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 (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
KEL:1,-2 or K+k-	***KEL*01.01***	c.578C>T	6	p.Thr193Met	PMID: 7849312	S76770.1	rs8176058	7:142957921
KEL:1weak or K+w	***KEL*01.02***	c.577A>T	6	p.Thr193Ser	PMID: 17076841	n.a.	rs61729031	7:142957922
KEL:1weak,3 or K+w, Kp(a+)	***KEL*01.03***	c.578C>T c.841C>T	6 8	p.Thr193Met p.Arg281Trp	PMID: 19347978	FM208212.1	rs8176058 rs8176059	7:142957921 7:142954267
KEL:2 or k+	***KEL*02***	c.578C	6	p.Thr193	PMID: 1712490	M64934 NM_000420.2	rs8176058	7:142957921
KEL:2 or k+	***KEL*02.00.02***	c.1546C>A	14	p.Arg516Arg	PMID: 24845979	HG512887.1	rs8176034	7:142943829
KEL:3,-4,-21 or Kp(a+b–c–)	***KEL*02.03***	c.841C>T	8	p.Arg281Trp	PMID: 8669078	AM085119	rs8176059	7:142954267
KEL:6,-7 or Js(a+b–)	***KEL*02.06***	c.1790T>C	17	p.Leu597Pro	PMID: 7570911	S80081.1	rs8176038	7:142943026
KEL:10 or Ul(a+)	***KEL*02.10***	c.1481A>T	13	p.Glu494Val	PMID: 8669078	n.a.	rs61729032	7:142944333
KEL: -12	***KEL*02.-12***	c.1643A>G	15	p.His548Arg	PMID: 9426633	n.a.	rs61729033	7:142943546
KEL:-14,-24	***KEL*02.-14.1***	c.538C>T	6	p.Arg180Cys	PMID: 9354821	n.a.	rs747437444	7:142957961
KEL:-14	***KEL*02.-14.2***	c.539G>A	6	p.Arg180His	PMID: 9354821	n.a.	rs61729039	7:142957960
KEL: -11,17	***KEL*02.17***	c.905T>C	8	p.Val302Ala	PMID: 8669078	n.a.	rs61729034	7:142954203
KEL:-18	***KEL*02.-18.1***	c.388C>T	4	p.Arg130Trp	PMID: 9426633	n.a.	rs184131044	7:142960940
KEL:-18	***KEL*02.-18.2***	c.389G>A	4	p.Arg130Gln	PMID: 9426633	n.a.	rs201110152	7:142960939
KEL:-19	***KEL*02.-19***	c.1475G>A	13	p.Arg492Gln	PMID: 9426633	n.a.	rs61729035	7:142944339
KEL:-3,-4,21 or Kp(a–b–c+)	***KEL*02.21***	c.842G>A	8	p.Arg281Gln	PMID: 8669078	n.a.	rs61729036	7:142954266
KEL:-22	***KEL*02.-22***	c.965C>T	9	p.Ala322Val	PMID: 9426633	n.a.	rs61729037	7:142953916
KEL:23	***KEL*02.23***	c.1145A>G	10	p.Gln382Arg	PMID: 9269063	n.a.	rs61729038	7:142952567
KEL: -14,24	***KEL*02.24***	c.539G>C	6	p.Arg180Pro	PMID: 9354821	n.a.	rs61729039	7:142957960

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
KEL:25,-28 or VLAN+ VONG-	***KEL*02.25***	c.743G>A	8	p.Arg248Gln	PMID: 8837356	n.a.	rs61729040	7:142954365
KEL:-26 or TOU-	***KEL*02.-26***	c.1217G>A	11	p.Arg406Gln	PMID: 9426633	n.a.	rs61729041	7:142946304
KEL:-27 or RAZ-	***KEL*02.-27***	c.745G>A	8	p.Glu249Lys	PMID: 11904003	n.a.	rs61729042	7:142954363
KEL:-25,28 or VLAN- VONG+	***KEL*02.28***	c.742C>T	8	p.Arg248Trp	(1), Abstract	n.a.	rs61728832	7:142954366
KEL:-29 or KALT-	***KEL*02.-29***	c.1868G>A	17	p.Arg623Lys	PMID: 16934067	JN038574.1	rs61729043	7:142942948
KEL:−30 or KTIM-	***KEL*02.-30***	c.913G>A	8	p.Asp305Asn	PMID: 16934067	JN038575.1	rs61729044	7:142954195
KEL:31, -38 or KYO+, KYOR-	***KEL*02.31***	c.875G>A	8	p.Arg292Gln	(2), Abstract PMID: 23968329	n.a.	rs201698610	7:142954233
KEL:-32 or KUCI-	***KEL*02.-32***	c.1271C>T	11	p.Ala424Val	PMID: 23560718	JN020633.1	rs779011501	7:142946250
KEL:-33 or KANT-	***KEL*02.-33***	c.1283G>T	11	p.Arg428Leu	PMID: 23560718	JN038573.1	rs750806448	7:142946238
KEL:-34 or KASH-	***KEL*02.-34***	c.758A>G	8	p.Tyr253Cys	(3), Abstract	n.a.	n.a.	7:142954350
KEL:-35 or KELP-	***KEL*02.-35***	c.780G>T c.2024G>A	8 18	p.Leu260Phe p.Arg675Gln	(4), Abstract	n.a.	rs1235779167 rs760716472	7:142954328 7:142942447
KEL:-36 or KETI-	***KEL*02.-36***	c.1391C>T	12	p.Thr464Ile	(5), Abstract	n.a.	rs190890637	7:142944665
KEL:-37,39 or KHUL-,KEAL+	***KEL*02.39***	c.877C>T	8	p.Arg293Trp	PMID: 23968329 PMID: 27679424	KF366655.1	rs557358978	7:142954231

Null phenotypes								
K_0	***KEL*01N.01***	c.578C>T c.1678C>G	6 15	p.Thr193Met p.Pro560Ala	PMID: 25960716	n.a.	rs8176058 rs61729046	7:142957921 7:142943511
K_0	***KEL*01N.02***	c.244T>C c.578C>T	4 6	p.Cys82Arg p.Thr193Met	PMID: 23581548	n.a.	rs369127636 rs8176058	7:142961084 7:142957921

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
K_0	***KEL*01N.03***	c.578C>T c.1382_1385del	6 12	p.Thr193Met p.Asn461Argfs*25	PMID: 27861976	KX431940.1	n.a.	7:142957921 7:142944671-142944674
K_0	***KEL*01N.04***	c.578C>T c.821T>A	6 8	p.Thr193Met p.Leu274*	PMID: 23581578		rs8176058 n.a.	7:142957921 7:142954287
K_0	***KEL*02N.01***	c.223+1g>c	i3	Aberrant splicing: p.Ser28AlafsTer113	PMID: 11134029	n.a.	rs369569464	7:142961359
K_0	***KEL*02N.02 (See also KEL*02N.26)***	c.382C>T c.1790T>C	4 17	p.Arg128* p.Leu597Pro	PMID: 11375401	n.a.	rs61729053 rs8176038	7:142960946 7:142943026
K_0	***KEL*02N.03***	c.246T>A	4	p.Cys82*	PMID: 11375401	n.a.	rs61729058	7:142961082
K_0	***KEL*02N.04***	c.1042C>T	9	p.Gln348*	PMID: 11375401 PMID: 17381630	AM085122.1	rs61729054	7:142953839
K_0	***KEL*02N.05***	c.2027G>A	18	p.Ser676Asn	PMID: 11375401	n.a.	rs61729051	7:142942444
K_0	***KEL*02N.06***	c.223+1g>a	i3	Aberrant splicing: p.Ser28AlafsTer113	PMID: 11375401 PMID: 17381630	AM085124.1	rs369569464	7:142961359
K_0	***KEL*02N.07***	c.574C>T	6	p.Arg192*	PMID: 11375401	n.a.	rs200430183	7:142957925
K_0	***KEL*02N.08***	c.526-2a>g	i5	Aberrant splicing: p.Leu176Alafs*9	PMID: 11918559	n.a.	n.a.	7:142957975
K_0	***KEL*02N.09***	c.1377G>A	12	p.Trp459*	PMID: 11918559	n.a.	rs61729052	7:142944679
K_0	***KEL*02N.10***	c.1420C>T	13	p.Gln474*	PMID: 15819675	DQ340982.1	rs61729056	7:142944394
K_0	***KEL*02N.11***	c.904delG	8	p.Val302Serfs*28	PMID: 15819675	DQ340981.1	rs61729059	7:142954204
K_0	***KEL*02N.12***	c.924+1g>a	i8	Aberrant splicing	PMID: 17381630	AM085117.1	rs568600999	7:142954183
K_0	***KEL*02N.13***	c.924+1g>t	i8	Aberrant splicing	PMID: 17381630	AM085127.1	rs568600999	7:142954183
K_0	***KEL*02N.14***	c.948G>A	9	p.Trp316*	PMID: 17381630	AM085128.1	rs61729049	7:142953933
K_0	***KEL*02N.15***	c.1216C>T	11	p.Arg406*	PMID: 17381630	AM085114.1	rs61729045	7:142946305

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
K_0	***KEL*02N.16***	c.1477C>T	13	p.Gln493*	PMID: 17381630	AM085125.1	rs61729050	7:142944337
K_0	***KEL*02N.17***	c.1546C>T	14	p.Arg516*	PMID: 17381630	AM085126.1 AM183930.1	rs8176034	7:142943829
K_0	***KEL*02N.18***	c.1678C>G	15	p.Pro560Ala	PMID: 17381630	AM085120.1	rs61729046	7:142943511
K_0	***KEL*02N.19***	c.2023C>T	18	p.Arg675*	PMID: 17381630	AM085118.1	rs61729047	7:142942448
K_0,	***KEL*02N.20***	c.1596G>A	15	p.Trp532*	PMID: 12869119	n.a.	n.a.	7:142943593
K_0	***KEL*02N.21***	c.1947C>G	18	p.Tyr649*	(1), Book	n.a.	rs902425813	7:142942524
K_0	***KEL*02N.22***	c.736−1g>c	i7	Aberrant splicing	PMID: 20384970	bankit1316809	rs765075509	7:142954373
K_0	***KEL*02N.23***	c.184dupT (*published as 185insT*)	3	p.Ser62Phefs*17	PMID: 19747286	EF208900.1	rs751207765	7:142961398
K_0	***KEL*02N.24***	c.715G>T	7	p.Glu239*	PMID: 19747286	EF208901.1	rs766427535	7:142954485
K_0	***KEL*02N.25***	c.1975delG	18	p.Glu659Argfs*22	PMID: 23581548	n.a.	rs1042359399	7:142942496
K_0	***KEL*02N.26 (See also KEL*02N.02)***	c.382C>T	4	p.Arg128*	PMID: 23581548	n.a.	rs61729053	7:142960946
K_0	***KEL*02N.27***	c.730delG	7	p.Ala244Profs*8	PMID: 21707797	n.a.	n.a.	7:142954470
K_0	***KEL*02N.28***	c.230G>T	4	p.Cys77Phe	PMID: 23968329	KF280266.1	n.a.	7:142961098
K_0	***KEL*02N.29***	c.1664G>A	15	p.Gly555Glu	PMID: 23968329	KF366656.1	n.a.	7:142943525
K_0	***KEL*02N.30***	c.71G>A	2	p.Trp24*	PMID: 24506314	n.a.	rs753369164	7:142961805
K_0	***KEL*02N.31***	c.1771+1g>a	i16	Aberrant splicing	PMID: 24506314	n.a.	rs869025768	7:142943275
K_0	***KEL*02N.32***	c.455A>G	5	p.Tyr152Cys	PMID: 25041236	n.a.	rs1228818924	7:142958374
K_0	***KEL*02N.33***	c.1726G>C	16	p.Gly576Arg	PMID: 25041236	n.a.	rs201778033	7:142943321

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
K_0	***KEL*02N.34***	c.841C>T c.2099G>A	8 19	p.Arg281Trp p.Arg700Gln	PMID: 24845979	HG512886.1	rs8176059 rs1268359042	7:142954267 7:142941352
K_0	***KEL*02N.35***	c.398T>C	4	p.Leu133Pro	PMID: 25156717	KF993652.1	n.a.	7:142960930
K_0	***KEL*02N.36***	c.436delG	5	p.Glu146Argfs*43	PMID: 25156717	KJ636457.1	rs1562964425	7:142958393
K_0	***KEL*02N.37***	c.1253T>C	11	p.Phe418Ser	PMID: 25156717	KF993653.1	rs149225200	7:142946268
K_0	***KEL*02N.38***	c.1832T>G	17	p.Leu611Arg	PMID: 25156717	KJ636456.1	n.a.	7:142942984
K_0	***KEL*02N.39***	c.2098C>T	19	p.Arg700*	PMID: 25156717	KF993655.1	rs565926203	7:142941353
K_0	***KEL*02N.40***	c.1474C>T	13	p.Arg492*	PMID: 25156717	KF993654.1	rs932456335	7:142944340
K_0	***KEL*02N.41***	c.267C>G	4	p.Tyr89*	PMID: 27888518	n.a.	rs879327552	7:142961061
K_0	***KEL*02N.42***	c.299G>C	4	p.Cys100Ser	PMID: 29280152	LC314159.1	rs 200268316	7:142961029
K_0	***KEL*02N.43***	c.328delA	4	p.Arg110Glyfs*79	PMID: 29280152	LC314160.1	n.a.	7:142961000
K_0	***KEL*02N.44***	c.2175delC	19	p.Ser726Profs*43	PMID: 29280152	LC314161.1	n.a.	7:142941273
K_0	***KEL*02N.45***	c.937G>A c.1073G>C	9	p.Ala313Thr p.Arg358Thr possibly aberrant splicing	PMID: 29280152	LC314162.1	rs191311545 n.a.	7:142953944 7:142953808
K_0	***KEL*02N.46***	c.160_161delATinsCTCC	3	p.Ile54Leufs*136	PMID: 29280152	LC314163.1	n.a.	7:142961422- 7:142961423
K_0	***KEL*02N.47 (See KEL*02M.18)***	c.1664G>T	15	p.Gly555Val	PMID: 29280152	LC314164.1	n.a.	7:142943525
K_0	***KEL*02N.48***	c.481A>T	5	p.Ile161Phe	PMID: 29280152	LC314165.1	n.a.	7:142958348
K_0	***KEL*02N.49***	c.997C>T	9	p.Gln333*	PMID: 29280152	LC314166.1	n.a.	7:142953884
K_0	***KEL*02N.50***	c.2120delG	19	p.Ser707Thrfs*17	PMID: 29280152	LC314167.1	n.a.	7:142941331

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
K_0	***KEL*02N.51***	c.1414-1G>C	i12	Aberrant splicing	PMID: 29280152	LC314168.1	rs906814829	7:142944401
K_0	***KEL*02N.52***	c.1813_1814insC	17	p.Gln605Profs*18	PMID: 29280152	LC314169.1	n.a.	7:142943002-7:142943003
K_0	***KEL*02N.53***	c.371delA	4	p.Lys124Argfs*65	PMID: 27861976	KX431939.1	n.a.	7:142960957
K_0	***KEL*02N.54***	c.201C>A	3	p.Tyr67*	PMID: 27861976	KX431938.1	n.a.	7:142961382
K_0	***KEL*02N.55***	c.712C>T	7	p.Gln238*	PMID: 32598050	MT009034	rs753948889	7:142954488
K_0	***KEL*02N.56***	c.1896_1897delCT	17	p.Leu633Argfs*50	PMID: 34137046	n.a.	n.a.	7:142942919-7:142942920
K_0	***KEL*02N.57***	c.223+1g>t	i3	Aberrant splicing: p.Ser28AlafsTer113	PMID: 34310722	MW465351	rs369569464	7:142961359
K_0	***KEL*02N.58***	c.184delT	3	p.Ser62Leufs*127	PMID: 23581578	n.a.	n.a.	7:142961399
K_0	***KEL*02N.59***	c.1708G>A	16	p.Val570Met	PMID: 23581578	n.a.	rs766803262	7:142943339
K_0	***KEL*02N.60***	c.1314+5G>A	i11	Aberrant splicing	PMID: 23581578	n.a.	n.a.	7:142946202
K_0	***KEL*02N.61***	c.972delC	9	p.Phe324Leufs*6	PMID: 34554576	MZ322306	n.a.	7:142953909
K_0	***KEL*02N.62***	c.1130T>C	10	p.Leu377Pro	PMID: 34554576	MF774805	rs1216525453	7:142952582
K_0	***KEL*02N.63***	c.454_456delTAC	5	p.Tyr152del	PMID: 34554576	MZ322305	rs1241298894	7:142958374
K_0	***KEL*02N.64***	c.523G>T	5	p.Glu175*	PMID: 34554576	MF774804	n.a.	7:142958306
K_0	***KEL*02N.65***	c.2038–2A>G	i18	Splicing defect	PMID: 34554576	MF774806	n.a.	7:142941415
K_0	***KEL*02N.66***	c.948G>T	9	p.Trp316Cys	(8), Abstract and submitted	n.a.	rs61729049	7:142953933

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
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	(6), Abstract	n.a.	rs8176058	7:142957921
Kmod	***KEL*01M.02***	c.578C>T c.977C>T	6 9	p.Thr193Met p.Pro326Leu	PMID: 24588083	HG514448.1	rs8176058, rs751284993	7:142957921 7:142953904
Kmod	***KEL*01M.03***	c.578C>T c.1339C>T c.1680A>C	6 12 15	p.Thr193Met p.Arg447Trp p.Pro560Pro	PMID: 26996808	LN899832.1	rs8176058 rs142604829 rs8176036	7:142957921 7:142944717 7:142943509
Kmod	***KEL*01M.04***	c.578C>T c.1920G>C c.1921G>A	6 17 17	p.Thr193Met p.Gly640Gly p.Gly641Arg	PMID: 26996808	LN899833.1	rs8176058 rs542976466 n.a.	7:142957921 7:142942896 7:142942895
Kmod	***KEL*01M.05***	c.578C>T c.1899A>G c.1934C>T	6 17 17	p.Thr193Met p.Leu633Leu p.Ala645Val	PMID: 26996808	LN899834.1 LN680548	rs8176058 rs8176039 rs147851584	7:142957921 7:142942917 7:142942882
Kmod	***KEL*01M.06***	c.578C>T c.1680A>C c.2107G>C	6 15 19	p.Thr193Met p.Pro560Pro p.Gly703Arg	PMID: 26996808	LN899835.1	rs8176058 rs8176036 rs191330570	7:142957921 7:142943509 7:142941344
Kmod	***KEL*02M.01***	c.1088G>A	10	p.Ser363Asn	PMID: 11375401 PMID: 12869119	n.a.	rs61729055	7:142952624
Kmod	***KEL*02M.02***	c.2030A>G	18	p.Tyr677Cys	PMID: 12869119	AM085116.1	rs147464117	7:142942441
Kmod KEL:−13	***KEL*02M.03***	c.986T>C	9	p.Leu329Pro	PMID: 12869119	n.a.	rs61729057	7:142953895
Kmod	***KEL*02M.04***	c.2107G>A	19	p.Gly703Arg	PMID: 12869119	n.a.	rs191330570	7:142941344
K_0 phenotype	***KEL*02M.05 (Only silent mutation)***	c.1719C>T	16	p.Gly573Gly	PMID: 24795954	AM085115.1 KC922434.1	rs145850557	7:142943328
Kmod	***KEL*02M.06***	c.306C>A c.1298C>T	4 11	p.Asp102Glu p.Pro433Leu	PMID: 17381630	AM085123.1	rs758637202 rs143238294	7:142961022 7:142946223
Kmod	***KEL*02M.07***	c.1763A>G	16	p.Tyr588Cys	PMID: 17381630	AM085121.1	rs61729048	7:142943284

Phenotype	Allele name	Nucleotide change (NM_000420.2)	Exon Intron	Predicted amino acid change	(Reference nr) PMID	Accession number	rs number	GRCh38
Kmod	***KEL*02M.08***	c.1490A>T	13	p.Asp497Val	(7), Abstract	AM183929.1	rs1286534156	7:142944324
Kmod	***KEL*02M.09***	c.1757T>G	16	p.Ile586Ser	(2), Book	n.a.	n.a.	7:142943290
Kmod	***KEL*02M.10***	c.787G>A	8	p.Gly263Arg	PMID: 20384970	EU362929	n.a.	7:142954321
Kmod	***KEL*02M.11***	c.1268C>T	11	p.Ala423Val	PMID: 9269063	n.a.	rs61728831	7:142946253
Kmod	***KEL*02M.12***	c.2111C>A	19	p.Pro704His	PMID: 25041236	FM208265	rs747806266	7:142941340
Kmod	***KEL*02M.13***	c.257G>A c.841C>T	4 8	p.Arg86Gln p.Arg281Trp	PMID: 25156717	KF993651.1 AM183928.1	rs777011308 rs8176059	7:142961071 7:142954267
Kmod	***KEL*02M.14 (K0 phenotype)***	c.1084C>A	10	p.Gln362Lys	PMID: 23581578	n.a.	rs766310210	7:142952628
Kmod	***KEL*02M.15***	c.575G>C	6	p.Arg192Pro	PMID: 26996808	LN899836.1	rs754663945	7:142957924
Kmod	***KEL*02M.16***	c.788G>A	8	p.Gly263Glu	PMID: 26996808	LN899837.1	rs775889759	7:142954320
Kmod	***KEL*02M.17***	c.586C>G	6	p.Leu196Val	PMID: 30586164	MH136803.1	rs760539605	7:142957913
Kmod	***KEL*02M.18 (See KEL*02N.47)***	c.1664G>T	15	p.Gly555Val	PMID: 31077392	LC440557.1	n.a.	7:142943525
Kmod	***KEL*02M.19***	c.575G>A	6	p.Arg192Gln	(9), submitted	OU383835.1	rs754663945	7:142957924

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

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PMID	20384970	Wester ES, Steffensen R, Ligthart PC, et al.: KEL*02 alleles with alterations in and around exon 8 in individuals with apparent KEL:1,-2 phenotypes. *Vox Sang* 2010; 99: 150-7.
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PMID	34554576	Floch A, Velliquette RW, Vege S, et al.: Five novel silenced KEL*02 alleles. *Transfusion* 2021; 61(11):E77-E79.
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	Track of changes		from	to
1	**Version**		**v6.0 21-June-2021**	**v7.0 30-NOV-2021**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Reviewed	reviewed:	Christoph Gassner	Christoph Gassner
4	Allele Table	Antigen/allele added:	KEL*02.-40 added 27-7-2020	KEL*02N.61 added 09-07-2021
5	Allele Table	Antigen/allele added:	rs773975756 removed from KEL*02N.44	KEL*02N.62 added 09-07-2021
6	Allele Table	Antigen/allele added:	KEL*02N.55 added 12-3-2020	KEL*02N.63 added 09-07-2021
7	Allele Table	Antigen/allele added:	KEL*02N.56 added 28-9-2020	KEL*02N.64 added 09-07-2021
8	Allele Table	Antigen/allele added:	KEL*02N.57 added 08-1-2021	KEL*02N.65 added 09-07-2021
9	Allele Table	Antigen/allele added:	KEL*02N.58 added 23-1-2021	KEL*02N.66 added 28-09-2021
10	Allele Table	Antigen/allele added:	KEL*02N.59 added 23-1-2021	KEL*02M.19 added 18-10-2021
11	Allele Table	Antigen/allele added:	KEL*02N.60 added 23-1-2021	KEL*01N.04 added 18-10-2021
12	Allele Table	Antigen/allele added:	KEL*02.00.02 added 18-10-2021 (incorrectly published as KEL*02.38)	KEL*02N.36 rs762799244 changed to rs1562964425
13	Allele Table	Antigen/allele added:		GRCh38 locations added
14	References	PMID unique		PMIDs instead of numbering
15	References	Abstracts renumbered		"(12), Abstract" renumbered to "(1), Abstract" "(14), Abstract" renumbered to "(2), Abstract" "(17), Abstract" renumbered to "(3), Abstract" "(18), Abstract" renumbered to "(4), Abstract" "(19), Abstract" renumbered to "(5), Abstract" "(37), Abstract" renumbered to "(6), Abstract" "(41), Abstract" renumbered to "(7), Abstract" "(53), Abstract" renumbered to "(8), Abstract" "(54), Abstract" renumbered to "(9), Abstract"

1	**Version**		**v6.0 21-June-2021**	**v7.0 30-NOV-2021**
16	References	Books renumbered		"(30), Book" renumbered to "(1), Book" "(42), Book" renumbered to "(2), Book"
17	**End Version**		**v6.0 21-June-2021**	**v7.0 30-NOV-2021**

	Track of changes		from	to
1	**Version**		**v5.3 25-FEB-2020**	**v6.0 21-June-2021**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Reviewed	reviewed:	Christoph Gassner	Christoph Gassner
4	General		First Excel map version. Spread-sheets "Intro", "Allele Table", "References", and "Versioning" created.	
5	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)
6	Intro	Antithetical Antigens line created in Intro:	KEL13 and KEL21 added to reference allele on basis of high frequency (to be verified)	KEL 40 stays provisional, no official application (28-7-2020 Peyrard)
7	Allele Table	Antigen/allele added:	KEL*01N.03 added	KEL*02.-40 added 27-7-2020
8	Allele Table	Antigen/allele added:	KEL*02.39 added	rs773975756 removed from KEL*02N.44
9	Allele Table	Antigen/allele added:	KEL*02.40 added	KEL*02N.55 added 12-3-2020
10	Allele Table	Antigen/allele added:	KEL*01N.03 added	KEL*02N.56 added 28-9-2020
11	Allele Table	Antigen/allele added:	KEL*02N.30 to KEL*02N.54 added	KEL*02N.57 added 08-1-2021
12	Allele Table	Antigen/allele added:	KEL*01M.02 to KEL*01M.06 added	KEL*02N.58 added 23-1-2021
13	Allele Table	Antigen/allele added:	KEL*02M.12 to KEL*02M.18 added	KEL*02N.59 added 23-1-2021
14	Allele Table	Antigen/allele added:	KEL*02N.26 and KEL*02N.02 same null mutation (no expression of Kel antigens). Allele in cis with Jsa and Jsb respectivily.	KEL*02N.60 added 23-1-2021
15	Allele Table	Antigen/allele added:	KEL*02N.61 to KEL*02N.65 added	KEL*02.00.02 added 18-10-2021 (incorrectly published as KEL*02.38)
16	**End Version**		**v5.3 25-FEB-2020**	**v6.0 21-June-2021**

Track of changes			from	to
1	**Version**		**v5.2 January 15, 2020**	**v5.3 25-FEB-2020**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Reviewed	reviewed:	Christoph Gassner	Christoph Gassner
4	Intro	LRG sequence added:	NP_000411.1 (protein)	NG_007492.2 (genomic) NM_000420.2 (transcript) NP_000411.1 (protein)
5	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)
6	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]; [KEL37 KEL39]

1	**Version**		**v5.2 January 15, 2020**	**v5.3 25-FEB-2020**
7	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)
8	Allele Table	Antigen/allele added:	KEL*02N.41 added	KEL*02.39 added
9	Allele Table	Antigen/allele added:	KEL*02N.42 added	KEL*02.40 added
10	Allele Table	Antigen/allele added:	KEL*02N.43 added	KEL*01N.03 added
11	Allele Table	Antigen/allele added:	KEL*02N.44 added	KEL*02N.30 to KEL*02N.54 added
12	Allele Table	Antigen/allele added:	KEL*02N.45 added	KEL*01M.02 to KEL*01M.06 added
13	Allele Table	Antigen/allele added:	KEL*02N.46 added	KEL*02M.12 to KEL*02M.18 added
14	Allele Table	Antigen/allele 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.
15	Allele Table	Antigen/allele added:	KEL*02N.48 added	KEL*02N.61 to KEL*02N.65 added
16	**End Version**		**v5.2 January 15, 2020**	**v5.3 25-FEB-2020**

Track of changes			from	to
1	**Version**		**v5.1 190413-190513**	**v5.2 January 15, 2020**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Reviewed	reviewed:	n.a.	Christoph Gassner
4	General		Not published online	First Excel map version. Spread-sheets "Intro", "Allele Table", "References", and "Versioning"
65	Intro	Text changed	n.a.	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."
6	Intro	LRG sequence added:	NG_007492.2 (genomic), NM_000420.2 (transcript)	NP_000411.1 (protein)
7	Intro	Antithetical Antigens line created in Intro:	n.a.	[KEL1 KEL2]; [KEL3 KEL4 KEL21]; [KEL6 KEL7]; [KEL11 KEL17]; [KEL14 KEL24]; [WT KEL25 KEL28]; [KEL31 KEL38]; [KEL37 KEL39]
8	Intro	Low frequency antigen line created in Intro	n.a.	KEL3, KEL6, KEL10, KEL17, KEL21, KEL23, KEL24, KEL25, KEL28, KEL31, KEL39 (extra line created because LF antigens KEL10 and KEL23 were missing from Intro)

1	**Version**		**v5.1 190413-190513**	**v5.2 January 15, 2020**
9	Reference allele		KEL16 added to reference allele on basis of high frequency (check Nicole Thorton)	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
10	Allele Table	Table column and header additions	References changed in PMID entries, column with rs numbers added, accession numbers added	Table columns "(Reference No.) PMID" created and content added and column "Accession number" and "rs-number" updated
11	Allele Table	Antigen/allele added:	KEL*01.03 added	KEL*01N.03 added
12	Allele Table	Antigen/allele added:	KEL*02.39 added	KEL*02N.41 added
13	Allele Table	Antigen/allele added:	KEL*02.40 added	KEL*02N.42 added
14	Allele Table	Antigen/allele added:	KEL*02M.17 added	KEL*02N.43 added
15	Allele Table	Antigen/allele added:	KEL*02M.18 added	KEL*02N.44 added
16	Allele Table	Antigen/allele added:	n.a.	KEL*02N.45 added
17	Allele Table	Antigen/allele added:	n.a.	KEL*02N.46 added
18	Allele Table	Antigen/allele added:	n.a.	KEL*02N.47 added
19	Allele Table	Antigen/allele added:	n.a.	KEL*02N.48 added
20	Allele Table	Antigen/allele added:	n.a.	KEL*02N.49 added
21	Allele Table	Antigen/allele added:	n.a.	KEL*02N.50 added
22	Allele Table	Antigen/allele added:	n.a.	KEL*02N.51 added
23	Allele Table	Antigen/allele added:	n.a.	KEL*02N.52 added
24	Allele Table	Antigen/allele added:	n.a.	KEL*02N.53 added
25	Allele Table	Antigen/allele added:	n.a.	KEL*02N.54 added

1	**Version**		**v5.1 190413-190513**	**v5.2 January 15, 2020**
26	Allele Table	Remark added	n.a.	KEL*02N.26 and KEL*02N.02 same null mutation (no expression of Kel antigens). Allele in cis with Jsa and Jsb respectivily.
27	**End Version**		**v5.1 190413-190513**	**v5.2 January 15, 2020**

	Track of changes		from	to
1	**Version**		**v5.0 180208**	**v5.1 190413-190513**
2	Author	created:	Barbera Veldhuisen	Barbera Veldhuisen
3	Reviewed	reviewed:	n.a.	n.a.
4	Intro	LRG ID line added:	n.a.	LRG_799
5	Intro	LRG sequence added:	n.a.	NG_007492.2 (genomic), NM_000420.2 (transcript)
6	Reference allele		KEL13 and KEL21 added to reference allele on basis of high frequency (check Nicole Thorton)	KEL16 added to reference allele on basis of high frequency (check Nicole Thorton)
7	Allele Table	Table column and header additions	Column with References added	References changed in PMID entries, column with rs numbers added, accession numbers added
8	Allele Table	Antigen/allele added:	KEL*02N.30 added	KEL*01.03 added
9	Allele Table	Antigen/allele added:	KEL*02N.31 added	KEL*02.39 added
10	Allele Table	Antigen/allele added:	KEL*02N.32 added	KEL*02.40 added
11	Allele Table	Antigen/allele added:	KEL*02N.33 added	KEL*02M.17 added
12	Allele Table	Antigen/allele added:	KEL*02N.34 added	KEL*02M.18 added
13	**End Version**		**v5.0 180208**	**v5.1 190413-190513**

	Track of changes		from	to
1	**Version**		**v4.0 160701**	**v5.0 180208**
2	Author	created:	Masja de Haas	Barbera Veldhuisen
3	Reviewer	reviewed:	n.a.	n.a.
4	General		Last word version publiced on ISBT website	Not published online
5	Intro	Text changed	32 antigens	36 antigens
6	Reference allele		Reference allele 21 antigens	KEL13 and KEL21 added to reference allele on basis of high frequency (check Nicole Thorton)
7	Allele Table	Table column and header additions	n.a.	Column with References added
8	Allele Table	Antigen/allele added:	n.a.	KEL*02N.30 added
9	Allele Table	Antigen/allele added:	n.a.	KEL*02N.31 added
10	Allele Table	Antigen/allele added:	n.a.	KEL*02N.32 added
11	Allele Table	Antigen/allele added:	n.a.	KEL*02N.33 added
12	Allele Table	Antigen/allele added:	n.a.	KEL*02N.34 added
13	Allele Table	Antigen/allele added:	n.a.	KEL*02N.35 added
14	Allele Table	Antigen/allele added:	n.a.	KEL*02N.36 added
15	Allele Table	Antigen/allele added:	n.a.	KEL*02N.37 added
16	Allele Table	Antigen/allele added:	n.a.	KEL*02N.38 added
17	Allele Table	Antigen/allele added:	n.a.	KEL*02N.39 added
18	Allele Table	Antigen/allele added:	n.a.	KEL*02N.40 added
19	Allele Table	Antigen/allele added:	n.a.	KEL*01M.02 added
20	Allele Table	Antigen/allele added:	n.a.	KEL*01M.03 added

1	**Version**		**v4.0 160701**	**v5.0 180208**
21	Allele Table	Antigen/allele added:	n.a.	KEL*01M.04 added
22	Allele Table	Antigen/allele added:	n.a.	KEL*01M.05 added
23	Allele Table	Antigen/allele added:	n.a.	KEL*01M.06 added
24	Allele Table	Antigen/allele added:	n.a.	KEL*02M.12 added
25	Allele Table	Antigen/allele added:	n.a.	KEL*02M.13 added
26	Allele Table	Antigen/allele added:	n.a.	KEL*02M.14 added
27	Allele Table	Antigen/allele added:	n.a.	KEL*02M.15 added
28	Allele Table	Antigen/allele added:	n.a.	KEL*02M.16
29	**End Version**		**v4.0 160701**	**v5.0 180208**

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