



wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 1, 2024 – 07:14 pm BST

PDB ID : 8PKS
Title : Low resolution crystal structure of Keap1-456, a repeat fragment from the human Keap1 beta-propeller
Authors : Wouters, S.M.L.
Deposited on : 2023-06-27
Resolution : 2.60 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.37.1
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) : 2.37.1

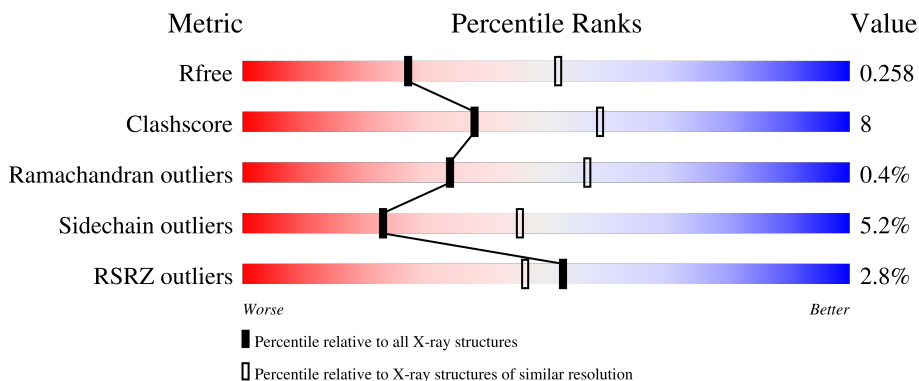
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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 $\leq 5\%$. 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	A	143	78% 16% . .
1	B	143	83% 13% .
1	C	143	84% 13% . .
1	D	143	82% 12% . .
1	E	143	74% 20% . .

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Mol	Chain	Length	Quality of chain
1	F	143	<p>85% 12% ..</p>
1	G	143	<p>77% 17% . .</p>
1	H	143	<p>79% 18% ..</p>
1	I	143	<p>83% 13% ...</p>
1	J	143	<p>79% 17% ..</p>
1	K	143	<p>65% 33% .</p>
1	L	143	<p>81% 17% ..</p>
1	M	143	<p>11% 72% 21% . 6%</p>
1	N	143	<p>6% 70% 24% ...</p>

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 15069 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 Kelch-like ECH-associated protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	139	1072	664	189	211	8	0	0	0
1	B	138	1048	651	182	207	8	0	0	0
1	C	139	1063	660	183	212	8	0	0	0
1	D	138	1052	653	183	208	8	0	0	0
1	E	139	1063	660	184	211	8	0	0	0
1	F	140	1068	663	185	212	8	0	0	0
1	G	139	1044	650	180	206	8	0	0	0
1	H	140	1068	663	184	213	8	0	0	0
1	I	140	1064	661	185	210	8	0	0	0
1	J	140	1061	660	184	209	8	0	0	0
1	K	140	1056	657	179	212	8	0	0	0
1	L	141	1060	660	182	210	8	0	0	0
1	M	134	998	623	171	197	7	0	0	0
1	N	140	1047	652	177	210	8	0	0	0

There are 56 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP Q14145

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Chain	Residue	Modelled	Actual	Comment	Reference
A	2	SER	-	expression tag	UNP Q14145
A	3	HIS	-	expression tag	UNP Q14145
A	4	MET	-	expression tag	UNP Q14145
B	1	GLY	-	expression tag	UNP Q14145
B	2	SER	-	expression tag	UNP Q14145
B	3	HIS	-	expression tag	UNP Q14145
B	4	MET	-	expression tag	UNP Q14145
C	1	GLY	-	expression tag	UNP Q14145
C	2	SER	-	expression tag	UNP Q14145
C	3	HIS	-	expression tag	UNP Q14145
C	4	MET	-	expression tag	UNP Q14145
D	1	GLY	-	expression tag	UNP Q14145
D	2	SER	-	expression tag	UNP Q14145
D	3	HIS	-	expression tag	UNP Q14145
D	4	MET	-	expression tag	UNP Q14145
E	1	GLY	-	expression tag	UNP Q14145
E	2	SER	-	expression tag	UNP Q14145
E	3	HIS	-	expression tag	UNP Q14145
E	4	MET	-	expression tag	UNP Q14145
F	1	GLY	-	expression tag	UNP Q14145
F	2	SER	-	expression tag	UNP Q14145
F	3	HIS	-	expression tag	UNP Q14145
F	4	MET	-	expression tag	UNP Q14145
G	1	GLY	-	expression tag	UNP Q14145
G	2	SER	-	expression tag	UNP Q14145
G	3	HIS	-	expression tag	UNP Q14145
G	4	MET	-	expression tag	UNP Q14145
H	1	GLY	-	expression tag	UNP Q14145
H	2	SER	-	expression tag	UNP Q14145
H	3	HIS	-	expression tag	UNP Q14145
H	4	MET	-	expression tag	UNP Q14145
I	1	GLY	-	expression tag	UNP Q14145
I	2	SER	-	expression tag	UNP Q14145
I	3	HIS	-	expression tag	UNP Q14145
I	4	MET	-	expression tag	UNP Q14145
J	1	GLY	-	expression tag	UNP Q14145
J	2	SER	-	expression tag	UNP Q14145
J	3	HIS	-	expression tag	UNP Q14145
J	4	MET	-	expression tag	UNP Q14145
K	1	GLY	-	expression tag	UNP Q14145
K	2	SER	-	expression tag	UNP Q14145
K	3	HIS	-	expression tag	UNP Q14145

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Chain	Residue	Modelled	Actual	Comment	Reference
K	4	MET	-	expression tag	UNP Q14145
L	1	GLY	-	expression tag	UNP Q14145
L	2	SER	-	expression tag	UNP Q14145
L	3	HIS	-	expression tag	UNP Q14145
L	4	MET	-	expression tag	UNP Q14145
M	1	GLY	-	expression tag	UNP Q14145
M	2	SER	-	expression tag	UNP Q14145
M	3	HIS	-	expression tag	UNP Q14145
M	4	MET	-	expression tag	UNP Q14145
N	1	GLY	-	expression tag	UNP Q14145
N	2	SER	-	expression tag	UNP Q14145
N	3	HIS	-	expression tag	UNP Q14145
N	4	MET	-	expression tag	UNP Q14145

- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	29	Total O 29 29	0	0
2	B	37	Total O 37 37	0	0
2	C	27	Total O 27 27	0	0
2	D	29	Total O 29 29	0	0
2	E	17	Total O 17 17	0	0
2	F	29	Total O 29 29	0	0
2	G	26	Total O 26 26	0	0
2	H	20	Total O 20 20	0	0
2	I	18	Total O 18 18	0	0
2	J	7	Total O 7 7	0	0
2	K	12	Total O 12 12	0	0
2	L	21	Total O 21 21	0	0
2	M	14	Total O 14 14	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	N	19	Total	O	0	0
			19	19		

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.

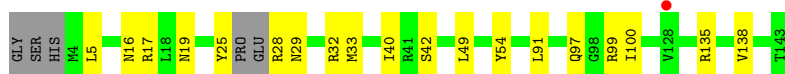
- Molecule 1: Kelch-like ECH-associated protein 1

Chain A:  78% 16% ..




- Molecule 1: Kelch-like ECH-associated protein 1

Chain B:  83% 13% .




- Molecule 1: Kelch-like ECH-associated protein 1

Chain C:  84% 13% ..




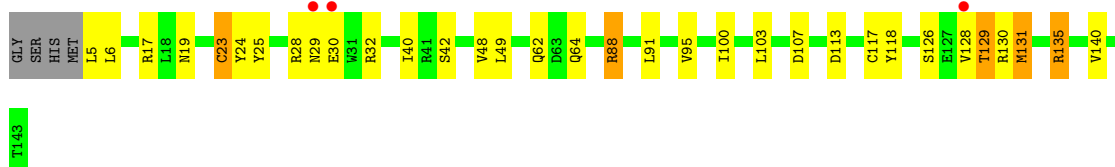
- Molecule 1: Kelch-like ECH-associated protein 1

Chain D:  82% 12% ..



- Molecule 1: Kelch-like ECH-associated protein 1

Chain E:  74% 20% ..



- Molecule 1: Kelch-like ECH-associated protein 1

Chain F: 85% 12% ..



- Molecule 1: Kelch-like ECH-associated protein 1

Chain G: 77% 17% ..



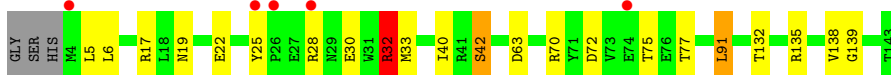
- Molecule 1: Kelch-like ECH-associated protein 1

Chain H: 79% 18% ..



- Molecule 1: Kelch-like ECH-associated protein 1

Chain I: 83% 13% ..



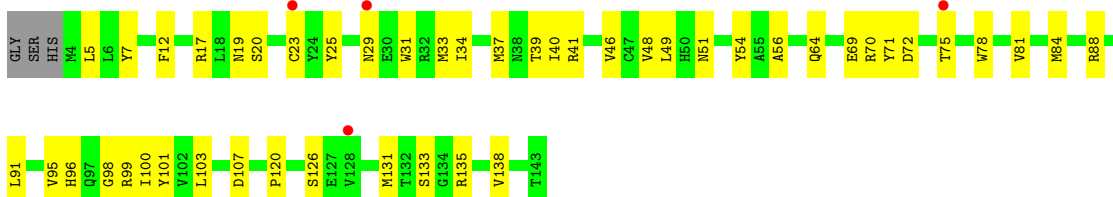
- Molecule 1: Kelch-like ECH-associated protein 1

Chain J: 79% 17% ..

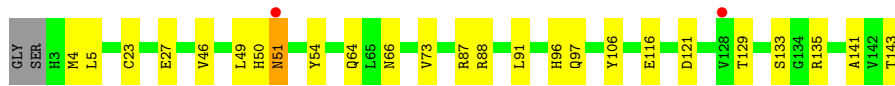
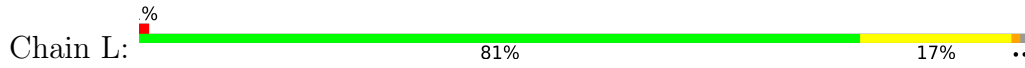


- Molecule 1: Kelch-like ECH-associated protein 1

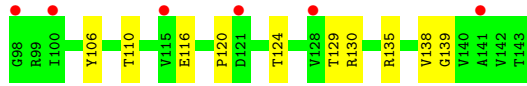
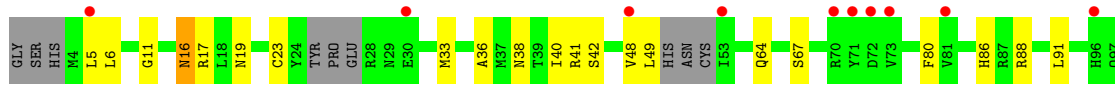
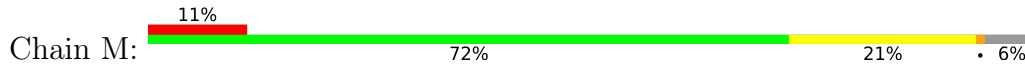
Chain K: 65% 33% ..



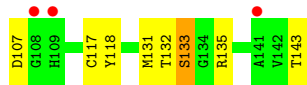
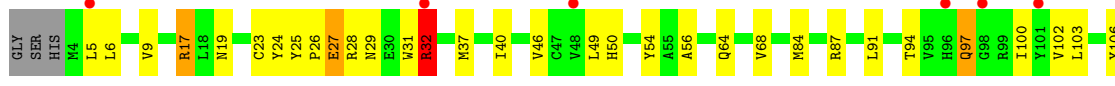
• Molecule 1: Kelch-like ECH-associated protein 1



• Molecule 1: Kelch-like ECH-associated protein 1



• Molecule 1: Kelch-like ECH-associated protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	46.85Å 220.96Å 248.75Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.54 – 2.60 48.54 – 2.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.54-2.60) 95.6 (48.54-2.60)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.28 (at 2.61Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.214 , 0.259 0.212 , 0.258	Depositor DCC
R_{free} test set	4032 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	54.2	Xtrriage
Anisotropy	0.164	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 55.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	15069	wwPDB-VP
Average B, all atoms (Å ²)	70.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.50% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	A	0.33	0/1094	0.59	0/1485
1	B	0.32	0/1069	0.57	0/1453
1	C	0.31	0/1086	0.56	0/1478
1	D	0.32	0/1073	0.57	1/1458 (0.1%)
1	E	0.30	0/1086	0.56	0/1478
1	F	0.30	0/1091	0.55	0/1485
1	G	0.33	0/1065	0.58	0/1449
1	H	0.31	0/1091	0.57	0/1485
1	I	0.34	0/1087	0.61	0/1480
1	J	0.34	0/1084	0.59	0/1476
1	K	0.37	0/1079	0.61	0/1471
1	L	0.30	0/1083	0.56	0/1476
1	M	0.31	0/1017	0.54	0/1383
1	N	0.37	0/1069	0.60	0/1457
All	All	0.32	0/15074	0.58	1/20514 (0.0%)

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	1
1	I	0	1
1	K	0	1
1	N	0	1
All	All	0	4

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	25	TYR	N-CA-CB	-5.33	101.00	110.60

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	28	ARG	Sidechain
1	I	32	ARG	Sidechain
1	K	99	ARG	Sidechain
1	N	32	ARG	Sidechain

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	1072	0	992	17	0
1	B	1048	0	964	15	0
1	C	1063	0	980	11	0
1	D	1052	0	970	14	0
1	E	1063	0	982	23	0
1	F	1068	0	984	10	0
1	G	1044	0	953	20	0
1	H	1068	0	982	18	0
1	I	1064	0	980	12	0
1	J	1061	0	976	17	0
1	K	1056	0	962	30	0
1	L	1060	0	967	14	0
1	M	998	0	913	18	0
1	N	1047	0	946	23	0
2	A	29	0	0	1	0
2	B	37	0	0	1	0
2	C	27	0	0	0	0
2	D	29	0	0	0	0
2	E	17	0	0	1	0
2	F	29	0	0	1	0
2	G	26	0	0	0	0
2	H	20	0	0	0	0
2	I	18	0	0	0	0
2	J	7	0	0	0	0
2	K	12	0	0	0	0
2	L	21	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	M	14	0	0	0	0
2	N	19	0	0	1	0
All	All	15069	0	13551	214	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 8.

The worst 5 of 214 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:N:100:ILE:HB	1:N:118:TYR:HB3	1.62	0.80
1:D:17:ARG:HG2	1:D:42:SER:HB2	1.65	0.79
1:B:16:ASN:HD21	1:G:17:ARG:HG3	1.50	0.77
1:D:25:TYR:HE2	1:D:32:ARG:HB2	1.47	0.76
1:C:72:ASP:HB3	1:C:75:THR:HG22	1.67	0.75

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	135/143 (94%)	127 (94%)	7 (5%)	1 (1%)	22	43
1	B	134/143 (94%)	128 (96%)	6 (4%)	0	100	100
1	C	137/143 (96%)	130 (95%)	7 (5%)	0	100	100
1	D	134/143 (94%)	129 (96%)	5 (4%)	0	100	100
1	E	137/143 (96%)	130 (95%)	6 (4%)	1 (1%)	22	43
1	F	138/143 (96%)	129 (94%)	8 (6%)	1 (1%)	22	43
1	G	135/143 (94%)	127 (94%)	7 (5%)	1 (1%)	22	43
1	H	138/143 (96%)	129 (94%)	8 (6%)	1 (1%)	22	43

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	I	138/143 (96%)	135 (98%)	3 (2%)	0	100	100
1	J	138/143 (96%)	133 (96%)	5 (4%)	0	100	100
1	K	138/143 (96%)	129 (94%)	9 (6%)	0	100	100
1	L	139/143 (97%)	132 (95%)	6 (4%)	1 (1%)	22	43
1	M	128/143 (90%)	124 (97%)	4 (3%)	0	100	100
1	N	138/143 (96%)	128 (93%)	9 (6%)	1 (1%)	22	43
All	All	1907/2002 (95%)	1810 (95%)	90 (5%)	7 (0%)	34	57

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	4	MET
1	A	30	GLU
1	H	28	ARG
1	G	51	ASN
1	N	50	HIS

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	111/117 (95%)	103 (93%)	8 (7%)	14	29
1	B	107/117 (92%)	103 (96%)	4 (4%)	34	60
1	C	110/117 (94%)	106 (96%)	4 (4%)	35	61
1	D	108/117 (92%)	104 (96%)	4 (4%)	34	60
1	E	110/117 (94%)	104 (94%)	6 (6%)	21	43
1	F	110/117 (94%)	106 (96%)	4 (4%)	35	61
1	G	105/117 (90%)	98 (93%)	7 (7%)	16	33
1	H	110/117 (94%)	106 (96%)	4 (4%)	35	61
1	I	109/117 (93%)	102 (94%)	7 (6%)	17	35
1	J	108/117 (92%)	103 (95%)	5 (5%)	27	51

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	K	108/117 (92%)	102 (94%)	6 (6%)	21	42
1	L	107/117 (92%)	104 (97%)	3 (3%)	43	69
1	M	100/117 (86%)	93 (93%)	7 (7%)	15	30
1	N	105/117 (90%)	95 (90%)	10 (10%)	8	16
All	All	1508/1638 (92%)	1429 (95%)	79 (5%)	23	46

5 of 79 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	K	126	SER
1	N	27	GLU
1	L	51	ASN
1	M	33	MET
1	N	97	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	N	97	GLN
1	M	16	ASN
1	K	97	GLN
1	K	62	GLN
1	L	51	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	139/143 (97%)	-0.15	0 100 100	39, 56, 83, 107	0
1	B	138/143 (96%)	-0.18	1 (0%) 87 86	39, 54, 77, 116	0
1	C	139/143 (97%)	-0.21	0 100 100	33, 48, 74, 116	0
1	D	138/143 (96%)	-0.03	2 (1%) 75 71	40, 59, 91, 136	0
1	E	139/143 (97%)	0.05	3 (2%) 62 56	48, 66, 106, 132	0
1	F	140/143 (97%)	-0.12	1 (0%) 87 86	44, 56, 82, 97	0
1	G	139/143 (97%)	0.19	5 (3%) 42 35	47, 71, 107, 125	0
1	H	140/143 (97%)	0.00	3 (2%) 63 58	45, 63, 106, 137	0
1	I	140/143 (97%)	-0.02	5 (3%) 42 35	40, 59, 104, 153	0
1	J	140/143 (97%)	0.11	4 (2%) 51 45	47, 68, 115, 125	0
1	K	140/143 (97%)	0.26	4 (2%) 51 45	50, 84, 112, 144	0
1	L	141/143 (98%)	-0.10	2 (1%) 75 71	41, 62, 92, 127	0
1	M	134/143 (93%)	0.64	16 (11%) 4 3	59, 84, 125, 151	0
1	N	140/143 (97%)	0.40	9 (6%) 19 14	50, 85, 119, 152	0
All	All	1947/2002 (97%)	0.06	55 (2%) 53 46	33, 65, 110, 153	0

The worst 5 of 55 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	M	73	VAL	5.1
1	M	128	VAL	4.0
1	M	96	HIS	3.7
1	E	128	VAL	3.7
1	H	27	GLU	3.6

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.