wwPDB X-ray Structure Validation Summary Report (i)

May 22, 2020 – 01:52 am BST

PDB ID	:	4MS8
Title	:	42F3 TCR pCPB9/H-2Ld Complex
Authors	:	Birnbaum, M.E.; Adams, J.J.; Garcia, K.C.
Deposited on	:	2013-09-18
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 following versions of software and data (see references (1)) were used in the production of this report:

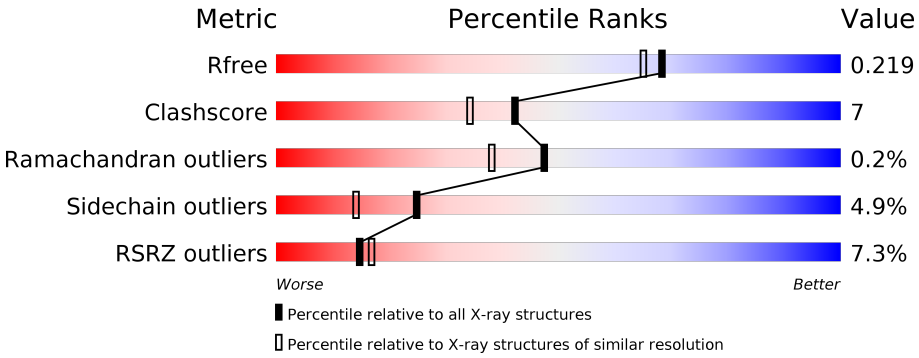
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 on 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	C	212	10%, 81%, 10%, 8%
2	D	243	%, 84%, 13%
3	A	180	12%, 70%, 18%, 10%
4	B	9	56%, 33%, 11%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5275 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 42F3 alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	196	Total	C	N	O	S	0	0	0
			1517	961	249	299	8			

- Molecule 2 is a protein called 42F3 beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	239	Total	C	N	O	S	0	0	0
			1895	1194	329	366	6			

- Molecule 3 is a protein called H-2 class I histocompatibility antigen, L-D alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	162	Total	C	N	O	S	0	0	0
			1335	846	230	252	7			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	EXPRESSION TAG	UNP P01897
A	8	TYR	PHE	ENGINEERED MUTATION	UNP P01897
A	12	THR	VAL	ENGINEERED MUTATION	UNP P01897
A	15	ARG	PRO	ENGINEERED MUTATION	UNP P01897
A	23	THR	ILE	ENGINEERED MUTATION	UNP P01897
A	30	ASP	ASN	ENGINEERED MUTATION	UNP P01897
A	49	VAL	ALA	ENGINEERED MUTATION	UNP P01897
A	131	ARG	LYS	ENGINEERED MUTATION	UNP P01897

- Molecule 4 is a protein called pCPB9.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	B	9	Total	C	N	O	0	1	0
			72	49	9	14			

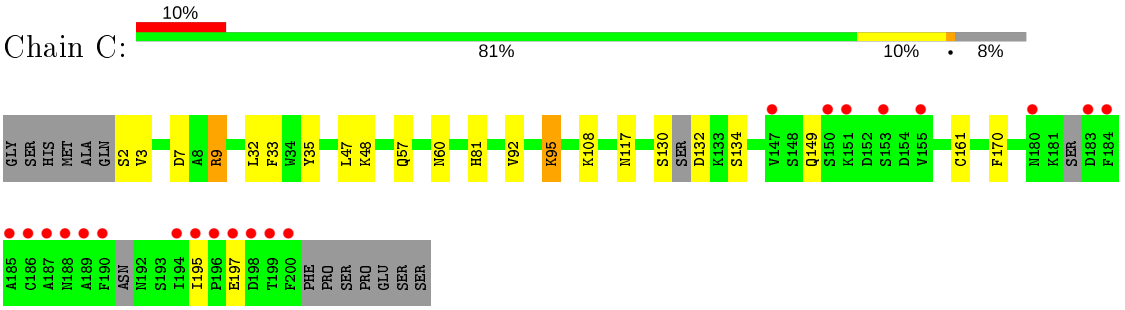
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	C	164	Total O 164 164	0	0
5	D	213	Total O 213 213	0	0
5	A	74	Total O 74 74	0	0
5	B	5	Total O 5 5	0	0

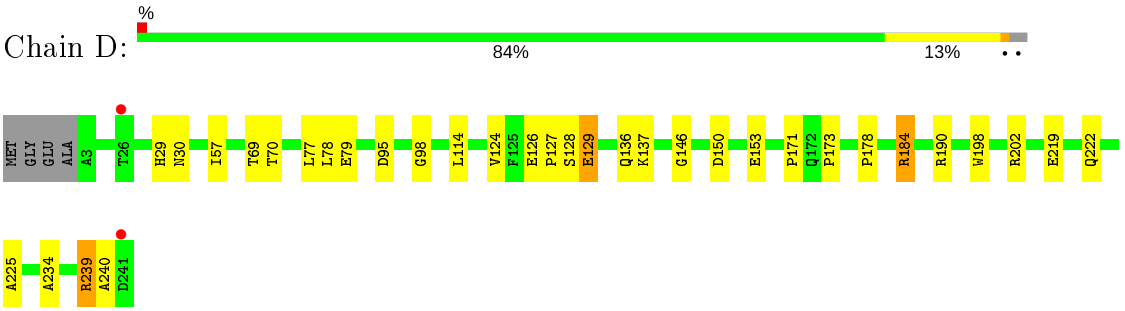
3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

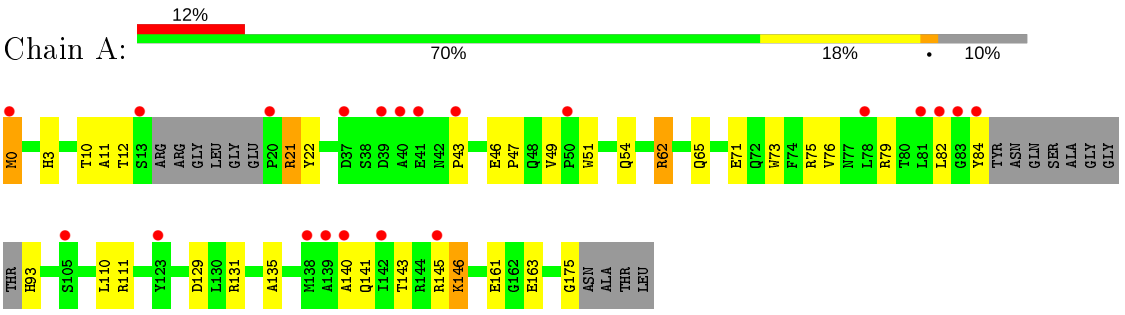
- Molecule 1: 42F3 alpha



- Molecule 2: 42F3 beta



- Molecule 3: H-2 class I histocompatibility antigen, L-D alpha chain



- Molecule 4: pCPB9


S1
E4
A5
G6
F7
F8
L9

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	175.26Å 60.62Å 70.10Å 90.00° 96.06° 90.00°	Depositor
Resolution (Å)	34.85 – 1.92 43.57 – 1.92	Depositor EDS
% Data completeness (in resolution range)	93.1 (34.85-1.92) 93.1 (43.57-1.92)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.32 (at 1.92Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.180 , 0.219 0.180 , 0.219	Depositor DCC
R_{free} test set	2658 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å^2)	31.0	Xtriage
Anisotropy	0.134	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 57.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5275	wwPDB-VP
Average B, all atoms (Å^2)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.86% 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

5.1 Standard geometry

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	C	0.81	1/1551 (0.1%)	0.81	0/2098
2	D	0.77	0/1947	0.80	1/2655 (0.0%)
3	A	0.64	0/1373	0.69	0/1861
4	B	0.62	0/77	0.56	0/103
All	All	0.75	1/4948 (0.0%)	0.77	1/6717 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	35	TYR	CD1-CE1	5.67	1.47	1.39

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	184	ARG	NE-CZ-NH2	-5.86	117.37	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	C	1517	0	1439	14	0
2	D	1895	0	1791	26	0
3	A	1335	0	1216	26	0
4	B	72	0	68	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	74	0	0	12	0
5	B	5	0	0	0	0
5	C	164	0	0	9	1
5	D	213	0	0	13	2
All	All	5275	0	4514	64	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 7.

The worst 5 of 64 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:C:130:SER:HG	1:C:132:ASP:N	1.62	0.96
1:C:9:ARG:NH2	5:C:435:HOH:O	2.00	0.93
2:D:136:GLN:O	5:D:374:HOH:O	1.95	0.84
3:A:84:TYR:O	5:A:241:HOH:O	2.00	0.80
3:A:111:ARG:NH1	5:A:237:HOH:O	2.16	0.78

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)
5:D:504:HOH:O	5:D:507:HOH:O[4_546]	1.83	0.37
5:C:455:HOH:O	5:D:446:HOH:O[4_546]	1.98	0.22

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	C	188/212 (89%)	184 (98%)	4 (2%)	0	100	100
2	D	237/243 (98%)	233 (98%)	4 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
3	A	156/180 (87%)	149 (96%)	6 (4%)	1 (1%)	25 14
4	B	8/9 (89%)	8 (100%)	0	0	100 100
All	All	589/644 (92%)	574 (98%)	14 (2%)	1 (0%)	47 38

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	43	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	C	169/186 (91%)	157 (93%)	12 (7%)	14 6
2	D	206/208 (99%)	200 (97%)	6 (3%)	42 33
3	A	131/148 (88%)	125 (95%)	6 (5%)	27 16
4	B	7/6 (117%)	6 (86%)	1 (14%)	3 1
All	All	513/548 (94%)	488 (95%)	25 (5%)	25 14

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	197	GLU
2	D	114	LEU
3	A	146	LYS
2	D	57	ILE
2	D	128	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	124	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

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

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95^{th} 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	C	196/212 (92%)	0.22	21 (10%) 6 7	23, 40, 73, 96	0
2	D	239/243 (98%)	-0.05	2 (0%) 86 87	24, 36, 63, 88	0
3	A	162/180 (90%)	0.71	21 (12%) 3 3	31, 59, 94, 117	0
4	B	9/9 (100%)	0.26	0 100 100	42, 47, 58, 61	0
All	All	606/644 (94%)	0.24	44 (7%) 15 17	23, 42, 80, 117	0

The worst 5 of 44 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	A	81	LEU	7.2
3	A	142	ILE	5.3
1	C	196	PRO	5.3
1	C	194	ILE	4.9
1	C	200	PHE	4.9

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.