



Full wwPDB NMR Structure Validation Report ⓘ

May 7, 2024 – 12:18 pm BST

PDB ID : 1W9R
Title : Solution Structure of Choline Binding Protein A, Domain R2, the Major Adhesin of *Streptococcus pneumoniae*
Authors : Luo, R.; Mann, B.; Lewis, W.S.; Rowe, A.; Heath, R.; Stewart, M.L.; Hamburger, A.E.; Bjorkman, P.J.; Sivakolundu, S.; Lacy, E.R.; Tuomanen, E.; Kriwacki, R.W.
Deposited on : 2004-10-15

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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/NMRValidationReportHelp>

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
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
wwPDB-ShiftChecker : v1.2
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36.2

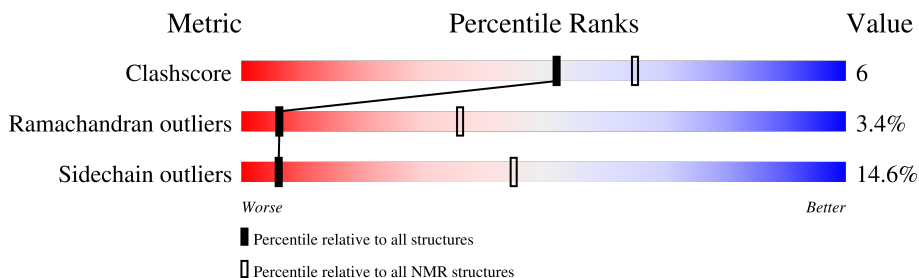
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	119	 73% 10% • 13%

2 Ensemble composition and analysis

This entry contains 19 models. The atoms present in the NMR models are not consistent. Some calculations may have failed as a result. All residues are included in the validation scores. Model 11 is the overall representative, medoid model (most similar to other models).

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:5-A:100 (96)	1.21	11
2	A:111-A:118 (8)	1.02	2

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15, 17
2	5, 14, 16
3	8, 18, 19
Single-model clusters	12

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1965 atoms, of which 998 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called CHOLINE BINDING PROTEIN A.

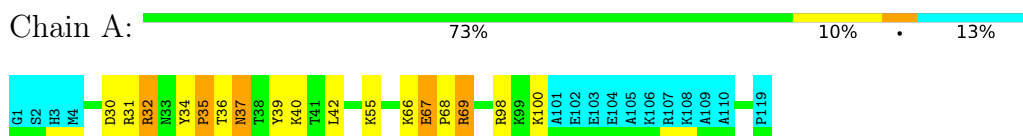
Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	119	1965	592	998	171	203	1	0

4 Residue-property plots [i](#)

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: CHOLINE BINDING PROTEIN A

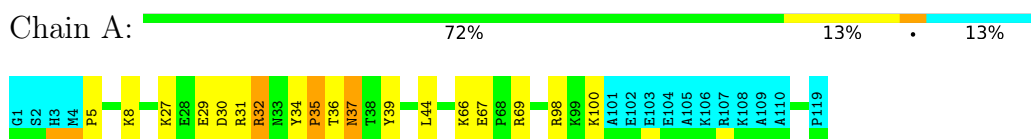


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

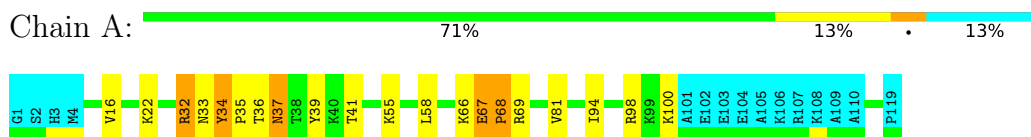
4.2.1 Score per residue for model 1

- Molecule 1: CHOLINE BINDING PROTEIN A



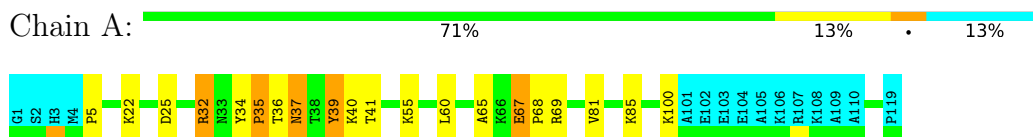
4.2.2 Score per residue for model 2

- Molecule 1: CHOLINE BINDING PROTEIN A



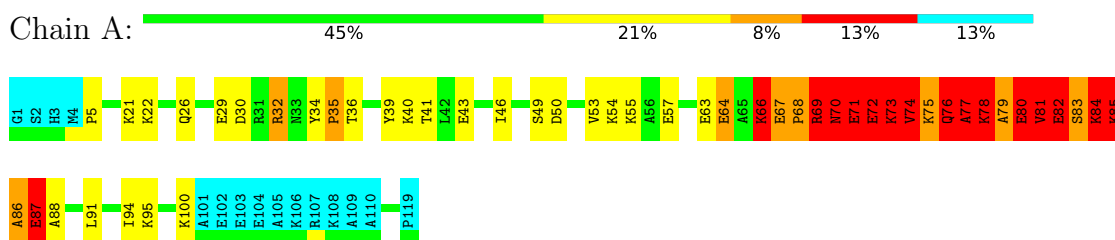
4.2.3 Score per residue for model 3

- Molecule 1: CHOLINE BINDING PROTEIN A



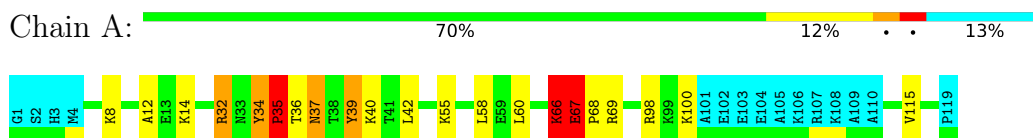
4.2.4 Score per residue for model 4

- Molecule 1: CHOLINE BINDING PROTEIN A



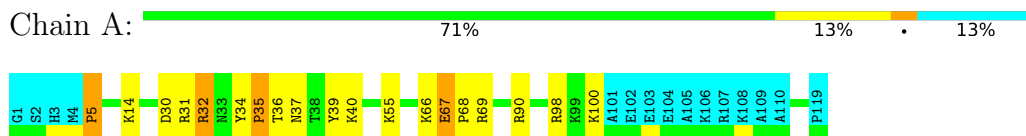
4.2.5 Score per residue for model 5

- Molecule 1: CHOLINE BINDING PROTEIN A



4.2.6 Score per residue for model 6

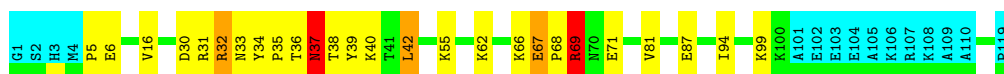
- Molecule 1: CHOLINE BINDING PROTEIN A



4.2.7 Score per residue for model 7

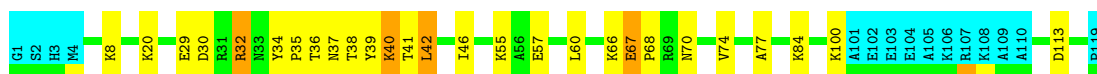
- Molecule 1: CHOLINE BINDING PROTEIN A





4.2.8 Score per residue for model 8

- Molecule 1: CHOLINE BINDING PROTEIN A



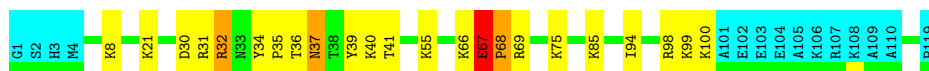
4.2.9 Score per residue for model 9

- Molecule 1: CHOLINE BINDING PROTEIN A



4.2.10 Score per residue for model 10

- Molecule 1: CHOLINE BINDING PROTEIN A



4.2.11 Score per residue for model 11 (medoid)

- Molecule 1: CHOLINE BINDING PROTEIN A



4.2.12 Score per residue for model 12

- Molecule 1: CHOLINE BINDING PROTEIN A

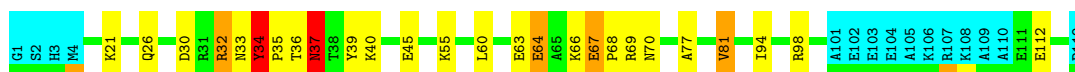




4.2.13 Score per residue for model 13

- Molecule 1: CHOLINE BINDING PROTEIN A

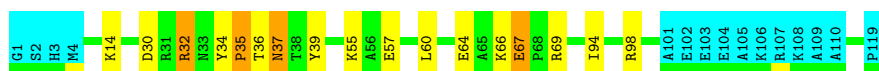
Chain A: 66% 17% 13%



4.2.14 Score per residue for model 14

- Molecule 1: CHOLINE BINDING PROTEIN A

Chain A: 73% 11% 13%



4.2.15 Score per residue for model 15

- Molecule 1: CHOLINE BINDING PROTEIN A

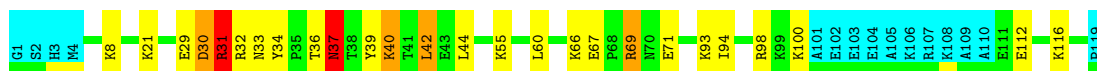
Chain A: 71% 12% 13%



4.2.16 Score per residue for model 16

- Molecule 1: CHOLINE BINDING PROTEIN A

Chain A: 66% 17% 13%



4.2.17 Score per residue for model 17

- Molecule 1: CHOLINE BINDING PROTEIN A

Chain A: 72% 9% 13%



4.2.18 Score per residue for model 18

- Molecule 1: CHOLINE BINDING PROTEIN A

Chain A: 71% 13% .. 13%



4.2.19 Score per residue for model 19

- Molecule 1: CHOLINE BINDING PROTEIN A

Chain A: 71% 13% . 13%



5 Refinement protocol and experimental data overview

The models were refined using the following method: *TAD*.

Of the 200 calculated structures, 19 were deposited, based on the following criterion: *LEAST ENERGY*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
CNS	refinement	8.0
CNS	structure solution	

No chemical shift data was provided.

6 Model quality i

6.1 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 (average) 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	4.01±14.23	3±12/860 (0.3± 1.4%)	1.71±2.15	11±22/1141 (1.0± 1.9%)
All	All	14.73	55/16333 (0.3%)	2.73	206/21658 (1.0%)

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	Planarity
1	A	0.3±1.3	3.7±4.6
All	All	6	70

All unique bond outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	82	GLU	CG-CD	508.70	9.15	1.51	4	1
1	A	87	GLU	CD-OE1	481.28	6.55	1.25	4	1
1	A	87	GLU	CG-CD	450.25	8.27	1.51	4	1
1	A	87	GLU	CD-OE2	435.25	6.04	1.25	4	1
1	A	83	SER	CB-OG	393.32	6.53	1.42	4	1
1	A	86	ALA	CA-CB	371.09	9.31	1.52	4	1
1	A	87	GLU	C-O	367.53	8.21	1.23	4	1
1	A	79	ALA	CA-CB	335.83	8.57	1.52	4	1
1	A	81	VAL	C-O	334.31	7.58	1.23	4	1
1	A	78	LYS	C-O	334.23	7.58	1.23	4	1
1	A	80	GLU	C-O	304.26	7.01	1.23	4	1
1	A	86	ALA	N-CA	300.50	7.47	1.46	4	1
1	A	82	GLU	N-CA	297.28	7.41	1.46	4	1
1	A	77	ALA	C-O	289.54	6.73	1.23	4	1
1	A	76	GLN	CD-OE1	279.17	7.38	1.24	4	1
1	A	72	GLU	CB-CG	268.92	6.63	1.52	4	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	76	GLN	N-CA	255.68	6.57	1.46	4	1
1	A	80	GLU	CA-CB	249.93	7.03	1.53	4	1
1	A	79	ALA	N-CA	249.37	6.45	1.46	4	1
1	A	82	GLU	CA-C	248.60	7.99	1.52	4	1
1	A	83	SER	CA-C	245.38	7.91	1.52	4	1
1	A	77	ALA	CA-CB	244.44	6.65	1.52	4	1
1	A	76	GLN	CD-NE2	243.38	7.41	1.32	4	1
1	A	75	LYS	CA-CB	235.16	6.71	1.53	4	1
1	A	84	LYS	CA-C	227.22	7.43	1.52	4	1
1	A	78	LYS	CD-CE	227.18	7.19	1.51	4	1
1	A	85	LYS	CA-C	226.72	7.42	1.52	4	1
1	A	81	VAL	CB-CG1	226.24	6.28	1.52	4	1
1	A	78	LYS	CB-CG	224.34	7.58	1.52	4	1
1	A	76	GLN	CA-C	223.97	7.35	1.52	4	1
1	A	87	GLU	CA-CB	215.57	6.28	1.53	4	1
1	A	84	LYS	CA-CB	200.22	5.94	1.53	4	1
1	A	75	LYS	CA-C	193.63	6.56	1.52	4	1
1	A	69	ARG	CZ-NH1	192.59	3.83	1.33	4	1
1	A	81	VAL	CA-C	191.02	6.49	1.52	4	1
1	A	78	LYS	CE-NZ	188.66	6.20	1.49	4	1
1	A	84	LYS	CE-NZ	188.57	6.20	1.49	4	1
1	A	81	VAL	CA-CB	182.95	5.38	1.54	4	1
1	A	73	LYS	CA-CB	180.37	5.50	1.53	4	1
1	A	77	ALA	N-CA	175.23	4.96	1.46	4	1
1	A	76	GLN	CB-CG	174.73	6.24	1.52	4	1
1	A	73	LYS	CD-CE	163.24	5.59	1.51	4	1
1	A	72	GLU	CA-C	161.36	5.72	1.52	4	1
1	A	80	GLU	CB-CG	158.69	4.53	1.52	4	1
1	A	74	VAL	CA-CB	157.55	4.85	1.54	4	1
1	A	80	GLU	CA-C	139.25	5.14	1.52	4	1
1	A	71	GLU	CA-CB	124.70	4.28	1.53	4	1
1	A	70	ASN	N-CA	123.50	3.93	1.46	4	1
1	A	74	VAL	CB-CG2	106.08	3.75	1.52	4	1
1	A	71	GLU	CA-C	102.84	4.20	1.52	4	1
1	A	70	ASN	CB-CG	102.49	3.86	1.51	4	1
1	A	73	LYS	CB-CG	60.37	3.15	1.52	4	1
1	A	74	VAL	N-CA	58.70	2.63	1.46	4	1
1	A	71	GLU	CB-CG	34.15	2.17	1.52	4	1
1	A	71	GLU	N-CA	32.66	2.11	1.46	4	1

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	69	ARG	NE-CZ-NH1	-161.14	39.73	120.30	4	5
1	A	87	GLU	OE1-CD-OE2	-86.49	19.51	123.30	4	1
1	A	79	ALA	N-CA-CB	-72.15	9.10	110.10	4	1
1	A	86	ALA	N-CA-CB	-70.77	11.03	110.10	4	1
1	A	77	ALA	N-CA-CB	-65.45	18.47	110.10	4	1
1	A	81	VAL	CA-CB-CG1	-58.30	23.45	110.90	4	1
1	A	87	GLU	CG-CD-OE2	-55.34	7.61	118.30	4	1
1	A	74	VAL	CA-CB-CG2	-53.30	30.95	110.90	4	1
1	A	87	GLU	CG-CD-OE1	-52.54	13.22	118.30	4	1
1	A	80	GLU	CA-CB-CG	-51.09	1.01	113.40	4	1
1	A	80	GLU	CA-C-O	-50.40	14.26	120.10	4	1
1	A	71	GLU	N-CA-CB	-50.21	20.23	110.60	4	1
1	A	81	VAL	CA-C-O	-48.86	17.49	120.10	4	1
1	A	80	GLU	CB-CA-C	-47.19	16.02	110.40	4	1
1	A	81	VAL	CB-CA-C	-47.03	22.04	111.40	4	1
1	A	81	VAL	N-CA-CB	-47.03	8.04	111.50	4	1
1	A	84	LYS	CB-CA-C	-46.25	17.91	110.40	4	1
1	A	76	GLN	OE1-CD-NE2	-45.60	17.02	121.90	4	1
1	A	73	LYS	CA-CB-CG	-44.40	15.73	113.40	4	1
1	A	75	LYS	CB-CA-C	-44.30	21.80	110.40	4	1
1	A	87	GLU	CB-CA-C	-43.73	22.95	110.40	4	1
1	A	74	VAL	N-CA-CB	-42.65	17.66	111.50	4	1
1	A	78	LYS	C-N-CA	-42.41	15.68	121.70	4	1
1	A	71	GLU	CA-CB-CG	-39.97	25.46	113.40	4	1
1	A	78	LYS	CD-CE-NZ	-39.93	19.85	111.70	4	1
1	A	74	VAL	CG1-CB-CG2	38.68	172.79	110.90	4	1
1	A	71	GLU	CB-CA-C	-37.27	35.86	110.40	4	1
1	A	85	LYS	C-N-CA	-36.20	31.19	121.70	4	1
1	A	76	GLN	CA-CB-CG	-36.02	34.15	113.40	4	1
1	A	72	GLU	CA-CB-CG	-35.68	34.91	113.40	4	1
1	A	82	GLU	N-CA-C	-34.42	18.07	111.00	4	1
1	A	76	GLN	N-CA-C	-33.86	19.57	111.00	4	1
1	A	81	VAL	N-CA-C	-33.66	20.11	111.00	4	1
1	A	84	LYS	CA-CB-CG	-33.55	39.60	113.40	4	1
1	A	70	ASN	C-N-CA	-33.04	39.11	121.70	4	1
1	A	78	LYS	O-C-N	31.96	173.84	122.70	4	1
1	A	71	GLU	N-CA-C	-30.94	27.46	111.00	4	1
1	A	83	SER	CA-CB-OG	-30.64	28.47	111.20	4	1
1	A	72	GLU	CB-CA-C	30.15	170.70	110.40	4	1
1	A	73	LYS	C-N-CA	-29.70	47.46	121.70	4	1
1	A	80	GLU	CB-CG-CD	-29.19	35.38	114.20	4	1
1	A	76	GLN	CB-CG-CD	-28.78	36.77	111.60	4	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	85	LYS	CA-C-O	-27.58	62.18	120.10	4	1
1	A	74	VAL	CA-CB-CG1	26.99	151.39	110.90	4	1
1	A	72	GLU	CA-C-N	-26.98	57.85	117.20	4	1
1	A	85	LYS	N-CA-C	-26.56	39.28	111.00	4	1
1	A	78	LYS	CA-C-O	-25.00	67.60	120.10	4	1
1	A	76	GLN	C-N-CA	-24.86	59.56	121.70	4	1
1	A	77	ALA	CB-CA-C	-24.30	73.65	110.10	4	1
1	A	77	ALA	O-C-N	-24.04	84.24	122.70	4	1
1	A	75	LYS	N-CA-CB	-23.47	68.35	110.60	4	1
1	A	81	VAL	C-N-CA	-23.46	63.06	121.70	4	1
1	A	82	GLU	CA-C-O	-23.04	71.71	120.10	4	1
1	A	81	VAL	CG1-CB-CG2	-22.63	74.69	110.90	4	1
1	A	85	LYS	CA-C-N	21.74	165.02	117.20	4	1
1	A	82	GLU	N-CA-CB	-21.63	71.67	110.60	4	1
1	A	75	LYS	CA-CB-CG	-21.09	66.99	113.40	4	1
1	A	75	LYS	CA-C-O	-21.05	75.90	120.10	4	1
1	A	82	GLU	CG-CD-OE1	-20.11	78.08	118.30	4	1
1	A	77	ALA	N-CA-C	-20.02	56.94	111.00	4	1
1	A	76	GLN	N-CA-CB	19.95	146.52	110.60	4	1
1	A	71	GLU	CB-CG-CD	-19.77	60.81	114.20	4	1
1	A	82	GLU	CB-CA-C	-19.58	71.25	110.40	4	1
1	A	83	SER	CB-CA-C	19.07	146.33	110.10	4	1
1	A	70	ASN	CB-CG-OD1	-18.11	85.37	121.60	4	1
1	A	76	GLN	CG-CD-NE2	17.92	159.70	116.70	4	1
1	A	70	ASN	N-CA-C	17.36	157.88	111.00	4	1
1	A	72	GLU	CB-CG-CD	-17.18	67.82	114.20	4	1
1	A	82	GLU	CG-CD-OE2	16.76	151.82	118.30	4	1
1	A	84	LYS	CD-CE-NZ	15.98	148.44	111.70	4	1
1	A	87	GLU	CA-C-O	15.86	153.40	120.10	4	1
1	A	86	ALA	CB-CA-C	-15.75	86.47	110.10	4	1
1	A	84	LYS	N-CA-CB	15.44	138.40	110.60	4	1
1	A	69	ARG	C-N-CA	-15.31	83.41	121.70	4	1
1	A	70	ASN	N-CA-CB	-15.15	83.33	110.60	4	1
1	A	82	GLU	CB-CG-CD	-14.69	74.53	114.20	4	1
1	A	75	LYS	N-CA-C	-14.44	72.01	111.00	4	1
1	A	76	GLN	CB-CA-C	14.17	138.73	110.40	4	1
1	A	71	GLU	CA-C-O	13.85	149.19	120.10	4	1
1	A	81	VAL	CA-CB-CG2	-12.57	92.04	110.90	4	1
1	A	83	SER	N-CA-C	-12.57	77.07	111.00	4	1
1	A	69	ARG	NH1-CZ-NH2	12.32	132.95	119.40	4	1
1	A	87	GLU	CA-CB-CG	-11.51	88.08	113.40	4	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	72	GLU	N-CA-C	-11.50	79.95	111.00	4	1
1	A	76	GLN	CG-CD-OE1	11.38	144.37	121.60	4	1
1	A	79	ALA	CB-CA-C	-10.79	93.91	110.10	4	1
1	A	73	LYS	CD-CE-NZ	10.73	136.39	111.70	4	1
1	A	87	GLU	N-CA-CB	-10.49	91.72	110.60	4	1
1	A	82	GLU	CA-C-N	10.40	140.08	117.20	4	1
1	A	72	GLU	CA-C-O	9.90	140.90	120.10	4	1
1	A	80	GLU	N-CA-CB	-9.73	93.08	110.60	4	1
1	A	74	VAL	N-CA-C	-9.63	85.01	111.00	4	1
1	A	73	LYS	CG-CD-CE	-9.24	84.19	111.90	4	1
1	A	84	LYS	N-CA-C	9.12	135.62	111.00	4	1
1	A	34	TYR	CB-CG-CD1	-8.90	115.66	121.00	1	1
1	A	34	TYR	CB-CG-CD2	-8.68	115.80	121.00	18	18
1	A	86	ALA	N-CA-C	-8.20	88.86	111.00	4	1
1	A	78	LYS	CG-CD-CE	-7.93	88.10	111.90	4	1
1	A	31	ARG	NE-CZ-NH1	7.57	124.09	120.30	18	8
1	A	69	ARG	CB-CA-C	7.46	125.32	110.40	18	9
1	A	78	LYS	CB-CG-CD	-7.43	92.28	111.60	4	1
1	A	67	GLU	N-CA-C	7.39	130.95	111.00	4	10
1	A	98	ARG	NE-CZ-NH1	6.98	123.79	120.30	17	13
1	A	32	ARG	NE-CZ-NH1	6.77	123.68	120.30	9	12
1	A	80	GLU	N-CA-C	-6.76	92.76	111.00	4	1
1	A	68	PRO	N-CA-CB	6.70	111.34	103.30	3	1
1	A	73	LYS	CB-CA-C	6.60	123.60	110.40	4	1
1	A	37	ASN	CB-CA-C	6.43	123.26	110.40	2	10
1	A	66	LYS	N-CA-CB	-6.33	99.21	110.60	5	2
1	A	39	TYR	CB-CG-CD1	-6.19	117.29	121.00	16	1
1	A	39	TYR	CB-CA-C	6.08	122.56	110.40	7	1
1	A	29	GLU	C-N-CA	5.91	136.47	121.70	17	1
1	A	90	ARG	NE-CZ-NH1	5.82	123.21	120.30	12	2
1	A	32	ARG	CB-CA-C	5.72	121.84	110.40	17	1
1	A	79	ALA	N-CA-C	-5.46	96.26	111.00	4	1
1	A	81	VAL	CA-C-N	5.44	129.16	117.20	4	1
1	A	69	ARG	N-CA-CB	-5.33	101.00	110.60	7	3
1	A	9	VAL	CA-CB-CG2	5.20	118.69	110.90	17	2
1	A	32	ARG	NE-CZ-NH2	-5.19	117.71	120.30	8	2
1	A	16	VAL	CA-CB-CG1	5.10	118.54	110.90	15	1
1	A	68	PRO	CA-C-N	-5.08	106.02	117.20	3	1
1	A	67	GLU	N-CA-CB	-5.05	101.51	110.60	17	1
1	A	98	ARG	NH1-CZ-NH2	-5.01	113.89	119.40	5	1

All unique chiral outliers are listed below. They are sorted by the frequency of occurrence in the

ensemble.

Mol	Chain	Res	Type	Atoms	Models (Total)
1	A	71	GLU	CA	1
1	A	72	GLU	CA	1
1	A	74	VAL	CA	1
1	A	80	GLU	CA	1
1	A	81	VAL	CA	1
1	A	87	GLU	CA	1

All unique planar outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	66	LYS	Peptide	10
1	A	68	PRO	Peptide	7
1	A	37	ASN	Peptide	6
1	A	67	GLU	Peptide	4
1	A	33	ASN	Peptide	3
1	A	34	TYR	Sidechain,Peptide	3
1	A	5	PRO	Peptide	3
1	A	63	GLU	Peptide	3
1	A	40	LYS	Peptide	3
1	A	32	ARG	Sidechain	3
1	A	64	GLU	Peptide	2
1	A	31	ARG	Peptide	2
1	A	65	ALA	Peptide	1
1	A	69	ARG	Sidechain	1
1	A	70	ASN	Sidechain,Peptide	1
1	A	72	GLU	Peptide,Mainchain	1
1	A	73	LYS	Peptide	1
1	A	76	GLN	Sidechain,Mainchain	1
1	A	77	ALA	Mainchain	1
1	A	78	LYS	Peptide	1
1	A	81	VAL	Mainchain	1
1	A	82	GLU	Sidechain,Mainchain,Peptide	1
1	A	85	LYS	Peptide,Mainchain	1
1	A	87	GLU	Sidechain	1
1	A	75	LYS	Peptide	1
1	A	30	ASP	Peptide	1

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	855	888	888	10±36
All	All	16245	16872	16865	188

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 6.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:50:ASP:HA	1:A:84:LYS:CB	1.62	1.20	4	1
1:A:50:ASP:CA	1:A:84:LYS:HB3	1.59	1.24	4	1
1:A:73:LYS:HG2	1:A:74:VAL:CA	1.56	1.22	4	1
1:A:57:GLU:CD	1:A:81:VAL:HG11	1.52	1.19	4	1
1:A:80:GLU:HG3	1:A:81:VAL:C	1.45	1.25	4	1
1:A:80:GLU:CA	1:A:81:VAL:CB	1.35	2.05	4	1
1:A:76:GLN:N	1:A:78:LYS:CB	1.34	1.89	4	1
1:A:80:GLU:CG	1:A:81:VAL:C	1.33	1.94	4	1
1:A:53:VAL:N	1:A:84:LYS:HG2	1.28	1.44	4	1
1:A:69:ARG:NH1	1:A:69:ARG:CG	1.25	2.00	4	1
1:A:70:ASN:HB2	1:A:72:GLU:N	1.25	1.47	4	1
1:A:57:GLU:CD	1:A:81:VAL:CG1	1.24	1.87	4	1
1:A:73:LYS:CG	1:A:74:VAL:CA	1.23	2.15	4	1
1:A:49:SER:O	1:A:84:LYS:CG	1.22	1.87	4	1
1:A:50:ASP:CA	1:A:84:LYS:CB	1.22	1.95	4	1
1:A:73:LYS:N	1:A:74:VAL:HG23	1.20	1.48	4	1
1:A:49:SER:O	1:A:84:LYS:HG3	1.18	1.00	4	1
1:A:57:GLU:HB2	1:A:77:ALA:CB	1.16	1.68	4	1
1:A:73:LYS:CG	1:A:74:VAL:HA	1.13	1.71	4	1
1:A:57:GLU:OE2	1:A:81:VAL:CG1	1.08	0.79	4	1
1:A:50:ASP:O	1:A:84:LYS:CB	1.07	2.03	4	1
1:A:80:GLU:O	1:A:80:GLU:HA	1.06	1.50	4	1
1:A:57:GLU:OE2	1:A:81:VAL:HG13	1.05	1.40	4	1
1:A:69:ARG:NH1	1:A:69:ARG:CD	1.03	2.20	4	1
1:A:69:ARG:CG	1:A:69:ARG:HH11	1.03	1.60	4	1
1:A:76:GLN:N	1:A:78:LYS:HB2	1.03	1.63	4	1
1:A:79:ALA:H	1:A:79:ALA:CB	1.03	1.66	4	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:50:ASP:C	1:A:84:LYS:CB	1.02	2.26	4	1
1:A:53:VAL:HG13	1:A:80:GLU:CA	1.01	1.84	4	1
1:A:74:VAL:H	1:A:74:VAL:CB	1.00	1.67	4	1
1:A:73:LYS:CA	1:A:74:VAL:HG23	0.98	1.88	4	1
1:A:53:VAL:H	1:A:84:LYS:CG	0.98	1.71	4	1
1:A:49:SER:C	1:A:84:LYS:HG3	0.98	1.78	4	1
1:A:53:VAL:HG13	1:A:80:GLU:HA	0.97	1.35	4	1
1:A:73:LYS:HG2	1:A:73:LYS:CA	0.97	1.89	4	1
1:A:70:ASN:CB	1:A:72:GLU:N	0.97	2.27	4	1
1:A:69:ARG:NH1	1:A:69:ARG:HG3	0.97	1.70	4	1
1:A:53:VAL:CG1	1:A:80:GLU:HA	0.97	1.89	4	1
1:A:80:GLU:OE1	1:A:81:VAL:HG21	0.97	1.47	4	1
1:A:86:ALA:H	1:A:86:ALA:CB	0.96	1.72	4	1
1:A:50:ASP:HA	1:A:84:LYS:CG	0.96	1.91	4	1
1:A:69:ARG:NH1	1:A:69:ARG:CB	0.96	2.27	4	1
1:A:72:GLU:C	1:A:75:LYS:CG	0.96	2.34	4	1
1:A:69:ARG:HH11	1:A:69:ARG:CB	0.95	1.73	4	1
1:A:73:LYS:H	1:A:74:VAL:HG23	0.95	1.14	4	1
1:A:57:GLU:OE2	1:A:81:VAL:HG12	0.95	1.59	4	1
1:A:69:ARG:NH1	1:A:69:ARG:HB3	0.94	1.78	4	1
1:A:72:GLU:OE2	1:A:75:LYS:HE2	0.93	1.62	4	1
1:A:84:LYS:HB3	1:A:84:LYS:C	0.93	1.83	4	1
1:A:50:ASP:CB	1:A:84:LYS:HB3	0.91	1.95	4	1
1:A:80:GLU:N	1:A:81:VAL:CB	0.91	2.32	4	1
1:A:53:VAL:H	1:A:84:LYS:HG2	0.91	0.76	4	1
1:A:53:VAL:HB	1:A:84:LYS:HB2	0.90	1.38	4	1
1:A:80:GLU:CA	1:A:80:GLU:CG	0.89	2.50	4	1
1:A:80:GLU:CD	1:A:80:GLU:C	0.88	2.32	4	1
1:A:69:ARG:NH1	1:A:69:ARG:HD2	0.88	1.81	4	1
1:A:80:GLU:HA	1:A:81:VAL:N	0.88	1.83	4	1
1:A:74:VAL:CG2	1:A:74:VAL:N	0.87	2.37	4	1
1:A:81:VAL:CG1	1:A:81:VAL:CA	0.87	2.52	4	1
1:A:77:ALA:CB	1:A:77:ALA:H	0.87	1.81	4	1
1:A:69:ARG:HH11	1:A:69:ARG:HG3	0.87	1.23	4	1
1:A:74:VAL:CA	1:A:74:VAL:CG2	0.86	2.53	4	1
1:A:43:GLU:HA	1:A:91:LEU:HG	0.86	1.44	4	1
1:A:73:LYS:HG2	1:A:74:VAL:HA	0.85	0.87	4	1
1:A:43:GLU:HA	1:A:91:LEU:CG	0.84	2.00	4	1
1:A:75:LYS:C	1:A:76:GLN:CA	0.84	2.46	4	1
1:A:72:GLU:C	1:A:75:LYS:HG2	0.83	1.93	4	1
1:A:53:VAL:HB	1:A:84:LYS:CB	0.83	2.01	4	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:57:GLU:HB2	1:A:77:ALA:HB3	0.83	1.48	4	1
1:A:73:LYS:HG2	1:A:74:VAL:C	0.82	1.90	4	1
1:A:79:ALA:CB	1:A:79:ALA:N	0.82	2.43	4	1
1:A:86:ALA:CB	1:A:86:ALA:N	0.80	2.44	4	1
1:A:83:SER:CA	1:A:84:LYS:N	0.79	2.46	4	1
1:A:71:GLU:CA	1:A:72:GLU:N	0.78	2.47	4	1
1:A:71:GLU:N	1:A:71:GLU:CB	0.78	2.41	4	1
1:A:75:LYS:CA	1:A:76:GLN:N	0.78	2.46	4	1
1:A:46:ILE:HG22	1:A:88:ALA:HA	0.78	1.56	4	1
1:A:75:LYS:C	1:A:75:LYS:CB	0.78	2.51	4	1
1:A:80:GLU:C	1:A:80:GLU:CB	0.78	2.52	4	1
1:A:50:ASP:CA	1:A:84:LYS:CG	0.77	2.57	4	1
1:A:80:GLU:CA	1:A:81:VAL:N	0.77	2.48	4	1
1:A:43:GLU:OE1	1:A:95:LYS:HB3	0.76	1.79	4	1
1:A:72:GLU:C	1:A:75:LYS:HD2	0.76	2.01	4	1
1:A:74:VAL:CB	1:A:74:VAL:N	0.75	2.48	4	1
1:A:76:GLN:NE2	1:A:76:GLN:OE1	0.75	2.19	4	1
1:A:81:VAL:C	1:A:81:VAL:HB	0.75	1.94	4	1
1:A:78:LYS:CD	1:A:78:LYS:NZ	0.74	2.50	4	1
1:A:77:ALA:CB	1:A:77:ALA:N	0.74	2.50	4	1
1:A:64:GLU:OE2	1:A:74:VAL:CB	0.73	2.36	4	1
1:A:72:GLU:C	1:A:75:LYS:CD	0.73	2.56	4	1
1:A:73:LYS:CA	1:A:74:VAL:CG2	0.73	2.65	4	1
1:A:76:GLN:C	1:A:78:LYS:HA	0.73	2.03	4	1
1:A:54:LYS:NZ	1:A:85:LYS:HB2	0.72	1.99	4	1
1:A:53:VAL:CB	1:A:84:LYS:CB	0.72	2.62	4	1
1:A:81:VAL:C	1:A:81:VAL:CB	0.72	2.52	4	1
1:A:84:LYS:CB	1:A:84:LYS:C	0.72	2.55	4	1
1:A:53:VAL:N	1:A:84:LYS:CG	0.71	2.39	4	1
1:A:73:LYS:HD3	1:A:75:LYS:HB2	0.71	1.62	4	1
1:A:87:GLU:O	1:A:88:ALA:N	0.71	2.23	4	1
1:A:50:ASP:O	1:A:84:LYS:HB2	0.71	1.86	4	1
1:A:73:LYS:CG	1:A:73:LYS:CA	0.71	2.61	4	1
1:A:81:VAL:CA	1:A:81:VAL:O	0.70	2.40	4	1
1:A:80:GLU:HG3	1:A:80:GLU:CA	0.70	2.15	4	1
1:A:71:GLU:HA	1:A:72:GLU:N	0.70	1.99	4	1
1:A:71:GLU:CB	1:A:71:GLU:C	0.69	2.61	4	1
1:A:87:GLU:CG	1:A:87:GLU:OE2	0.68	2.42	4	1
1:A:72:GLU:C	1:A:75:LYS:CB	0.67	2.62	4	1
1:A:87:GLU:CG	1:A:87:GLU:OE1	0.67	2.42	4	1
1:A:54:LYS:HZ1	1:A:85:LYS:HB2	0.66	1.51	4	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:73:LYS:H	1:A:74:VAL:CG2	0.66	2.00	4	1
1:A:74:VAL:CA	1:A:74:VAL:HG22	0.66	2.19	4	1
1:A:76:GLN:N	1:A:76:GLN:C	0.66	2.49	4	1
1:A:82:GLU:N	1:A:82:GLU:C	0.66	2.49	4	1
1:A:43:GLU:HA	1:A:91:LEU:CD1	0.65	2.20	4	1
1:A:69:ARG:HH11	1:A:69:ARG:HB3	0.64	1.37	4	1
1:A:50:ASP:CG	1:A:84:LYS:HB3	0.64	2.13	4	1
1:A:80:GLU:CA	1:A:81:VAL:C	0.64	2.66	4	1
1:A:78:LYS:CD	1:A:78:LYS:HZ3	0.63	2.07	4	1
1:A:71:GLU:N	1:A:71:GLU:C	0.62	2.52	4	1
1:A:76:GLN:N	1:A:78:LYS:CA	0.62	2.62	4	1
1:A:80:GLU:CA	1:A:80:GLU:O	0.62	2.39	4	1
1:A:57:GLU:HB2	1:A:77:ALA:HB1	0.61	1.69	4	1
1:A:87:GLU:OE2	1:A:87:GLU:OE1	0.61	2.19	4	1
1:A:42:LEU:H	1:A:42:LEU:HD22	0.60	1.57	16	5
1:A:73:LYS:CG	1:A:74:VAL:C	0.60	2.62	4	1
1:A:57:GLU:CB	1:A:77:ALA:CB	0.59	2.64	4	1
1:A:50:ASP:CA	1:A:84:LYS:HG3	0.59	2.24	4	1
1:A:43:GLU:CD	1:A:95:LYS:HB3	0.59	2.17	4	1
1:A:43:GLU:OE1	1:A:95:LYS:CB	0.58	2.51	4	1
1:A:72:GLU:O	1:A:75:LYS:HD2	0.58	1.98	4	1
1:A:50:ASP:C	1:A:84:LYS:HB3	0.56	1.96	4	1
1:A:80:GLU:H	1:A:81:VAL:CB	0.54	2.12	4	1
1:A:71:GLU:C	1:A:71:GLU:HB2	0.53	2.23	4	1
1:A:71:GLU:C	1:A:71:GLU:CG	0.52	2.78	4	1
1:A:43:GLU:CA	1:A:91:LEU:HD12	0.52	2.34	4	1
1:A:74:VAL:CA	1:A:74:VAL:HG23	0.51	2.19	4	1
1:A:50:ASP:HA	1:A:84:LYS:HB3	0.51	0.73	4	1
1:A:73:LYS:CE	1:A:73:LYS:HB3	0.50	2.36	4	1
1:A:71:GLU:CB	1:A:71:GLU:H	0.49	2.16	4	1
1:A:57:GLU:OE1	1:A:81:VAL:CG1	0.49	2.52	4	1
1:A:80:GLU:CG	1:A:80:GLU:C	0.49	2.80	4	1
1:A:50:ASP:N	1:A:84:LYS:HG3	0.49	2.23	4	1
1:A:53:VAL:CA	1:A:84:LYS:HG2	0.48	2.23	4	1
1:A:81:VAL:O	1:A:81:VAL:HA	0.48	2.06	4	1
1:A:50:ASP:C	1:A:84:LYS:CG	0.47	2.79	4	1
1:A:78:LYS:HB3	1:A:78:LYS:HE2	0.47	1.87	4	1
1:A:19:ALA:HB1	1:A:51:VAL:HG22	0.46	1.87	11	1
1:A:43:GLU:OE2	1:A:95:LYS:HB3	0.46	2.11	4	1
1:A:76:GLN:C	1:A:78:LYS:CA	0.45	2.82	4	1
1:A:46:ILE:CG2	1:A:88:ALA:HA	0.45	2.35	4	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:84:LYS:HA	1:A:84:LYS:HE2	0.45	1.87	8	1
1:A:53:VAL:HG11	1:A:80:GLU:HA	0.45	1.80	4	1
1:A:40:LYS:CB	1:A:41:THR:HA	0.45	2.42	8	1
1:A:67:GLU:HG2	1:A:70:ASN:H	0.45	1.71	12	1
1:A:43:GLU:OE1	1:A:95:LYS:CA	0.45	2.65	4	1
1:A:33:ASN:HD22	1:A:39:TYR:HB2	0.44	1.72	17	1
1:A:53:VAL:CB	1:A:84:LYS:HB2	0.44	2.20	4	1
1:A:73:LYS:CD	1:A:75:LYS:HB2	0.44	2.41	4	1
1:A:67:GLU:N	1:A:68:PRO:HA	0.44	2.28	10	1
1:A:57:GLU:CB	1:A:77:ALA:HB3	0.44	2.33	4	1
1:A:42:LEU:HD22	1:A:42:LEU:C	0.44	2.33	8	1
1:A:80:GLU:OE1	1:A:80:GLU:CB	0.43	2.66	4	1
1:A:80:GLU:OE1	1:A:80:GLU:C	0.43	2.55	4	1
1:A:73:LYS:N	1:A:74:VAL:CG2	0.42	2.45	4	1
1:A:67:GLU:HB3	1:A:68:PRO:HD2	0.42	1.92	5	1
1:A:39:TYR:CG	1:A:40:LYS:N	0.42	2.88	3	3
1:A:67:GLU:C	1:A:69:ARG:H	0.42	2.18	7	2
1:A:43:GLU:CB	1:A:91:LEU:HB3	0.42	2.44	4	1
1:A:34:TYR:N	1:A:35:PRO:HD2	0.42	2.30	17	1
1:A:60:LEU:HG	1:A:77:ALA:HB2	0.41	1.91	8	1
1:A:74:VAL:O	1:A:77:ALA:HB3	0.41	2.16	8	1
1:A:34:TYR:CB	1:A:35:PRO:CD	0.41	2.98	5	2
1:A:57:GLU:OE1	1:A:77:ALA:HB3	0.41	2.16	4	1
1:A:49:SER:HB3	1:A:87:GLU:OE2	0.41	2.15	4	1
1:A:42:LEU:N	1:A:42:LEU:HD13	0.41	2.31	7	1
1:A:77:ALA:O	1:A:81:VAL:HG13	0.41	2.16	13	1
1:A:50:ASP:O	1:A:84:LYS:CG	0.40	2.68	4	1
1:A:43:GLU:CA	1:A:91:LEU:CD1	0.40	2.95	4	1
1:A:53:VAL:N	1:A:84:LYS:HE3	0.40	2.30	4	1
1:A:12:ALA:HB1	1:A:58:LEU:HD22	0.40	1.93	5	1

6.3 Torsion angles [i](#)

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	104/119 (87%)	93±4 (89±4%)	7±3 (7±3%)	3±2 (3±2%)	6	37
All	All	1964/2261 (87%)	1761 (90%)	137 (7%)	66 (3%)	6	36

All 16 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	39	TYR	17
1	A	35	PRO	11
1	A	30	ASP	8
1	A	41	THR	6
1	A	68	PRO	5
1	A	70	ASN	4
1	A	71	GLU	3
1	A	5	PRO	2
1	A	67	GLU	2
1	A	64	GLU	2
1	A	77	ALA	1
1	A	6	GLU	1
1	A	113	ASP	1
1	A	40	LYS	1
1	A	112	GLU	1
1	A	31	ARG	1

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	93/103 (90%)	79±3 (85±4%)	14±3 (15±4%)	6	45
All	All	1767/1957 (90%)	1509 (85%)	258 (15%)	6	45

All 53 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	36	THR	19
1	A	32	ARG	18

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Mol	Chain	Res	Type	Models (Total)
1	A	37	ASN	18
1	A	55	LYS	18
1	A	35	PRO	16
1	A	67	GLU	16
1	A	69	ARG	13
1	A	100	LYS	12
1	A	94	ILE	9
1	A	8	LYS	8
1	A	68	PRO	7
1	A	60	LEU	6
1	A	40	LYS	6
1	A	14	LYS	6
1	A	29	GLU	5
1	A	81	VAL	5
1	A	66	LYS	5
1	A	42	LEU	5
1	A	16	VAL	4
1	A	85	LYS	4
1	A	21	LYS	4
1	A	26	GLN	4
1	A	73	LYS	4
1	A	30	ASP	4
1	A	57	GLU	4
1	A	22	LYS	3
1	A	44	LEU	2
1	A	78	LYS	2
1	A	87	GLU	2
1	A	38	THR	2
1	A	99	LYS	2
1	A	20	LYS	2
1	A	34	TYR	2
1	A	33	ASN	2
1	A	27	LYS	1
1	A	58	LEU	1
1	A	25	ASP	1
1	A	70	ASN	1
1	A	71	GLU	1
1	A	74	VAL	1
1	A	80	GLU	1
1	A	82	GLU	1
1	A	84	LYS	1
1	A	115	VAL	1

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Mol	Chain	Res	Type	Models (Total)
1	A	62	LYS	1
1	A	46	ILE	1
1	A	45	GLU	1
1	A	112	GLU	1
1	A	64	GLU	1
1	A	31	ARG	1
1	A	93	LYS	1
1	A	116	LYS	1
1	A	15	LYS	1

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	4-A	7

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
4	A	86:ALA	C	87:GLU	N	8.48
4	A	87:GLU	C	88:ALA	N	7.99
4	A	80:GLU	C	81:VAL	N	7.48
4	A	83:SER	C	84:LYS	N	6.38
4	A	71:GLU	C	72:GLU	N	5.59
4	A	75:LYS	C	76:GLN	N	4.85
4	A	74:VAL	C	75:LYS	N	4.45

7 Chemical shift validation

No chemical shift data were provided