



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 4, 2026 – 06:08 PM UTC

PDB ID : 3CDG / pdb_00003cdg
Title : Human CD94/NKG2A in complex with HLA-E
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Heroux, A.; Hoare, H.L.; Beddoe, T.; Reid, H.H.; Wilce, M.C.J.; Brooks, A.G.;
Rossjohn, J.
Deposited on : 2008-02-26
Resolution : 3.40 Å(reported)

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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 : 4-5-2 with Phenix2.0
Xtrriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

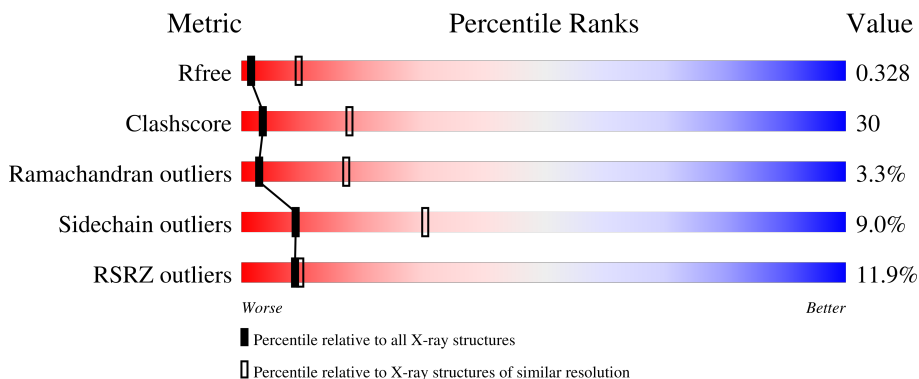
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.40 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}	180053	1001 (3.44-3.36)
Clashscore	190562	1022 (3.44-3.36)
Ramachandran outliers	187476	1012 (3.44-3.36)
Sidechain outliers	187428	1012 (3.44-3.36)
RSRZ outliers	180081	1001 (3.44-3.36)

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	273	
1	C	273	
2	B	100	
2	D	100	
3	E	123	

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Mol	Chain	Length	Quality of chain
3	J	123	<p>10% 47% 45% 7%</p>
4	F	120	<p>13% 37% 53% 8%</p>
4	K	120	<p>13% 40% 51% 6%</p>
5	P	9	<p>22% 44% 33%</p>
5	Q	9	<p>11% 67% 22%</p>

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 10200 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, alpha chain E.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	273	Total	C	N	O	S	0	0	0
			2234	1396	401	430	7			
1	C	273	Total	C	N	O	S	0	0	0
			2234	1396	401	430	7			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	Total	C	N	O	S	0	0	0
			837	533	141	159	4			
2	D	100	Total	C	N	O	S	0	0	0
			837	533	141	159	4			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	expression tag	UNP P61769
D	0	MET	-	expression tag	UNP P61769

- Molecule 3 is a protein called Natural killer cells antigen CD94.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	J	123	Total	C	N	O	S	0	0	0
			1010	632	167	201	10			
3	E	123	Total	C	N	O	S	0	0	0
			1010	632	167	201	10			

- Molecule 4 is a protein called NKG2-A/NKG2-B type II integral membrane protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	K	116	Total	C	N	O	S	0	0	0
			931	585	166	171	9			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	F	120	961	600	171	181	9	0	0	0

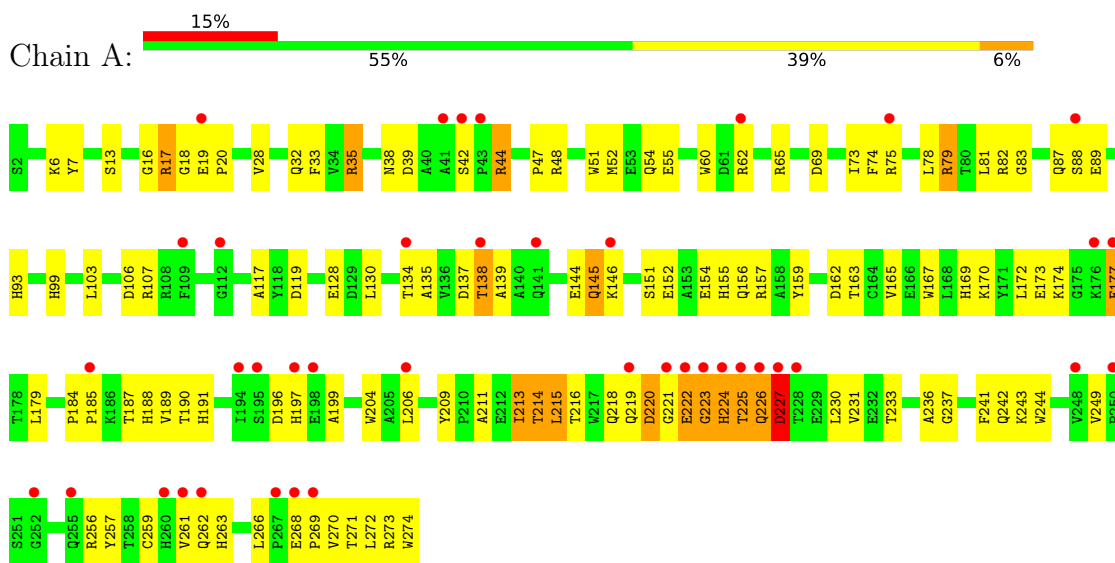
- Molecule 5 is a protein called leader peptide of HLA class I histocompatibility antigen, alpha chain G.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	P	9	73	49	12	11	1	0	0	0
5	Q	9	73	49	12	11	1	0	0	0

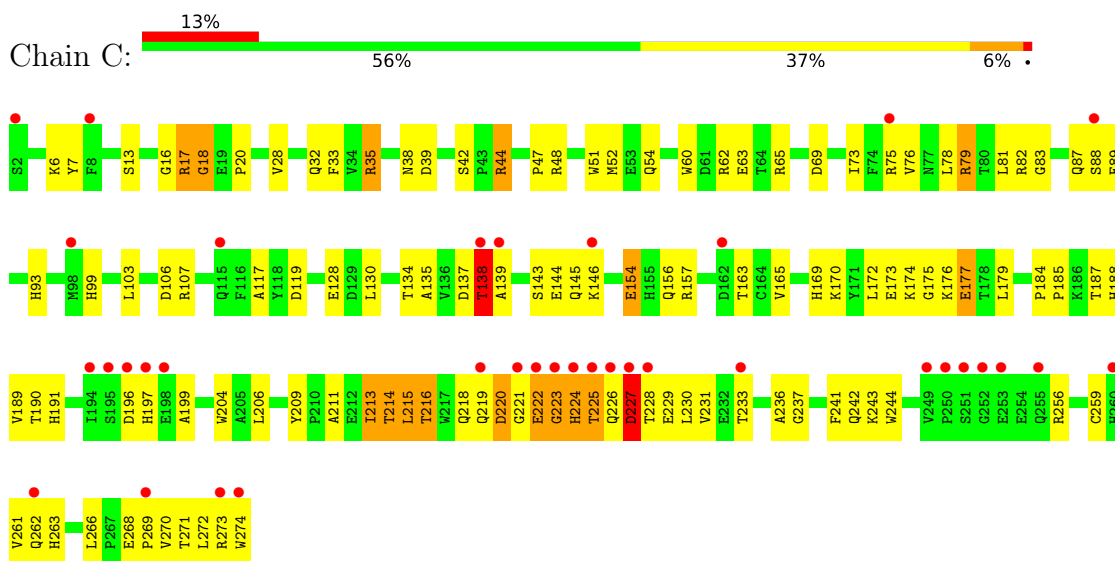
3 Residue-property plots

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.

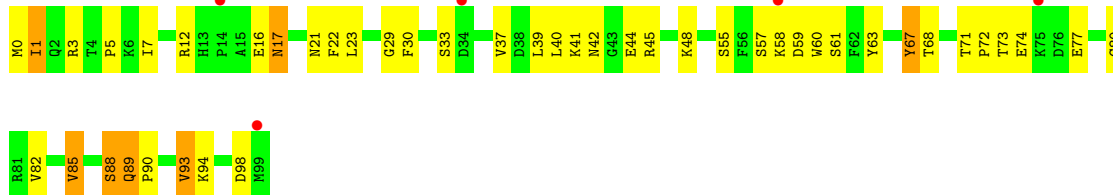
- Molecule 1: HLA class I histocompatibility antigen, alpha chain E



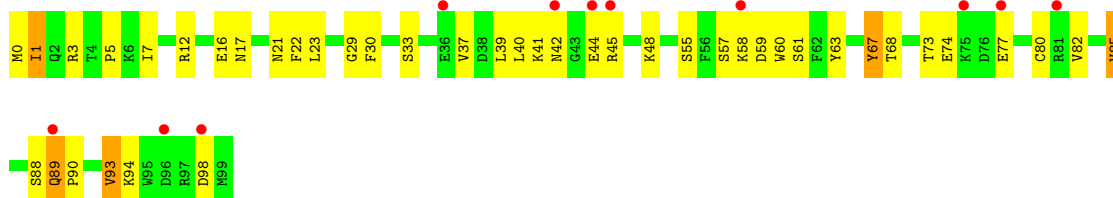
- Molecule 1: HLA class I histocompatibility antigen, alpha chain E



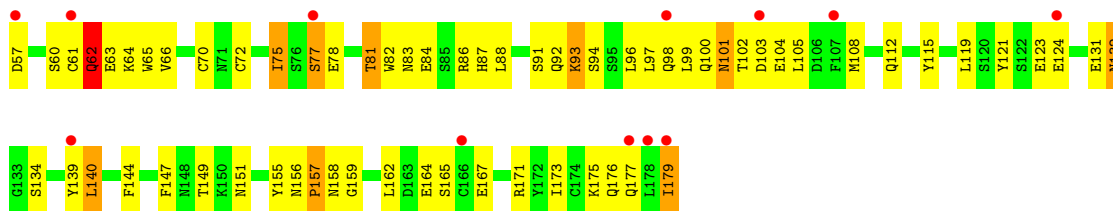
- Molecule 2: Beta-2-microglobulin



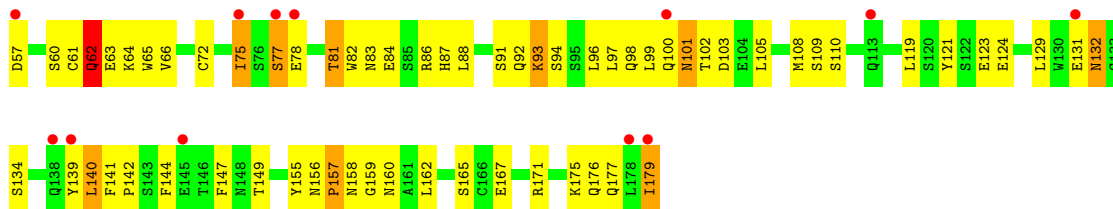
- Molecule 2: Beta-2-microglobulin



- Molecule 3: Natural killer cells antigen CD94

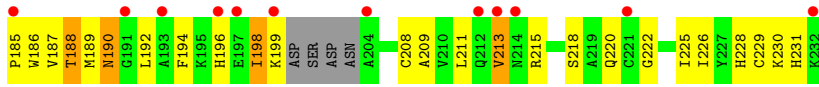


- Molecule 3: Natural killer cells antigen CD94

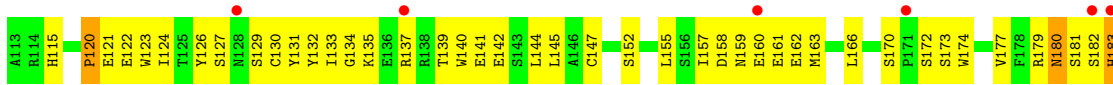


- Molecule 4: NKG2-A/NKG2-B type II integral membrane protein

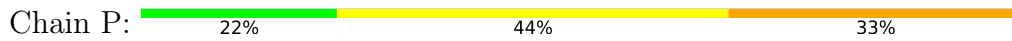




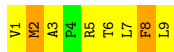
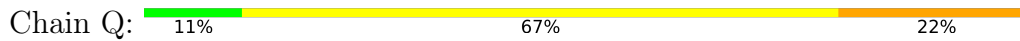
- Molecule 4: NKG2-A/NKG2-B type II integral membrane protein



- Molecule 5: leader peptide of HLA class I histocompatibility antigen, alpha chain G



- Molecule 5: leader peptide of HLA class I histocompatibility antigen, alpha chain G



4 Data and refinement statistics

Property	Value	Source
Space group	I 41 3 2	Depositor
Cell constants a, b, c, α , β , γ	345.20Å 345.20Å 345.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 3.40 50.00 – 3.40	Depositor EDS
% Data completeness (in resolution range)	99.9 (50.00-3.40) 99.9 (50.00-3.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.58 (at 3.41Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.249 , 0.279 0.303 , 0.328	Depositor DCC
R_{free} test set	2434 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	100.7	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 105.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.26$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	10200	wwPDB-VP
Average B, all atoms (Å ²)	118.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.34% 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	0.49	1/2300 (0.0%)	0.82	3/3127 (0.1%)
1	C	0.48	3/2300 (0.1%)	0.81	3/3127 (0.1%)
2	B	0.44	0/860	0.75	0/1162
2	D	0.44	0/860	0.75	0/1162
3	E	0.41	0/1036	0.78	1/1402 (0.1%)
3	J	0.47	0/1036	0.78	1/1402 (0.1%)
4	F	0.38	0/985	0.78	3/1330 (0.2%)
4	K	0.38	0/954	0.75	1/1286 (0.1%)
5	P	0.41	0/74	0.95	0/98
5	Q	0.48	0/74	0.78	0/98
All	All	0.45	4/10479 (0.0%)	0.79	12/14194 (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
4	F	3	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	227	ASP	C-O	-6.72	1.15	1.24
1	C	227	ASP	C-N	5.66	1.41	1.33
1	A	227	ASP	C-O	-5.45	1.17	1.24
1	C	138	THR	CA-CB	5.40	1.62	1.53

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	K	183	HIS	N-CA-C	6.54	118.11	107.32
4	F	205	GLU	CA-C-N	-6.51	113.17	122.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	205	GLU	C-N-CA	-6.51	113.17	122.94
4	F	183	HIS	N-CA-C	6.20	117.56	107.32
3	E	77	SER	N-CA-C	-5.74	106.92	114.04

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	F	199	LYS	CA
4	F	200	ASP	CA
4	F	203	ASN	CA

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
4	F	205	GLU	Peptide

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	A	2234	0	2072	153	0
1	C	2234	0	2072	142	0
2	B	837	0	803	39	0
2	D	837	0	803	41	0
3	E	1010	0	913	59	0
3	J	1010	0	913	66	0
4	F	961	0	915	85	0
4	K	931	0	895	59	0
5	P	73	0	83	11	0
5	Q	73	0	83	9	0
All	All	10200	0	9552	584	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 30.

The worst 5 of 584 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:221:GLY:O	1:A:222:GLU:HG3	1.07	1.23
1:C:221:GLY:O	1:C:222:GLU:HG3	1.08	1.22
1:A:219:GLN:HE21	1:A:225:THR:CG2	1.58	1.16
1:A:219:GLN:HE21	1:A:225:THR:HG22	1.14	1.13
1:C:219:GLN:HE21	1:C:225:THR:CG2	1.61	1.13

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	271/273 (99%)	225 (83%)	35 (13%)	11 (4%)	2	15
1	C	271/273 (99%)	226 (83%)	35 (13%)	10 (4%)	2	16
2	B	98/100 (98%)	90 (92%)	7 (7%)	1 (1%)	12	40
2	D	98/100 (98%)	89 (91%)	9 (9%)	0	100	100
3	E	121/123 (98%)	101 (84%)	16 (13%)	4 (3%)	3	17
3	J	121/123 (98%)	101 (84%)	16 (13%)	4 (3%)	3	17
4	F	118/120 (98%)	91 (77%)	21 (18%)	6 (5%)	1	10
4	K	112/120 (93%)	91 (81%)	17 (15%)	4 (4%)	2	16
5	P	7/9 (78%)	4 (57%)	3 (43%)	0	100	100
5	Q	7/9 (78%)	5 (71%)	2 (29%)	0	100	100
All	All	1224/1250 (98%)	1023 (84%)	161 (13%)	40 (3%)	3	17

5 of 40 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	213	ILE
1	A	215	LEU
1	A	222	GLU

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Mol	Chain	Res	Type
1	A	224	HIS
3	J	62	GLN

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	236/236 (100%)	216 (92%)	20 (8%)	10 33
1	C	236/236 (100%)	216 (92%)	20 (8%)	10 33
2	B	95/95 (100%)	86 (90%)	9 (10%)	8 29
2	D	95/95 (100%)	87 (92%)	8 (8%)	10 34
3	E	114/114 (100%)	103 (90%)	11 (10%)	8 28
3	J	114/114 (100%)	103 (90%)	11 (10%)	8 28
4	F	109/109 (100%)	99 (91%)	10 (9%)	8 29
4	K	105/109 (96%)	98 (93%)	7 (7%)	15 41
5	P	8/8 (100%)	5 (62%)	3 (38%)	0 0
5	Q	8/8 (100%)	6 (75%)	2 (25%)	0 1
All	All	1120/1124 (100%)	1019 (91%)	101 (9%)	9 30

5 of 101 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	145	GLN
2	D	85	VAL
5	Q	2	MET
1	C	163	THR
1	C	220	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 67 such sidechains are listed below:

Mol	Chain	Res	Type
3	E	156	ASN

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Mol	Chain	Res	Type
3	E	177	GLN
4	F	228	HIS
3	J	132	ASN
3	J	101	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 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	273/273 (100%)	1.15	40 (14%) 6 7	34, 115, 173, 251	0
1	C	273/273 (100%)	0.98	36 (13%) 7 8	34, 115, 172, 251	0
2	B	100/100 (100%)	0.68	5 (5%) 34 25	74, 102, 161, 184	0
2	D	100/100 (100%)	0.87	11 (11%) 10 11	75, 104, 161, 184	0
3	E	123/123 (100%)	0.91	12 (9%) 13 13	38, 109, 150, 203	0
3	J	123/123 (100%)	0.95	12 (9%) 13 13	37, 107, 150, 203	0
4	F	120/120 (100%)	1.09	16 (13%) 7 8	41, 128, 167, 221	0
4	K	116/120 (96%)	1.11	16 (13%) 6 8	93, 128, 165, 178	0
5	P	9/9 (100%)	0.65	0 100 100	95, 102, 117, 126	0
5	Q	9/9 (100%)	0.49	0 100 100	92, 99, 120, 130	0
All	All	1246/1250 (99%)	0.99	148 (11%) 9 10	34, 115, 165, 251	0

The worst 5 of 148 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	J	179	ILE	10.6
1	C	225	THR	8.5
1	C	224	HIS	8.4
1	A	224	HIS	7.3
3	E	179	ILE	7.2

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 oligosaccharides 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.