Characteristics of Blood Group Antibodies

BIO-RAD

Antibody	ISBT Symbol	Immunoglobulin class: IgM	Immunoglobulin class: IgG	*In vitro* characteristics: Saline RT	*In vitro* characteristics: IAT	*In vitro* characteristics: Papain 37°C*	*In vitro* characteristics: May show dosage	*In vitro* characteristics: Complement binding	Associated with: HDFN	Associated with: HTR	Antigen Frequency (%): Caucasians	Antigen Frequency (%): Blacks	Antigen Frequency (%): Others	Remarks
ABO (ISBT No 001) & H Blood Group (ISBT No 018) Systems														
Anti-A	ABO1	Yes	Yes	Yes for IgM component	Yes for IgG component	↑↑		Yes some hemolytic	No to moderate	No to severe	43	27	Asians: 28 Mexicans: 28 South American Indians: 0	
Anti-B	ABO2	Yes	Yes	Yes for IgM component	Yes for IgG component	↑↑		Yes some hemolytic	No to moderate	No to severe	9	20	Asians: 27 Mexicans: 13 South American Indians: 0	
Anti-A_1B	ABO3	Yes	Yes	Yes for IgM component	Yes for IgG component	↑↑		Rare	No to severe	None to mild/delayed	56	51	Asians: 57 Mexicans: 45	Anti-A_1B is only produced by group O individuals, and cannot be separated into anti-A and anti-B.
Anti-A_1	ABO4	Yes	Rare	Yes	Rare	↑↑		Rare	No	None to mild/delayed	34	19	Asians: 27	Frequency: 1-2% in blood group A_2, 25% in blood group A_2B, 99% in blood group A_1
Anti-H	H1	Yes	Rare	Yes	Rare	↑↑		Some	Possible in O_h mothers	No to severe in O_h and $H+^w$	All populations: 99.9			Alloanti-H is present in the serum of Bombay (O_h) and Para-Bombay ($H+^w$) people. O cells show the strongest antigen expression, A_1B cells the weakest.
MNS (ISBT No 002) Blood Group System														
Anti-M	MNS1	Yes	Yes	IgM and IgG	Rare	↓↓	Yes		No (except in extremely rare cases)	No (except in extremely rare cases)	78	74		Many examples are naturally-occurring. May be pH dependant. More common in children, and in patients with bacterial infections.
Anti-N	MNS2	Yes	Yes	IgM and IgG	Rare	↓↓	Yes		No	No	72	75		Many examples are naturally-occurring. Rare N-S-s-U- individuals make an antibody that reacts with N on GPA and GPB, and is usually clinically significant.
Anti-S	MNS3	Some	Most	Some	Most	V	Yes	Some	No to severe (rare)	No to moderate (rare)	55	31		The S antigen is sensitive to trace amounts of chlorine.
Anti-s	MNS4	Yes	Yes	Some	Most	V	Yes	Rare	No to severe (rare)	No to mild (rare)	89	93		Reacts often by IAT after incubation at RT or lower. A pH of 6.0 enhances the reactivity of some anti-s.
Anti-U	MNS5		Yes	No	Yes	↔			Mild to severe	Mild to severe	99.9	99		Autoantibody has been identified to cause WAIHA in rare cases.
P1PK (ISBT No 003) & GLOB (ISBT No 028) Blood Group Systems														
Anti-P1	P1PK1	Yes	Rare	Yes	Very rare	↑↑		Rare	No	No to moderate/ delayed (rare)	79	94	Cambodian, Vietnamese: 20	There is considerable variation in the strength of P1 expression on RBC's. This variation is inherited, and at least partially dependent on the zygosity of P^1 alleles.
Anti-P	GLOB1	Yes	Yes	Some	Some	↑↑		Yes some hemolytic	No to mild (in P^k mothers with anti-P)	No to severe (rare)	All populations: > 99.9			Autoanti-P exists as a biphasic autohemolysin in PCH, detected by the Donath-Landsteiner test may occur after viral illness, particularly in children.
Anti-PP1P^k (Tj^a)			Yes	Some	Some	↑↑		Yes	Yes	Yes	100			Alloantibody in sera of p- people may cause complete hemolysis in fresh serum Anti-PP1P^k is a potential cause of early abortion.
Rh (ISBT No 004) Blood Group System														
Anti-D	RH1	Some	Most	Rare	Yes	↑↑		Extremely rare	Mild to severe	Mild to severe/ immediate or delayed	85	92	Asians: 99 Native Americans: 99	Occurs frequently with anti-C.
Anti-C	RH2	Yes	Yes	Rare	Yes	↑↑	Yes	No	Mild	Mild to severe/ immediate or delayed	68	27	Asians: 93	Anti-C is often found in antibody mixtures, especially with anti-G or anti-D.
Anti-E	RH3	Yes	Yes	Some	Yes	↑↑	Yes	No	Mild	Mild to severe/ immediate or delayed	29	22	Asians: 39	Occurs frequently with anti-c.
Anti-c	RH4	Some	Most	Rare	Yes	↑↑	Yes	No	Mild to severe	Mild to severe/ immediate or delayed	80	98	Asians: 47	Occurs frequently with anti-E.
Anti-e	RH5	Some	Most	Rare	Yes	↑↑	Yes	No	Rare, usually mild	Mild to moderate/ delayed/ hemoglobinuria	98		Asians: 96	Occurs frequently with anti-C.
Anti-C^w	RH8	Yes	Yes	Yes	Yes	↑↑		No	Mild to moderate	Mild to severe/ immediate or delayed	2	1	Finns: 4 Latvians: 9	Most C^w+ are C+; rare examples are C-.
Lutheran (ISBT No 005) Blood Group System														
Anti-Lu^a	LU1	Yes	Yes	Most	Some	↔ to ↓		Rare	No to mild (rare)	No	8	5		Characteristic reaction picture of "loose" agglutinates surrounded by unagglutinated RBCs in tube technique. Sera containing anti-Lu^a often also contain HLA antibodies.
Anti-Lu^b	LU2	Yes	Yes	Some	Most	↔ to ↓		Rare	Mild	Mild to moderate	All populations: 99.8			
Anti-Lu3	LU3		Yes	No	Yes	↔		Rare	No data	No data	All populations: 100			Anti-Lu3 is only made by immunized individuals of the rare recessive type Lu(a-b-).
Kell (ISBT No 006) Blood Group System														
Anti-K	KEL1	Some	Most	Some	Yes	↔		Rare	Mild to severe (rare)	Mild to severe/ delayed/hemolytic	9	2	Asians: rare Iranian Jews: 12 Arabs: 25	Anti-K may not react well by LISS procedures. Some bacteria trigger production of IgM anti-K. Expression of K can be acquired through bacterial activity *in vivo* and *in vitro*.
Anti-k	KEL2	Rare	Most	Rare	Yes	↔		No	Mild to severe (rare)	Mild to moderate/ delayed	99.8	100		
Anti-Kp^a	KEL3		Yes	Very rare	Yes	↔		No	Mild to severe	Mild to moderate/ delayed	2	< 0.01		In the presence of Kp^a, other inherited Kell antigens are suppressed (cis-modifying effect) to varying degrees. Anti-Kp^a appears often combined with anti-K.
Anti-Kp^b	KEL4	Rare	Yes	Rare	Yes	↔		No	Mild to moderate	No to moderate/ delayed	100			Sera containing anti-Kp^b often contain anti-K.
Anti-Js^a	KEL6	Rare	Most	Rare	Yes	↔ to ↑		No	Mild to severe	No to moderate/ delayed	< 0.01	20		
Anti-Js^b	KEL7		Yes	Very rare	Yes	↔ to ↑		No	Mild to severe	Mild to moderate/ delayed	100	99		
Lewis (ISBT No 007) Blood Group System														
Anti-Le^a	LE1	Most	Some	Yes	Some	↑↑		Yes some hemolytic	No (one mild case)	No (rare cases of hemolytic reactions)	22	23		Anti-Le^a and anti-Le^b in conjunction are frequently naturally occurring antibodies made by Le(a-b-) people, especially during pregnancy. There are two kinds of anti-Le^b: anti-Le^{b1} (LE4), reacting with group O and A_1 Le(b+) RBCs, and anti-Le^{b2}, reacting with all Le(b+) RBCs. Other antibodies react specifically with the compound antigens, e.g., ALe^b (LE5) and BLe^b (LE6).
Anti-Le^b	LE2	Most	Some	Yes	Some	↑↑		Yes some hemolytic	No	No	72	55		
Duffy (ISBT No 008) Blood Group System														
Anti-Fy^a	FY1	Rare	Yes	Very rare	Yes	↓↓	Some	Rare	Mild to severe (rare)	Mild to severe (rare)/ immediate/delayed	66	10	Asians: 99 Thais: 97	
Anti-Fy^b	FY2	Very rare	Yes	Very rare	Yes	↓↓	Some	Rare	Mild (rare)	Mild to severe (rare)/ immediate (rare)/ delayed	83	23	Chinese: 9.2 Asians: 18.5 Thais: 31	
Anti-Fy3	FY3		Yes		Yes	↔	Yes	Rare	Mild (rare)	Mild to moderate/ immediate (rare)/ delayed/hemolytic	100	32	Asians: 99.9 Yemeni Jews: 99 Israeli Jews: 96 Israeli Arabs: 75	
Kidd (ISBT No 009) Blood Group System														
Anti-Jk^a	JK1	Yes many IgG + IgM	Yes many IgG + IgM	Rare	Yes	↑	Some	Yes if IgM present some hemolytic	Mild to moderate (rare)	No to severe/ immediate or delayed/ hemolytic	77	92	Asians: 72	Anti-Jk^a deteriorates *in vitro* and *in vivo*.
Anti-Jk^b	JK2	Yes many IgG + IgM	Yes many IgG + IgM	Rare	Yes	↑	Some	Yes if IgM present some hemolytic	No to mild (rare)	No to severe/ immediate or delayed/ hemolytic	74	49	Asians: 76	Anti-Jk^b deteriorates *in vitro* and *in vivo*.
Anti-Jk3	JK3	Rare	Yes	Rare	Yes	↑		Yes some hemolytic	No to mild	No to severe/ immediate or delayed	100		Polynesians, Finns: > 99	
Diego (ISBT No 010) Blood Group System														
Anti-Di^a	DI1		Yes (often IgG1 and IgG3)		Yes	↔		Some	Mild to severe	No to severe/ delayed	Most populations: 0.01 South American Indians: from 2 in Caracas Indians to 54 in Kaingangnes Indians, Japanese: 12, Chippewa Indians (Canada): 11, Chinese: 5, Hispanics: 1, Poles: 0.47			
Anti-Di^b	DI2		Yes		Yes	↔	Yes	No	Mild	No to moderate/ delayed	Most populations: 100 Native Americans: 99			
Anti-Wr^a	DI3	Yes	Yes	Yes	Yes	↔			Mild to severe	No to severe/ immediate or delayed/ hemolytic	All populations: < 0.01			Alloanti-Wr^a is often a naturally-occurring antibody and is found in the serum of 1-2% of blood donors. It is frequently found in multispecific sera and is a common specificity in patients with AIHA.
Yt (ISBT No 011) Blood Group System														
Anti-Yt^a	YT1		Yes (some are IgG4)		Yes	V		Some	No	No to moderate (rare)/ delayed	Most populations: > 99.8 Israeli Jews: 98.6, Israeli Arabs: 97.6, Israeli Druse: 97.4			Experts agree that anti-Yt^a are often benign and antigen-negative blood may not need to be transfused.
Anti-Yt^b	YT2		Yes		Yes	V			No	No	Europeans: 8, Israeli Jews: 21.3, Israeli Arabs: 23.5, Israeli Druse: 26 Not found in Japanese			Anti-Yt^b is rare and usually occurs in sera with other antibodies.
Xg (ISBT No 012) Blood Group System														
Anti-Xg^a	XG1	Rare	Most	Some	Most	↓↓		Some	No	No	89 Females, 66 Males			
Dombrock (ISBT No 014) Blood Group System														
Anti-Do^a	DO1		Yes		Yes	↑			Positive DAT but no clinical HDFN	Delayed and acute/ hemolytic	67	55	Japanese: 24 Thais: 14	Anti-Do^a is notorious for disappearing *in vivo*.
Anti-Do^b	DO2		Yes		Yes	↑			Positive DAT but no clinical HDFN	Acute and delayed	82	89		
Colton (ISBT No 015) Blood Group System														
Anti-Co^a	CO1	Very rare	Yes		Yes	↔		Some	Mild to severe (rare)	No to moderate/ delayed/immediate/ hemolytic	All populations: 99.5			
Anti-Co^b	CO2		Yes		Yes	↔		Rare	Mild	No to moderate/ delayed/hemolytic	All populations: 10			
Chido/Rodgers (ISBT No 017) Blood Group System														
Anti-Ch1	CH/RG1		Yes (mostly IgG2 and IgG4)		Yes	↓			No	Not hemolytic	Most populations: 96		Japanese: 99	Most anti-Ch1 are IgG2 and IgG4. A few reports describe anaphylactic transfusion reactions from plasma products and platelets. Soluble plasma antigen in donor blood may neutralise patient's antibody. Anti-Ch1 reacts strongly with C4-coated RBCs.
Anti-Rg1	CH/RG11		Yes		Yes	↓			No	Not hemolytic	All populations: > 98			A few reports describe anaphylactic transfusion reactions from plasma products and platelets.
Knops (ISBT No 022) Blood Group System														
Anti-Kn^a	KN1		Yes		Yes	↓			No	No	94.5	99.9		
Anti-McC^a	KN3		Yes		Yes	↓			No	No	98	94		
Anti-Yk^a	KN5		Yes		Most	↓			No	No	92	98		
John Milton Hagen, JMH (ISBT No 026) Blood Group System														
Anti-JMH	JMH1		Yes		Yes	↓			No	No	All populations: 100			JMH— or JMH-weak phenotypes can be (transiently) acquired; anti-JMH in that case is mostly IgG4.
I (ISBT No 027) Blood Group System & Ii (ISBT No 207) Blood Group Collection														
Anti-I	I1	Yes	Rare	Yes	Very rare	↑↑		Yes some hemolytic	No	No	Adults: > 99			Most common cold autoantibody, rare alloantibody in I— (adult I), high titre at 0–4°C, wide thermal range, associated with CHAD and Mycoplasma pneumoniae infection.
Anti-i	I2	Yes	Rare	Most	Very rare	↑↑		Yes some hemolytic	Rare	No	100			Autoantibody can occur in serum of people with infectious mononucleosis and some lymphoproliferative disorders.
JR (ISBT No 032) Blood Group System														
Anti-Jr^a	JR1	Some	Yes		Yes	↑		Some	Positive DAT but usually no HDFN; however one fatal case of HFDN	Probably	All populations: > 99			The Jr(a-) phenotype has been found mostly in Japanese and other Asians, but also in persons of northern European extraction, Bedouin Arabs, and in one Mexican.
Lan (ISBT No 033) Blood Group System														
Anti-Lan	LAN1		Yes		Yes	↔		Some	No to mild	No to severe/ hemolytic	All populations: > 99			The Lan— phenotypes found in about 1 in 20,000 people; found in Blacks, Caucasians and Japanese.
Vel (ISBT No 034) Blood Group System														
Anti-Vel	VEL1	Yes (usually a mixture of IgM and IgG)	Yes (usually a mixture of IgM and IgG)		Yes	↑↑		Yes some hemolytic	Positive DAT to severe	No to severe/ hemolytic	All populations: > 99.9			Red cells with a weak Vel expression may be mistyped as Vel-. Vel- RBCs have been found in 1 in ~4,000 people and 1 in ~1,700 in Norwegians and Swedes.
Cost (ISBT No 205) Blood Group Collection														
Anti-Cs^a	COST1		Yes		Yes	↔			No	No	Most populations: > 98	95		
Anti-Cs^b	COST2		Yes		Yes	↔					Most populations: 34			Only one example of antibody is published.

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Legend*

Papain treated cells, 37°C

↑↑	markedly enhanced
↑	enhanced
↔	unaffected
↓	weakened
↓↓	denatured
V	variable

Abbreviations

AIHA	Autoimmune hemolytic anemia
CHAD	Cold hemagglutinin disease
DAT	Direct antiglobulin test
HDFN	Hemolytic disease of the fetus and newborn
HTR	Hemolytic transfusion reaction
IAT	Indirect antiglobulin test
Ig	Immunoglobulin
ISBT	International Society of Blood Transfusion
LISS	Low-ionic strength solution
PCH	Paroxysmal cold hemoglobinuria
RBC	Red blood cell
RT	Room temperature

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