wwPDB X-ray Structure Validation Summary Report (i)

Sep 28, 2024 – 06:52 pm BST

PDB ID	:	2VLK
Title	:	The Structural Dynamics and Energetics of an Immunodominant T-cell Receptor are Programmed by its Vbeta Domain
Authors	:	Ishizuka, J.; Stewart-Jones, G.; Van Der Merwe, A.; Bell, J.; Mcmichael, A.; Jones, Y.
Deposited on	:	2008-01-15
Resolution	:	2.50 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

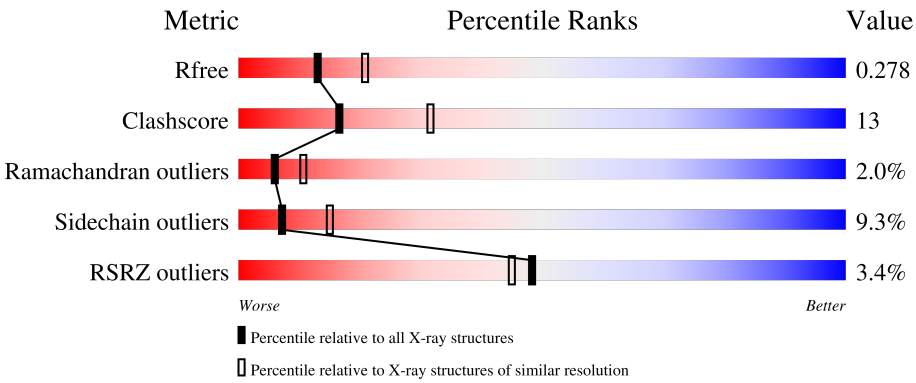
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5504 (2.50-2.50)
Clashscore	180529	6282 (2.50-2.50)
Ramachandran outliers	177936	6191 (2.50-2.50)
Sidechain outliers	177891	6193 (2.50-2.50)
RSRZ outliers	164620	5504 (2.50-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	276	5%, 74%, 21%, • •
2	B	100	%, 85%, 12%, •
3	C	9	11%, 89%, 11%
4	D	201	3%, 76%, 17%, 6%, •
5	E	244	2%, 73%, 19%, 5%, • •

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 6833 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, A-2 ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	276	2252	1407	410	426	9	0	0	0

- Molecule 2 is a protein called BETA-2-MICROGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	836	533	141	158	4	0	0	0

- Molecule 3 is a protein called FLU MATRIX PEPTIDE.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	C	9	68	49	9	10	0	0	0

- Molecule 4 is a protein called JM22 TCR ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	199	1530	959	255	310	6	0	0	0

- Molecule 5 is a protein called JM22 TCR BETA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	E	240	1932	1218	334	375	5	0	0	0

- Molecule 6 is water.

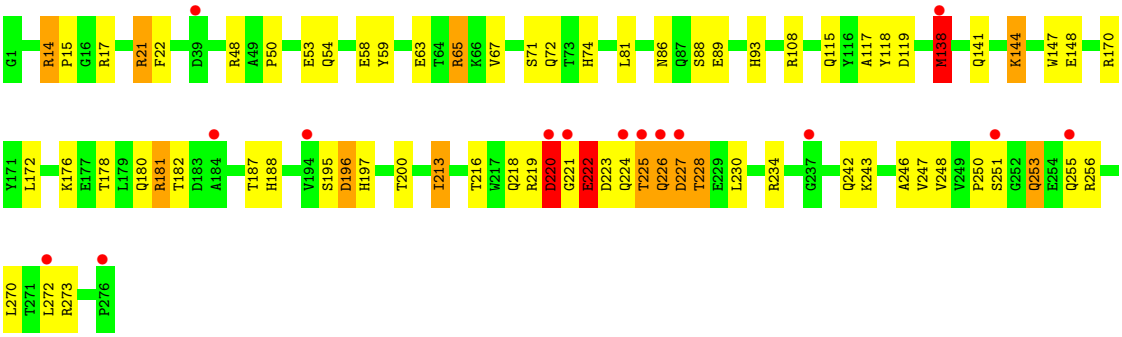
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	A	75	75	75	0	0
			Total	O		
6	B	31	31	31	0	0
			Total	O		
6	C	2	2	2	0	0
			Total	O		
6	D	47	47	47	0	0
			Total	O		
6	E	60	60	60	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

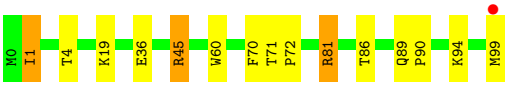
• Molecule 1: HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, A-2 ALPHA CHAIN

Chain A:



• Molecule 2: BETA-2-MICROGLOBULIN

Chain B:

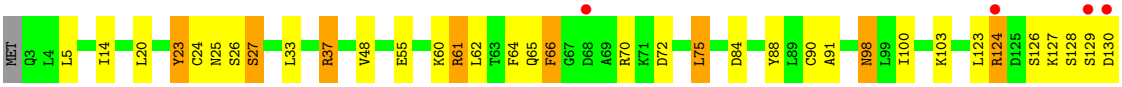


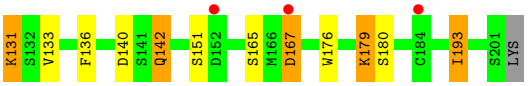
• Molecule 3: FLU MATRIX PEPTIDE

Chain C:

• Molecule 4: JM22 TCR ALPHA CHAIN

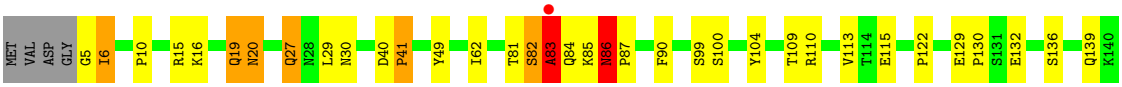
Chain D:





• Molecule 5: JM22 TCR BETA CHAIN

Chain E:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	210.80Å 47.89Å 112.82Å 90.00° 112.34° 90.00°	Depositor
Resolution (Å)	104.26 – 2.50 104.26 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.7 (104.26-2.50) 99.7 (104.26-2.50)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.84 (at 2.50Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.218 , 0.288 0.210 , 0.278	Depositor DCC
R_{free} test set	1827 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	47.1	Xtriage
Anisotropy	0.130	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 54.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	6833	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.49% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|$ >5	RMSZ	#$\|Z\|$ >5
1	A	0.75	1/2317 (0.0%)	0.79	1/3145 (0.0%)
2	B	0.75	0/859	0.73	0/1162
3	C	0.97	0/69	0.67	0/92
4	D	0.73	0/1560	0.80	3/2113 (0.1%)
5	E	0.75	0/1985	0.79	1/2700 (0.0%)
All	All	0.75	1/6790 (0.0%)	0.78	5/9212 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
5	E	0	2
All	All	0	4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	138	MET	CB-CG	6.29	1.71	1.51

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	138	MET	CB-CG-SD	6.32	131.37	112.40
5	E	146	LEU	CA-CB-CG	6.25	129.69	115.30
4	D	123	LEU	CA-CB-CG	5.30	127.48	115.30
4	D	61	ARG	NE-CZ-NH1	-5.27	117.66	120.30
4	D	37	ARG	NE-CZ-NH2	-5.21	117.69	120.30

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	226	GLN	Peptide
1	A	227	ASP	Peptide
5	E	83	ALA	Peptide
5	E	86	ASN	Peptide

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2252	0	2098	61	0
2	B	836	0	803	12	0
3	C	68	0	75	2	0
4	D	1530	0	1480	39	0
5	E	1932	0	1829	54	0
6	A	75	0	0	14	1
6	B	31	0	0	4	1
6	C	2	0	0	0	0
6	D	47	0	0	6	1
6	E	60	0	0	8	0
All	All	6833	0	6285	164	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 13.

The worst 5 of 164 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:E:86:ASN:HA	6:E:2029:HOH:O	1.26	1.28
4:D:142:GLN:HG3	6:D:2041:HOH:O	1.41	1.18
4:D:61:ARG:NH1	4:D:84:ASP:OD2	1.86	1.08
5:E:183:LEU:HG	5:E:185:ASP:H	1.23	1.02
1:A:21:ARG:HG2	1:A:21:ARG:HH11	1.27	0.97

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:D:2003:HOH:O	6:D:2003:HOH:O[2_654]	1.01	1.19
6:A:2063:HOH:O	6:B:2025:HOH:O[1_565]	2.11	0.09

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	274/276 (99%)	251 (92%)	15 (6%)	8 (3%)	3	6
2	B	98/100 (98%)	94 (96%)	4 (4%)	0	100	100
3	C	7/9 (78%)	7 (100%)	0	0	100	100
4	D	197/201 (98%)	187 (95%)	8 (4%)	2 (1%)	13	25
5	E	238/244 (98%)	218 (92%)	14 (6%)	6 (2%)	4	7
All	All	814/830 (98%)	757 (93%)	41 (5%)	16 (2%)	6	11

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	86	ASN
1	A	222	GLU
1	A	227	ASP
4	D	179	LYS
5	E	20	ASN

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	231/232 (100%)	203 (88%)	28 (12%)	4 8
2	B	95/95 (100%)	90 (95%)	5 (5%)	19 38
3	C	7/7 (100%)	7 (100%)	0	100 100
4	D	175/177 (99%)	157 (90%)	18 (10%)	6 12
5	E	212/215 (99%)	196 (92%)	16 (8%)	11 23
All	All	720/726 (99%)	653 (91%)	67 (9%)	7 15

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	E	136	SER
5	E	164	LYS
5	E	236	SER
1	A	255	GLN
1	A	253	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
5	E	19	GLN
5	E	139	GLN
5	E	233	GLN
5	E	84	GLN
2	B	89	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

There are no ligands in this entry.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	276/276 (100%)	0.16	15 (5%)	32	30	20, 35, 59, 76	0
2	B	100/100 (100%)	-0.14	1 (1%)	79	76	19, 31, 48, 60	0
3	C	9/9 (100%)	0.18	1 (11%)	12	11	20, 21, 25, 29	0
4	D	199/201 (99%)	0.06	7 (3%)	47	44	18, 36, 55, 58	0
5	E	240/244 (98%)	-0.03	4 (1%)	69	65	19, 35, 50, 59	0
All	All	824/830 (99%)	0.04	28 (3%)	48	45	18, 34, 55, 76	0

The worst 5 of 28 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	227	ASP	4.0
1	A	237	GLY	3.3
4	D	184	CYS	3.1
1	A	221	GLY	2.9
1	A	226	GLN	2.8

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.