAB1124F	FAB1124P	FAB1124C		FAB1124N	FAB1124V/FAB1124T/ FAB1124R/FAB1124S	BAM1124	MAB1124 (FC, ICC/IF, IHC, IP)
Gr-1/Ly-6G	Mouse	RB6-8C5	FAB1037A	FAB1037F	FAB1037P	FAB1037C		FAB1037N	FAB1037V	BAM1037	MAB1037 (FC, ICC/IF, IHC, IP)
TER-119	Mouse	TER-119	FAB1125A	FAB1125F	FAB1125P			FAB1125N	FAB1125V	BAM1125	MAB1125 (FC, IHC, IP, WB)

Antibodies for Select Markers used to Identify B Cell Subsets by Flow Cytometry

Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							
			APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
							488	700	405/594/647/750	
B220/CD45 R	Mouse	RA3-6B2	FAB1217A	FAB1217F	FAB1217P	FAB1217C	FAB1217G	FAB1217N	FAB1217V/FAB1217T/ FAB1217R/FAB1217S	MAB1217 (FC, ICC/IF, IP)
B7-1/CD80	Human	37711		FAB140F	FAB140P					MAB140 (B/N, E, FC, IHC)
B7-1/CD80	Mouse	16-10A1	NBP1-43030	NBP1-43990	NBP1-43842					NBP1-43385 (FA, FC, IHC, IP)
B7-2/CD86	Human	37301	FAB141A	FAB141F	FAB141P	FAB141C		FAB141N	FAB141T/FAB141R	MAB141 (B/N, FC, WB)
B7-2/CD86	Mouse	GL1	FAB741A		FAB741P	FAB741C	FAB741G			MAB741 (B/N, FC, WB)
BAFF R/ TNFRSF13C	Human	Polyclonal	FAB1162A		FAB1162P					AF1162 (B/N, FC, WB)
BAFF R/ TNFRSF13C	Mouse	204406		FAB1755F						MAB1755 (FC)
BCMA/ TNFRSF17	Human	Polyclonal	FAB193A	FAB193F	FAB193P			FAB193N		AF193 (B/N, E, FC, WB)
BLIMP1/ PRDM1	Human	646702	IC36081A		IC36081P		IC36081G	IC36081N	IC36081R	
BLIMP1/ PRDM1	Human/Mouse	3H2-E8	NB600-235APC	NB600-235F	NB600-235PE	NB600-235PCP	NB600-235AF488	NB600-235AF700	NB600-235AF405/ NB600-235AF647	NB600-235 (ChIP, E, FC, ICC/IF, IHC, WB)
C1q R1/CD93	Human	273107	FAB23791A							MAB23791 (FC, WB)
C1q R1/CD93	Mouse	223437	FAB1696A		FAB1696P					MAB1696 (FC, ICC/IF)
CD1c	Human	Polyclonal	FAB5910A		FAB5910P					

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

■ R&D Systems product ■ Novus Biologicals product

Antibodies for Select Markers used to Identify B Cell Subsets by Flow Cytometry											
	Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							
				APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
								488	700	405/594/647/750	
	CD1d	Human	51.1	NBP1-43460APC		NBP1-43460PE	NBP1-43460PCP	NBP1-43460AF488	NBP1-43460AF700	NBP1-43460AF405/ NBP1-43460AF647	NBP1-43460 (FC, IHC, IP)
		Mouse	1B1	NBP1-43461APC		NBP1-43461PE	NBP1-43461PCP	NBP1-43461AF488	NBP1-43461AF700	NBP1-43461AF405/ NBP1-43461AF647	NBP1-43461 (FC, IHC, IP)
	CD5	Human	205919			FAB1636P					MAB1636 (FA, FC, WB)
		Mouse	53-7.3	FAB115A	FAB115F	FAB115P			FAB115N	FAB115V	MAB115 (FA, FC, IHC, IP)
	Neprilysin/ CD10	Human	HI10a	NB100-77917APC	NB100-77918	NB100-77917PE	NB100-77917PCP	NB100-77917AF488	NB100-77917AF700	NB100-77917AF405/ NB100-77917AF647	NB100-77917 (FC, WB)
	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)
			4G7		NBP1-79128	NBP1-79129					NBP1-50058 (FC, ICC/IF)
			SJ25-C1	NBP1-28379		NBP1-28378					NBP1-28375 (FC, IHC, IP)
		Mouse	1D3	NBP2-24968	NBP2-24967	NBP2-24966	NBP2-24965PCP	NBP2-24965AF488	NBP2-24965AF700	NBP2-24965AF405/ NBP2-24965AF647	NBP2-24965 (FC)
	CD20/MS4A1	Human	396444	FAB4225A	FAB4225F	FAB4225P			FAB4225N	FAB4225V	MAB4225 (FC)
		Human	2H7	NB100-64858APC	NB100-63542	NB100-64858PE	NB100-64858PCP	NB100-64858AF488	NB100-64858AF700	NB100-64858AF405/ NB100-64858AF647	NB100-64858 (FC, IHC, IP)
		Mouse	AISB12	NBP1-43435APC		NBP1-43435PE	NBP1-43435PCP	NBP1-43435AF488	NBP1-43435AF700	NBP1-43435AF405/ NBP1-43435AF647	NBP1-43435 (FC, WB)
	CD21	Human	544408	FAB4909A	FAB4909F	FAB4909P					MAB4909 (FC, WB)
	CD23/Fcε RII	Human	138628			FAB123P					MAB123 (B/N, FC, WB)
		Mouse	691632	FAB6900A		FAB6900P				FAB6900T	MAB6900 (FC)
		Mouse	B3B4		NB100-77387	NB100-63615					
	CD24	Human	ML5	FAB5247A							
		Human/Mouse	M1/69	NB100-77388APC	NBP2-00007	NB100-77388PE	NB100-77388PCP	NB100-77388AF488	NB100-77388AF700	NB100-77388AF405/ NB100-77388AF647	NB100-77388 (FC)
		Mouse	910019	FAB8547A		FAB8547P		FAB8547G			MAB8547 (FC, IHC)
	CD25/IL-2 Rα	Human	24212	FAB1020A		FAB1020P		FAB1020G			MAB1020 (FC, WB)
		Human	BC96	NBP1-43049	NB100-77772	NBP1-43879					NBP1-43430 (FC)
		Mouse	280406	FAB2438A		FAB2438P	FAB2438C	FAB2438G			MAB2438 (FC)
		Mouse	PC61	NBP2-30135	NBP2-30134	NBP2-27426	NBP2-27425PCP	NBP2-27425AF488	NBP2-27425AF700	NBP2-27425AF405/ NBP2-27425AF647	NBP2-27425 (FC)
		Mouse	7D4	NBP1-27921		NBP1-27920					
	CD27	Human	57703	FAB382A	FAB382F	FAB382P					MAB382 (B/N, FC, WB)
		Human/Mouse	LG.3A10		NBP1-50436						NBP1-43427 (FC, IHC, IP)
		Human/ Mouse/Rat	LG.7F9	NBP1-43428APC	NBP1-44021	NBP1-43428PE	NBP1-43428PCP	NBP1-43428AF488	NBP1-43428AF700	NBP1-43428AF405/ NBP1-43428AF647	NBP1-43428 (FA, FC, IP)
		Mouse	137915	FAB5741A		FAB5741P					MAB5741 (E, FC)
	CD30	Human	81337		FAB229F	FAB229P					MAB229 (FA, FC, WB)
	CD34	Human	QBEnd10	FAB7227A		FAB7227P		FAB7227G			
		Human	756510			FAB72271P		FAB72271G			MAB72271 (FC, ICC/IF)
	CD38	Human	240742	FAB2404A	FAB2404F	FAB2404P	FAB2404C				MAB2404 (FC, ICC/IF, IP)
		Human	HIT2	NB110-55355	NB500-592	NBP1-44720	NBP1-44723	NB500-510AF488	NB500-510AF700	NB500-510AF405/ NB500-510AF647	NB500-510 (FC, IHC, WB)
		Mouse	90	NB100-77405APC	NBP1-27957	NB100-77405PE	NB100-77405PCP	NB100-77405AF488	NB100-77405AF700	NB100-77405AF405/ NB100-77405AF647	NB100-77405 (FC)

Fluorochrome-conjugated Antibodies for Detecting Different Stages of Human and Mouse B Cell Development *continued*

Antibodies for Select Markers used to Identify B Cell Subsets by Flow Cytometry											
	Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							
				APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
								488	700	405/594/647/750	
■	CD40/ TNFRSF5	Human	82111	FAB6321A		FAB6321P					MAB6321 (FA, FC, ICC/IF)
□		Human	5C3		NBP1-44013	NBP1-43869					NBP1-43416 (FA, FC, IHC)
■	CD43	Human	290111	FAB2038A		FAB2038P					MAB2038 (FC, ICC/IF)
□		Human	DF-T1	NBP2-33140APC		NBP2-33140PE	NBP2-33140PCP	NBP2-33140AF488	NBP2-33140AF700	NBP2-33140AF405/ NBP2-33140AF647	NBP2-15190 (E, FC, ICC/IF, IHC, IP, WB)
□		Mouse	R2/60	NBP1-43413APC	NBP1-44011	NBP1-43413PE	NBP1-43413PCP	NBP1-43413AF488	NBP1-43413AF700	NBP1-43413AF405/ NBP1-43413AF647	NBP1-43413 (FC, IP, WB)
■	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)
■	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)
■	CXCR5	Human	51505	FAB190A	FAB190F	FAB190P	FAB190C		FAB190N		MAB190 (B/N, FC, ICC/IF, IHC)
■		Mouse	614641	FAB6198A	FAB6198F	FAB6198P	FAB6198C				MAB6198 (FC, ICC/IF)
■	FCRL3/FcRH3	Human	546828	FAB3126A		FAB3126P		FAB3126G			MAB3126 (FC)
■	Flt-3/Flk-2/ CD135	Human	66903	FAB812A	FAB812F	FAB812P			FAB812N		MAB812 (FC)
□		Mouse	113308	FAB7681A		FAB7681P					MAB7681 (FC, ICC/IF)
■	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)
■	HVEM/ TNFRSF14	Human	94801	FAB356A							MAB356 (E, FC, WB)
□	IgD	Mouse	11-26c		NBP1-43937	NBP1-43732					NBP1-43258 (FC)
□		Mouse	AMS-9.1	NBP1-48638APC	NBP2-29913	NBP1-48638PE	NBP1-48638PCP	NBP1-48638AF488	NBP1-48638AF700	NBP1-48638AF405/ NBP1-48638AF647	NBP1-48638 (FC)
□	IgM	Mouse	II/41	NBP1-42995	NBP1-43947	NBP1-43763					NBP1-43303 (E, FC, IHC)
■	IL-3 Rα	Human	32703	FAB301A		FAB301P	FAB301C	FAB301G	FAB301N		MAB301 (B/N, FC, ICC/IF, IHC, WB)
□		Human	6H6	NB600-1185APC	NB100-77827	NB600-1185PE	NB600-1185PCP	NB600-1185AF488	NB600-1185AF700	NB600-1185AF405/ NB600-1185AF647	NB600-1185 (FC, IHC, WB)
■	IL-4 Rα	Human	25463	FAB230A	FAB230F	FAB230P	FAB230C		FAB230N		MAB230 (B/N, FC, IHC, WB)
■	IL-7 Rα/CD127	Human	40131	FAB306A		FAB306P	FAB306C	FAB306G	FAB306N		MAB306 (FC, WB)
■		Mouse	A7R34	FAB47742A		FAB47742P		FAB47742G	FAB47742N		
■	IL-10	Human	127107		IC2172F	IC2172P					
□		Human	JES3-9D7								NBP2-27574 (E, FC, WB)
□		Mouse	AP-MAB0851	NBP1-06673APC		NBP1-06673PE	NBP1-06673PCP	NBP1-06673AF488	NBP1-06673AF700	NBP1-06673AF405/ NBP1-06673AF647	NBP1-06673 (FC, IP)

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

■ R&D Systems product □ Novus Biologicals product

Antibodies for Select Markers used to Identify B Cell Subsets by Flow Cytometry											
	Molecule	Species	Clone	Fluorochrome-conjugated Antibodies for Flow Cytometry (Catalog #s)							
				APC	Fluorescein	PE	PerCP	Alexa Fluor		Additional Alexa Fluor conjugates	Unconjugated Antibodies (Applications)
								488	700	405/594/647/750	
	MHC class II	Human	CVS20					NBP2-34848AF488			NBP2-34848 (FC, IHC, IP)
		Mouse	M5/114.15.2	FAB6118A	FAB6118F						
	TACI/ TNFRSF13B	Human	165604	FAB1741A		FAB1741P	FAB1741C	FAB1741G			MAB1741 (B/N, FC)
		Mouse	166010	FAB1041A		FAB1041P					MAB1041 (E, FC, WB)
	TGF-β1	Human	9016	IC240A	IC240F	IC240P					MAB240 (B/N, E, FC, IHC, WB)
		Mouse	860206								MAB7666 (FC)
	TGF-β1, 2, 3	Multi-species	1D11	IC1835A		IC1835P			IC1835N		
	Pax5	Human/Mouse	1H9			NBP2-00257					
	Sca-1/Ly6	Mouse	177228	FAB1226A		FAB1226P		FAB1226G	FAB1226N		MAB1226 (FC, ICC/IF)
	L-Selectin/ CD62L	Mouse	95218		FAB5761F	FAB5761P					MAB5761 (FC)
		Mouse	MEL-14	NBP1-28010	NBP1-28007	NB100-63971					NBP2-00260 (FC, IHC, IP)
	Siglec-2/CD22	Human	219934		FAB1968F	FAB1968P					MAB1968 (FC, ICC/IF)
		Mouse	308501	FAB2296A	FAB2296F	FAB2296P					MAB2296 (FC, WB)
	Siglec-G	Mouse	805903	FAB7775A							MAB7775 (FC)
	Syndecan-1/ CD138	Human	359103	FAB2780A	FAB2780F	FAB2780P					MAB2780 (FC, IHC)
		Human	B-A38		NB100-63417	NB110-81751	NBP1-57898				NB100-64980 (FA, FC, ICC/IF, IHC, WB)
		Mouse	300506	FAB2966A	FAB2966F	FAB2966P					MAB2966 (FC, ICC/IF)

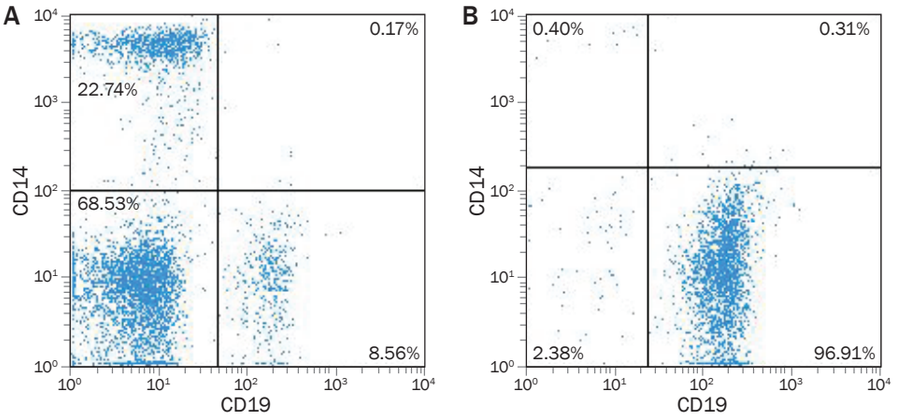
Additional Products for B Cell Research

In addition to the large selection of fluorochrome-conjugated antibodies that are offered by R&D Systems and Novus Biologicals, R&D Systems offers several kits to simplify your B cell research including B Cell Isolation and Expansion Kits, and recombinant proteins for B cell culture and differentiation. We also offer a wide range of assays designed to provide insight into the B cell-mediated immune response such as B Cell ELISpot Development Modules, Luminex® Immunoglobulin Isotyping Assays, and ELISA Kits to quantify B cell-secreted molecules.

B Cell Isolation Kits

R&D Systems® MagCellect™ B Cell Isolation Kits are designed to isolate B cells from a mononuclear cell suspension by negative selection. Using these kits, unwanted cells are magnetically tagged with a biotinylated antibody cocktail and streptavidin ferrofluid. The cell suspension is subsequently placed in a magnetic field, and the desired, untouched B cell population is harvested by aspiration and immediately available for a variety of downstream applications.

B Cell Isolation Kits	
Kit	**Catalog #**
MagCellect™ Human B Cell Isolation Kit	MAGH103
MagCellect™ Mouse B Cell Isolation Kit	MAGM204
MagCellect™ Rat B Cell Isolation Kit	MAGR303



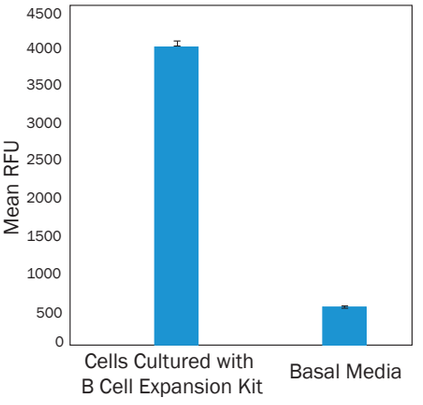
Enrichment of Human B Cells using the MagCellect Human B Cell Isolation Kit. Ficolled human peripheral blood mononuclear cells before (**A**) and after (**B**) isolation of B cells using the MagCellect Human B Cell Isolation Kit (Catalog # MAGH103). Dot plots reflect double-staining of all viable cells using a Fluorescein-conjugated Mouse Anti-Human CD19 Monoclonal Antibody (R&D Systems, Catalog # FAB4867F) and a PE-conjugated Mouse Anti-Human CD14 Monoclonal Antibody (R&D Systems, Catalog # FAB3832P).

B Cell Expansion Kit

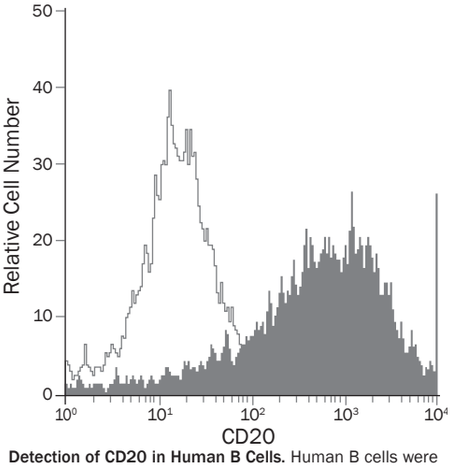
R&D Systems® CellXVivo™ Human B Cell Expansion Kit contains all of the reagents necessary to expand a population of 10^7 human B cells 3–5-fold.

B Cell Expansion Kit	
Kit	**Catalog #**
CellXVivo™ Human B Cell Expansion Kit	CDK005

LEARN MORE
rndsystems.com/CellXVivo



Expansion of B Cells using the CellXVivo™ Human B Cell Expansion Kit. Human B cells were isolated from peripheral blood mononuclear cells and cultured for five days using reagents included in the CellXVivo™ Human B Cell Expansion Kit (R&D Systems, Catalog # CDK005). B cell expansion was measured with Resazurin (R&D Systems, Catalog # AR002).



Detection of CD20 in Human B Cells. Human B cells were expanded for 5 days using reagents included in the Human B Cell Expansion Kit. The cells were labeled with a PE-conjugated Mouse Anti-Human CD20 Monoclonal Antibody (R&D Systems, Catalog # FAB4225P; filled histogram) or a PE-conjugated Mouse IgG_1 Isotype control (R&D Systems, Catalog # IC002P; open histogram).

Recombinant Proteins

R&D Systems is the most referenced manufacturer of recombinant and natural proteins in the scientific literature. By maintaining stringent production and purification standards, we ensure that our proteins provide researchers with industry-leading bioactivity and lot-to-lot consistency. In addition to the more than 4,800 proteins that we manufacture under standard conditions, we also offer Animal-Free™ and GMP-grade recombinant proteins as well as custom protein development services.

Select Recombinant Proteins for B Cell Culture & Differentiation		
Molecule	**Species**	**Catalog #**
CD40 Ligand	Human	6420-CL
	Mouse	8230-CL
IL-2	Human	202-IL
	Mouse	402-IL
IL-4	Human	204-IL
	Mouse	404-ML
IL-6	Human	206-IL
	Mouse	406-ML
IL-10	Human	217-IL
	Mouse	417-ML
IL-21	Human	8879-IL
	Mouse	594-ML
Recombinant Human IL-2, IL-4, and IL-6 are also available as GMP-grade proteins.		

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B Cell ELISpot Development Modules

B Cell ELISpot Development Modules contain the basic components required to develop an ELISpot assay to detect IgE, IgG, or IgM-secreting B cells.

B Cell ELISpot Development Modules	
Kit	**Catalog #**
Human IgE B Cell ELISpot Development	SELB001
Human IgG B Cell ELISpot Development	SELB002
Human IgM B Cell ELISpot Development	SELB003
Mouse IgG B Cell ELISpot Development	SELB004
Mouse IgM B Cell ELISpot Development	SELB005

Luminex® Mouse Immunoglobulin Isotyping Assay

This bead-based assay is designed to simultaneously quantify multiple mouse immunoglobulin isotype concentrations in cell culture supernatants, serum, or EDTA plasma. The assay is designed for use with the Luminex MAGPIX®, Luminex 100™, Luminex 200™, or Bio-Rad® Bio-Plex® dual laser, flow-based sorting and detection analyzers.

Luminex® Immunoglobulin Isotyping Assay		
Analyte	**Polystyrene Beads Catalog #**	**Magnetic Beads Catalog #**
Mouse IgG_1	LXIGM1	LXMIGMG1
Mouse IgG_{2A}	LXIGM2	LXMIGMG2
Mouse IgG_{2B}	LXIGM3	LXMIGMG3
Mouse IgG_3	LXIGM4	LXMIGMG4
Mouse IgA	LXIGM5	LXMIGMG5
Mouse IgM	LXIGM6	LXMIGMG6
Mouse Immunoglobulin Isotyping Base Kit	LXIGM	LXMIGMG

Learn More
rndsystems.com/Luminex

B Cell-related ELISA Kits

R&D Systems offers complete Quantikine® ELISA Kits and DuoSet® ELISA Development Systems for detecting B cell-secreted cytokines

Select B Cell-related ELISA Kits			
Molecule	**Species**	**Quantikine® ELISA Catalog #**	**DuoSet® ELISA Catalog #**
IL-6	Human	D6050	DY206
	Mouse	M6000B	DY406
IL-10	Human	D1000B	DY217B
	Mouse	M1000B	DY417
TGF-β1	Human	DB100B	DY240
	Mouse	MB100B	DY1679
TNF-α	Human	DTA00C	DY210
	Mouse	MTA00B	DY410

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