



# Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 04:17 pm BST

PDB ID : 6MNG  
Title : 4738 TCR bound to IAb Padi4  
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Deposited on : 2018-10-01  
Resolution : 2.66 Å(reported)

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

We welcome your comments at [validation@mail.wwpdb.org](mailto: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 ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) 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

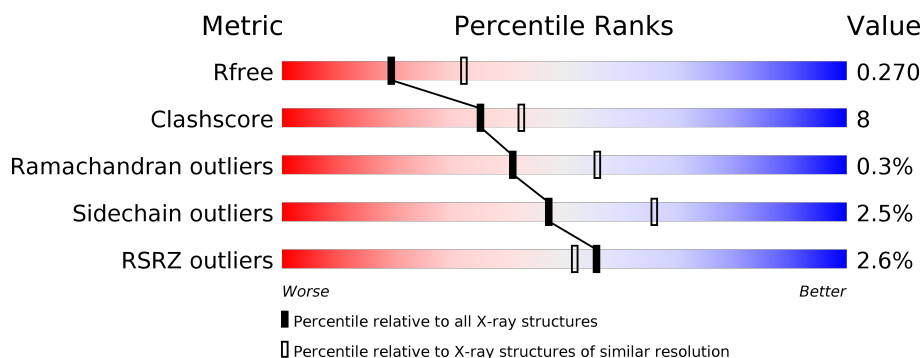
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.66 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	1332 (2.68-2.64)
Clashscore	141614	1374 (2.68-2.64)
Ramachandran outliers	138981	1349 (2.68-2.64)
Sidechain outliers	138945	1349 (2.68-2.64)
RSRZ outliers	127900	1318 (2.68-2.64)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	179	<div> <div>8%</div> <div> <div></div> <div>74%</div> <div>22%</div> <div>••</div> </div> </div>
2	D	217	<div> <div>%</div> <div> <div></div> <div>72%</div> <div>16%</div> <div>•</div> <div>11%</div> </div> </div>
3	A	208	<div> <div>%</div> <div> <div></div> <div>82%</div> <div>13%</div> <div>•</div> </div> </div>
4	B	239	<div> <div></div> <div> <div></div> <div>79%</div> <div>20%</div> <div>•</div> </div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6088 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 H-2 class II histocompatibility antigen, A-B alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	174	Total	C	N	O	S	0	0	0
			1286	833	207	243	3			

- Molecule 2 is a protein called Padi4 (92-105) peptide and MHCII I-Ab beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	193	Total	C	N	O	S	0	0	0
			1529	969	264	289	7			

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	-12	GLY	-	linker	UNP Q9Z183
D	-11	GLY	-	linker	UNP Q9Z183
D	-10	GLY	-	linker	UNP Q9Z183
D	-9	GLY	-	linker	UNP Q9Z183
D	-8	SER	-	linker	UNP Q9Z183
D	-7	LEU	-	linker	UNP Q9Z183
D	-6	VAL	-	linker	UNP Q9Z183
D	-5	PRO	-	linker	UNP Q9Z183
D	-4	ARG	-	linker	UNP Q9Z183
D	-3	GLY	-	linker	UNP Q9Z183
D	-2	SER	-	linker	UNP Q9Z183
D	-1	GLY	-	linker	UNP Q9Z183
D	0	GLY	-	linker	UNP Q9Z183
D	1	GLY	-	linker	UNP Q9Z183
D	2	GLY	-	linker	UNP Q9Z183

- Molecule 3 is a protein called 4738 TCR alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	199	Total	C	N	O	S	0	0	0
			1468	935	238	289	6			

- Molecule 4 is a protein called 4738 TCR beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	B	239	Total	C	N	O	S	0	0	0
			1792	1135	318	333	6			

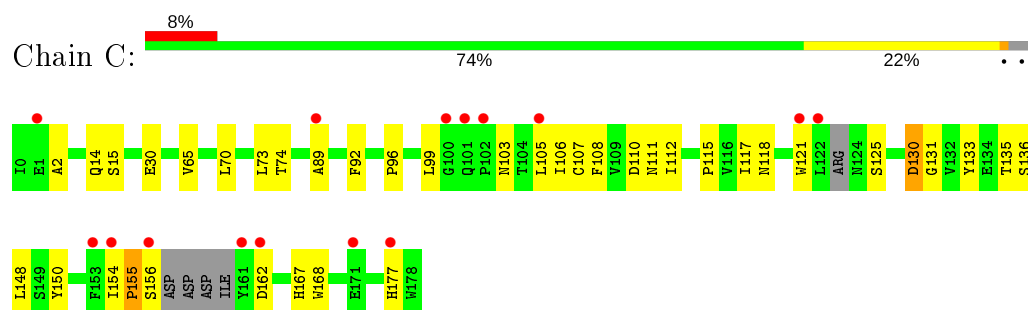
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	5	Total	O	0	0
			5	5		
5	D	2	Total	O	0	0
			2	2		
5	A	2	Total	O	0	0
			2	2		
5	B	4	Total	O	0	0
			4	4		

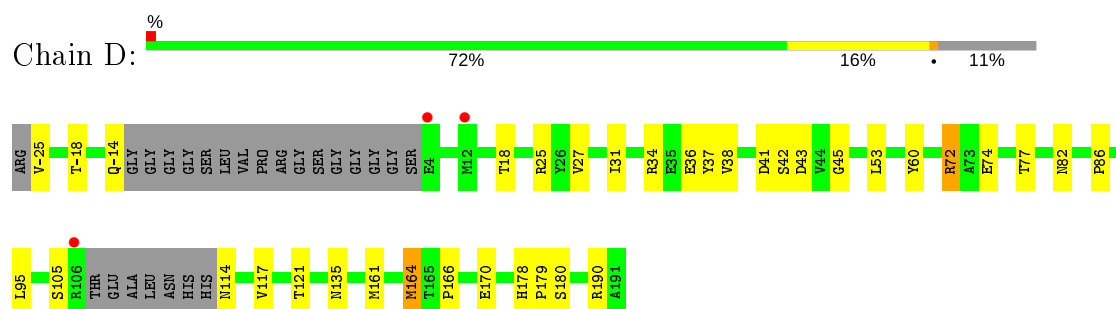
### 3 Residue-property plots [i](#)

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.

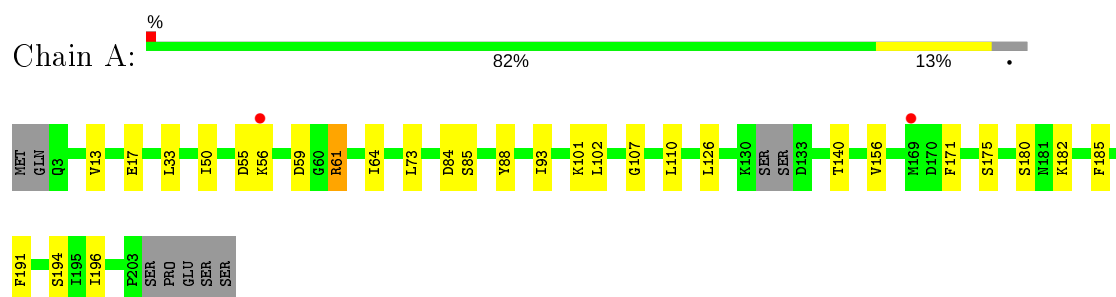
- Molecule 1: H-2 class II histocompatibility antigen, A-B alpha chain



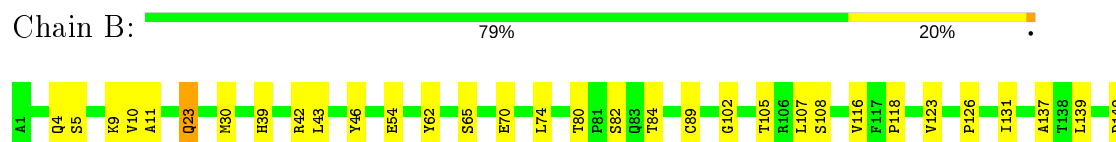
- Molecule 2: Padi4 (92-105) peptide and MHCII I-Ab beta chain

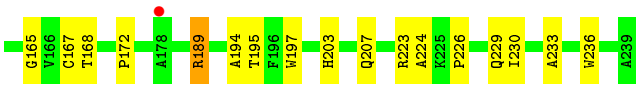


- Molecule 3: 4738 TCR alpha chain



- Molecule 4: 4738 TCR beta chain





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	250.92Å 69.16Å 64.15Å 90.00° 91.48° 90.00°	Depositor
Resolution (Å)	29.66 – 2.66 29.66 – 2.66	Depositor EDS
% Data completeness (in resolution range)	99.2 (29.66-2.66) 99.2 (29.66-2.66)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.00 (at 2.68Å)	Xtriage
Refinement program	PHENIX 1.10.1_2155	Depositor
R, $R_{free}$	0.230 , 0.269 0.232 , 0.270	Depositor DCC
$R_{free}$ test set	1991 reflections (6.32%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	57.5	Xtriage
Anisotropy	0.298	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 40.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.011 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	6088	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.80% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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	C	0.32	0/1326	0.49	0/1822
2	D	0.29	0/1569	0.47	1/2143 (0.0%)
3	A	0.30	1/1505 (0.1%)	0.53	2/2059 (0.1%)
4	B	0.26	0/1845	0.46	0/2527
All	All	0.29	1/6245 (0.0%)	0.49	3/8551 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	61	ARG	C-N	-5.15	1.22	1.34

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	72	ARG	NE-CZ-NH1	-5.39	117.61	120.30
3	A	59	ASP	O-C-N	5.17	131.99	123.20
3	A	61	ARG	NE-CZ-NH1	-5.03	117.78	120.30

There are no chirality outliers.

There are no planarity outliers.

### 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	C	1286	0	1112	31	0
2	D	1529	0	1406	23	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1468	0	1291	20	0
4	B	1792	0	1623	29	0
5	A	2	0	0	0	0
5	B	4	0	0	0	0
5	C	5	0	0	1	0
5	D	2	0	0	0	0
All	All	6088	0	5432	94	1

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 8.

All (94) 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:154:ILE:O	1:C:156:SER:N	2.02	0.92
2:D:-25:VAL:HG21	2:D:86:PRO:HA	1.67	0.76
1:C:107:CYS:HB2	1:C:121:TRP:CH2	2.25	0.71
1:C:110:ASP:OD1	1:C:111:ASN:N	2.29	0.65
3:A:61:ARG:NH2	3:A:84:ASP:OD2	2.29	0.65
2:D:45:GLY:O	2:D:72:ARG:NH1	2.31	0.64
3:A:55:ASP:O	3:A:56:LYS:HB2	1.98	0.63
2:D:164:MET:HE1	2:D:166:PRO:HG3	1.81	0.63
1:C:99:LEU:HA	1:C:155:PRO:HB2	1.80	0.62
4:B:62:TYR:HB3	4:B:74:LEU:HD11	1.82	0.61
4:B:207:GLN:HG3	4:B:230:ILE:HG23	1.82	0.61
2:D:135:ASN:HD21	2:D:170:GLU:HG2	1.64	0.61
2:D:25:ARG:NH1	2:D:43:ASP:OD2	2.33	0.61
1:C:2:ALA:HA	2:D:18:THR:HG22	1.83	0.60
1:C:108:PHE:HD1	1:C:148:LEU:HD21	1.65	0.59
4:B:9:LYS:HZ2	4:B:11:ALA:HB2	1.68	0.58
4:B:4:GLN:NE2	4:B:89:CYS:H	2.02	0.57
1:C:73:LEU:HD21	2:D:37:TYR:CE2	2.40	0.57
2:D:-14:GLN:NE2	2:D:60:TYR:OH	2.37	0.57
4:B:39:HIS:HB3	4:B:42:ARG:HD2	1.85	0.57
4:B:116:VAL:O	4:B:223:ARG:NH1	2.37	0.56
3:A:88:TYR:O	3:A:107:GLY:HA2	2.04	0.56
1:C:107:CYS:HB2	1:C:121:TRP:CZ2	2.41	0.55
3:A:13:VAL:HG13	3:A:17:GLU:HB2	1.89	0.54
1:C:73:LEU:HD21	2:D:37:TYR:CZ	2.43	0.54
3:A:180:SER:OG	3:A:182:LYS:CB	2.57	0.52
2:D:27:VAL:HG22	2:D:41:ASP:HA	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:56:LYS:HG3	3:A:64:ILE:O	2.10	0.52
1:C:167:HIS:CD2	1:C:168:TRP:H	2.28	0.51
4:B:46:TYR:CE2	4:B:54:GLU:HB2	2.46	0.51
3:A:182:LYS:CB	3:A:185:PHE:HB2	2.40	0.51
4:B:203:HIS:HB3	4:B:236:TRP:CZ3	2.46	0.51
3:A:50:ILE:HD11	3:A:56:LYS:H	1.76	0.50
3:A:171:PHE:O	4:B:165:GLY:HA2	2.11	0.50
4:B:203:HIS:HB3	4:B:236:TRP:CE3	2.47	0.50
2:D:37:TYR:CD2	2:D:38:VAL:HG23	2.47	0.50
1:C:89:ALA:HA	1:C:108:PHE:O	2.12	0.50
4:B:149:ASP:HB2	4:B:172:PRO:HG2	1.93	0.49
4:B:131:ILE:HG23	4:B:194:ALA:HB1	1.95	0.49
4:B:123:VAL:HG23	4:B:233:ALA:HB3	1.93	0.48
1:C:108:PHE:CD1	1:C:148:LEU:HD21	2.46	0.48
2:D:37:TYR:CE2	2:D:38:VAL:HG23	2.49	0.48
4:B:126:PRO:HG2	4:B:137:ALA:HB1	1.95	0.48
2:D:117:VAL:HG22	2:D:161:MET:HG3	1.96	0.48
1:C:70:LEU:O	1:C:74:THR:OG1	2.19	0.47
1:C:105:LEU:HD23	1:C:106:ILE:N	2.29	0.47
1:C:135:THR:CG2	1:C:148:LEU:H	2.27	0.47
1:C:115:PRO:HG3	1:C:145:PHE:CE2	2.50	0.47
1:C:135:THR:HG22	1:C:148:LEU:H	1.79	0.47
3:A:93:ILE:HB	3:A:102:LEU:HD23	1.97	0.46
2:D:53:LEU:HD12	2:D:53:LEU:H	1.81	0.46
4:B:126:PRO:HD3	4:B:139:LEU:HG	1.97	0.45
1:C:30:GLU:OE2	1:C:136:SER:OG	2.33	0.45
1:C:92:PHE:CE1	1:C:106:ILE:HD12	2.51	0.45
4:B:9:LYS:NZ	4:B:11:ALA:HB2	2.32	0.45
4:B:80:THR:HG22	4:B:82:SER:H	1.82	0.45
1:C:118:ASN:ND2	5:C:202:HOH:O	2.38	0.44
1:C:107:CYS:CB	1:C:121:TRP:CZ2	3.01	0.44
1:C:143:TYR:HB2	2:D:34:ARG:HG3	2.00	0.44
3:A:56:LYS:HA	3:A:64:ILE:O	2.18	0.44
4:B:118:PRO:HD3	4:B:226:PRO:HB3	2.00	0.43
4:B:126:PRO:HD2	4:B:197:TRP:CZ2	2.53	0.43
4:B:9:LYS:NZ	4:B:10:VAL:O	2.48	0.43
3:A:156:VAL:HA	3:A:180:SER:HB2	1.99	0.43
1:C:14:GLN:HG2	1:C:15:SER:N	2.34	0.43
4:B:167:CYS:SG	4:B:189:ARG:HD2	2.59	0.43
2:D:95:LEU:HD22	2:D:180:SER:HB3	2.00	0.43
2:D:82:ASN:HA	2:D:86:PRO:HD2	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:B:84:THR:HG23	4:B:108:SER:HA	2.01	0.42
3:A:191:PHE:HB2	3:A:196:ILE:HD11	2.01	0.42
1:C:162:ASP:HA	1:C:177:HIS:HA	2.02	0.42
3:A:101:LYS:HE3	4:B:43:LEU:HD23	2.01	0.42
3:A:50:ILE:HD11	3:A:56:LYS:N	2.33	0.42
1:C:112:ILE:HG23	1:C:117:ILE:HD11	2.00	0.42
1:C:133:TYR:HD2	1:C:150:TYR:HD2	1.67	0.42
1:C:96:PRO:HD3	2:D:121:THR:HG21	2.02	0.42
1:C:65:VAL:HG11	2:D:-18:THR:O	2.20	0.42
1:C:130:ASP:O	1:C:131:GLY:C	2.58	0.41
3:A:85:SER:HA	3:A:110:LEU:O	2.20	0.41
1:C:115:PRO:HG3	1:C:145:PHE:CD2	2.55	0.41
3:A:126:LEU:HD22	4:B:126:PRO:HA	2.02	0.41
4:B:23:GLN:HE21	4:B:23:GLN:HB3	1.65	0.41
3:A:33:LEU:HD22	3:A:73:LEU:HD22	2.02	0.41
4:B:116:VAL:O	4:B:226:PRO:HG3	2.20	0.41
4:B:4:GLN:HE21	4:B:102:GLY:HA3	1.85	0.41
1:C:112:ILE:HG12	1:C:117:ILE:HD11	2.03	0.41
2:D:42:SER:HG	2:D:42:SER:H	1.65	0.41
3:A:140:THR:HB	3:A:175:SER:HB3	2.02	0.40
2:D:178:HIS:CG	2:D:179:PRO:HD2	2.56	0.40
2:D:31:ILE:HG13	2:D:36:GLU:HA	2.03	0.40
2:D:74:GLU:HA	2:D:77:THR:OG1	2.20	0.40
3:A:191:PHE:CB	3:A:196:ILE:HD11	2.51	0.40
4:B:223:ARG:HG2	4:B:224:ALA:N	2.36	0.40
4:B:30:MET:HE1	4:B:70:GLU:C	2.42	0.40

All (1) 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)
2:D:43:ASP:O	2:D:190:ARG:NH2[1_554]	2.11	0.09

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	168/179 (94%)	158 (94%)	8 (5%)	2 (1%)	13	19
2	D	187/217 (86%)	177 (95%)	10 (5%)	0	100	100
3	A	195/208 (94%)	178 (91%)	17 (9%)	0	100	100
4	B	237/239 (99%)	227 (96%)	10 (4%)	0	100	100
All	All	787/843 (93%)	740 (94%)	45 (6%)	2 (0%)	41	56

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	155	PRO
1	C	125	SER

### 5.3.2 Protein sidechains ⓘ

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	123/160 (77%)	121 (98%)	2 (2%)	62	78
2	D	161/192 (84%)	158 (98%)	3 (2%)	57	74
3	A	146/185 (79%)	145 (99%)	1 (1%)	84	91
4	B	176/204 (86%)	167 (95%)	9 (5%)	24	37
All	All	606/741 (82%)	591 (98%)	15 (2%)	47	66

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	103	ASN
1	C	130	ASP
2	D	105	SER
2	D	114	ASN
2	D	164	MET
3	A	194	SER

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Mol	Chain	Res	Type
4	B	5	SER
4	B	23	GLN
4	B	65	SER
4	B	105	THR
4	B	107	LEU
4	B	168	THR
4	B	189	ARG
4	B	195	THR
4	B	229	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
3	A	98	ASN
4	B	4	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 carbohydrates 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 ⓘ

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	C	174/179 (97%)	0.38	15 (8%) 10 8	30, 58, 96, 113	0
2	D	193/217 (88%)	-0.04	3 (1%) 72 69	34, 47, 68, 79	0
3	A	199/208 (95%)	-0.16	2 (1%) 82 81	32, 47, 77, 96	0
4	B	239/239 (100%)	-0.16	1 (0%) 92 93	32, 45, 79, 93	0
All	All	805/843 (95%)	-0.01	21 (2%) 56 52	30, 47, 81, 113	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	154	ILE	7.0
1	C	102	PRO	4.8
1	C	156	SER	4.6
1	C	153	PHE	4.5
1	C	161	TYR	4.0
1	C	171	GLU	3.8
1	C	162	ASP	3.6
1	C	121	TRP	3.6
1	C	100	GLY	3.4
4	B	178	ALA	3.2
1	C	89	ALA	3.1
3	A	169	MET	3.1
1	C	122	LEU	2.9
1	C	101	GLN	2.7
1	C	1	GLU	2.5
1	C	177	HIS	2.3
2	D	12	MET	2.3
2	D	4	GLU	2.2
2	D	106	ARG	2.1
3	A	56	LYS	2.0
1	C	105	LEU	2.0

## 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 carbohydrates 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.