

The Human T cell Receptor Beta Variable (TRBV) Genes

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Key Words

Human genes · IMGT · T Cell receptor ·
Beta variable genes

Abstract

'Human T Cell Receptor Beta Variable (TRBV) Genes', the seventh report of the 'IMGT Locus on Focus' section, comprises four tables: (1) 'Number of human germline TRBV genes at 7q35 and potential repertoire'; (2) 'Human germline TRBV genes at 7q35'; (3) 'Human TRBV orphans on chromosome 9 (9p21)', and (4) 'Human TRBV allele table'. These tables are available at the IMGT Marie-Paule page from *IMGT*, the international ImMunoGeneTics database (<http://imgt.cines.fr:8104>) created by Marie-Paule Lefranc, Université Montpellier II, CNRS, France.

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Introduction

'Human T Cell Receptor Beta Variable (TRBV) Genes' is the seventh report of the 'IMGT Locus on Focus' section launched in

the April 1998 issue of *Experimental and Clinical Immunogenetics* [1]. We have previously reported the complete repertoire of the human germline IGLV, IGKV and IGHV genes, as well as orphon genes [2–6]. Germline gene tables, allele tables and protein displays have been provided for the human IGLV and IGLJ [2, 6], IGKV and IGKJ [3, 6], IGHV, IGHD and IGHJ [4–6] genes. This seventh report on the human T cell receptor beta variable genes comprises four tables: (1) 'Number of human germline TRBV genes at 7q35 and potential repertoire'; (2) 'Human germline TRBV genes at 7q35'; (3) 'Human TRBV orphans on chromosome 9 (9p21)', and (4) 'Human TRBV allele table'. These tables are available at the IMGT Marie-Paule page from *IMGT*, the international ImMunoGeneTics database (<http://imgt.cines.fr:8104>) created by Marie-Paule Lefranc, Université Montpellier II, CNRS, France [7–9]. Descriptions of functionality (functional, open reading frame, pseudogene) and of mutations are according to the IMGT Scientific chart [9], available at the IMGT Marie-Paule page. Nucleotide and amino acid numbering of the V-REGION is according to the IMGT unique numbering [8, 10].

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Table 1. Number of human germline TRBV genes at 7q35 and potential repertoire

IMGT TRBV subgroups are according to Rowen, L. et al., Science, 272, 1755-1762 (1996).

62-65 TRBV genes belonging to 30 subgroups, on 620 kilobases :

39-41 FUNCTIONAL
7 ORF (Open Reading Frame)
10-11 PSEUDOGENE
4 FUNCTIONAL or PSEUDOGENE
1 FUNCTIONAL or ORF
1 ORF or PSEUDOGENE

Potential repertoire : 39-46 FUNCTIONAL TRBV genes belonging to 23 subgroups

Subgroup	Functional	ORF	Pseudogene	Total
TRBV1	-	-	1	1
TRBV2	1	-	-	1
TRBV3	1	-	0-1**	1-2**
TRBV4	2-3**	-	-	2-3**
TRBV5	5	2	1	8
TRBV6	5(+1)*-6**(+1)*	2	(1)*	8-9**
TRBV7	5(+1)*	1(+2)*	1(+1)*	9
TRBV8	-	-	2	2
TRBV9	1	-	-	1
TRBV10	2(+1)*	-	(1)*	3
TRBV11	3	-	-	3
TRBV12	3	-	2	5
TRBV13	1	-	-	1
TRBV14	1	-	-	1
TRBV15	1	-	-	1
TRBV16	(1)*	-	(1)*	1
TRBV17	-	1	-	1
TRBV18	1	-	-	1
TRBV19	1	-	-	1
TRBV20	1	-	-	1
TRBV21	-	-	1	1
TRBV22	-	-	1	1
TRBV23	-	1	-	1
TRBV24	1	-	-	1
TRBV25	1	-	-	1
TRBV26	-	-	1	1
TRBV27	1	-	-	1
TRBV28	1	-	-	1
TRBV29	1	-	-	1
TRBV30	(1)*	-	(1)*	1
Total	39-41(+5)*	7(+2)*	10-11(+5)*	62-65

* FUNCTIONAL or PSEUDOGENE (TRBV6-2, TRBV10-1, TRBV16, TRBV30)

* FUNCTIONAL or ORF (TRBV7-3)

* ORF or PSEUDOGENE (TRBV7-4)

** Allelic polymorphism by insertion/deletion (TRBV3-2, TRBV4-3, TRBV6-3)

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Table 2. Human germline TRBV genes at 7q35

Fct: FUNCTIONALITY
 F: Functional
 P: Pseudogene
 ORF: Open Reading Frame
 Vg: Vestigial
 R: Rearranged
 T: Transcribed
 Pr: Translated into protein

"+" or "-" indicates if the gene sequences have been found (+) or not been found (-) rearranged (R), transcribed (T), and/or translated into protein (Pr). Arbitrarily that information is shown on the first line of each gene when the data have been confirmed by several studies.

- **parentheses** when the accession number refers to rearranged genomic DNA or cDNA and the corresponding germline gene has not yet been isolated.

- **brackets** when the accession number refers to genomic DNA, but not known as being germline or rearranged.

- **reference sequences in bold** have been mapped: "mapped" refers to sequences which have been obtained from clones (phages, cosmids, YACs...) either by subcloning or PCR, and does not apply to sequences obtained directly from genomic DNA.

The original L36092 sequence (684973 bp) has been split in EMBL into three sequences of 267156 bp (U66059), 215422 bp (U66060) and 232650 bp (U66061). L36092 has become secondary accession number of U66059, U66060 and U66061. In IMGT, the original sequence L36092 which is fully annotated has also been kept as primary accession number, in addition to U66059, U66060 and U66061.

TRBV subgroup	TRBV gene name	Fct	R	T	Pr	Position in L36092(a)	Position in L36092(b)	Reference sequences	Accession numbers	Sequences from the literature
1	1	P(1)	-	-	-	91000-92750	91557-92006	V1	L36092/U66059 [11]	
		F	+	+	+	92751-97500	93552-93986	V2	L36092/U66059 [11]	
2	2	(F)	+	+	+			Vbeta23	M62379 [19]#c	
		(F)	+	+	+			Vbeta22	M64351 [20]#c	
		F	+	+	+	97501-103500	101150-101609	V9S1	U07977 [14]	V3-1[L36092/U66059][11]
		(F)	+	+	+			Vbeta9.n	L06889 [21]#c	
3	3-1	P(2)	+	+		147001-163700	151879-152338	V3-2	L36092/U66059 [11]	
		P(2)	+	+				V9S2P	U07978 [14]	
4	4-1	F	+	+		103501-110000	105774-106227	V7S1	U07977 [14]	V4-1[L36092/U66059][11]
		(F)	+	+				Vbeta7.1	MT13855 [22]#c	
4	4-2	F	+	+		131001-140300	138078-138531	V7S2	U07975 [14]	V7S2[U07976][14], V7S2[U07978][14], V4-2[L36092/U66059][11], V4-2[L36190][11], V7S3[AF009660][41]
		(F)	+	+				Vbeta7	X58811 [23]#c	
4	4-3	F	+	+		153701-160000	155338-155791	V7S3	U07978 [14]	V4-3[L36092/U66059][11]
		(F)	+	+				Vbeta7	X58812 [23]#c	
5	5-1	(F)	+	+				Vbeta7.n2	L06888 [21]#c	
		(F)	+	+				Vbeta7.2b	X57616 [24]#c	
5	5-1	F	+	+		110001-117500	113622-114091	V5-1	L36092/U66059 [11]	
		(F)	+	+				ph24	MT14271 [10]#c	
5	5-2	P(3)	-	-		180001-194000	187166-187605	V5-2	L36092/U66059 [11]	[AF009660][41]
		ORF(4)	-	-		202001-205500	203911-204377	Vbeta5.5	X61439 [4]	V5-3[L36092/U66059][11]
5	5-3	ORF(4)	-	-				V5S5	AF009660 [41]	
		F	+	+		274001-280000	277826-278290	V5-4	L36092/U66060 [11]	V5S5[AF009663][41]
5	5-4	F	+	+				V5S6	AF009662 [41]	
		(F)	+	+				Vbeta5.5	S50547 [25]#	
5	5-5	(F)	+	+				Vbeta5	X58804 [23]#c	
		F	+	+		282251-300000	297271-297735	V5-5	L36092/U66060 [11]	[AF009663][41]
5	5-5	(F)	+	+				Vbeta5.3a	X57611 [24]#c	
		(F)	+	+				Vbeta5	X58801 [23]#c	

6	5-6	F	+	+	+	311001-319000	314783-315248	V5-6	L36092/U66060 [11]	[AF009663][41]	
	5-7	ORF(5)	-	-	-	330001-338000	334800-335266	V5-7	L36092/U66060 [11]	[AF009663][41], BV557[L26226][12][19]°	
	5-8	F	+	+	+	350001-360000	354936-355402	V5-8	L36092/U66060 [11]	[AF009663][41]	
		(F)	+	+	+			Vbeta5	X58803 [23]#c		
	6-1	F	+	+	+	117501-123000	120903-121335	Vbeta13.3	X61446 [4]	V6-1[L36092/U66059][11]	
		F	+	+	+	140301-147000	141898-142330	Vbeta13.2	X61445 [4]	V13S2[U07975][14], V13S2[U07976][14], V13S2[U07978][14], V13S2[AF009660][41], V13S2[X75418][47][33]°, V13S2[X75419][47][33]°	
	7		(P)(10)	+	+				Vbeta.HPB-2	M31347 [26]#g	
			(P)(10)	+	+	+			Weiss [27]#	U07978 [14]	
		6-3	F	+	+	160001-166000	163579-164011	V13S2	U07978 [14]	V6-3[L36092/U66059][11], BV1359[L26229][12][19]°	
		6-4	F	+	+	194001-197000	195522-195956	Vbeta13.5	X61653 [4]	V6-4[L36092/U66059][11]	
			F	+	+			V13S5	AF009660 [41]		
		6-5	F	+	+	260001-288000	265721-266156	V6-5	L36092/U66060 [11]	V13S1[AF009662][41], [AF009663][41]	
			F	+	+	280001-286500	284296-284728	V6-6	L36092/U66060 [11]	[AF009663][41]	
		6-6	F	+	+			V13S6	AF009662 [41]		
(F)			+	+			Vbeta13	X58815 [23]#c			
(F)			+	+			Vbeta13.4	X74848 [28]#c			
(F)			+	+			Vbeta13.n3	L06892 [21]#c			
6-7		ORF(6)	+	-	300001-304500	302579-303011	V6-7	L36092/U66060 [11]	[AF009663][41], BV13S8[L26227][12][19]°		
6-8		F	+	-	319001-324500	322096-322523	V6-8	L36092/U66060 [11]	[AF009663][41], BV13S7[L26228][12][19]°		
6-9		ORF(7)	-	-	338001-344500	342106-342537	Vbeta13.4	X61447 [4]	V6-9[L36092/U66060][11], [AF009663][41]		
7-1	ORF(8)	-	-	123001-131000	124764-125252	Vbeta6.10	X61444 [4]	V7-1[L36092/U66059][11]			
7-2	F	+	+	166001-170000	167212-167708	Vbeta6.7a	X61442 [4]	V6S7[U07976][14], V6S7[U07978][14], V7-2[L36092/U66059][11]			
7-3	F	+	+			Vbeta6.7b	X61443 [4]	V7-2[L36190][11], V6S7[AF009660][41]			
	F	+	+			V6S7	U07975 [14]				
	(F)	+	+			Vbeta6.6	M27387 [29]#c				
	F	+	+			Vbeta6.1	X61440 [4]				
	ORF(15)	+	+			V beta6.1	M97943 [5]	BV6S1[L33103][15], V7-3[L36092/U66059][11]			
	ORF(15)	+	+			BV6S1	L33105 [15]	Tcrb-V6.1A[M6751][44][26]°, Tcrb-V6.1B[M67512][44][27]°			
	(F)	+	+			Vbeta6.1	X74843 [28]#c	BV6S1[L33103][15]			
	(F)	+	+				M13550 [30]#c	V6S1[AF009660][41]			
	ORF(7)	-	-			V7-4	L36092/U66060 [11]	V6S1[AF009662][41], [AF009663][41], Vbeta6.11c[L14432][31][17]°, Vbeta6.11d[L14459][31][18]°			
7-4	ORF(7)	-	-	268001-274000	269879-270340	V7-4	L36092/U66060 [11]	V6S1[AF009662][41], [AF009663][41]			
	[ORF](7)	+	+			Vbeta6.11a	L13762 [31]°				
	[PI](10)	+	+			Vbeta6.11b	L14431 [31]°				
7-5	P(10)	-	-	288501-292250	288811-289282	V7-5	L36092/U66060 [11]	V6S12[AF009662][41], Vbeta6.12b[L14475][31][18]°, Vbeta6.12a[M97503][31][28]°			
	P(10)	-	-				AF009663 [41]				
7-6	F	+	+	304501-311000	306894-307386	V7-6	L36092/U66060 [11]	[AF009663][41], Vbeta6.13b[L14480][31][17]°, Vbeta6.13a[M97504][31][29]°			
	(F)	+	+			Vbeta6	X58806 [23]#c				
7-7	F	+	+	324501-330000	326337-326838	V7-7	L36092/U66060 [11]	[AF009663][41], Vbeta6.14b[L14483][31][19]°, Vbeta6.14a[M97505][31][30]°			
	(F)	+	+			Vbeta6.7	X57607 [24]#c				
7-8	F	+	+	344501-350000	346720-347203	Vbeta.ATL12-2	M11953 [3]	V7-8[L36092/U66060][11], [AF009663][41]			
	F	+	+			Vbeta6.3	X61441 [4]				
	(F)	+	+			Vbeta6.3	M27384 [29]#c				

(continued)

Table 2 (continued)

8	7-9	F	+	+	+	360001-367500	364137-364609	V7-9	L36092/U66060 [11]	[AF009661][41], BV6S4 [U03115][8], Vbeta6.9[X64741][40][32]°	
	8-1	(F)	+	+	+				M15564 [39]#c AF009663 [41]		
	8-2	(F)	+	+	+			phi22	M14261 [10]#c		
	9		(F)	+	+	+			Vbeta6.5	M27385 [29]#c X74844 [28]#c	
			(F)	+	+	+			Vbeta6.5	L14854 [33]#c	
	10		(F)	-	-	-	170001-180000	(9)-173804	V8-1	L36092/U66059 [11]	[AF009660][41]
			P(10)	-	-	-	200001-202000	200895-201355	V8-2	L36092/U66059 [11]	[AF009660][41]
	11	10-1	F	+	+	+	205501-210000	206647-207121	V9	L36092/U66059 [11] AF009660 [41]	
			(F)	+	+	+			Vbeta1.1	M27380 [29]#c	
		10-2	F	+	+	+	210001-219000	214638-215087	BV12S4	U17050 [16]	V10-1[L36092/U66059][11], BV12S4 [L26230][12][19]°
(F)			+	+	+			BV12S4	AF009660 [41]		
10-3		P(11)	+	+	+	234001-244000	239704-240153	BV12S4	U17051 [16]°		
		(F)	+	+	+			BV12S3	U17049 [16]	V10-2[L36092/U66059][11]	
12		11-1	F	+	+	+	375001-384500	379088-379517	BV12S2	U03115 [8]	V10-3[L36092/U66060][11], [AF009661][41], [AF009663][41], Vbeta12.2[L33100][35][23]°
			(F)	+	+	+			BV12S2	U17047 [16]	
		11-2	F	+	+	+			Vbeta12.2	L33101 [35]°	
			(F)	+	+	+			Vbeta12.2	L33102 [35]°	
	11-3	F	+	+	+	219001-226000	222397-222844	V21.1	M33233 [13]	V11-1[L36092/U66059][11]	
		(F)	+	+	+	244001-255200	248684-249102	V21.2	L36092/U66059 [11]		
	13	12-1	F	+	+	+	384501-393000	389716-390153	V21.2	M33234 [13]	
			(F)	+	+	+			Vbeta21	X58796 [23]#c	
		12-2	F	+	+	+			Vbeta21	X58797 [23]#c	
			(F)	+	+	+			Vbeta21	M62377 [19]#c	
12-3		P(11)	-	-	-	228001-234000	229930-230372	Vbeta21.4a	40J#		
		(F)	+	+	+	255201-260000	255591-256033	Vbeta8.5	X07224 [7]	V12-1[L36092/U66059][11]	
12-4		F	+	+	+	393001-397000	395318-395764	v-beta8.1	X07192 [7]	V12-2[L36092/U66059][11], [AF009663][41]	
		(F)	+	+	+	397001-405000	398641-399087	VbetaM3-2	K02546 [6]	[AF009661][41]	
14		12-5	(F)	+	+			phi8	M14264 [10]#c		v-beta8.2[X07222][7], BV8S2 [U03115][8], V12-4[L36092/U66060][11]
			F	-	-	-	405001-419000	415832-416278	v-beta8.3	X07223 [7]	BV8S3 [U03115][8], V12-5 [L36092/U66060][11]
	14	F	+	+	+	367501-375000	370656-371139	BV23S1	U03115 [8]	V13[L36092/U66060][11], [AF009661][41], [AF009663][41], Vbeta23[U66844][46][31]	
		(F)	+	+	+			Vbeta22	M62378 [19]#c		
	15	F	+	+	+	419001-423500	422775-423207	Vbeta16	X06154 [9]	BV16S1 [U03115][8], V14 [L36092/U66060][11]	
		(F)	+	+	+			Vbeta16b	X57722 [24]#g		
	16	F	+	+	+	423501-430000	427850-428318	BV24S1	U03115 [8]	V15[L36092/U66060][11]	
		(F)	+	+	+			Vbeta24	X58800 [23]#c		
	16	F	+	+	+			BV25S1	M62376 [19]#c		
		(F)	+	+	+	430001-435000	432859-433312	BV25S1	L26231 [12]	V16[L36092/U66060][11]	
		(F)	+	+				L26054 [36]#c			

17	17	ORF(13)	-	-	435001-445000	436475-437209	BV26S1	U03115 [8] L36092/U66060 [11]	V17 [L36092/U66060][11]
18	18	F	+	+	445001-452700	450546-451164	V18	L36092/U66060 [11]	
19	19	F	+	+	452701-458000	453806-454281	BV17S1 BV17S1	U48280 [17] U48259 [17]	V19 [L36092/U66060/U66061][11]
20	20-1	(F)	+	+	458001-467000	461476-462148	Vbeta17.1 Vbeta.MT1-1	M97725 [37]#c M11955 [3]	V20-1 [L36092/U66060/U66061][11]
		F	+	+			BV2S1	X72719 [2]	
		(F)	+	+			ph34	M11954 [3]#g	
		(F)	+	+			Vbeta2.1b	M14263 [10]#c X57604 [24]#g	
		(F)	+	+			Vbeta2.3a	D13088 [32]#c	
		(F)	+	+			Vbeta2.1	X74852 [28]#c	
21	21-1	P(12)	+	+	467001-474000	471659-472119	BV10.1	L27608 [18]	V21-1 [L36092/U66060/U66061][11], V10S.1[L48728][42]
22	22	P(10)	-	-	474001-478500	476480-476930	V22	L36092/U66061 [11]	
23	23-1	ORF(4)	+	+	478501-485000	480699-481195	V23	L36092/U66061 [11]	[L48730][42], BV19[L27614][18](21) ^a
24	24-1	F	+	+	485001-497500	490040-490516	Vbeta.ATL2-1	M11951 [3]	BV15-1 [L27612][18], V24-1 [L36092/U66061][11]
25	25-1	F	+	+	497501-510000	504415-504882	BV11.1	L27610 [18]	
26	26	P(14)	-	-	522001-537500	529336-529820	V26	L36092/U66061 [11]	
27	27	F	+	+	547201-552000	549038-549510	V27	L36092/U66061 [11]	
28	28	F	+	+	552001-565000	554328-554808	V3S1	U08314 [45]	V28 [L36092/U66061][11], Vbeta2 [M18464][43](24) ^a
29	29-1	F	+	+	565001-579000	573946-574659	V29-1	L36092/U66061 [11]	VB4 [L27623][18](22) ^a
		(F)	+	+			Vbeta4	M13847 [22]#c	
		(F)	+	+			Vbeta4.3	X04926 [38]#c	
30	30	F	+	+	659001-684873	667298-666820	V30	L36092/U66061 [11]	
		F	+	+			Vbeta18	Z13967 [1]	
		P(16)	-	-			Vbeta18	[1]	
		(F)	+	+			Vbeta20.n1	M13554 [30]#c L06893 [21]#c	
A	A	P(10)	-	-	510001-522000	515043-515497		L36092 [11]	
B	B	P(11)	-	-	537501-547200	545032-545501		L36092 [11]	

Rearranged, #: rearranged cDNA, #: rearranged genomic DNA.

^a DNA genomic sequence, but not known as being genuine or rearranged.

TRBV genes are designated by a number for the subgroup [11] followed, whenever there are several genes belonging to the same subgroup, by a dash and a number for their relative localisation in the locus. Orphans have been described for each of the following subgroups: TRBV 20, 21, 23, 24, 25 and 29, the single member gene in the main locus is designated by the subgroup number followed by a dash and the number 1. To date, no orphan has been reported which belongs to subgroup 22, therefore the IMGT designation of the single member gene is TRBV22.

IMGT notes:

- (1) STOP-CODON in L-PART1; 1st_CYS replaced by Arg in V-EXON.
- (2) 1st_CYS replaced by STOP-CODON in V-EXON.
- (3) Frameshift in V-EXON; V-HEPTAMER violates consensus.
- (4) GT replaced by AT in DONOR_SPLICE.
- (5) CONSERVED_TRP replaced by Ser in V-EXON.
- (6) CONSERVED_TRP replaced by Arg in V-EXON.
- (7) Leu replaced by Arg in V-EXON.
- (8) 1st_CYS replaced by Tyr in V-EXON; missing V-SPACER and V-NONAMER.
- (9) Frameshift in V-EXON, L-PART1 is missing.
- (10) Frameshift in V-EXON.
- (11) One amino acid replaced by STOP-CODON in V-EXON.
- (12) Frameshift in L-PART1.
- (13) 2nd_CYS replaced by Tyr in V-EXON.

(continued)

Table 2 (continued)

- (14) STOP-CODON in L-PART1; 2nd_CYS replaced by Tyr in V-EXON.
 (15) 2nd_CYS replaced by Arg in V-EXON.
 (16) Arg replaced by STOP-CODON in V-EXON.
 (17) V-GENE is partial; partial L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 100 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (18) V-GENE is partial; partial L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 21 to 108 are absent (partial FR1-IMGT, no CDR1-IMGT, no FR2-IMGT, no CDR2-IMGT, no FR3-IMGT, no CDR3-IMGT).
 (19) V-GENE is partial; no L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 100 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (20) V-GENE is partial; no L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 92 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (21) V-GENE is partial; no L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 90 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (22) V-GENE is partial; no L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 99 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (23) V-GENE is partial; AA 105 to 108 are absent (no CDR3-IMGT).
 (24) V-GENE is partial; no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 9 to 108 are absent (partial FR1-IMGT, no FR2-IMGT, no CDR2-IMGT, no FR3-IMGT, no CDR3-IMGT).
 (25) V-J-GENE is partial; partial L-PART1, no J-REGION.
 (26) V-REGION is partial; AA 1 to 24 and 106 to 108 are absent (partial FR1-IMGT, partial CDR3-IMGT). AA position 55, 83 are missing, probably typing errors.
 (27) V-REGION is partial; AA 1 to 24 and 106 to 108 are absent (partial FR1-IMGT, no CDR2-IMGT, no FR3-IMGT, partial CDR3-IMGT). G position 47 is missing, ACT position 70 to 72 are missing. A position 110 inserted. GGA position 139 to 141 are missing and A position 73 replaced by G, probably typing errors.
 (28) V-GENE is partial; partial L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 100 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (29) V-GENE is partial; partial L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 25 to 108 are absent (partial FR1-IMGT, no FR2-IMGT, no CDR2-IMGT, no FR3-IMGT, no CDR3-IMGT).
 (30) V-GENE is partial; partial L-PART1, no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 24 to 108 are absent (partial FR1-IMGT, no FR2-IMGT, no CDR2-IMGT, no FR3-IMGT, no CDR3-IMGT).
 (31) V-GENE is partial; no V-NONAMER.
 (32) V-REGION is partial; AA 1 to 3 and 76 to 108 are absent (partial FR1-IMGT, partial FR3-IMGT, no CDR3-IMGT).
 (33) V-GENE is partial; no V-HEPTAMER, no V-NONAMER and V-REGION is partial; AA 93 to 108 are absent (partial FR3-IMGT and no CDR3-IMGT).
 (a) Arbitrary limits of the DNA sequence assigned to the different TRBV genes.
 (b) Limits from INIT-CODON (ATG) to the last nucleotide of V-REGION.

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Table 3. Human TRBV orphans on chromosome 9 (9p21)**Fct:** FUNCTIONALITY

P: Pseudogene

ORF: Open Reading Frame

R: Rearranged

T: Transcribed

Pr: Translated into protein

"+" or "-" indicates if the gene sequences have been found (+) or not been found (-) rearranged (R), transcribed (T), and/or translated into protein (Pr). Arbitrarily that information is shown on the first line of each gene when the data have been confirmed by several studies. Functionality is shown between **brackets** when the accession number refers to genomic DNA, but not known as being germline or rearranged.

TRBV subgroup	TRBV gene name	Fct	R	T	Pr	Reference sequences	Accession numbers	Sequences from the literature
20	20/OR9-2	ORF				Vbeta2.OR	L05149 [3]	ORBV2S2[X72717][2] [°] ; Vb2.or[L09704][1] [°]
		[ORF]				ORBV2S2	X72718 [2] [°]	
21	21/OR9-2	ORF				Vbeta10.or	L05151 [3]	Vb10.or[L27609][5]
23	23/OR9-2	ORF				Vb19.or	L27615 [5]	BV19S2(O)[L26225][4] [°]
		ORF				Vbeta15.OR	L05153 [3]	
24	24/OR9-2	ORF				Vbeta15.or	L27613 [5]	
		P(1)				Vbeta11.OR	L05152 [3]	
25	25/OR9-2	P(1)				Vb11.or	L27611 [5]	
		ORF				Vbeta4.OR	L05150 [3]	
29	29/OR9-2	ORF				Vb4.or	L27616 [5]	
		ORF						

[°] DNA genomic sequence, but not known as being germline or rearranged.

IMG T notes:

(1) Frameshift in V-EXON.

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Table 4. Human TRBV allele table

Fct: FUNCTIONALITY

F: Functional

P: Pseudogene

ORF: Open Reading Frame

vg: Vestigial

Functionality is shown between:

- parentheses when the accession number refers to rearranged genomic DNA or cDNA and the corresponding germline gene has not yet been isolated.
- brackets when the accession number refers to genomic DNA, but not known as being germline or rearranged.

The IMGT allele table refers to the V-REGION polymorphism. It does not include polymorphisms in the other parts of the V-GENE. V-REGION alleles are only described for genes which have at least one functional or ORF allele.

The accession number of a reference sequence is given for each allele.

Nucleotide mutations and amino acid changes in CDR3-IMGT of rearranged sequences, are not taken into account for the description of polymorphism.

The original L36092 sequence (684973 bp) has been split in EMBL into three sequences of 267156 bp (U66059), 215422 bp (U66060) and 232650 bp (U66061). L36092 has become secondary accession number of U66059, U66060 and U66061. In IMGT, the original sequence L36092 which is fully annotated has also been kept as primary accession number, in addition to U66059, U66060 and U66061.

Part 1 - TRBV genes at 7q35

TRBV sub-group	TRBV gene name	Fct	TRBV allele name	Accession number	Confirmed by genetics and/or data	Description of mutations
2		F	V2*01	L36092/U66059	+	
		(F)	V2*02	M62379		g65 , R22 a237 g65>a, R22>H a237>g
3	3-1	F	V2*03	M64351		
		(F)	V2*03	M64351		
3	3-1	F	V3-1*01	U07977	+	t174 c181 u61 c225 c256 c258 H86 t174>c c181>a, l61>I c225>a c256>a, c258>a, H86>K
		(F)	V3-1*02	L06889		
4	4-1	F	V4-1*01	U07977	+	t93 t93>a
		(F)	V4-1*02	M13855		
4	4-2	F	V4-2*01	U07975	+	t263 F88 t263>g, F88>C
		(F)	V4-2*02	X58811		
4	4-3	F	V4-3*01	U07978	+	t84 g183 t263 F88 t263>c, F88>S
		(F)	V4-3*02	X58812		
4	4-3	(F)	V4-3*03	L06888		g183>t
		(F)	V4-3*04	X57616		
5	5-1	F	V5-1*01	L36092/U66059	+	a2 K1 a9 t28 Y10 a64 S22 c137 P46 c215 P72 a2>g, K1>R a9>g t28>c, Y10>H a64>g, S22>g c137>t, P46>L c215>t, P72>L
		(F)	V5-1*02	M14271		
5	5-3	ORF	V5-3*01	X61439	+	g254 C85 g254>a, C85>Y
		ORF	V5-3*02	AF009660	+	t60 t212 71F g257 86S t60>a t212>c, 71F>S g257>a, 86S>N
5	5-4	F	V5-4*01	L36092/U66060	+	
		(F)	V5-4*02	AF009662		
5	5-4	(F)	V5-4*03	S50547		
		(F)	V5-4*04	X58804		
5	5-5	F	V5-5*01	L36092/U66060	+	a54 Q18 g83 28G a54>c, Q18>H g83>a, 28G>E
		(F)	V5-5*02	X57611		
5	5-5	(F)	V5-5*03	X58801		
		(F)	V5-5*04	X58801		
5	5-6	F	V5-6*01	L36092/U66060	+	
		(F)	V5-6*02	X58801		
5	5-7	ORF	V5-7*01	L36092/U66060	+	
		(F)	V5-7*02	X58801		
5	5-8	F	V5-8*01	L36092/U66060	+	t154 F52 t154>c, F52>L
		(F)	V5-8*02	X58803		

Table 4 (continued)

9	9	F	V9*01	L36092/U66059	+	g165 ,Q55	
		F	V9*02	AF009660		g165>c,Q55>H	
		(F)	V9*03	M27380		g165>a	
10	10-1	F	V10-1*01	U17050	+	a180 ,Q60 g274 ,E92	
		F	V10-1*02	AF009660		a180>c,Q60>H	
		[P]	V10-1*03	U17051		a180>c,Q60>H g274>t,E92>*	
	10-2	F	V10-2*01	U17049	+	t228	
		[F]	V10-2*02	U17048		t228>c	
	10-3	F	V10-3*01	U03115	+	c72 t93 g156	
		F	V10-3*02	U17047		c72>t	
		[F]	V10-3*03	L33101		t93>c g156>a	
		[F]	V10-3*04	L33102		t93>c	
11	11-1	F	V11-1*01	M83233	+		
	11-2	F	V11-2*01	L36092/U66059	+	g276 g292 ,D98	
		[F]	V11-2*02	M83235		g292>a,D98>N	
		(F)	V11-2*03	X58796		g276>a	
	11-3	F	V11-3*01	M83234	+	a17 a45 a48 t75 t128 ,L43 t279 g301 ,V101	
		(F)	V11-3*02	X58797		a48>g	t128>g,L43>R
		(F)	V11-3*03	M62377		a17>g a45>g	t75>a
		(F)	V11-3*04	[2]			t128>g,L43>R
12	12-3	F	V12-3*01	X07192	+		
	12-4	F	V12-4*01	K02546	+	c87 a269 ,K90	
		(F)	V12-4*02	M14264	+	c87>t a269>g,K90>R	
	12-5	F	V12-5*01	X07223	+		
13	13	F	V13-1*01	U03115	+	a38 ,K13 t135 c157 ,L53	
		(F)	V13-1*02	M62378		a38>g,K13>R t135>c c157>t,L53>F	
14	14	F	V14*01	X06154	+	g204	
		(F)	V14*02	X57722		g204>a	
15	15	F	V15*01	U03115	+	a32 ,Q11 g172 ,D58 t267 a295 ,T99 t308 ,L103	
		(F)	V15*02	X58800	+	a295>g,T99>A	
		(F)	V15*03	M62376		a32>g,Q11>R g172>a,D58>N t267>a a295>g,T99>A t308>a,L103>Q	
16	16	F	V16*01	L26231		t93 ,X31 a160 ,I54	
		P	V16*02	U03115	+	t93>g,X31>*	
		(F)	V16*03	L26054		a160>g,I54>V	
17	17	ORF	V17*01	U03115	+		
18	18	F	V18*01	L36092/U66060	+		
19	19	F	V19*01	U48260	+	a134 ,D45 g171 ,Q57	
		F	V19*02	U48259		a134>t,D45>V g171>c,Q57>H	
		(F)	V19*03	M97725		g171>c,Q57>H	
20	20-1	F	V20-1*01	M11955	+	c27 t28 ,W10 c76 c142 ,Q48 t155 ,L52 g159 ,M53 c179 ,S60	
		F	V20-1*02	X72719	+	t28>a,W10>R	
		(F)	V20-1*03	M11954			c179>g,S60>c
		(F)	V20-1*04	M14263		t28>a,W10>R c76>t c142>a,Q48>K	
		(F)	V20-1*05	X57604		t28>a,W10>R	c142>a,Q48>K
		(F)	V20-1*06	D13088		c27>t t28>a,W10>R	c142>a,Q48>K
		(F)	V20-1*07	X74852		t28>a,W10>R	c142>a,Q48>K t155>a,L52>Q g159>c,M53>I
23	23-1	ORF	V23-1*01	L36092/U66061	+		
24	24-1	F	V24-1*01	M11951	+		
25	25-1	F	V25-1*01	L27610	+		
27	27	F	V27*01	L36092/U66061	+		

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