

# Protein Displays of the Human T Cell Receptor Alpha, Beta, Gamma and Delta Variable and Joining Regions

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## Key Words

Human · IMGT · T cell receptor · Alpha variable and joining regions · Beta variable and joining regions · Gamma variable and joining regions · Delta variable and joining regions

## Abstract

'Protein Displays of the Human T Cell Receptor Alpha, Beta, Gamma and Delta Variable and Joining Regions', the 13th report of the 'IMGT Locus in Focus' section, comprises 8 figures: (1) 'Protein display of the human TRA V-REGIONS'; (2) 'Protein display of the human TRB V-REGIONS'; (3) 'Protein display of the human TRG V-REGIONS'; (4) 'Protein display of the human TRD V-REGIONS'; (5) 'Protein display of the human TRA J-REGIONS'; (6) 'Protein display of the human TRB J-

REGIONS'; (7) 'Protein display of the human TRG J-REGIONS'; (8) 'Protein display of the human TRD J-REGIONS', and 4 tables entitled: (1) 'FR-IMGT and CDR-IMGT length of the human TRAV genes'; (2) 'FR-IMGT and CDR-IMGT length of the human TRBV genes'; (3) 'FR-IMGT and CDR-IMGT length of the human TRGV genes'; (4) 'FR-IMGT and CDR-IMGT length of the human TRDV genes'. These figures and 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, Montpellier, France.

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'Protein Displays of the Human T cell Receptor Alpha, Beta, Gamma and Delta Variable and Joining Regions' is the 13th report of the 'IMGT Locus in 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 TRAV [2] and TRAJ [3], TRBV [4], TRBD and TRBJ [5] genes, localized at the TRA (14q11.2) locus and at the TRB locus (7q35), respectively, as well as TRBV orphon genes identified on chromosome 9 (9p21) [4]. This 13th report completes these data by providing the protein displays of the corresponding reference coding regions. It comprises 8 figures: (1) 'Protein display of the human TRA V-REGIONS'; (2) 'Protein display of the human TRB V-REGIONS'; (3) 'Protein display of the human TRG V-REGIONS'; (4) 'Protein display of the human TRD V-REGIONS'; (5) 'Protein display of the human TRA J-REGIONS'; (6) 'Protein display of the human TRB J-REGIONS'; (7) 'Protein display of the human TRG J-REGIONS'; (8) 'Protein display of the human TRD J-REGIONS'; and 4 tables entitled: (1) 'FR-IMGT and CDR-IMGT length of the human TRAV genes'; (2) 'FR-IMGT and CDR-IMGT length of the human TRBV genes'; (3) 'FR-IMGT and CDR-IMGT length of the human TRGV genes'; (4) 'FR-IMGT and CDR-IMGT length of the human TRDV genes'. These figures and 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, Montpellier, France [6–9]. Nucleotide and amino acid numbering of the V-REGION is according to the IMGT unique numbering system [1, 10, 11]. Detailed protein displays of the human TRB D-REGIONS [5] and TRD D-REGIONS are available in IMGT Repertoire > Alignments

of alleles > Human TRBD and TRDD Overviews, respectively.

In figures 1–4, the T cell receptor genes are designated according to the IMGT gene tables [2–5] and locus representations (see IMGT Repertoire at IMGT Home page, <http://imgt.cines.fr:8104>, IMGT Repertoire >1. Locus and Genes). Only FUNCTIONAL and ORF V-GENEs are shown. In tables 1–4, numbers in bold, on the second line at the top of each column, represent the IMGT unique numbering for the FR-IMGT and CDR-IMGT. Numbers in parentheses, on the third line, correspond to the range of FR-IMGT and CDR-IMGT lengths (in number of amino acids) observed for the TRAV, TRBV, TRGV and TRDV genes (tables 1–4, respectively). Numbers in the CDR1-IMGT, CDR2-IMGT and CDR3-IMGT columns show the CDR lengths in number of amino acids. Information in the FR1-IMGT, FR2-IMGT and FR3-IMGT columns shows the gaps compared to the IMGT numbering: the number of missing amino acids is indicated following the sign '-' with, in parentheses, the position(s) of the missing amino acid(s) compared to the IMGT numbering. Columns are left blank if there are no gaps. The proteolytic cleavage site between the leader peptide and the V-REGION is putative and the assignment of amino acid 1 (IMGT numbering) to one or the other region is uncertain.

**Fig. 1.** Protein display of the human TRA V-REGIONS. Only the \*01 allele of each functional or ORF V-REGION is shown. Letters in red correspond to amino acids which are polymorphic in the other alleles. TRAV genes are listed, for each subgroup, according to their position from 5' to 3' in the locus. The 8 amino acids in 5' of TRAV23/DV6 and the 6 amino acids in 5' of TRAV29/DV5, as predicted by the program SIGSEQ2 and as described by Wülfung and Plückthun [12], are not shown.

TRAV gene	TRBV-14C <sup>a</sup> (1-28)	TRBV-14C <sup>a</sup> (1-28)		CD43-TRBV (23-31)		TRBV-28C <sup>b</sup> (29-35)		CD43-TRBV (15-63)		TRBV-28C <sup>b</sup> (45-104)		TRBV-28C <sup>b</sup> (125-215)	
		16	26	39	48	52	49	70	66	92	100	112	
KD000059, TRAV1-1													
KD000059, TRAV1-2													
KD000059, TRAV2													
KD000059, TRAV3													
KD000059, TRAV4													
KD000059, TRAV5													
KD000059, TRAV6													
KD000059, TRAV7													
KD000059, TRAV8													
KD000059, TRAV9													
KD000059, TRAV10													
KD000059, TRAV11													
KD000059, TRAV12													
KD000059, TRAV13													
KD000059, TRAV14													
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KD000059, TRAV30													
KD000059, TRAV31													
KD000059, TRAV32													
KD000059, TRAV33													
KD000059, TRAV34													
KD000059, TRAV35													
KD000059, TRAV36													
KD000059, TRAV37													
KD000059, TRAV38													
KD000059, TRAV39													
KD000059, TRAV40													
KD000059, TRAV41													

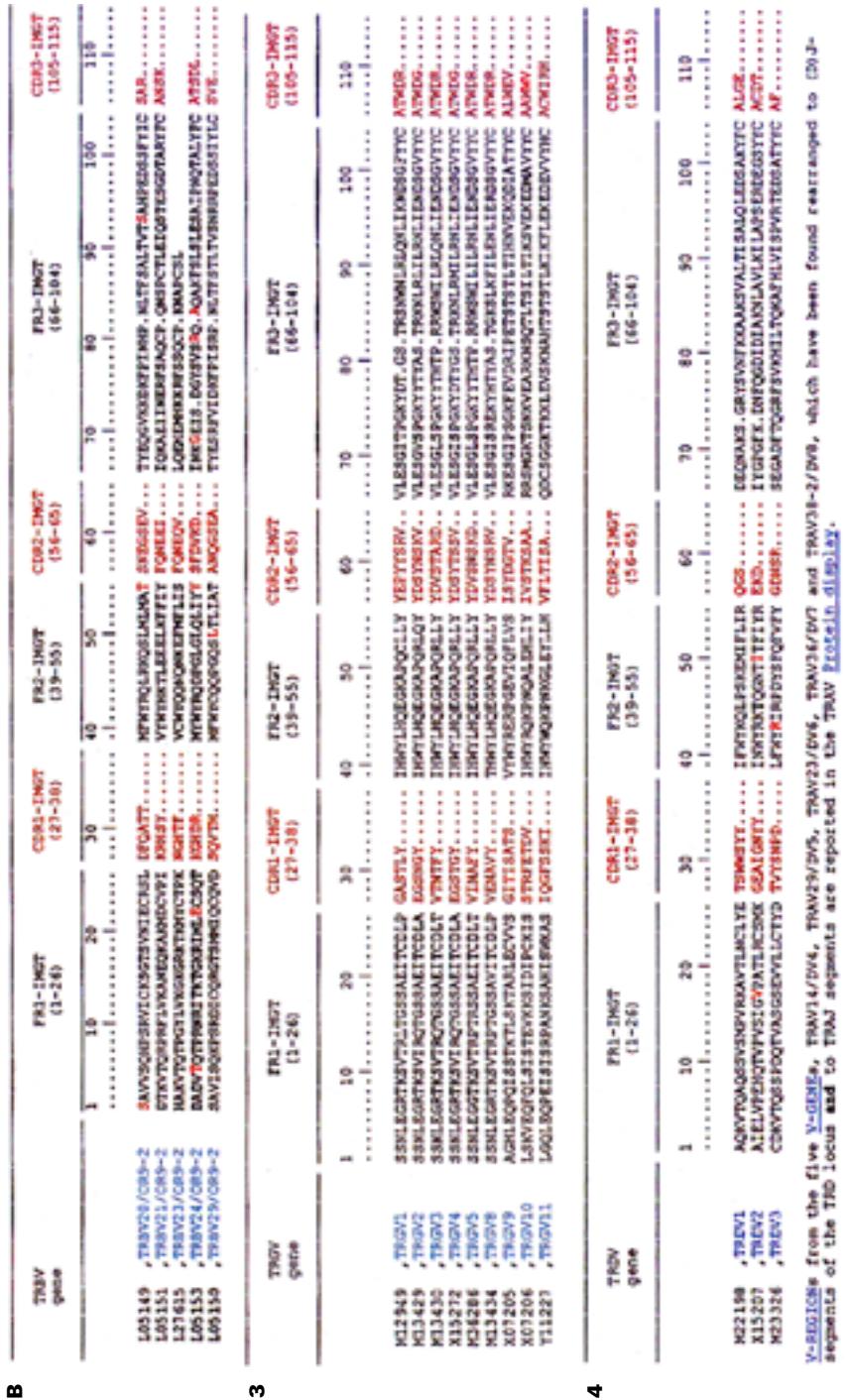
<sup>a</sup>CD43-TRBV-14C was expressed in HEK293T cells. <sup>b</sup>CD43-TRBV-28C was expressed in HEK293T cells. CD43-TRBV-14C and CD43-TRBV-28C were expressed in HEK293T cells. CD43-TRBV-14C and CD43-TRBV-28C were expressed in HEK293T cells.

THE ONE	THE ONE	PBL+IMM (L1-26)	CBL1-26H7 (L27-38)	PBL-IMM (39-53)	CBL2-26H7 (54-65)	F32-16H7 (66-164)	CBL-16H7 (165-175)
1	19	23	36	48	59	69	119
2	19	23	36	48	59	69	119
3	19	23	36	48	59	69	119
4	19	23	36	48	59	69	119
5	19	23	36	48	59	69	119
6	19	23	36	48	59	69	119
7	19	23	36	48	59	69	119
8	19	23	36	48	59	69	119
9	19	23	36	48	59	69	119
10	19	23	36	48	59	69	119
11	19	23	36	48	59	69	119
12	19	23	36	48	59	69	119
13	19	23	36	48	59	69	119
14	19	23	36	48	59	69	119
15	19	23	36	48	59	69	119
16	19	23	36	48	59	69	119
17	19	23	36	48	59	69	119
18	19	23	36	48	59	69	119
19	19	23	36	48	59	69	119
20	19	23	36	48	59	69	119
21	19	23	36	48	59	69	119
22	19	23	36	48	59	69	119
23	19	23	36	48	59	69	119
24	19	23	36	48	59	69	119
25	19	23	36	48	59	69	119
26	19	23	36	48	59	69	119
27	19	23	36	48	59	69	119
28	19	23	36	48	59	69	119
29	19	23	36	48	59	69	119
30	19	23	36	48	59	69	119
31	19	23	36	48	59	69	119
32	19	23	36	48	59	69	119
33	19	23	36	48	59	69	119
34	19	23	36	48	59	69	119
35	19	23	36	48	59	69	119
36	19	23	36	48	59	69	119
37	19	23	36	48	59	69	119
38	19	23	36	48	59	69	119
39	19	23	36	48	59	69	119
40	19	23	36	48	59	69	119
41	19	23	36	48	59	69	119
42	19	23	36	48	59	69	119
43	19	23	36	48	59	69	119
44	19	23	36	48	59	69	119
45	19	23	36	48	59	69	119
46	19	23	36	48	59	69	119
47	19	23	36	48	59	69	119
48	19	23	36	48	59	69	119
49	19	23	36	48	59	69	119
50	19	23	36	48	59	69	119
51	19	23	36	48	59	69	119
52	19	23	36	48	59	69	119
53	19	23	36	48	59	69	119
54	19	23	36	48	59	69	119
55	19	23	36	48	59	69	119
56	19	23	36	48	59	69	119
57	19	23	36	48	59	69	119
58	19	23	36	48	59	69	119
59	19	23	36	48	59	69	119
60	19	23	36	48	59	69	119
61	19	23	36	48	59	69	119
62	19	23	36	48	59	69	119
63	19	23	36	48	59	69	119
64	19	23	36	48	59	69	119
65	19	23	36	48	59	69	119
66	19	23	36	48	59	69	119
67	19	23	36	48	59	69	119
68	19	23	36	48	59	69	119
69	19	23	36	48	59	69	119
70	19	23	36	48	59	69	119
71	19	23	36	48	59	69	119
72	19	23	36	48	59	69	119
73	19	23	36	48	59	69	119
74	19	23	36	48	59	69	119
75	19	23	36	48	59	69	119
76	19	23	36	48	59	69	119
77	19	23	36	48	59	69	119
78	19	23	36	48	59	69	119
79	19	23	36	48	59	69	119
80	19	23	36	48	59	69	119
81	19	23	36	48	59	69	119
82	19	23	36	48	59	69	119
83	19	23	36	48	59	69	119
84	19	23	36	48	59	69	119
85	19	23	36	48	59	69	119
86	19	23	36	48	59	69	119
87	19	23	36	48	59	69	119
88	19	23	36	48	59	69	119
89	19	23	36	48	59	69	119
90	19	23	36	48	59	69	119
91	19	23	36	48	59	69	119
92	19	23	36	48	59	69	119
93	19	23	36	48	59	69	119
94	19	23	36	48	59	69	119
95	19	23	36	48	59	69	119
96	19	23	36	48	59	69	119
97	19	23	36	48	59	69	119
98	19	23	36	48	59	69	119
99	19	23	36	48	59	69	119
100	19	23	36	48	59	69	119
101	19	23	36	48	59	69	119
102	19	23	36	48	59	69	119
103	19	23	36	48	59	69	119
104	19	23	36	48	59	69	119
105	19	23	36	48	59	69	119
106	19	23	36	48	59	69	119
107	19	23	36	48	59	69	119
108	19	23	36	48	59	69	119
109	19	23	36	48	59	69	119
110	19	23	36	48	59	69	119
111	19	23	36	48	59	69	119
112	19	23	36	48	59	69	119
113	19	23	36	48	59	69	119
114	19	23	36	48	59	69	119
115	19	23	36	48	59	69	119
116	19	23	36	48	59	69	119
117	19	23	36	48	59	69	119
118	19	23	36	48	59	69	119
119	19	23	36	48	59	69	119
120	19	23	36	48	59	69	119
121	19	23	36	48	59	69	119
122	19	23	36	48	59	69	119
123	19	23	36	48	59	69	119
124	19	23	36	48	59	69	119
125	19	23	36	48	59	69	119
126	19	23	36	48	59	69	119
127	19	23	36	48	59	69	119
128	19	23	36	48	59	69	119
129	19	23	36	48	59	69	119
130	19	23	36	48	59	69	119
131	19	23	36	48	59	69	119
132	19	23	36	48	59	69	119
133	19	23	36	48	59	69	119
134	19	23	36	48	59	69	119
135	19	23	36	48	59	69	119
136	19	23	36	48	59	69	119
137	19	23	36	48	59	69	119
138	19	23	36	48	59	69	119
139	19	23	36	48	59	69	119
140	19	23	36	48	59	69	119
141	19	23	36	48	59	69	119
142	19	23	36	48	59	69	119
143	19	23	36	48	59	69	119
144	19	23	36	48	59	69	119
145	19	23	36	48	59	69	119
146	19	23	36	48	59	69	119
147	19	23	36	48	59	69	119
148	19	23	36	48	59	69	119
149	19	23	36	48	59	69	119
150	19	23	36	48	59	69	119
151	19	23	36	48	59	69	119
152	19	23	36	48	59	69	119
153	19	23	36	48	59	69	119
154	19	23	36	48	59	69	119
155	19	23	36	48	59	69	119
156	19	23	36	48	59	69	119
157	19	23	36	48	59	69	119
158	19	23	36	48	59	69	119
159	19	23	36	48	59	69	119
160	19	23	36	48	59	69	119
161	19	23	36	48	59	69	119
162	19	23	36	48	59	69	119
163	19	23	36	48	59	69	119
164	19	23	36	48	59	69	119
165	19	23	36	48	59	69	119
166	19	23	36	48	59	69	119
167	19	23	36	48	59	69	119
168	19	23	36	48	59	69	119
169	19	23	36	48	59	69	119
170	19	23	36	48	59	69	119
171	19	23	36	48	59	69	119
172	19	23	3				

## Human TRAV, TRBV, TRGV and TRDV Protein Displays

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209



**Fig. 2.** Protein display of the human TRB V-REGIONS. Only the \*01 allele of each functional or ORF V-REGION is shown. Letters in red correspond to amino acids which are polymorphic in the other alleles. **A** TRBV genes at the TRB locus (7q35). TRBV genes are listed, for each

**Fig. 3.** Protein display of the human TRG V-REGIONS. Only the \*01 allele of each functional or ORF V-REGION is shown. Letters in red subgroup, according to their position from 5' to 3' in the locus. **B** Orphans on chromosome 9 (9p21).

(129 of *IRG9*, 108 and 109 of *IRG10*) correspond to amino acids which are polymorphic in the other alleles. Human *IRGV* genes

**Fig. 4.** Protein display of the human TRD V-REGIONS. Only the \*01 allele of each functional or ORF V-REGION is shown. Letters in red correspond to amino acids which are polymorphic in the other alleles. Human TRDV genes are listed from 5' to 3' in the locus.

TRAJ segments		
	1	10
M94081 , TRAJ1L	... TIVVWKLITFGQGTRKQWKL	
M94081 , TRAJ29	... KEGKAKIPTFGQGTRQVVF	
M94081 , TRAJ29 [11]	... *TTRURLLTFGQGTRQLTVWP	
M94081 , TRAJ37	... TQGGSEKLVFGQGTRQLTVWP	
M94081 , TRAJ54	... YTGAKSKLTFGQGTRLLTVWP	
M94081 , TRAJ54	... IGGAGKLLTFGQGTRLLTVWP	
M94081 , TRAJ53	... NSGGGNYKLTFGQGTRLLTVWP	
M94081 , TRAJ52	... NGGGTYKMLTFGQGTRLLTVWP	
M94081 , TRAJ50	... KTFIDRVIIFGQGTRLLTVWP	
M94081 , TRAJ49	... NTGQHQYTFGQGTRLLTVWP	
M94081 , TRAJ48	... SNGGKMLTFGQGTRLLTVWP	
M94081 , TRAJ47	... EYSHMLVFGQGTRLLTVWP	
M94081 , TRAJ46	... KNGGGHLYTFGQGTRLLTVWP	
M94081 , TRAJ45	... YSGGGADGLYTFGQGTRLLTVWP	
M94081 , TRAJ44	... NTGIGASGLTFGQGTRQLVWP	
M94081 , TRAJ43	... NNGGKMLTFGQGTRLLTVWP	
M94081 , TRAJ41	... NSGGGTYALNFGQGTRLLTVWP	
M94081 , TRAJ40	... TISGUTTYKLTFGQGTRKLYLA	
M94081 , TRAJ39	... ANNACNNMLTFGQGTRLLTVWP	
M94081 , TRAJ38	... NAGGGKMLTFGQGTRLLTVWP	
M94081 , TRAJ37	... GSQNTQKLIIFGQGTRLLTVWP	
M94081 , TRAJ36	... QGSGANLIFTFGQGTRLLTVWP	
M94081 , TRAJ35	... IGGGQVYLHCGGFGQGTRQVYLP	
M94081 , TRAJ34	... SYNTTCKLETFGQGTRQLVWP	
M94081 , TRAJ33	... GGGTQLEMGATFGQGTRLLTVWP	
M94081 , TRAJ32	... NYGGATWKLITFGQGTRLLAVWP	
M94081 , TRAJ31	... NNGGKMLTFGQGTRLLVWP	
M94081 , TRAJ30	... NRGGKHLITFGQGTRLLVWP	
X02889 , TRAJ29	... NGGGTFLVFGQGTRALSVIA	
M94081 , TRAJ28	... YSGAGSYLQTFGQGTRKLSVIP	
M94081 , TRAJ27	... INTNANGKLTFGQGTRLLVWP	
M94081 , TRAJ26	... INTGQMFVTFGQGTRLLVWP	
X02889 , TRAJ25	... EGQQFSTIFGQGTRLLVWP	
X02889 , TRAJ24	... TTDGDKKTFGQGTRQVYVWP	
M94081 , TRAJ23	... ITNGQKRLIFGQGTRLLSVIP	
X02886 , TRAJ22	... ERGSGAQKLTFGQGTRQLVLP	
M94081 , TRAJ21	... TRHFKFTFGQGTRKLYWP	
M94081 , TRAJ20	... ENHDKLSTFGQGTRLLVWP	
M94081 , TRAJ19	... TQRTTRITTFGQGTRKHWVWP	
M94081 , TRAJ18	... DNGSTLGLYTFGQGTRQLVWP	
X05773 , TRAJ17	... IRRAAGKHLITFGQGTRVLVWP	
M94081 , TRAJ16	... FDDGQKLLTFGQGTRMLAVOL	
X05775 , TRAJ15	... RQATLALITFGQGTRLLVWP	
M94081 , TRAJ14	... ITSTFIIIFGQGTRALVWP	
M94081 , TRAJ13	... NSGGGTYKVTFGQGTRKLQVWP	
X02885 , TRAJ12	... NSGGTYKLTFGQGTRLLVWP	
M94081 , TRAJ11	... NSGGTFLVFGQGTRLLVWP	
M94081 , TRAJ10	... ILTGGGKMLTFGQGTRQLKVEL	
M94081 , TRAJ9	... SHTGGGKLTFGQGTRLLVWP	
M94081 , TRAJ8	... NTGFDKLVTFGQGTRLLVWP	
M94081 , TRAJ7	... DYGGRNLATFGQGTRQVYVWP	
M94081 , TRAJ6	... AASGGYIPTFGQGTRLLVWP	
M94081 , TRAJ5	... DTGKQALITFGQGTRQLVWP	
M94081 , TRAJ4	... FGQGTHMLIFGQGTRLLVWP	
X02884 , TRAJ3	... GTSSASKEIIFGQGTRLLVWP	
X02884 , TRAJ2	... MTOGTTDGLTFGQGTRMVFIS	
X02884 , TRAJ1	... TESITDQDIFGQGTRVWTP	

**IMGT note:**  
(1) The first codons of the J-REGION is a STOP-CODON which may disappear during rearrangements.

**Fig. 5.** Protein display of the human TRA J-REGIONS. Only the \*01 allele of each functional or ORF J-REGION is shown. Letters in red correspond to amino acids which are polymorphic in the other alleles and to the conserved motif FGXG. Human TRAJ segments are listed from 5' to 3' in the locus.

		TRBJ segments		
		1	10	
X00936	, TRBJ1-1	..NTEA <b>F</b> QQGTRLTVV		
X00936	, TRBJ1-2	..NTGTF <b>F</b> GQGTRLTVV		
M14158	, TRBJ1-3	.SNTT <b>T</b> F <b>E</b> GQGTRLTVV		
M14158	, TRBJ1-4	.TN <b>E</b> KL <b>F</b> <b>G</b> QGTRLTVL		
M14158	, TRBJ1-5	.SNQPM <b>F</b> QGOTRLTVL		
M14158	, TRBJ1-6	SYNSPLH <b>F</b> QGOTRLTVT		
X02987	, TRBJ2-1	.SYNEQ <b>F</b> PQGOTRLTVL		
X02987	, TRBJ2-2	.NTGEL <b>F</b> E <b>G</b> QTRLTVL		
X02987	, TRBJ2-3	LGAAGGR <b>F</b> QGOTRLVL..		
X02987	, TRBJ2-4	.STEQ <b>F</b> PQGOTRLTVL		
X02987	, TRBJ2-5	.AKNQ <b>F</b> A <b>G</b> QTRLTVL		
X02987	, TRBJ2-6	.QETQ <b>F</b> PQGOTRLTVL		
M14159	, TRBJ2-7	IGANVLT <b>F</b> A <b>G</b> QTRLTV		
M14159	, TRBJ2-8	.SYEQ <b>F</b> PQGOTRLTVT		

**Fig. 6.** Protein display of the human TRB J-REGIONS. Only the \*01 allele of each functional or ORF J-REGION is shown. The letter F (Phe) of TRBJ2-7 corresponds to an amino acid which is polymorphic in another allele. The conserved motif FGXG is in red. Human TRBJ segments are listed from 5' to 3' in the locus.

		TRGJ segments		
		1	10	20
M12960	, TRGJ1	...NYKKL <b>F</b> GSQTRLTVT..		
M12961	, TRGJ2	...NYKKL <b>F</b> GSQTRLTVT..		
M12950	, TRGJP	QQELGKKIKV <b>F</b> QGOTKLII..		
X08084	, TRGJP1	..TTGWTK <b>F</b> E <b>G</b> OTLIVTSP		
M16016	, TRGJP2	..SSDMIK <b>F</b> AKGOTRLLIVTSP		

**Fig. 7.** Protein display of the human TRG J-REGIONS. Only the \*01 allele of each functional or ORF J-REGION is shown. The conserved motif FGXG is in red.

		TRDJ segments		
		1	10	20
H20289	, TRDJ1	...TKL <b>F</b> QMKOTRNTVEP..		
L34386	, TRDJ2	..LTAQ <b>F</b> T <b>K</b> QGOTQLIVEP..		
M21508	, TRDJ3	SHDTR <b>F</b> Q <b>K</b> QTRKLEVEP..		
AJ249814	, TRDJ4	...RPL <b>F</b> K <b>K</b> TYLEVQQ..		

**Fig. 8.** Protein display of the human TRD J-REGIONS. Only the \*01 allele of each functional or ORF J-REGION is shown. The conserved motif FGXG is in red.

**Table 1 - FR-IMGT and CDR-IMGT length of the human TRAV genes**

An asterisk (\*) indicates a longer N-terminal end as predicted by the program SIGSEQ2  
 [Wülfing and Plückthun. *Immunology Today* 1995; 16:405-406].

TRAV genes	FR1-IMGT 1 to 26	CDR1-IMGT 27 to 38	FR2-IMGT 39 to 55	CDR2-IMGT 56 to 65	FR3-IMGT 66 to 104	CDR3-IMGT (germline V-GENE) 105 to 115
	(25,26,32,34)	(5 to 7)	(16,17)	(0 to 4)	(36 to 38)	(2 to 5)
TRAV1-1, TRAV1-2	-1 (aa 7)	6		2	-1 (aa 73)	3
TRAV2	-1 (aa 7)	6		0	-3 (aa 73,81,82)	3
TRAV3		6		4	-1 (aa 73)	4
TRAV4	-1 (aa 7)	7		1	-1 (aa 73)	4
TRAV5	-1 (aa 8)	6		3	-1 (aa 73)	3
TRAV6		6		3	-1 (aa 73)	3
TRAV7		6		3	-3 (aa 73,81,82)	3
TRAV8-1 to 8-4, TRAV8-6, TRAV8-7		6		4	-1 (aa 73)	3
		6		4	-1 (aa 73)	3
		6		4	-1 (aa 73)	5
TRAV9-1, TRAV9-2		6		3	-1 (aa 73)	3
TRAV10		6		3	-1 (aa 73)	3
TRAV11		6		3	-1 (aa 73)	2
TRAV12-1, TRAV12-2, TRAV12-3		6		2	-2 (aa 70,73)	3
		6		2	-1 (aa 73)	3
		6		2	-1 (aa 73)	3
TRAV13-1, TRAV13-2		6		3	-1 (aa 73)	3
TRAV14/DV4		7		4	-1 (aa 73)	4
TRAV16		6		0	-1 (aa 73)	3
TRAV17		5		3	-1 (aa 73)	3
TRAV18		6		2	-1 (aa 73)	3
TRAV19		7		4	-1 (aa 73)	4
TRAV20		6		3	-3 (aa 73,81,82)	3
TRAV21		6		3	-1 (aa 73)	3
TRAV22		5		1	-1 (aa 73)	3
TRAV23/DV6	+8 aa in 5**	6		3	-1 (aa 73)	3
TRAV24		6		3	-1 (aa 73)	2
TRAV25		5		3	-1 (aa 73)	2
TRAV26-1, TRAV26-2	-1 (aa 7)	7		1	-1 (aa 73)	4
TRAV27		5		3	-1 (aa 73)	2
TRAV29/DV5	+6 aa in 5**	6		3	-1 (aa 73)	3
TRAV30	-1 (aa 5)	5		3	-1 (aa 73)	3
TRAV34		5		3	-1 (aa 73)	3
TRAV35		5		3	-1 (aa 73)	3
TRAV36/DV7		6	-1 (aa 50)	3	-1 (aa 73)	3
TRAV38-1, TRAV38-2/DV8		7		4	-1 (aa 73)	4
TRAV39		5		3	-1 (aa 73)	3
TRAV40	-1 (aa 8)	6		0	-3 (aa 66,73,82)	3
TRAV41		5		1	-1 (aa 73)	3

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**Table 2 - FR-IMGT and CDR-IMGT length of the human TRBV genes**

TRBV genes	FR1-IMGT 1 to 26	CDR1-IMGT 27 to 38	FR2-IMGT 39 to 55	CDR2-IMGT 56 to 65	FR3-IMGT 66 to 104	CDR3-IMGT (germline V- GENE) 105 to 115
	(26)	(5,6)	(17)	(5 to 7)	(37,38)	(3 to 5)
TRBV2		5		6	-1 (aa 82)	4
TRBV3-1		5		6	-2 (aa 73,82)	4
TRBV4-1 to TRBV4-3		5		6	-2 (aa 73,82)	4
TRBV5-1, TRBV5-3 to TRBV5-8		5		6	-2 (aa 73,82)	4
TRBV6-1 to TRBV6-7		5		6	-2 (aa 73,82)	4
TRBV6-8		5		5	-2 (aa 73,82)	4
TRBV6-9		5		6	-2 (aa 73,82)	4
TRBV7-1 to TRBV7-4, TRBV7-6 to TRBV7-9		5		6	-1 (aa 82)	4
TRBV9		5		6	-2 (aa 73,82)	4
TRBV10-1 to TRBV10-3		5		6	-2 (aa 73,82)	4
TRBV11-1 to TRBV11-3		5		6	-1 (aa 82)	4
TRBV12-3 to TRBV12-5		5		6	-1 (aa 82)	4
TRBV13		5		6	-2 (aa 73,82)	4
TRBV14		5		6	-1 (aa 82)	4
TRBV15		5		6	-2 (aa 73,82)	4
TRBV16		5		6	-1 (aa 82)	4
TRBV17		5		6	-1 (aa 82)	3
TRBV18		5		6	-1 (aa 82)	4
TRBV19		5		6	-2 (aa 73,82)	4
TRBV20-1		6		7	-1 (aa 82)	3
TRBV23-1		5		6	-1 (aa 82)	4
TRBV24-1		5		6	-2 (aa 73,82)	5
TRBV25-1		5		6	-2 (aa 73,82)	4
TRBV27		5		6	-2 (aa 73,82)	4
TRBV28		5		6	-2 (aa 73,82)	4
TRBV29-1		5		7	-1 (aa 82)	3
TRBV30		6		5	-2 (aa 73,82)	3

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**Table 3 - FR-IMGT and CDR-IMGT length of the human TRGV genes**

TRGV genes	FR1-IMGT 1 to 26	CDR1-IMGT 27 to 38	FR2-IMGT 39 to 55	CDR2-IMGT 56 to 65	FR3-IMGT 66 to 104	CDR3-IMGT (germline V- GENE) 105 to 115
	(26)	(6,8)	(17)	(7,8)	(38,39)	(4 to 6)
TRGV1,		6		8	-2(aa79,82)	5
TRGV2,		6		8	-1 (aa 82)	5
TRGV3,		6		8	-1 (aa 82)	5
TRGV4,		6		8	-1 (aa 82)	5
TRGV5,		6		8	-1 (aa 82)	5
TRGV8		6		8	-1 (aa 82)	5
TRGV9		8		7		5
TRGV10		8		8		4,5*
TRGV11		8		7		6

\* polymorphic CDR3-IMGT length (4 or 5 amino acids)

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**Table 4 - FR-IMGT and CDR-IMGT length of the human TRDV genes**

TRDV genes	FR1-IMGT 1 to 26	CDR1-IMGT 27 to 38	FR2-IMGT 39 to 55	CDR2-IMGT 56 to 65	FR3-IMGT 66 to 104	CDR3-IMGT (germline V- GENE) 105 to 115
	(26)	(7,8)	(17)	(3,5)	(38,39)	(4)
TRDV1		7		3	-1 (aa 73)	4
TRDV2		8		3	-1 (aa 73)	4
TRDV3		7		5		2

Five genes designated as TRAV/DV have been found rearranged either to D and J segments of the TRD locus or to TRAJ segments, and can therefore be used in the synthesis of delta or alpha chains. These genes (TRAV14/DV4, TRAV23/DV6, TRAV29/DV5, TRAV36/DV7 and TRAV38-2/DV8) are reported in Table 1.

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