Veterinary Immunology and Immunopathology 132 (2009) 282–287

Contents lists available at ScienceDirect

Veterinary Immunology and Immunopathology

journal homepage: www.elsevier.com/locate/vetimm

Short communication

The structure and functional analysis of canine T-cell receptor beta region

Jan Matiasovic [a,*], Radka Andrysikova [b], Daniela Karasova [a], Miroslav Toman [a,b], Martin Faldyna [a,b]

[a] Veterinary Research Institute, Brno, Czech Republic
[b] University of Veterinary and Pharmaceutical Sciences Brno, Brno, Czech Republic

ARTICLE INFO

Article history:
Received 9 September 2008
Received in revised form 25 May 2009
Accepted 3 June 2009

Keywords:
TRB
ENSEMBL
GenBank

ABSTRACT

VDJ recombination is a key process in T-cell receptor (TCR) and immunoglobulin (Ig) molecules development. Comparison of ENSEMBL and GenBank database information revealed major differences in dog T-cell receptor beta (TRB) region annotations. ENSEMBL based genomic alignment of dog TRB sequence with human sequence and annotation showed a very similar structure of TRB. However, there is only one cluster of DJC segments in dogs. In dog, 38 V segments are followed by 1 D segment, 6 J segments and 1 C segment. Like humans and mice, dogs have another V segment opposite in orientation downstream of the C segment. V segments anticipated were analyzed using the RT-PCR and capillary electrophoresis. Thirty-one of them were identified in samples of thymus and spleen RNA and thus believed to be subjected to chromosomal rearrangement and RNA splicing. We identified and analyzed probable structure of canine TCR beta region, which is different when compared to sequences published in GenBank or ENSEMBL databases.

1. Introduction

As man's best friend, veterinary medicine can often have a focus on the canine species. Dogs suffer from various diseases that involve the immune system. A very important problem is a group of autoimmune disorders (Felsburg, 1994; Pedersen, 1999), which can involve both primary immunodeficiency (Giger et al., 1987; Felsburg et al., 1999) and autoimmunity (Lewis et al., 1965). Moreover, the dog has also been used as a biomedical model, namely in studies on hematopoietic stem cell transplantation (Ladiges et al., 1990; Wagner and Storb, 1996; Kirk, 2003).

T-cell receptors (TCRs) are heterodimer surface structures expressed on the surface of T lymphocytes. They are responsible for a specific recognition of antigen fragments presented by antigen-presenting cells via major histocompatibility complex (Kuby, 1997). TCRs can be subdivided into two different categories based on the protein chains used: αβ TCR and γδ TCR. Canines, humans and mice belong to animal species in which αβ TCR T lymphocytes are the predominant lymphocyte population in both peripheral blood and lymphoid organs (Faldyna et al., 2001, 2005). Maturation of T lymphocytes in the thymus involves rearrangement of chromosomal locuses coding protein chains of TCR by a mechanism closely related to chains of immunoglobulins. This process assembles mature TCR genes from individual V (variable), D (diversity) and J (joining) segments. Production of functional VDJβ rearrangement allows assembly and expression of pre-TCR receptor, which drives T lymphocyte precursors proliferation and maturation. Subsequently, the rearrangement of TCRα locus is activated (Jackson and Krangel, 2006).

Public genome databases constitute a repository of biological research data research done throughout the world. Veterinary medicine embarked on the dog genome sequence shortly after the human genome sequence had been published. The poodle's genome sequence (Kirkness et al., 2003) represents 1.5× coverage of the entire dog

* Corresponding author. Tel.: +420 53333 1317; fax: +420 54121 1229.
E-mail address: matiasovic@vri.cz (J. Matiasovic).

0165-2427/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.vetimm.2009.06.001

Table 1
RSSs identified, primers used and V segments expression analyzed as presence of RT-PCR products on capillary electrophoresis.

5′ RSS					Segment	3′ RSS					Primer	Primer sequence	
From	Nonamer	N12	Heptamer	To		From	Heptamer	N23	Nonamer	To	Primer	5′ position	5′ sequence 3′	RT-PCR[a]
					LOC482754	9993634	CACAGTG	N23	ATACAAACC	9993596	V1	9993677	ATGTGACCCAGAGCAGAACC	Yes
					ENSCAFG 0.24754	9942224	CATCCTG	N23	CAACCAAAA	9942186	V2	9942453	GTACTGGTATCAGCAGAGGGC	Yes
					TRBV2	9940885	ATCTGTG	N23	GAAAAATGT	9940847	V3	9940905	GTAGAGCCAGCCCAGAGATG	No
											V3.2	9940939	AGCTGGAAGGTCTGATGGAT	No
					TRBV3-1	9938361	CACAGCC	N23	GCACAAACC	9938323	V4	9938535	CCTCAAGCAACTGCTGAAGATC	Yes
					TRBV4-1	9935521	CACTTTG	N23	CAAAAGGTA	9935483	V5	9935599	GAATGGAGACAGGGTCCTGTAATC	Yes
					ENSCAFG 0.30817	9934877	CACAGCC	N23	GCACAAACA	9934839	V6	9935092	CAACATCTGGGACATGATGAG	Yes
					TRBV17		nd		nd		V7	9933606	CAGAAAGTGGAGTTTCTAATTTTATTCTACAG	No
					TRBV7-1	9933437	CACAGCC	N23	ACACAGACC	9933399	V8	9933476	GGGAGACTCAGCCATGTACC	No
											V8.2	9933542	GGATCGATTCTCAGCTGGAAA	No
					ENSCAFG 0.30815	9927728	CACAGCC	N23	GCACAAACC	9927690	V9	9927829	TTTCTCACCTGAGACATCTGACAAAT	Yes
					TRBV4-2	9924205	CACAGCC	N23	GCACAAACA	9924167	V10	9924377	GTCAGAAGCCACCGAAGCTTAT	Yes
					Similar to *TRBV7-1*	9922764	CACAGGC	N23	ACACAAACC	9922573	V11	9922810	CAGAGCTGGGAGACTCAACC	No
											V11.2	9922873	CAAGGATCAATTCTCAGCTGGAT	Yes
					Similar to *TRBV3-1*	9919382	CACAGCC	N23	GCACAAACC	9919344	V12	9919437	TCAACTCTCTGGAGACAGGAGAC	Yes
					ENSCAFG 0.03814	9915980	CACAGCC	N23	GCACAAACC	9915942	V13	9916057	CAGCTCCAGGTTCTACCTTCA	Yes
					TRBV7-2	9914607	CACAGCC	N23	GCACAAGCT	9914569	V14	9914696	CAGCTGAGTTGCCTGACAGA	No
											V14.2	9914737	TTCCCTCAGAGAAGGCTGAC	No
					Similar to XM_851617	9912379	CACAATA	N23	TCGGAAAGA	9912341	V15	9912435	TGAAGTCAACCAGCACCAAC	No
											V15.2	9912555	GAGACCATACCCTGAACTCTTGA	No
					ENSCAFG 0.03812	9903489	CACAGCC	N23	ACAAAAACC	9903451	V16	9903695	CCCTGAGATGTTCCCTTATCTCT	Yes
					TRBV6-8	9898425	CACAGCG	N23	ACAAAAAAT	9898387	V17	9898497	GGAGCTTCCTTCTCAAGCTG	Yes
					TRBV7-9	9894674	CACAGTG	N23	TTACAAACC	9894636	V18	9894694	CTCTGTGCCAGCAGTCTCAC	Yes
					TRBV6-6	9891547	CACAGCT	N23	ACCGAAAGC	9891509	V19	9891640	ACGTCTCCCGAAATGTGAAG	Yes
					TRBV5-8	9885867	CACAGCC	N23	GCACAAGCC	9885829	V20	9885966	GATTCTCAGGGCAGCAGTTC	Yes
					TRBV13	9879267	CACAGCC	N23	ACTCAAACT	9879229	V21	9879461	ATCTCGTCTCTGGACACAACACT	Yes
					TRBV10-3	9874468	CACAGCA	N23	ACATAAAGG	9874430	V22	9874535	TCCCCCTCCTACTGGACTCT	Yes
					TRBV11-3	9866975	CACCGCG	N23	ACATAAAAC	9866937	V23	9867066	CAGAGAGGCCCAAAGGAGTAG	No
											V23.2	9867138	GGATCTCCCGATTCAGTTTG	Yes
					TRBV12-4	9860125	CACAACA	N23	GCAGAAACC	9860087	V24	9860147	ACCTATGTGGCAGCAGGGTA	No
											V24.2	9860192	CATCCTGAAGATCCAGCCAAC	Yes
					TRBV14	9852768	CACAGTA	N23	GCAGAAACC	9852730	V25	9852864	CTCAGCAGAGATGCCTGACA	Yes
					TRBV15	9847639	CACGGAG	N23	GCACAAACC	9847601	V26	9847704	TCTCTTAGCATCCGCTCACC	Yes
					TRBV23-1	9844042	CACAGTG	N23	CACAAACAT	9844004	V27	9844172	ATTTCTTTCCAGGATAACGCTGT	Yes
					TRBV18	9833441	CACATCA	N23	GCACAAACG	9833403	V28	9833523	CCGAAGACGGACTTAGCATC	Yes
					TRBV19	9830161	CACAGTG	N23	GCAGAAATG	9830123	V29	9830374	GTGTGACTCTGGAATGTGAACAG	Yes
					TRBV20-1	9825013	CACAGCC	N23	ACAAGAACC	9824975	V30	9825156	CCTTACCCTTATGGTGACCTCTA	Yes
					TRBV21-1	9817815	CATAGTG	N23	CACAAACGC	9817777	V31	9817909	CAGCTACATGCCCCAAGAAC	Yes
					LOC482750	9813345	CACAGCG	N23	ACACAAACT	9813313	V32	9813434	AGAGGAGAAGGGGCTGTTTC	No
											V32.2	9813512	CTGCGGCTGATTTACCTCTC	No
					TRBV24-1	9804427	CACAGTG	N23	ACAGAAAGC	9804389	V33	9804567	CTACGGCTGATCTCCTACTCCTT	Yes
					TRBV25-1	9799153	CACAGTG	N23	ATAAAAAGG	9799115	V34	9799186	GACATCCCTGTACCTCTGTGC	Yes
					XM_851617	9792290	CACAGCA	N23	ACAAGAAAG	9792252	V35	9792518	TTGGGGACAGGAAAGAAATTAAC	Yes
					TRBV27	9782989	CACAGCG	N23	ACAGAAAGG	9782951	V36	9783089	GGGTCTCTCGGAAAGAGAAG	No
											V36.2	9783112	GGAGATGTCCCTGATGGGTA	No
					TRBV28	9773836	CACAGTG	N23	ACAAGATGC	9773798	V37	9773924	TCGAGGAAGAAGAAGGATGC	Yes
					TRBV29-1	9767293	CACAGCG	N23	ACAAGAACC	9767255	V38	9767484	TACCCAAGTCACCTTGATGTTCT	Yes