



Full wwPDB NMR Structure Validation Report ⓘ

May 28, 2020 – 10:43 pm BST

PDB ID : 2KVA
Title : SOLUTION STRUCTURE OF CI-MPR ligand-free domain 5
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Deposited on : 2010-03-10

This is a Full wwPDB NMR Structure Validation 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/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : 2.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

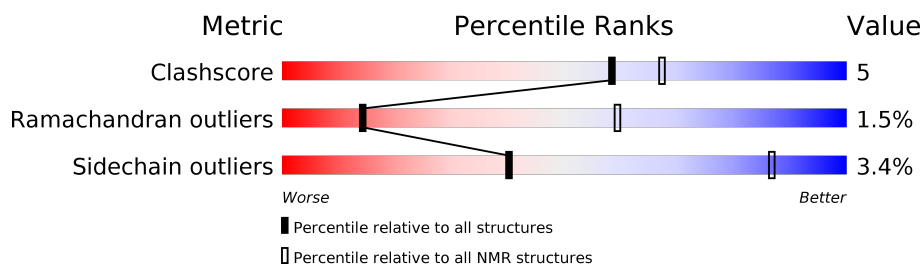
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 87%.

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	148	

2 Ensemble composition and analysis

This entry contains 20 models. Model 14 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

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:586-A:696, A:700-A:707, A:712-A:725 (133)	0.46	14

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 4 clusters and 5 single-model clusters were found.

Cluster number	Models
1	14, 15, 16, 17, 18, 19
2	2, 3, 5, 9, 20
3	7, 8
4	4, 12
Single-model clusters	1; 6; 10; 11; 13

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2134 atoms, of which 956 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Cation-independent mannose-6-phosphate receptor.

Mol	Chain	Residues	Atoms						Trace
1	A	148	Total	C	H	N	O	S	0
			2134	734	956	198	239	7	

There are 6 discrepancies between the modelled and reference sequences:

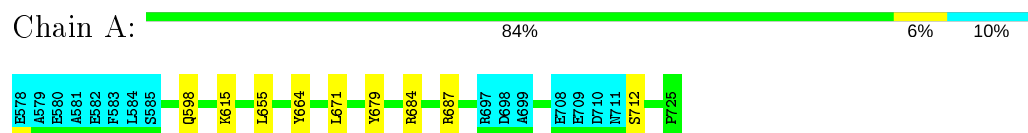
Chain	Residue	Modelled	Actual	Comment	Reference
A	578	GLU	-	expression tag	UNP P08169
A	579	ALA	-	expression tag	UNP P08169
A	580	GLU	-	expression tag	UNP P08169
A	581	ALA	-	expression tag	UNP P08169
A	582	GLU	-	expression tag	UNP P08169
A	583	PHE	-	expression tag	UNP P08169

4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: Cation-independent mannose-6-phosphate receptor

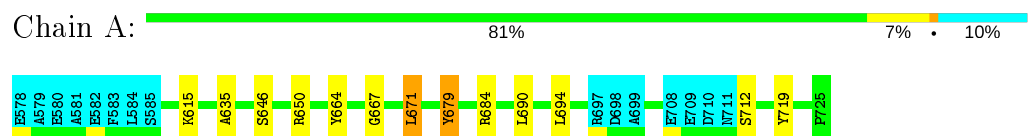


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

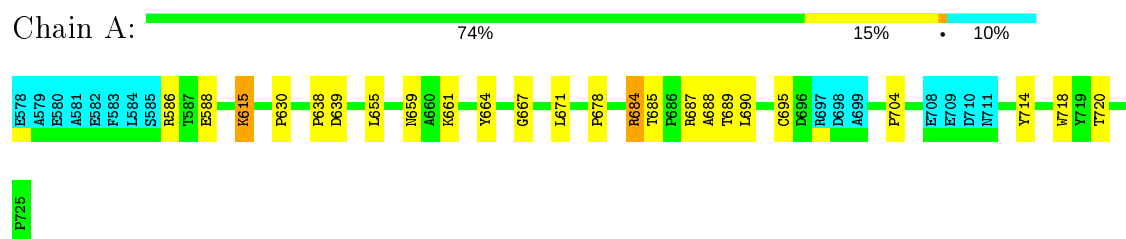
4.2.1 Score per residue for model 1

- Molecule 1: Cation-independent mannose-6-phosphate receptor



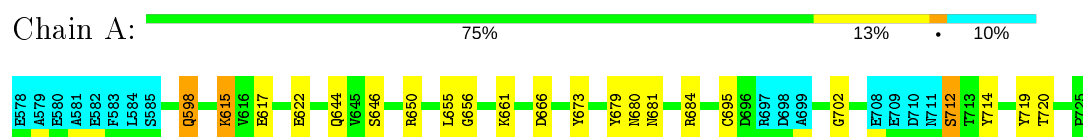
4.2.2 Score per residue for model 2

- Molecule 1: Cation-independent mannose-6-phosphate receptor



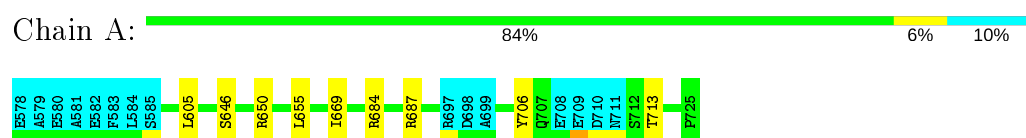
4.2.3 Score per residue for model 3

- Molecule 1: Cation-independent mannose-6-phosphate receptor



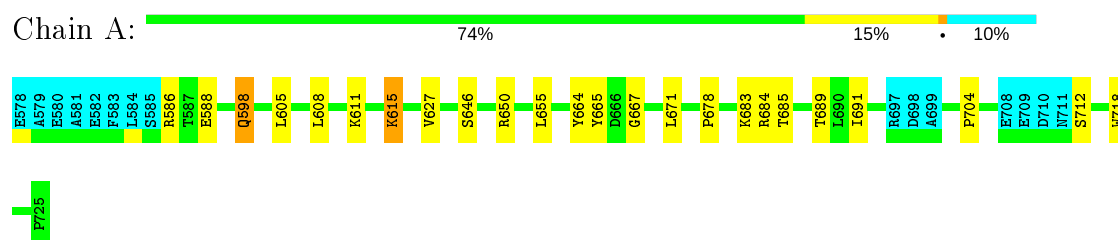
4.2.4 Score per residue for model 4

- Molecule 1: Cation-independent mannose-6-phosphate receptor



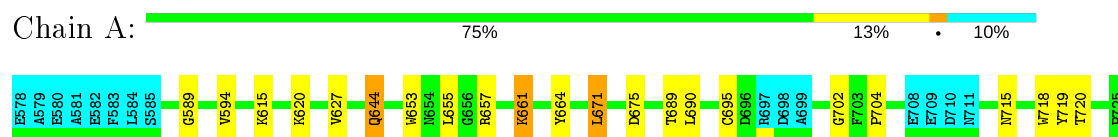
4.2.5 Score per residue for model 5

- Molecule 1: Cation-independent mannose-6-phosphate receptor



4.2.6 Score per residue for model 6

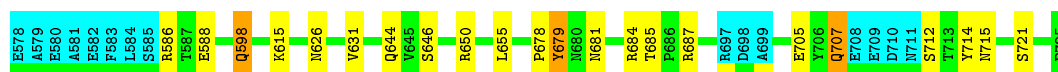
- Molecule 1: Cation-independent mannose-6-phosphate receptor



4.2.7 Score per residue for model 7

- Molecule 1: Cation-independent mannose-6-phosphate receptor

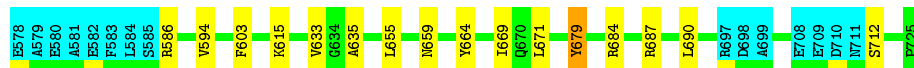




4.2.8 Score per residue for model 8

- Molecule 1: Cation-independent mannose-6-phosphate receptor

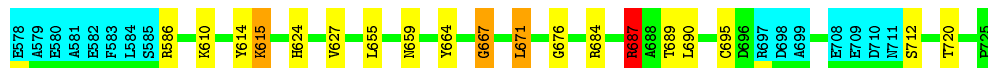
Chain A: 79% 10% 10%



4.2.9 Score per residue for model 9

- Molecule 1: Cation-independent mannose-6-phosphate receptor

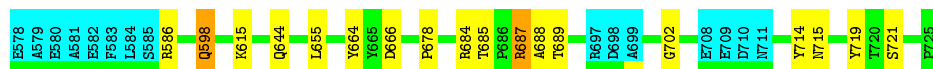
Chain A: 77% 10% 10%



4.2.10 Score per residue for model 10

- Molecule 1: Cation-independent mannose-6-phosphate receptor

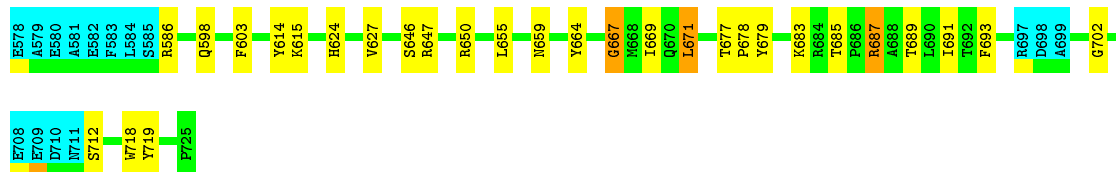
Chain A: 78% 11% 10%



4.2.11 Score per residue for model 11

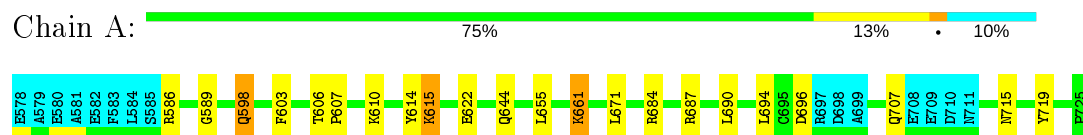
- Molecule 1: Cation-independent mannose-6-phosphate receptor

Chain A: 70% 18% 10%



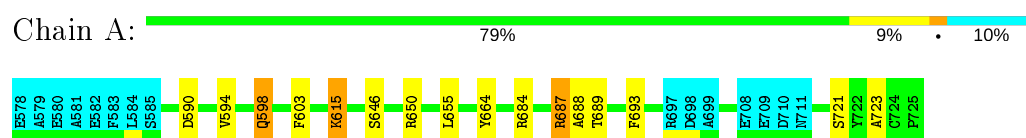
4.2.12 Score per residue for model 12

- Molecule 1: Cation-independent mannose-6-phosphate receptor



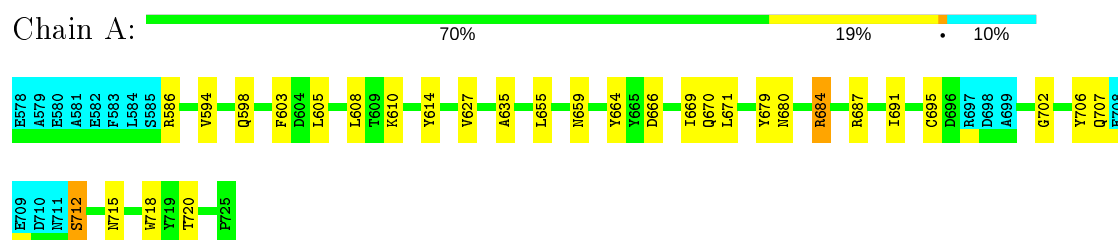
4.2.13 Score per residue for model 13

- Molecule 1: Cation-independent mannose-6-phosphate receptor



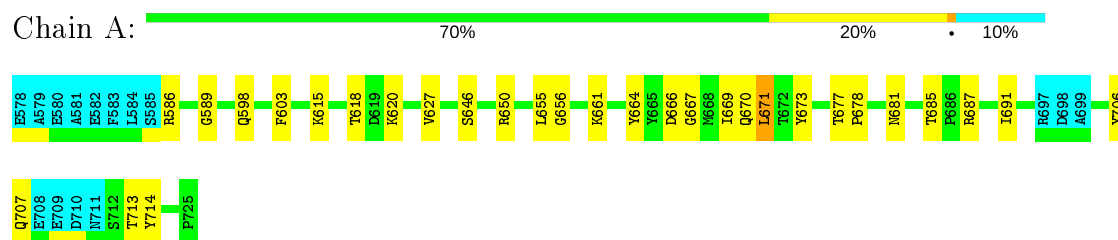
4.2.14 Score per residue for model 14 (medoid)

- Molecule 1: Cation-independent mannose-6-phosphate receptor



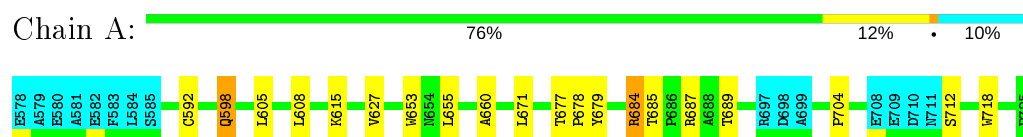
4.2.15 Score per residue for model 15

- Molecule 1: Cation-independent mannose-6-phosphate receptor



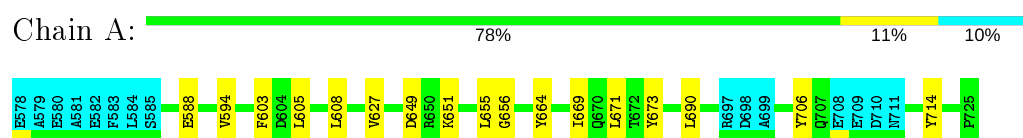
4.2.16 Score per residue for model 16

- Molecule 1: Cation-independent mannose-6-phosphate receptor



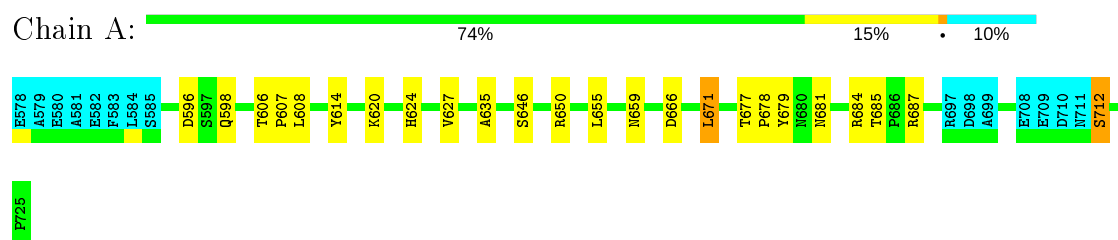
4.2.17 Score per residue for model 17

- Molecule 1: Cation-independent mannose-6-phosphate receptor



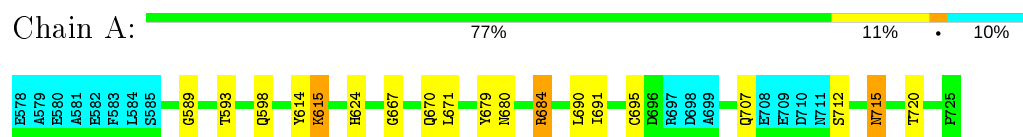
4.2.18 Score per residue for model 18

- Molecule 1: Cation-independent mannose-6-phosphate receptor



4.2.19 Score per residue for model 19

- Molecule 1: Cation-independent mannose-6-phosphate receptor



4.2.20 Score per residue for model 20

- Molecule 1: Cation-independent mannose-6-phosphate receptor



E578	A579	E580	A581	E582	F583	L584	S585		M591		Y594		Q598		F603		T606	P607	L608		K615		L655		A660	R661	L662	S663	T664		Y679		R687		C695	D696	R697	D698	A699		G702		E708	E709	D710	N711	S712	T713	Y714		Y719	T720	S721	Y722		F725
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5 Refinement protocol and experimental data overview

The models were refined using the following method: *AUTOMATED METHODS WERE USED FOR BACKBONE CHEMICAL SHIFT ASSIGNMENT AND ITERATIVE NOE REFINEMENT. FINAL STRUCTURES WERE OBTAINED BY MOLECULAR DYNAMICS IN EXPLICIT SOLVENT.*

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
Xplor-NIH	refinement	2.9.3

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 6 of this report.

Chemical shift file(s)	input_cs.cif
Number of chemical shift lists	1
Total number of shifts	1608
Number of shifts mapped to atoms	1608
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	87%

No validations of the models with respect to experimental NMR restraints is performed at this time.

COVALENT-GEOMETRY INFOmissingINFO

5.1 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	1058	864	985	10±3
All	All	21160	17280	19700	201

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 5.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:679:TYR:OH	1:A:712:SER:HA	0.70	1.87	16	6
1:A:676:GLY:HA3	1:A:687:ARG:NH2	0.69	2.03	9	1
1:A:586:ARG:HA	1:A:664:TYR:O	0.62	1.94	5	8
1:A:655:LEU:HA	1:A:687:ARG:NH2	0.62	2.10	9	1
1:A:655:LEU:HD23	1:A:714:TYR:CD1	0.60	2.32	17	4
1:A:695:CYS:HA	1:A:720:THR:O	0.59	1.97	3	7
1:A:707:GLN:HG2	1:A:715:ASN:HB3	0.59	1.74	7	1
1:A:646:SER:O	1:A:650:ARG:HA	0.58	1.97	3	9
1:A:655:LEU:HB3	1:A:689:THR:OG1	0.57	1.99	10	8
1:A:655:LEU:HG	1:A:687:ARG:HD3	0.56	1.77	20	7
1:A:687:ARG:HA	1:A:687:ARG:CZ	0.56	2.30	10	1
1:A:627:VAL:HA	1:A:671:LEU:HD11	0.56	1.75	9	6
1:A:664:TYR:CZ	1:A:667:GLY:HA2	0.55	2.36	9	5
1:A:615:LYS:HD3	1:A:615:LYS:O	0.54	2.02	9	6
1:A:687:ARG:NE	1:A:688:ALA:H	0.53	2.01	10	3
1:A:687:ARG:HA	1:A:687:ARG:NH1	0.53	2.18	10	1
1:A:678:PRO:HA	1:A:685:THR:O	0.53	2.04	10	8
1:A:707:GLN:HG3	1:A:715:ASN:HB3	0.52	1.81	12	2
1:A:622:GLU:O	1:A:644:GLN:HA	0.52	2.04	3	2
1:A:605:LEU:O	1:A:608:LEU:HB2	0.52	2.05	16	4
1:A:670:GLN:HA	1:A:691:ILE:O	0.52	2.05	15	3
1:A:608:LEU:HB3	1:A:627:VAL:HG21	0.51	1.83	5	2
1:A:630:PRO:HB2	1:A:638:PRO:O	0.51	2.06	2	1
1:A:589:GLY:O	1:A:661:LYS:HA	0.51	2.06	15	1
1:A:655:LEU:HG	1:A:687:ARG:CD	0.50	2.35	15	6
1:A:594:VAL:CG2	1:A:664:TYR:HB2	0.50	2.37	17	4
1:A:669:ILE:HB	1:A:693:PHE:HB2	0.49	1.83	11	1
1:A:644:GLN:OE1	1:A:653:TRP:HB2	0.49	2.07	6	1
1:A:649:ASP:OD1	1:A:651:LYS:HG3	0.48	2.07	17	1
1:A:661:LYS:C	1:A:661:LYS:HD2	0.48	2.28	6	1
1:A:671:LEU:O	1:A:690:LEU:HA	0.48	2.07	19	7
1:A:702:GLY:HA2	1:A:719:TYR:O	0.48	2.09	6	5
1:A:704:PRO:HB3	1:A:718:TRP:CE3	0.48	2.44	2	4
1:A:610:LYS:HE2	1:A:614:TYR:CZ	0.48	2.43	9	3
1:A:605:LEU:HD21	1:A:669:ILE:HG21	0.48	1.84	4	1
1:A:679:TYR:OH	1:A:687:ARG:HG3	0.47	2.09	20	1
1:A:594:VAL:HG21	1:A:664:TYR:HB2	0.47	1.85	14	4
1:A:598:GLN:NE2	1:A:598:GLN:H	0.47	2.08	12	3
1:A:591:ASN:HA	1:A:660:ALA:CB	0.47	2.39	20	1
1:A:603:PHE:CD2	1:A:669:ILE:HD11	0.47	2.45	17	5
1:A:671:LEU:HB3	1:A:691:ILE:HB	0.46	1.88	5	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:702:GLY:HA3	1:A:718:TRP:NE1	0.46	2.26	14	1
1:A:614:TYR:O	1:A:624:HIS:HA	0.46	2.11	19	4
1:A:681:ASN:O	1:A:684:ARG:HD2	0.45	2.12	3	1
1:A:677:THR:HB	1:A:687:ARG:NH1	0.45	2.27	15	4
1:A:615:LYS:O	1:A:615:LYS:HD3	0.45	2.12	5	2
1:A:679:TYR:CZ	1:A:712:SER:HA	0.45	2.47	8	1
1:A:592:CYS:H	1:A:660:ALA:HB1	0.44	1.72	16	1
1:A:598:GLN:H	1:A:598:GLN:NE2	0.44	2.10	5	4
1:A:691:ILE:HG21	1:A:718:TRP:CE3	0.44	2.48	11	1
1:A:693:PHE:HB3	1:A:723:ALA:HB2	0.44	1.89	13	1
1:A:659:ASN:HD21	1:A:661:LYS:HB3	0.44	1.72	2	1
1:A:589:GLY:O	1:A:661:LYS:HG2	0.44	2.12	12	2
1:A:694:LEU:O	1:A:719:TYR:HA	0.43	2.13	1	2
1:A:656:GLY:HA3	1:A:673:TYR:HB3	0.43	1.90	3	3
1:A:679:TYR:HH	1:A:712:SER:HA	0.43	1.73	16	1
1:A:657:ARG:HD2	1:A:675:ASP:OD2	0.43	2.13	6	1
1:A:589:GLY:HA3	1:A:593:THR:O	0.43	2.14	19	1
1:A:690:LEU:O	1:A:715:ASN:HA	0.43	2.14	6	1
1:A:707:GLN:CG	1:A:715:ASN:HB3	0.43	2.43	14	1
1:A:591:ASN:HA	1:A:660:ALA:HB3	0.42	1.91	20	1
1:A:594:VAL:HB	1:A:662:LEU:HB2	0.42	1.90	20	1
1:A:687:ARG:HD3	1:A:714:TYR:CE2	0.42	2.49	10	2
1:A:592:CYS:N	1:A:660:ALA:HB1	0.42	2.29	16	1
1:A:683:LYS:HD2	1:A:683:LYS:N	0.42	2.30	11	1
1:A:606:THR:N	1:A:607:PRO:HD2	0.42	2.29	18	3
1:A:661:LYS:NZ	1:A:661:LYS:HB3	0.42	2.29	6	1
1:A:707:GLN:HG3	1:A:715:ASN:O	0.41	2.15	7	1
1:A:627:VAL:HA	1:A:671:LEU:CD2	0.41	2.45	16	1
1:A:608:LEU:CB	1:A:627:VAL:HG21	0.41	2.46	18	1
1:A:633:VAL:HG12	1:A:635:ALA:H	0.41	1.76	8	1
1:A:687:ARG:HD2	1:A:712:SER:O	0.41	2.16	9	1
1:A:626:ASN:HB2	1:A:631:VAL:HG12	0.41	1.91	7	1
1:A:644:GLN:HG2	1:A:655:LEU:HD11	0.41	1.93	7	2
1:A:653:TRP:HB3	1:A:687:ARG:NH1	0.41	2.31	16	1
1:A:696:ASP:HB3	1:A:719:TYR:CD1	0.41	2.50	12	1
1:A:596:ASP:OD1	1:A:598:GLN:HB2	0.40	2.17	18	1
1:A:608:LEU:HD11	1:A:722:TYR:CG	0.40	2.52	20	1

5.2 Torsion angles [i](#)

5.2.1 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	132/148 (89%)	120±2 (91±1%)	10±2 (7±2%)	2±1 (1±1%)	14	59
All	All	2640/2960 (89%)	2405 (91%)	196 (7%)	39 (1%)	14	59

All 10 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	684	ARG	11
1	A	712	SER	7
1	A	666	ASP	5
1	A	667	GLY	4
1	A	635	ALA	3
1	A	681	ASN	3
1	A	680	ASN	3
1	A	590	ASP	1
1	A	679	TYR	1
1	A	639	ASP	1

5.2.2 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	116/128 (91%)	112±1 (97±1%)	4±1 (3±1%)	40	87
All	All	2320/2560 (91%)	2242 (97%)	78 (3%)	40	87

All 21 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	615	LYS	16
1	A	598	GLN	12
1	A	684	ARG	7
1	A	671	LEU	6
1	A	659	ASN	5
1	A	687	ARG	4
1	A	588	GLU	4
1	A	661	LYS	3
1	A	603	PHE	3
1	A	679	TYR	3
1	A	620	LYS	3
1	A	715	ASN	2
1	A	707	GLN	2
1	A	611	LYS	1
1	A	714	TYR	1
1	A	644	GLN	1
1	A	617	GLU	1
1	A	586	ARG	1
1	A	705	GLU	1
1	A	618	THR	1
1	A	683	LYS	1

5.2.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.4 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.5 Ligand geometry ⓘ

There are no ligands in this entry.

5.6 Other polymers [i](#)

There are no such molecules in this entry.

5.7 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 87% for the well-defined parts and 84% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *assigned_chem_shift_list_1*

6.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	1608
Number of shifts mapped to atoms	1608
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	2

6.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	141	-0.43 ± 0.10	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	130	-0.61 ± 0.08	Should be applied
$^{13}\text{C}'$	135	0.07 ± 0.18	None needed (< 0.5 ppm)
^{15}N	135	-0.31 ± 0.37	None needed (< 0.5 ppm)

6.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 87%, i.e. 1399 atoms were assigned a chemical shift out of a possible 1608. 14 out of 14 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	639/649 (98%)	258/258 (100%)	256/266 (96%)	125/125 (100%)
Sidechain	650/784 (83%)	412/465 (89%)	225/277 (81%)	13/42 (31%)

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	Total	¹H	¹³C	¹⁵N
Aromatic	110/175 (63%)	70/91 (77%)	38/80 (48%)	2/4 (50%)
Overall	1399/1608 (87%)	740/814 (91%)	519/623 (83%)	140/171 (82%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 84%, i.e. 1489 atoms were assigned a chemical shift out of a possible 1781. 15 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	688/724 (95%)	277/288 (96%)	276/296 (93%)	135/140 (96%)
Sidechain	691/873 (79%)	438/516 (85%)	239/311 (77%)	14/46 (30%)
Aromatic	110/184 (60%)	70/96 (73%)	38/84 (45%)	2/4 (50%)
Overall	1489/1781 (84%)	785/900 (87%)	553/691 (80%)	151/190 (79%)

6.1.4 Statistically unusual chemical shifts ⓘ

The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	644	GLN	HE22	3.72	9.27 – 4.77	-7.3
1	A	704	PRO	HD3	0.86	5.52 – 1.72	-7.3

6.1.5 Random Coil Index (RCI) plots ⓘ

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:

