



Full wwPDB NMR Structure Validation Report ⓘ

Mar 8, 2026 – 03:55 PM UTC

PDB ID : 1K9C / pdb_00001k9c
Title : Solution Structure of Calreticulin P-domain subdomain (residues 189-261)
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Deposited on : 2001-10-29

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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	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

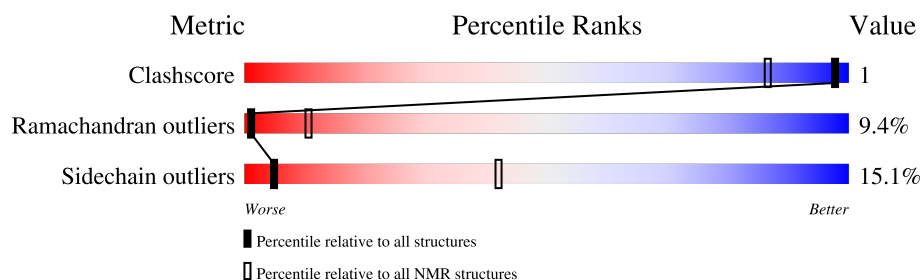
1 Overall quality at a glance

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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	74	68% 14% 19%

2 Ensemble composition and analysis

This entry contains 20 models. Model 13 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *closest to the average*.

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:195-A:206 (12)	2.06	13
2	A:214-A:261 (48)	1.24	13

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, 3, 4, 6, 8, 9, 10, 12, 14, 16, 18, 19, 20
2	5, 7, 15
3	2, 13, 17
Single-model clusters	11

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1179 atoms, of which 560 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called CALRETICULIN.

Mol	Chain	Residues	Atoms						Trace
1	A	74	Total	C	H	N	O	S	0
			1179	388	560	100	130	1	

There is a discrepancy between the modelled and reference sequences:

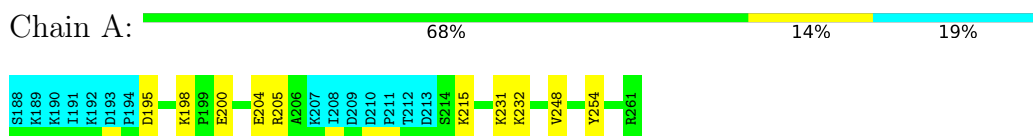
Chain	Residue	Modelled	Actual	Comment	Reference
A	188	SER	-	cloning artifact	UNP P18418

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: CALRETICULIN

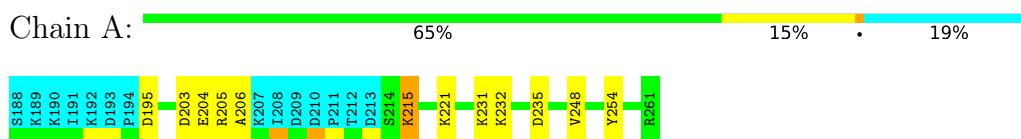


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

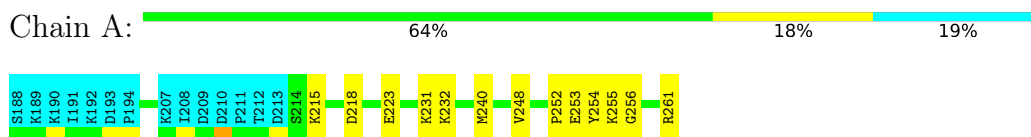
4.2.1 Score per residue for model 1

- Molecule 1: CALRETICULIN



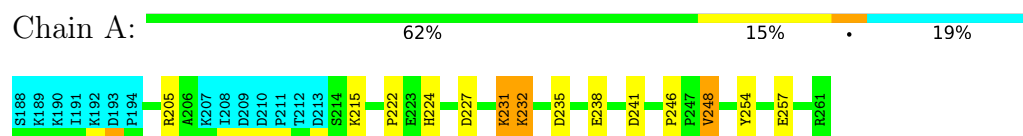
4.2.2 Score per residue for model 2

- Molecule 1: CALRETICULIN



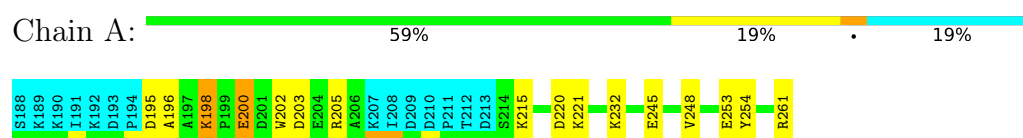
4.2.3 Score per residue for model 3

- Molecule 1: CALRETICULIN



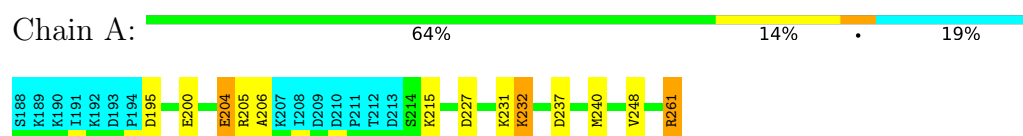
4.2.4 Score per residue for model 4

- Molecule 1: CALRETICULIN



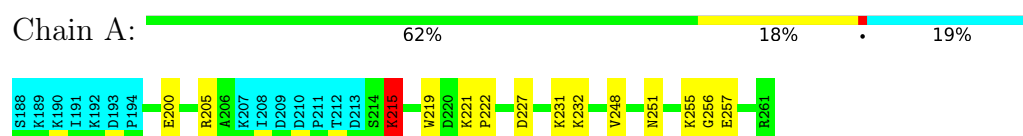
4.2.5 Score per residue for model 5

- Molecule 1: CALRETICULIN



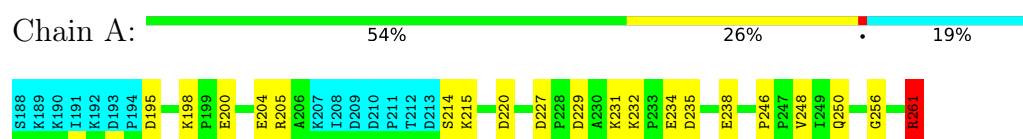
4.2.6 Score per residue for model 6

- Molecule 1: CALRETICULIN



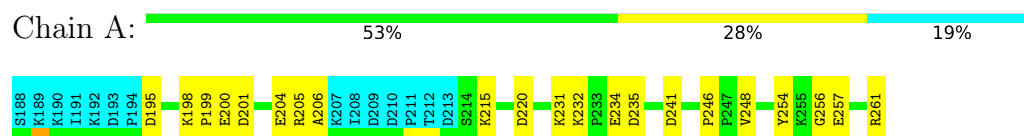
4.2.7 Score per residue for model 7

- Molecule 1: CALRETICULIN



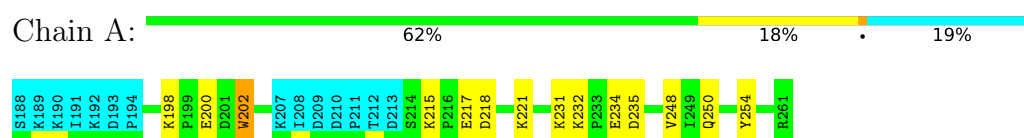
4.2.8 Score per residue for model 8

- Molecule 1: CALRETICULIN



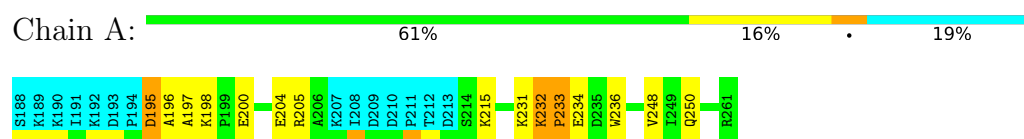
4.2.9 Score per residue for model 9

- Molecule 1: CALRETICULIN



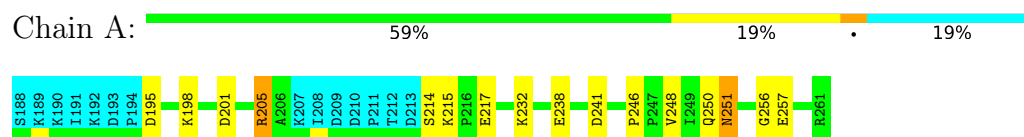
4.2.10 Score per residue for model 10

- Molecule 1: CALRETICULIN



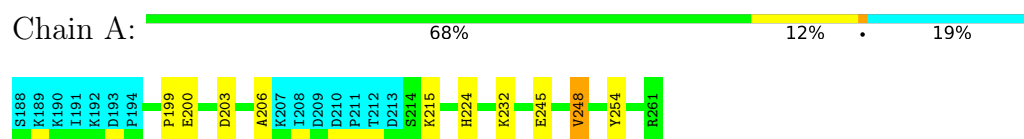
4.2.11 Score per residue for model 11

- Molecule 1: CALRETICULIN



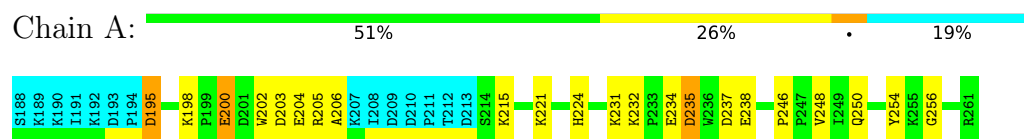
4.2.12 Score per residue for model 12

- Molecule 1: CALRETICULIN



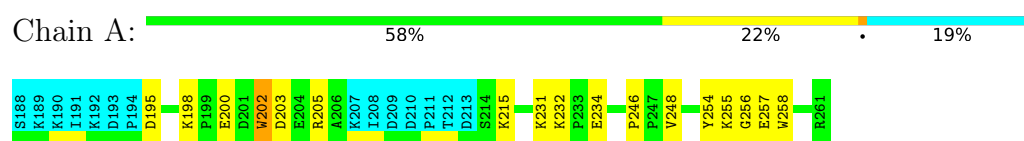
4.2.13 Score per residue for model 13 (medoid)

- Molecule 1: CALRETICULIN



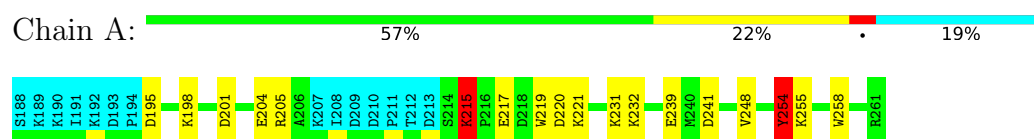
4.2.14 Score per residue for model 14

- Molecule 1: CALRETICULIN



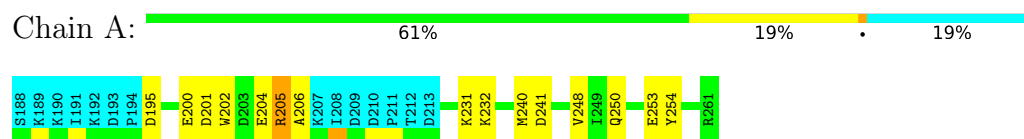
4.2.15 Score per residue for model 15

- Molecule 1: CALRETICULIN



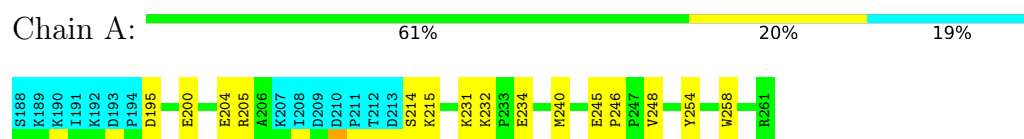
4.2.16 Score per residue for model 16

- Molecule 1: CALRETICULIN



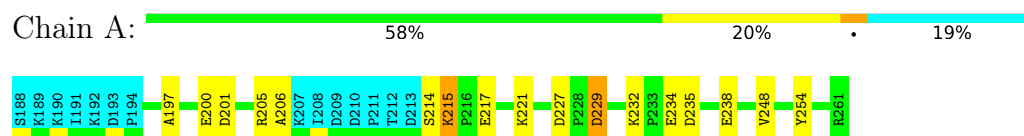
4.2.17 Score per residue for model 17

- Molecule 1: CALRETICULIN



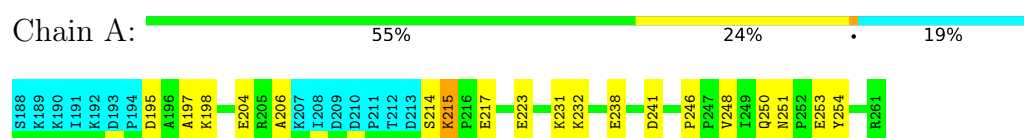
4.2.18 Score per residue for model 18

• Molecule 1: CALRETICULIN



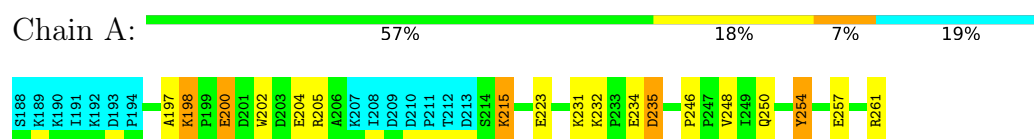
4.2.19 Score per residue for model 19

• Molecule 1: CALRETICULIN



4.2.20 Score per residue for model 20

• Molecule 1: CALRETICULIN



5 Refinement protocol and experimental data overview

The models were refined using the following method: *torsion angle dynamics, simulated annealing*.

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

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

Software name	Classification	Version
DYANA	structure solution	1.68
DYANA	refinement	1.68

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	0.70±0.02	0±0/529 (0.0± 0.0%)	1.48±0.06	4±2/723 (0.5± 0.3%)
All	All	0.70	0/10580 (0.0%)	1.48	74/14460 (0.5%)

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	0.0±0.0	0.8±0.8
All	All	0	17

There are no bond-length outliers.

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	227	ASP	CA-CB-CG	8.49	121.09	112.60	7	5
1	A	246	PRO	N-CA-CB	7.40	107.34	103.19	20	9
1	A	237	ASP	CA-CB-CG	-7.38	105.22	112.60	5	1
1	A	237	ASP	CA-C-N	7.36	135.60	121.54	13	1
1	A	237	ASP	C-N-CA	7.36	135.60	121.54	13	1
1	A	234	GLU	CA-C-N	6.83	133.21	122.49	8	4
1	A	234	GLU	C-N-CA	6.83	133.21	122.49	8	4
1	A	201	ASP	CA-C-N	6.67	129.22	120.28	16	1
1	A	201	ASP	C-N-CA	6.67	129.22	120.28	16	1
1	A	255	LYS	CA-C-N	6.50	127.31	120.03	15	1
1	A	255	LYS	C-N-CA	6.50	127.31	120.03	15	1
1	A	235	ASP	CA-CB-CG	6.48	119.08	112.60	13	5
1	A	198	LYS	CB-CA-C	6.35	116.53	111.00	19	1
1	A	233	PRO	CA-C-N	5.97	129.09	120.38	10	1
1	A	233	PRO	C-N-CA	5.97	129.09	120.38	10	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	203	ASP	CA-CB-CG	-5.96	106.64	112.60	13	2
1	A	261	ARG	CB-CA-C	5.95	121.41	110.10	5	2
1	A	229	ASP	CA-CB-CG	5.88	118.48	112.60	18	1
1	A	235	ASP	N-CA-CB	-5.85	102.49	110.56	7	1
1	A	201	ASP	CA-CB-CG	5.67	118.27	112.60	15	1
1	A	222	PRO	CA-C-N	5.65	127.78	120.44	3	1
1	A	222	PRO	C-N-CA	5.65	127.78	120.44	3	1
1	A	224	HIS	CB-CG-CD2	-5.50	124.05	131.20	13	1
1	A	197	ALA	CA-C-N	5.47	135.15	121.80	20	2
1	A	197	ALA	C-N-CA	5.47	135.15	121.80	20	2
1	A	202	TRP	N-CA-C	5.45	117.22	111.28	16	1
1	A	251	ASN	CA-C-N	5.39	126.57	119.84	6	1
1	A	251	ASN	C-N-CA	5.39	126.57	119.84	6	1
1	A	245	GLU	CA-C-N	5.38	123.59	119.66	17	1
1	A	245	GLU	C-N-CA	5.38	123.59	119.66	17	1
1	A	204	GLU	CA-C-N	5.25	131.49	123.47	5	1
1	A	204	GLU	C-N-CA	5.25	131.49	123.47	5	1
1	A	199	PRO	CA-C-N	5.24	131.54	121.54	12	2
1	A	199	PRO	C-N-CA	5.24	131.54	121.54	12	2
1	A	232	LYS	CA-C-N	5.15	126.28	119.84	10	1
1	A	232	LYS	C-N-CA	5.15	126.28	119.84	10	1
1	A	248	VAL	CA-C-N	5.14	130.33	122.92	12	1
1	A	248	VAL	C-N-CA	5.14	130.33	122.92	12	1
1	A	256	GLY	CA-C-N	5.12	131.31	121.54	11	1
1	A	256	GLY	C-N-CA	5.12	131.31	121.54	11	1
1	A	252	PRO	CA-C-N	5.08	131.25	121.54	2	1
1	A	252	PRO	C-N-CA	5.08	131.25	121.54	2	1
1	A	202	TRP	CA-CB-CG	5.08	123.25	113.60	14	1
1	A	250	GLN	CA-C-N	5.03	134.07	121.80	11	1
1	A	250	GLN	C-N-CA	5.03	134.07	121.80	11	1
1	A	195	ASP	CA-CB-CG	5.02	117.62	112.60	10	1

There are no chirality outliers.

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	200	GLU	Peptide	4
1	A	205	ARG	Sidechain	3
1	A	261	ARG	Sidechain	2
1	A	255	LYS	Peptide	2

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	254	TYR	Sidechain	2
1	A	222	PRO	Peptide	1
1	A	256	GLY	Peptide	1
1	A	234	GLU	Peptide	1
1	A	253	GLU	Peptide	1

6.2 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 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	508	444	444	0±1
All	All	10160	8880	8880	10

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:224:HIS:HB3	1:A:248:VAL:HG21	0.81	1.48	12	2
1:A:217:GLU:CD	1:A:217:GLU:H	0.54	2.10	11	1
1:A:231:LYS:HA	1:A:231:LYS:HE2	0.50	1.83	3	1
1:A:224:HIS:CB	1:A:248:VAL:HG21	0.49	2.32	3	2
1:A:219:TRP:CZ2	1:A:258:TRP:HA	0.48	2.44	15	1
1:A:214:SER:HA	1:A:258:TRP:CZ2	0.47	2.44	17	1
1:A:215:LYS:HD3	1:A:219:TRP:CD1	0.42	2.49	15	2

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	59/74 (80%)	43±2 (72±3%)	11±2 (18±4%)	6±2 (9±3%)	1	10
All	All	1180/1480 (80%)	853 (72%)	216 (18%)	111 (9%)	1	10

All 24 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	232	LYS	20
1	A	215	LYS	18
1	A	254	TYR	14
1	A	200	GLU	10
1	A	195	ASP	8
1	A	206	ALA	8
1	A	256	GLY	5
1	A	203	ASP	3
1	A	253	GLU	2
1	A	196	ALA	2
1	A	198	LYS	2
1	A	220	ASP	2
1	A	197	ALA	2
1	A	251	ASN	2
1	A	204	GLU	2
1	A	214	SER	2
1	A	217	GLU	2
1	A	255	LYS	1
1	A	205	ARG	1
1	A	202	TRP	1
1	A	233	PRO	1
1	A	236	TRP	1
1	A	257	GLU	1
1	A	238	GLU	1

6.3.2 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 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	54/68 (79%)	46±3 (85±5%)	8±3 (15±5%)	5	42
All	All	1080/1360 (79%)	917 (85%)	163 (15%)	5	42

All 32 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	248	VAL	19
1	A	231	LYS	16
1	A	205	ARG	14
1	A	198	LYS	10
1	A	204	GLU	9
1	A	215	LYS	7
1	A	221	LYS	7
1	A	250	GLN	7
1	A	241	ASP	6
1	A	195	ASP	6
1	A	235	ASP	5
1	A	238	GLU	5
1	A	257	GLU	5
1	A	202	TRP	5
1	A	261	ARG	5
1	A	240	MET	4
1	A	234	GLU	4
1	A	223	GLU	3
1	A	201	ASP	3
1	A	200	GLU	3
1	A	218	ASP	2
1	A	254	TYR	2
1	A	232	LYS	2
1	A	245	GLU	2
1	A	214	SER	2
1	A	220	ASP	2
1	A	229	ASP	2
1	A	217	GLU	2
1	A	251	ASN	1
1	A	258	TRP	1
1	A	239	GLU	1
1	A	253	GLU	1

6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.5 Carbohydrates [i](#)

There are no oligosaccharides 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](#)

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided