wwPDB X-ray Structure Validation Summary Report (i)

Oct 19, 2023 – 01:07 AM EDT

PDB ID	:	2IAL
Title	:	Structural basis for recognition of mutant self by a tumor-specific, MHC class II-restricted TCR
Authors	:	Deng, L.; Langley, R.J.; Mariuzza, R.A.
Deposited on	:	2006-09-08
Resolution	:	1.92 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:

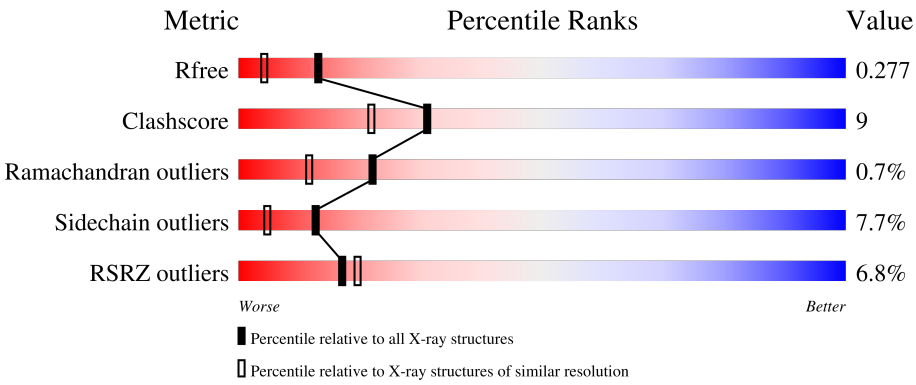
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.92 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}	130704	7937 (1.94-1.90)
Clashscore	141614	8644 (1.94-1.90)
Ramachandran outliers	138981	8530 (1.94-1.90)
Sidechain outliers	138945	8530 (1.94-1.90)
RSRZ outliers	127900	7793 (1.94-1.90)

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	202	19% 75% 20% • •
1	C	202	4% 81% 12% • •
2	B	240	% 74% 21% •
2	D	240	4% 75% 19% 5%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 7105 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 CD4+ T cell receptor E8 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	196	1534	961	258	308	7	0	0	0
1	C	195	1526	957	257	305	7	0	0	0

- Molecule 2 is a protein called CD4+ T cell receptor E8 beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	239	1901	1206	324	362	9	0	0	0
2	D	239	1901	1206	324	362	9	0	0	0

- Molecule 3 is water.

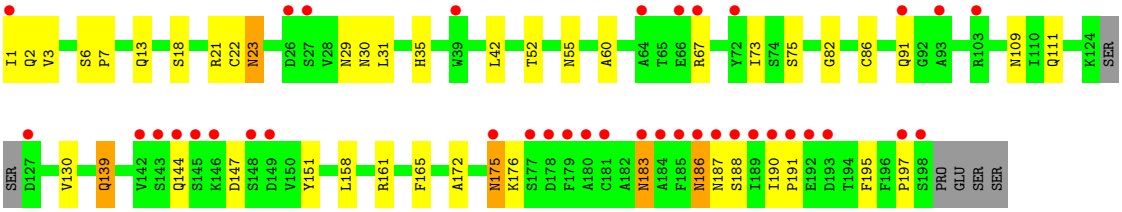
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	27	27	27	0	0
3	B	94	94	94	0	0
3	C	44	44	44	0	0
3	D	78	78	78	0	0

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: CD4+ T cell receptor E8 alpha chain

Chain A:

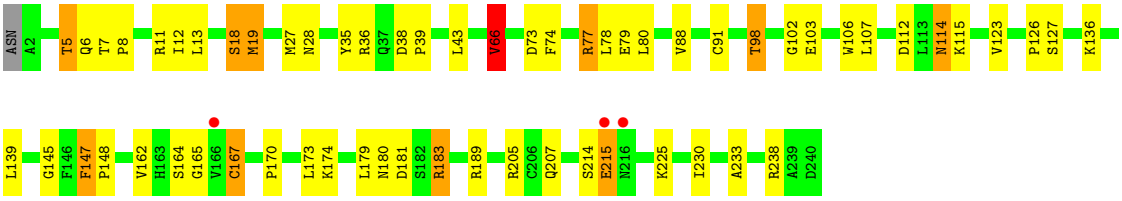


- Molecule 1: CD4+ T cell receptor E8 alpha chain

Chain C:

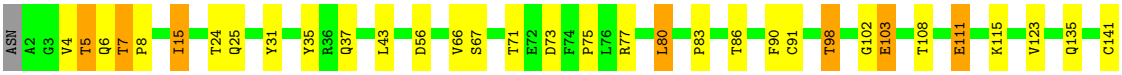
- Molecule 2: CD4+ T cell receptor E8 beta chain

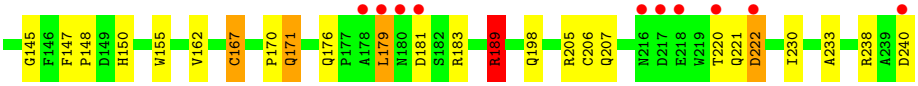
Chain B:



- Molecule 2: CD4+ T cell receptor E8 beta chain

Chain D:




G145
F146
F147
P148
D149
H150
W155
V162
C167
P170
Q171
Q176
P177
A178
L179
N180
D181
S182
R183
R189
Q198
R205
C206
Q207
N216
D217
E218
W219
T220
Q221
D222
I230
A233
R238
A239
D240

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	170.04Å 65.66Å 84.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.31 – 1.92 44.31 – 1.92	Depositor EDS
% Data completeness (in resolution range)	94.1 (44.31-1.92) 94.1 (44.31-1.92)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.03 (at 1.92Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.208 , 0.265 0.222 , 0.277	Depositor DCC
R_{free} test set	3495 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	26.1	Xtriage
Anisotropy	0.178	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 38.7	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	0.94	EDS
Total number of atoms	7105	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.78% 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	0.80	0/1566	0.83	0/2129
1	C	0.92	2/1558 (0.1%)	0.95	4/2118 (0.2%)
2	B	1.02	3/1956 (0.2%)	0.96	10/2666 (0.4%)
2	D	0.97	2/1956 (0.1%)	0.91	2/2666 (0.1%)
All	All	0.94	7/7036 (0.1%)	0.92	16/9579 (0.2%)

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
1	C	0	1
2	B	0	4
2	D	0	3
All	All	0	10

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	103	GLU	CG-CD	7.21	1.62	1.51
2	B	103	GLU	CG-CD	6.27	1.61	1.51
2	D	167	CYS	CB-SG	-6.04	1.72	1.82
2	B	35	TYR	CD1-CE1	5.68	1.47	1.39
2	B	167	CYS	CB-SG	-5.55	1.72	1.81

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	158	LEU	CA-CB-CG	9.59	137.37	115.30
2	B	183	ARG	NE-CZ-NH2	-8.99	115.80	120.30
2	B	183	ARG	NE-CZ-NH1	8.03	124.31	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	156	CYS	CA-CB-SG	7.66	127.79	114.00
2	D	7	THR	C-N-CD	-6.98	105.25	120.60

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	6	SER	Mainchain,Peptide
2	B	147	PHE	Mainchain,Peptide
2	B	7	THR	Mainchain,Peptide
1	C	6	SER	Peptide
2	D	7	THR	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	1534	0	1463	36	0
1	C	1526	0	1459	21	0
2	B	1901	0	1800	40	0
2	D	1901	0	1800	40	0
3	A	27	0	0	0	0
3	B	94	0	0	6	0
3	C	44	0	0	2	0
3	D	78	0	0	6	0
All	All	7105	0	6522	122	0

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 9.

The worst 5 of 122 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)
1:A:175:ASN:ND2	1:A:175:ASN:H	1.75	0.84
1:A:21:ARG:HE	1:A:23:ASN:HD21	1.22	0.83

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:ASN:HD21	1:C:161:ARG:HH22	1.24	0.83
2:B:77:ARG:HD3	2:B:79:GLU:OE2	1.79	0.83
2:B:170:PRO:HD2	3:B:322:HOH:O	1.80	0.81

There are no symmetry-related clashes.

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	192/202 (95%)	177 (92%)	14 (7%)	1 (0%)	29 18
1	C	191/202 (95%)	182 (95%)	8 (4%)	1 (0%)	29 18
2	B	237/240 (99%)	231 (98%)	4 (2%)	2 (1%)	19 9
2	D	237/240 (99%)	229 (97%)	6 (2%)	2 (1%)	19 9
All	All	857/884 (97%)	819 (96%)	32 (4%)	6 (1%)	22 11

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	148	PRO
1	C	7	PRO
2	D	8	PRO
2	B	8	PRO
2	D	148	PRO

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	176/182 (97%)	160 (91%)	16 (9%)	9 3
1	C	175/182 (96%)	164 (94%)	11 (6%)	18 8
2	B	206/207 (100%)	193 (94%)	13 (6%)	18 8
2	D	206/207 (100%)	187 (91%)	19 (9%)	9 3
All	All	763/778 (98%)	704 (92%)	59 (8%)	13 5

5 of 59 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	238	ARG
2	D	181	ASP
1	C	128	LYS
2	D	179	LEU
2	D	98	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	187	ASN
2	D	65	ASN
2	D	171	GLN
2	D	150	HIS
1	A	175	ASN

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 monosaccharides 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	196/202 (97%)	1.01	38 (19%)	1	1	21, 37, 68, 77	0
1	C	195/202 (96%)	0.30	8 (4%)	37	40	17, 28, 43, 57	0
2	B	239/240 (99%)	0.25	3 (1%)	77	79	15, 25, 39, 58	0
2	D	239/240 (99%)	0.26	10 (4%)	36	39	17, 28, 46, 55	0
All	All	869/884 (98%)	0.43	59 (6%)	17	19	15, 29, 51, 77	0

The worst 5 of 59 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	187	ASN	8.0
1	A	189	ILE	6.1
1	C	1	ILE	5.9
1	A	193	ASP	5.8
1	A	191	PRO	5.8

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.