Names for KEL (ISBT 006) Blood Group Alleles

Intro

General description:	The Kell blood group system consists of 36 antigens carried on a type II transmembrane glycoprotein of 732 amino acids (aka CD238). The Kell glycoprotein is a zinc-dependent metalloproteinase that has been shown to have endothelin-3-converting enzyme activity. A single disulfide bond (Kell Cys72 - XK Cys347) links the KEL protein to the XK membrane protein that carries the Kx antigen. Absence of XK leads to a reduction of expression of Kell antigens on the red blood cell membrane.

Gene name:	*KEL*
Number of exons:	19
Initiation codon:	Within exon 1
Stop codon:	Within exon 19
Entrez Gene ID:	3792
LRG:	LRG_799
LRG sequence:	NG_007492.3 (genomic) NM_000420.3, ENST00000355265.7 (transcript) NP_000411.1, ENSP00000347409.2 (protein)
Reference allele:	*KEL*02* (shaded) Acceptable: *k* if inferred by haemagglutination
Reference allele *KEL*02* encodes:	KEL2, KEL4, KEL5, KEL7, KEL11, KEL12, KEL13, KEL14, KEL16, KEL18, KEL19, KEL20, KEL22, KEL26, KEL27, KEL29, KEL30, KEL32, KEL33, KEL34, KEL35, KEL36, KEL37, KEL38
Antithetical antigens:	[KEL1 KEL2]; [KEL3 KEL4 KEL21]; [KEL6 KEL7]; [KEL11 KEL17]; [KEL14 KEL24]; [KEL31 KEL38]; [KEL37 KEL39]
Low frequency antigens:	KEL3, KEL6, KEL10, KEL17, KEL21, KEL23, KEL24, KEL25, KEL28, KEL31, KEL39

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
KEL:1,-2 or K+k-	*KEL*01.01*	c.578C>T	6	p.Thr193Met	(1), PMID: 7849312	S76770.1	rs8176058
KEL:1weak or K+w	*KEL*01.02*	c.577A>T	6	p.Thr193Ser	(2), PMID: 17076841	n.a.	rs61729031
KEL:1weak,3 or K+w, Kp(a+)	*KEL*01.03*	c.578C>T c.841C>T	6 8	p.Thr193Met p.Arg281Trp	(3), PMID: 19347978	FM208212.1	rs8176058 rs8176059
KEL:2 or k+	*KEL*02*	c.578C	6	p.Thr193	(4), PMID: 1712490	M64934 NM_000420.2	rs8176058
KEL:2 or k+	*KEL*02.00.02*	c.1546C>A	14	p.Arg516Arg	(21), PMID: 24845979	HG512887.1	rs8176034
KEL:3,-4,-21 or Kp(a+b–c–)	*KEL*02.03*	c.841C>T	8	p.Arg281Trp	(5), PMID: 8669078	AM085119	rs8176059
KEL:6,-7 or Js(a+b–)	*KEL*02.06*	c.1790T>C	17	p.Leu597Pro	(6), PMID: 7570911	S80081.1	rs8176038
KEL:10 or Ul(a+)	*KEL*02.10*	c.1481A>T	13	p.Glu494Val	(5), PMID: 8669078	n.a.	rs61729032
KEL: -12	*KEL*02.-12*	c.1643A>G	15	p.His548Arg	(7), PMID: 9426633	n.a.	rs61729033
KEL:-14,-24	*KEL*02.-14.1*	c.538C>T	6	p.Arg180Cys	(8), PMID: 9354821	n.a.	rs747437444
KEL:-14	*KEL*02.-14.2*	c.539G>A	6	p.Arg180His	(8), PMID: 9354821	n.a.	rs61729039
KEL: -11,17	*KEL*02.17*	c.905T>C	8	p.Val302Ala	(5), PMID: 8669078	n.a.	rs61729034
KEL:-18	*KEL*02.-18.1*	c.388C>T	4	p.Arg130Trp	(7), PMID: 9426633	n.a.	rs184131044
KEL:-18	*KEL*02.-18.2*	c.389G>A	4	p.Arg130Gln	(7), PMID: 9426633	n.a.	rs201110152
KEL:-19	*KEL*02.-19*	c.1475G>A	13	p.Arg492Gln	(7), PMID: 9426633	n.a.	rs61729035
KEL:-3,-4,21 or Kp(a–b–c+)	*KEL*02.21*	c.842G>A	8	p.Arg281Gln	(5), PMID: 8669078	n.a.	rs61729036
KEL:-22	*KEL*02.-22*	c.965C>T	9	p.Ala322Val	(7), PMID: 9426633	n.a.	rs61729037
KEL:23	*KEL*02.23*	c.1145A>G	10	p.Gln382Arg	(9), PMID: 9269063	n.a.	rs61729038
KEL: -14,24	*KEL*02.24*	c.539G>C	6	p.Arg180Pro	(8), PMID: 9354821	n.a.	rs61729039
KEL:25,-28 or VLAN+ VONG-	*KEL*02.25*	c.743G>A	8	p.Arg248Gln	(10), PMID: 8837356	n.a.	rs61729040

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
KEL:-26 or TOU-	*KEL*02.-26*	c.1217G>A	11	p.Arg406Gln	(7), PMID: 9426633	n.a.	rs61729041
KEL:-27 or RAZ-	*KEL*02.-27*	c.745G>A	8	p.Glu249Lys	(11), PMID: 11904003	n.a.	rs61729042
KEL:-25,28 or VLAN- VONG+	*KEL*02.28*	c.742C>T	8	p.Arg248Trp	(12), Abstract	n.a.	rs61728832
KEL:-29 or KALT-	*KEL*02.-29*	c.1868G>A	17	p.Arg623Lys	(13), PMID: 16934067	JN038574.1	rs61729043
KEL:−30 or KTIM-	*KEL*02.-30*	c.913G>A	8	p.Asp305Asn	(13), PMID: 16934067	JN038575.1	rs61729044
KEL:31, -38 or KYO+, KYOR-	*KEL*02.31*	c.875G>A	8	p.Arg292Gln	(14), Abstract (15), PMID: 23968329	n.a.	rs201698610
KEL:-32 or KUCI-	*KEL*02.-32*	c.1271C>T	11	p.Ala424Val	(16), PMID: 23560718	JN020633.1	rs779011501
KEL:-33 or KANT-	*KEL*02.-33*	c.1283G>T	11	p.Arg428Leu	(16), PMID: 23560718	JN038573.1	rs750806448
KEL:-34 or KASH-	*KEL*02.-34*	c.758A>G	8	p.Tyr253Cys	(17), Abstract	n.a.	n.a.
KEL:-35 or KELP-	*KEL*02.-35*	c.780G>T c.2024G>A	8 18	p.Leu260Phe p.Arg675Gln	(18), Abstract	n.a.	rs1235779167 rs760716472
KEL:-36 or KETI-	*KEL*02.-36*	c.1391C>T	12	p.Thr464Ile	(19), Abstract	n.a.	rs190890637
KEL:-37,39 or KHUL-,KEAL+	*KEL*02.39*	c.877C>T	8	p.Arg293Trp	(15), PMID: 23968329 (20), PMID: 27679424	KF366655.1	rs557358978

Null Phenotypes							
K_0	*KEL*01N.01*	c.578C>T c.1678C>G	6 15	p.Thr193Met p.Pro560Ala	(22), PMID: 25960716	n.a.	rs8176058 rs61729046
K_0	*KEL*01N.02*	c.244T>C c.578C>T	4 6	p.Cys82Arg p.Thr193Met	(23), PMID: 23581548	n.a.	rs369127636 rs8176058
K_0	*KEL*01N.03*	c.1382_1385del4	12	p.Asn461Argfs*25	(48), PMID: 27861976	KX431940.1	n.a.
K_0	*KEL*02N.01*	c.223+1g>c	i3	Aberrant splicing: p.Ser28AlafsTer113	(24), PMID: 11134029	n.a.	rs369569464

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
K_0	*KEL*02N.02 (See also KEL*02N.26)*	c.382C>T c.1790T>C	4 17	p.Arg128* p.Leu597Pro	(25), PMID: 11375401	n.a.	rs61729053 rs8176038
K_0	*KEL*02N.03*	c.246T>A	4	p.Cys82*	(25), PMID: 11375401	n.a.	rs61729058
K_0	*KEL*02N.04*	c.1042C>T	9	p.Gln348*	(25), PMID: 11375401 (28), PMID: 17381630	AM085122.1	rs61729054
K_0	*KEL*02N.05*	c.2027G>A	18	p.Ser676Asn	(25), PMID: 11375401	n.a.	rs61729051
K_0	*KEL*02N.06*	c.223+1g>a	i3	Aberrant splicing: p.Ser28AlafsTer113	(25), PMID: 11375401 (28), PMID: 17381630	AM085124.1	rs369569464
K_0	*KEL*02N.07*	c.574C>T	6	p.Arg192*	(25), PMID: 11375401	n.a.	rs200430183
K_0	*KEL*02N.08*	c.526-2a>g	i5	Aberrant splicing: p.Leu176Alafs*9	(26), PMID: 11918559	n.a.	n.a.
K_0	*KEL*02N.09*	c.1377G>A	12	p.Trp459*	(26), PMID: 11918559	n.a.	rs61729052
K_0	*KEL*02N.10*	c.1420C>T	13	p.Gln474*	(27), PMID: 15819675	DQ340982.1	rs61729056
K_0	*KEL*02N.11*	c.904delG	8	p.Val302Serfs*28	(27), PMID: 15819675	DQ340981.1	rs61729059
K_0	*KEL*02N.12*	c.924+1g>a	i8	Aberrant splicing	(28), PMID: 17381630	AM085117.1	rs568600999
K_0	*KEL*02N.13*	c.924+1g>t	i8	Aberrant splicing	(28), PMID: 17381630	AM085127.1	rs568600999
K_0	*KEL*02N.14*	c.948G>A	9	p.Trp316*	(28), PMID: 17381630	AM085128.1	rs61729049
K_0	*KEL*02N.15*	c.1216C>T	11	p.Arg406*	(28), PMID: 17381630	AM085114.1	rs61729045
K_0	*KEL*02N.16*	c.1477C>T	13	p.Gln493*	(28), PMID: 17381630	AM085125.1	rs61729050
K_0	*KEL*02N.17*	c.1546C>T	14	p.Arg516*	(28), PMID: 17381630	AM085126.1 AM183930.1	rs8176034
K_0	*KEL*02N.18*	c.1678C>G	15	p.Pro560Ala	(28), PMID: 17381630	AM085120.1	rs61729046
K_0	*KEL*02N.19*	c.2023C>T	18	p.Arg675*	(28), PMID: 17381630	AM085118.1	rs61729047
$K_{0,}$	*KEL*02N.20*	c.1596G>A	15	p.Trp532*	(29), PMID: 12869119	n.a.	n.a.

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
K_0	*KEL*02N.21*	c.1947C>G	18	p.Tyr649*	(30), Book	n.a.	rs902425813
K_0	*KEL*02N.22*	c.736−1g>c	i7	Aberrant splicing	(31), PMID: 20384970	bankit1316809	rs765075509
K_0	*KEL*02N.23*	c.184dupT (*published as 185insT*)	3	p.Ser62Phefs*17	(32), PMID: 19747286	EF208900.1	rs751207765
K_0	*KEL*02N.24*	c.715G>T	7	p.Glu239*	(32), PMID: 19747286	EF208901.1	rs766427535
K_0	*KEL*02N.25*	c.1975delG	18	p.Glu659Argfs*22	(23), PMID: 23581548	n.a.	rs1042359399
K_0	*KEL*02N.26 (See also KEL*02N.02)*	c.382C>T	4	p.Arg128*	(23), PMID: 23581548	n.a.	rs61729053
K_0	*KEL*02N.27*	c.730delG	7	p.Ala244Profs*8	(33), PMID: 21707797	n.a.	n.a.
K_0	*KEL*02N.28*	c.230G>T	4	p.Cys77Phe	(15), PMID: 23968329	KF280266.1	n.a.
K_0	*KEL*02N.29*	c.1664G>A	15	p.Gly555Glu	(15), PMID: 23968329	KF366656.1	n.a.
K_0	*KEL*02N.30*	c.71G>A	2	p.Trp24*	(34), PMID: 24506314	n.a.	rs753369164
K_0	*KEL*02N.31*	c.1771+1g>a	i16	Aberrant splicing	(34), PMID: 24506314	n.a.	rs869025768
K_0	*KEL*02N.32*	c.455A>G	5	p.Tyr152Cys	(35), PMID: 25041236	n.a.	rs1228818924
K_0	*KEL*02N.33*	c.1726G>C	16	p.Gly576Arg	(35), PMID: 25041236	n.a.	rs201778033
K_0	*KEL*02N.34*	c.841C>T c.2099G>A	8 19	p.Arg281Trp p.Arg700Gln	(21), PMID: 24845979	HG512886.1	rs8176059 rs1268359042
K_0	*KEL*02N.35*	c.398T>C	4	p.Leu133Pro	(36), PMID: 25156717	KF993652.1	n.a.
K_0	*KEL*02N.36*	c.436delG	5	p.Glu146Argfs*43	(36), PMID: 25156717	KJ636457.1	rs762799244
K_0	*KEL*02N.37*	c.1253T>C	11	p.Phe418Ser	(36), PMID: 25156717	KF993653.1	rs149225200
K_0	*KEL*02N.38*	c.1832T>G	17	p.Leu611Arg	(36), PMID: 25156717	KJ636456.1	n.a.
K_0	*KEL*02N.39*	c.2098C>T	19	p.Arg700*	(36), PMID: 25156717	KF993655.1	rs565926203

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
K_0	*KEL*02N.40*	c.1474C>T	13	p.Arg492*	(36), PMID: 25156717	KF993654.1	rs932456335
K_0	*KEL*02N.41*	c.267C>G	4	p.Tyr89*	(46), PMID: 27888518	n.a.	rs879327552
K_0	*KEL*02N.42*	c.299G>C	4	p.Cys100Ser	(47), PMID: 29280152	LC314159.1	rs 200268316
K_0	*KEL*02N.43*	c.328delA	4	p.Arg110Glyfs*79	(47), PMID: 29280152	LC314160.1	n.a.
K_0	*KEL*02N.44*	c.2175delC	19	p.Ser726Profs*43	(47), PMID: 29280152	LC314161.1	n.a.
K_0	*KEL*02N.45*	c.937G>A c.1073G>C	9	p.Ala313Thr p.Arg358Thr possibly aberrant splicing	(47), PMID: 29280152	LC314162.1	rs191311545 n.a.
K_0	*KEL*02N.46*	c.160_161delATinsCTCC	3	p.Ile54Leufs*136	(47), PMID: 29280152	LC314163.1	n.a.
K_0	*KEL*02N.47 (See*	c.1664G>T	15	p.Gly555Val	(47), PMID: 29280152	LC314164.1	n.a.
K_0	*KEL*02N.48*	c.481A>T	5	p.Ile161Phe	(47), PMID: 29280152	LC314165.1	n.a.
K_0	*KEL*02N.49*	c.997C>T	9	p.Gln333*	(47), PMID: 29280152	LC314166.1	n.a.
K_0	*KEL*02N.50*	c.2120delG	19	p.Ser707Thrfs*17	(47), PMID: 29280152	LC314167.1	n.a.
K_0	*KEL*02N.51*	c.1414-1G>C	i12	Aberrant splicing	(47), PMID: 29280152	LC314168.1	rs906814829
K_0	*KEL*02N.52*	c.1813_1814insC	17	p.Gln605Profs*18	(47), PMID: 29280152	LC314169.1	n.a.
K_0	*KEL*02N.53*	c.371delA	4	p.Lys124Argfs*65	(48), PMID: 27861976	KX431939.1	n.a.
K_0	*KEL*02N.54*	c.201C>A	3	p.Tyr67*	(48), PMID: 27861976	KX431938.1	n.a.
K_0	*KEL*02N.55*	c.712C>T	7	p.Gln238*	(49), PMID: 32598050	MT009034	rs753948889
K_0	*KEL*02N.56*	c.1896-1897delCT	17	p.Leu633Argfs*50	(50), PMID: 34137046	n.a.	n.a.
K_0	*KEL*02N.57*	c.223+1g>t	i3	Aberrant splicing: p.Ser28AlafsTer113	(51), Submitted	MW465351	rs369569464
K_0	*KEL*02N.58*	c.184delT	3	p.Ser62Leufs*127	(43), PMID: 23581578	n.a.	n.a.

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
K_0	*KEL*02N.59*	c.1708G>A	16	p.Val570Met	(43), PMID: 23581578	n.a.	rs766803262
K_0	*KEL*02N.60*	c.1314+5G>A	i11	Aberrant splicing	(43), PMID: 23581578	n.a.	n.a.
Mod phenotypes (weak expression KEL antigens) Classification of a mod phenotype may depend on the reagents used							
Kmod or KEL:1weak	*KEL*01M.01*	c.578C>G	6	p.Thr193Arg	(37), Abstract	n.a.	rs8176058
Kmod	*KEL*01M.02*	c.578C>T c.977C>T	6 9	p.Thr193Met p.Pro326Leu	(38), PMID: 24588083	HG514448.1	rs8176058, rs751284993
Kmod	*KEL*01M.03*	c.578C>T c.1339C>T c.1680A>C	6 12 15	p.Thr193Met p.Arg447Trp p.Pro560Pro	(39), PMID: 26996808	LN899832.1	rs8176058 rs142604829 rs8176036
Kmod	*KEL*01M.04*	c.578C>T c.1920G>C c.1921G>A	6 17 17	p.Thr193Met p.Gly640Gly p.Gly641Arg	(39), PMID: 26996808	LN899833.1	rs8176058 rs542976466 n.a.
Kmod	*KEL*01M.05*	c.578C>T c.1899A>G c.1934C>T	6 17 17	p.Thr193Met p.Leu633Leu p.Ala645Val	(39), PMID: 26996808	LN899834.1 LN680548	rs8176058 rs8176039 rs147851584
Kmod	*KEL*01M.06*	c.578C>T c.1680A>C c.2107G>C	6 15 19	p.Thr193Met p.Pro560Pro p.Gly703Arg	(39), PMID: 26996808	LN899835.1	rs8176058 rs8176036 rs191330570
Kmod	*KEL*02M.01*	c.1088G>A	10	p.Ser363Asn	(25), PMID: 11375401 (29), PMID: 12869119	n.a.	rs61729055
Kmod	*KEL*02M.02*	c.2030A>G	18	p.Tyr677Cys	(29), PMID: 12869119	AM085116.1	rs147464117
Kmod KEL:−13	*KEL*02M.03*	c.986T>C	9	p.Leu329Pro	(29), PMID: 12869119	n.a.	rs61729057
Kmod	*KEL*02M.04*	c.2107G>A	19	p.Gly703Arg	(29), PMID: 12869119	n.a.	rs191330570

Phenotype	Allele name	Nucleotide change	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number
K_0 phenotype	*KEL*02M.05 (Only silent mutation)*	c.1719C>T	16	p.Gly573Gly	(40), PMID: 24795954	AM085115.1 KC922434.1	rs145850557
Kmod	*KEL*02M.06*	c.306C>A c.1298C>T	4 11	p.Asp102Glu p.Pro433Leu	(28), PMID: 17381630	AM085123.1	rs758637202 rs143238294
Kmod	*KEL*02M.07*	c.1763A>G	16	p.Tyr588Cys	(28), PMID: 17381630	AM085121.1	rs61729048
Kmod	*KEL*02M.08*	c.1490A>T	13	p.Asp497Val	(41), Abstract	AM183929.1	rs1286534156
Kmod	*KEL*02M.09*	c.1757T>G	16	p.Ile586Ser	(42), Book	n.a.	n.a.
Kmod	*KEL*02M.10*	c.787G>A	8	p.Gly263Arg	(31), PMID: 20384970	EU362929	n.a.
Kmod	*KEL*02M.11*	c.1268C>T	11	p.Ala423Val	(9), PMID: 9269063	n.a.	rs61728831
Kmod	*KEL*02M.12*	c.2111C>A	19	p.Pro704His	(35), PMID: 25041236	FM208265	rs747806266
Kmod	*KEL*02M.13*	c.257G>A c.841C>T	4 8	p.Arg86Gln p.Arg281Trp	(36), PMID: 25156717	KF993651.1 AM183928.1	rs777011308 rs8176059
Kmod	*KEL*02M.14 (K0 phenotype)*	c.1084C>A	10	p.Gln362Lys	(43), PMID: 23581578	n.a.	rs766310210
Kmod	*KEL*02M.15*	c.575G>C	6	p.Arg192Pro	(39), PMID: 26996808	LN899836.1	rs754663945
Kmod	*KEL*02M.16*	c.788G>A	8	p.Gly263Glu	(39), PMID: 26996808	LN899837.1	rs775889759
Kmod	*KEL*02M.17*	c.586C>G	6	p.Leu196Val	(44), PMID: 30586164	MH136803.1	rs760539605
Kmod	*KEL*02M.18 (See KEL*02N.47)*	c.1664G>T	15	p.Gly555Val	(45), PMID: 31077392	LC440557.1	n.a.

Nucleotide 1 is the first nucleotide of the translation-initiating codon, which is 120 bp downstream of the traditional position for the first nucleotide in early

References

1. PMID: 7849312 — Lee S, Wu X, Reid M, et al.: Molecular basis of the Kell (K1) phenotype. *Blood* 1995; 85: 912-6.

2. PMID: 17076841 — Poole J, Warke N, Hustinx H, et al.: A KEL gene encoding serine at position 193 of the Kell glycoprotein results in expression of KEL1 antigen. *Transfusion* 2006; 46: 1879-85.

3. PMID: 19347978 — Körmöczi GF, Scharberg EA, Gassner C: A novel KEL*1,3 allele with weak Kell antigen expression confirming the cis-modifier effect of KEL3. *Transfusion* 2009; 49: 733-9.

4. PMID: 1712490 — Lee S, Zambas ED, Marsh WL, et al.: Molecular cloning and primary structure of Kell blood group protein. *Proc Natl Acad Sci U S A* 1991; 88: 6353-7.

5. PMID: 8669078 — Lee S, Wu X, Son S, et al.: Point mutations characterize KEL10, the KEL3, KEL4, and KEL21 alleles, and the KEL17 and KEL11 alleles. *Transfusion* 1996; 36: 490-4.

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Track of changes			from version	to version
	Version		**v7.0 January 15, 2020**	**v5.0 25-FEB-2020**
1	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
2	Reviewer	reviewed:	Christoph Gassner	Christoph Gassner
3	General		First Excel map version. Spread-sheets "Intro", "Allele Table", "References", and "Versioning" created.	First Excel map version. Spread-sheets "Intro", "Allele Table", "References", and "Versioning" created.
4	Intro	Text changed	Text added: "The protein links via a single disulfide bond to the XK membrane protein that carries the Kx antigen. Absence of XK leads to a reduction of expression of Kell antigens on the red blood cell membrane."	Text added: "The protein links via a single disulfide bond to the XK membrane protein that carries the Kx antigen. Absence of XK leads to a reduction of expression of Kell antigens on the red blood cell membrane."
5	Intro	LRG ID line added:	LRG_799	LRG_799
6	Intro	LRG sequence added:	NP_000411.1 (protein)	NG_007492.2 (genomic) NM_000420.2 (transcript) NP_000411.1 (protein)
7	Intro	Antithetical Antigens line created in Intro:	[KEL1 KEL2]; [KEL3 KEL4 KEL21]; [KEL6 KEL7]; [KEL11 KEL17]; [KEL14 KEL24]; [WT KEL25 KEL28]; [KEL31 KEL38]; [KEL37 KEL39]	KEL13 and KEL21 added to reference allele on basis of high frequency (to be verified)

8	Intro	Low frequency antigen line created in Intro	KEL3, KEL6, KEL10, KEL17, KEL21, KEL23, KEL24, KEL25, KEL28, KEL31, KEL39 (extra line created because LF antigens KEL10 and KEL23 were missing from Intro)	Reference allele line moved from Allele Table to Intro: reference allele with 24 antigens: KEL2, KEL4, KEL5, KEL7, KEL11, KEL12, KEL13, KEL14, KEL16, KEL18, KEL19, KEL20, KEL22, KEL26, KEL27, KEL29, KEL30, KEL32, KEL33, KEL34, KEL35, KEL36, KEL37, KEL38 [KEL1 KEL2]; [KEL3 KEL4 KEL21]; [KEL6 KEL7]; [KEL11 KEL17]; [KEL14 KEL24]; [WT KEL25 KEL28]; [KEL31 KEL38]; [KEL27 KEL29]
9	Reference allele		Reference allele line moved from Allele Table to Intro: reference allele with 24 antigens: KEL2, KEL4, KEL5, KEL7, KEL11, KEL12, KEL13, KEL14, KEL16, KEL18, KEL19, KEL20, KEL22, KEL26, KEL27, KEL29, KEL30, KEL32, KEL33, KEL34, KEL35, KEL36, KEL37, KEL38	KEL3, KEL6, KEL10, KEL17, KEL21, KEL23, KEL24, KEL25, KEL28, KEL31, KEL39 (extra line created since low frequency antigens KEL10 and KEL23 were missing in Intro)
10	Allele Table	Table column and header additions	Table columns "(Reference No.) PMID" created and content added and column "Accession number" and "rs-number" updated	Table columns "(Reference No.) PMID" created and content added and column "Accession number" and "rs-number" updated
11	Allele Table	added:	KEL*01N.03 added	KEL*01N.03 added
12	Allele Table	added:	KEL*02N.41 added	KEL*02.39 added
13	Allele Table	added:	KEL*02N.42 added	KEL*02.40 added
14	Allele Table	added:	KEL*02N.43 added	KEL*01N.03 added
15	Allele Table	added:	KEL*02N.44 added	KEL*02N.30 to KEL*02N.54 added
16	Allele Table	added:	KEL*02N.45 added	KEL*01M.02 to KEL*01M.06 added
17	Allele Table	added:	KEL*02N.46 added	KEL*02M.12 to KEL*02M.18 added
	Allele Table	added:	KEL*02N.47 added	KEL*02N.26 and KEL*02N.02 same null mutation (no expression of Kel antigens). Allele in cis with Jsa and Jsb respectivily.
18	Allele Table	added:	KEL*02N.48 added	

19	Allele Table	added:	KEL*02N.49 added	
20	Allele Table	added:	KEL*02N.50 added	
21	Allele Table	added:	KEL*02N.51 added	
22	Allele Table	added:	KEL*02N.52 added	
23	Allele Table	added:	KEL*02N.53 added	
24	Allele Table	added:	KEL*02N.54 added	
25	Allele Table	Remark added	KEL*02N.26 and KEL*02N.02 same null mutation (no expression of Kel antigens). Allele in cis with Jsa and Jsb respectivily.	
26	**End Version**		**v7.0 January 15, 2020**	**v5.0 25-FEB-2020**

	Track of changes		from version	to version
1	**Version**		**v5.0 25-FEB-2020**	**v6.0 30-JUN-2021**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Version	reviewed:	Christoph Gassner	Christoph Gassner
4	Intro	LRG sequence added:	NG_007492.2 (genomic) NM_000420.2 (transcript) NP_000411.1 (protein)	NG_007492.3 (genomic) NM_000420.3, ENST00000355265.7 (transcript) NP_000411.1, ENSP00000347409.2 (protein)
5	Allele Table	changed	KEL: (incorrectly published as KEL*02.38), *KEL*02.40*	*KEL*02.00.02*
6	Allele Table	added:		rs773975756 removed from KEL*02N.44
7	Allele Table	added:		KEL*02N.55 added 12-3-2020
8	Allele Table	added:		KEL*02N.56 added 28-9-2020
9	Allele Table	added:		KEL*02N.57 added 08-1-2021
10	Allele Table	added:		KEL*02N.58 added 23-1-2021
11	Allele Table	added:		KEL*02N.59 added 23-1-2021
12	Allele Table	added:		KEL*02N.60 added 23-1-2021
13	References			Reference: Vox Sanguinis abbreviated to Vox Sang. (Abstract) moved to the end: [Abstract]
14	**End Version**		**v5.0 25-FEB-2020**	**v6.0 30-JUN-2021**

Antigens of the Kel System

001	002	003	004	005	006	007	008	009	010	011	012	
K	k	Kpa	Kpb	Ku	Jsa	Jsb	...	...	Ula	K11	K12	10
013	014	015	016	017	018	019	020	021	022	023	024	
K13	K14	...	K16	K17	K18	K19	Km	Kpc	K22	K23	K24	11
025	026	027	028	029	030	031	032	033	034	035	036	
VLAN	TOU	RAZ	VONG	KALT	KTIM	KYO	KUCI	KANT	KASH	KELP	KETI	12
037	038	039										
KHUL	KYOR	KEAL										3
											total	36

Antigens in reference sequence