



Full wwPDB NMR Structure Validation Report ⓘ

Apr 27, 2016 – 02:26 AM BST

PDB ID : 2M5G
Title : Solution structure of FimA wt
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Deposited on : 2013-02-24

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
<http://wwpdb.org/validation/2016/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
Mogul : unknown
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : rb-20027457
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20027457

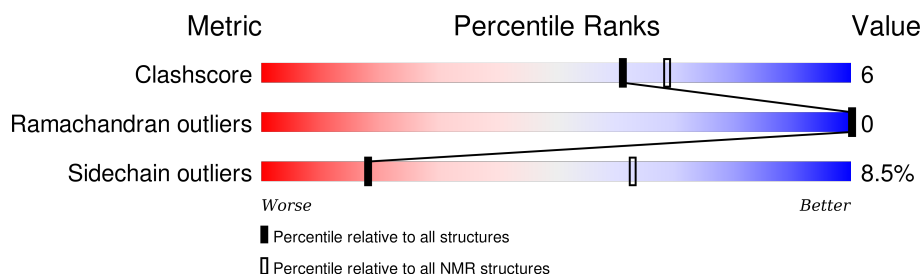
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 27%.

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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	159	 85% 8% • 6%

2 Ensemble composition and analysis

This entry contains 20 models. Model 18 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *minimized average structure*.

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:4-A:89, A:95-A:158 (150)	0.24	18

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 5 clusters. No single-model clusters were found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 2188 atoms, of which 1075 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Type-1 fimbrial protein, A chain.

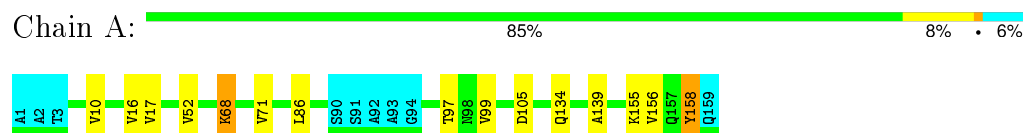
Mol	Chain	Residues	Atoms						Trace
1	A	159	Total	C	H	N	O	S	0
			2188	680	1075	196	235	2	

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: Type-1 fimbrial protein, A chain

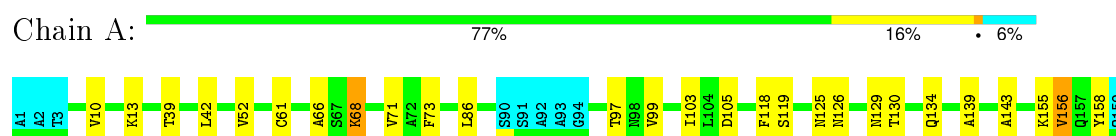


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

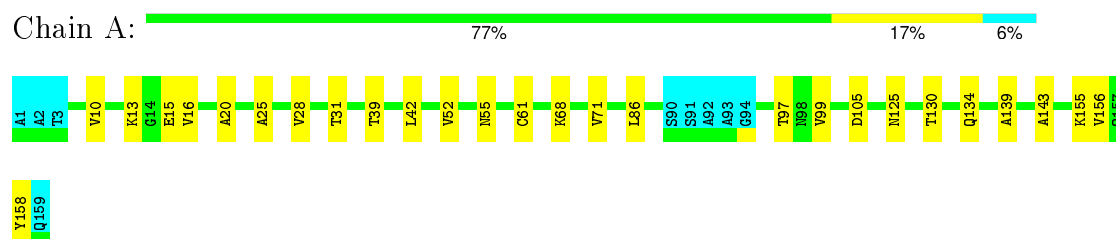
4.2.1 Score per residue for model 1

- Molecule 1: Type-1 fimbrial protein, A chain



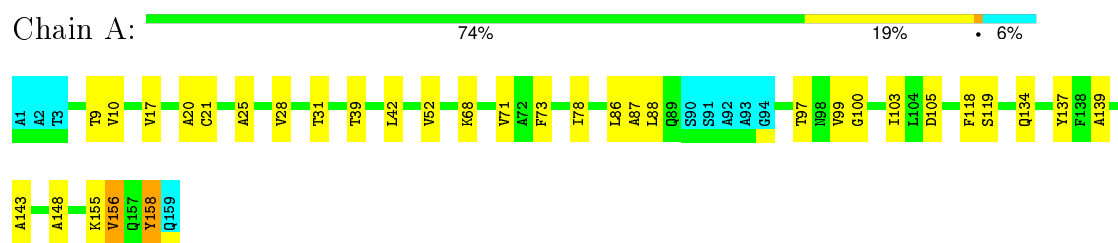
4.2.2 Score per residue for model 2

- Molecule 1: Type-1 fimbrial protein, A chain



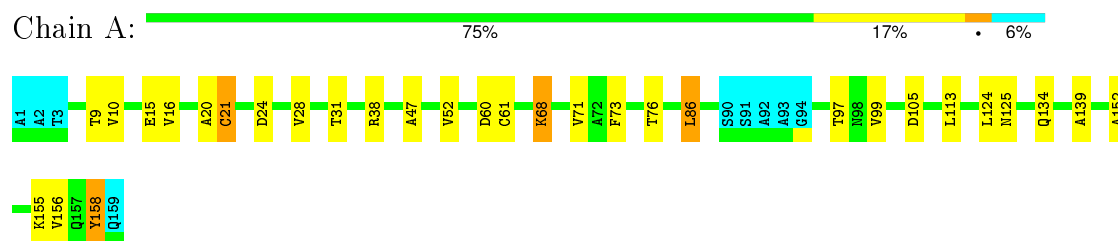
4.2.3 Score per residue for model 3

- Molecule 1: Type-1 fimbrial protein, A chain



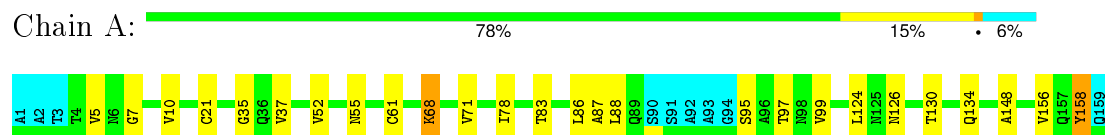
4.2.4 Score per residue for model 4

- Molecule 1: Type-1 fimbrial protein, A chain



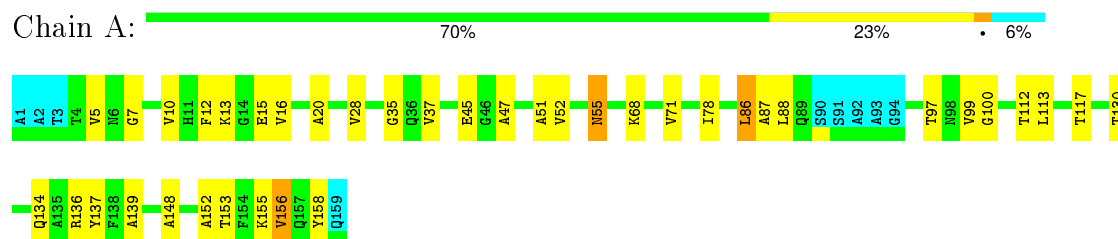
4.2.5 Score per residue for model 5

- Molecule 1: Type-1 fimbrial protein, A chain



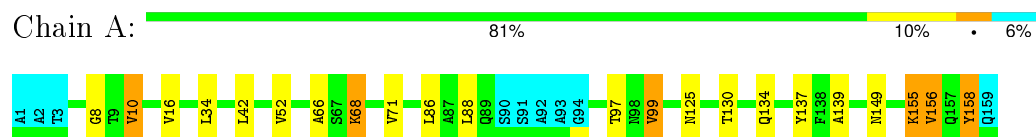
4.2.6 Score per residue for model 6

- Molecule 1: Type-1 fimbrial protein, A chain



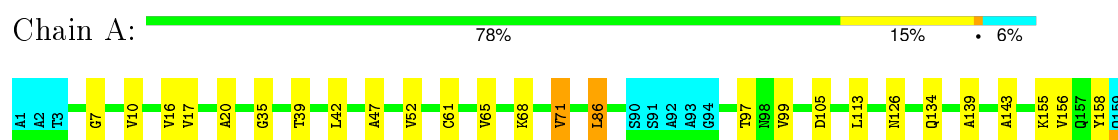
4.2.7 Score per residue for model 7

- Molecule 1: Type-1 fimbrial protein, A chain



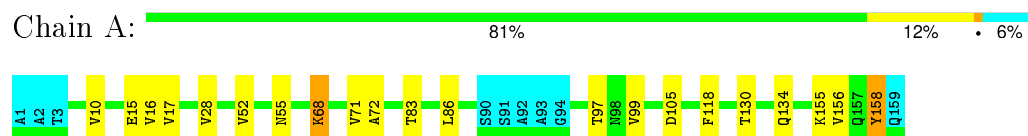
4.2.8 Score per residue for model 8

- Molecule 1: Type-1 fimbrial protein, A chain



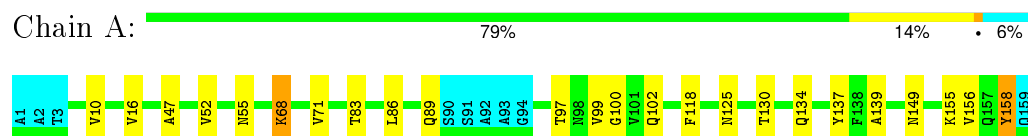
4.2.9 Score per residue for model 9

- Molecule 1: Type-1 fimbrial protein, A chain



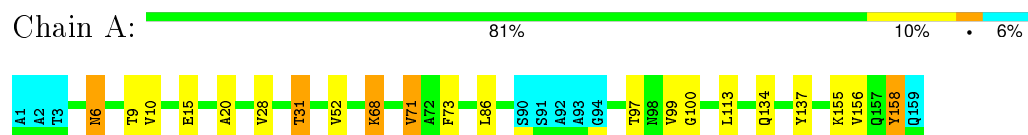
4.2.10 Score per residue for model 10

- Molecule 1: Type-1 fimbrial protein, A chain



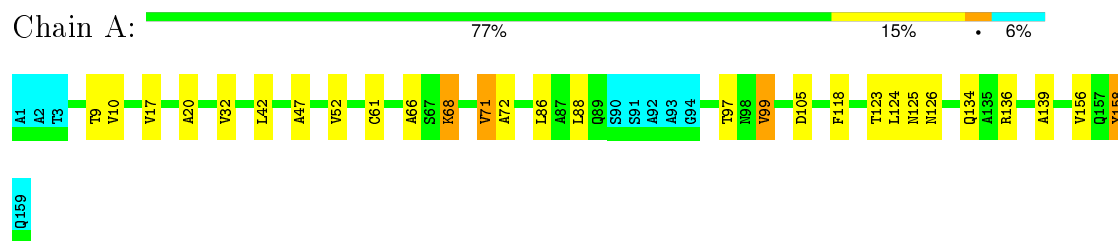
4.2.11 Score per residue for model 11

- Molecule 1: Type-1 fimbrial protein, A chain



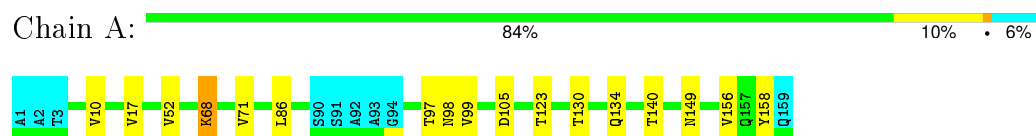
4.2.12 Score per residue for model 12

- Molecule 1: Type-1 fimbrial protein, A chain



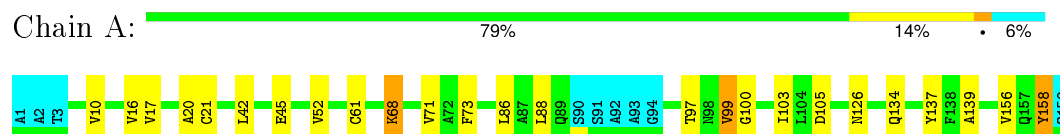
4.2.13 Score per residue for model 13

- Molecule 1: Type-1 fimbrial protein, A chain



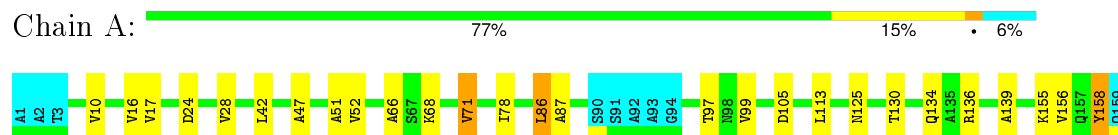
4.2.14 Score per residue for model 14

- Molecule 1: Type-1 fimbrial protein, A chain



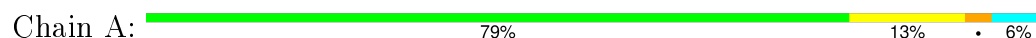
4.2.15 Score per residue for model 15

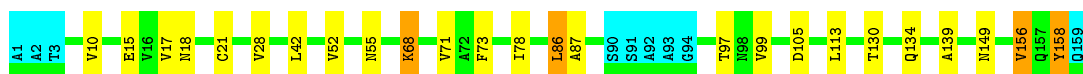
- Molecule 1: Type-1 fimbrial protein, A chain



4.2.16 Score per residue for model 16

- Molecule 1: Type-1 fimbrial protein, A chain

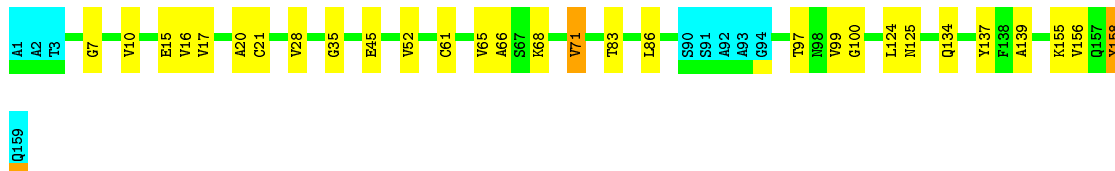




4.2.17 Score per residue for model 17

- Molecule 1: Type-1 fimbrial protein, A chain

Chain A: 76% 17% 6%



4.2.18 Score per residue for model 18 (medoid)

- Molecule 1: Type-1 fimbrial protein, A chain

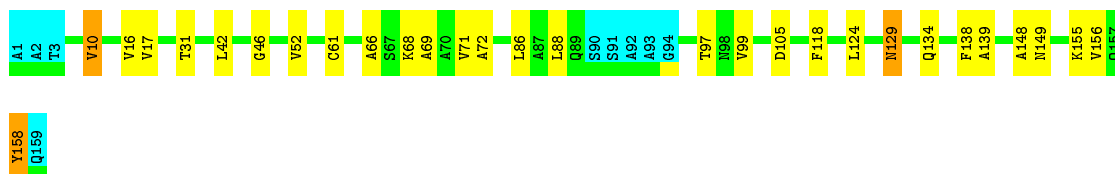
Chain A: 79% 16% 6%



4.2.19 Score per residue for model 19

- Molecule 1: Type-1 fimbrial protein, A chain

Chain A: 76% 16% 6%



4.2.20 Score per residue for model 20

- Molecule 1: Type-1 fimbrial protein, A chain

Chain A: 82% 11% 6%



5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
SPARKY	structure solution	
SPARKY	refinement	
CNS	refinement	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	2m5g_cs.str
Number of chemical shift lists	1
Total number of shifts	668
Number of shifts mapped to atoms	668
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	27%

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

6 Model quality [i](#)

6.1 Standard geometry [i](#)

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	1060	1025	1025	12±3
All	All	21200	20500	20500	233

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:15:GLU:HG3	1:A:28:VAL:HB	0.72	1.59	9	7
1:A:68:LYS:O	1:A:158:TYR:HA	0.68	1.86	16	12
1:A:68:LYS:HG3	1:A:123:THR:HA	0.62	1.71	12	2
1:A:71:VAL:HG12	1:A:156:VAL:HG12	0.61	1.72	20	20
1:A:17:VAL:HG21	1:A:156:VAL:HG22	0.61	1.72	20	9
1:A:105:ASP:OD1	1:A:119:SER:HB3	0.58	1.98	1	2
1:A:52:VAL:O	1:A:134:GLN:HA	0.57	2.00	18	20
1:A:48:THR:HB	1:A:136:ARG:HH11	0.57	1.60	20	1
1:A:86:LEU:HD22	1:A:113:LEU:HD13	0.56	1.76	6	3
1:A:61:CYS:O	1:A:126:ASN:HA	0.56	2.01	8	5
1:A:16:VAL:HG23	1:A:17:VAL:HG22	0.55	1.76	17	5
1:A:66:ALA:HB1	1:A:158:TYR:HB2	0.54	1.77	1	7
1:A:47:ALA:HB3	1:A:139:ALA:HB3	0.52	1.80	12	7
1:A:51:ALA:HA	1:A:136:ARG:HB3	0.52	1.82	6	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:39:THR:HB	1:A:143:ALA:O	0.51	2.05	3	4
1:A:42:LEU:HB3	1:A:139:ALA:HB2	0.51	1.82	15	10
1:A:45:GLU:HA	1:A:139:ALA:O	0.51	2.05	18	3
1:A:71:VAL:HA	1:A:156:VAL:HA	0.50	1.82	8	11
1:A:88:LEU:HG	1:A:148:ALA:HA	0.50	1.84	19	5
1:A:13:LYS:HA	1:A:28:VAL:O	0.49	2.06	2	1
1:A:17:VAL:HG21	1:A:156:VAL:CG2	0.49	2.37	16	4
1:A:100:GLY:O	1:A:137:TYR:HA	0.49	2.07	3	7
1:A:61:CYS:SG	1:A:124:LEU:HD22	0.48	2.47	19	2
1:A:88:LEU:HD21	1:A:99:VAL:O	0.48	2.08	7	3
1:A:8:GLY:HA3	1:A:137:TYR:OH	0.47	2.09	7	1
1:A:69:ALA:HB2	1:A:124:LEU:HD21	0.47	1.87	19	1
1:A:20:ALA:HB3	1:A:158:TYR:CE1	0.47	2.44	17	8
1:A:73:PHE:O	1:A:113:LEU:HA	0.46	2.10	4	4
1:A:72:ALA:HB2	1:A:118:PHE:CD1	0.46	2.46	9	3
1:A:118:PHE:HE1	1:A:155:LYS:HD2	0.46	1.71	9	3
1:A:9:THR:HB	1:A:31:THR:HG22	0.46	1.85	11	4
1:A:73:PHE:CE1	1:A:103:ILE:HG21	0.45	2.46	14	3
1:A:71:VAL:HA	1:A:155:LYS:O	0.45	2.11	3	2
1:A:16:VAL:HG21	1:A:155:LYS:HA	0.45	1.87	6	10
1:A:78:ILE:HA	1:A:87:ALA:HB2	0.45	1.89	5	5
1:A:118:PHE:CE1	1:A:155:LYS:HE3	0.44	2.47	10	1
1:A:20:ALA:O	1:A:61:CYS:HA	0.44	2.12	14	1
1:A:7:GLY:HA2	1:A:35:GLY:C	0.44	2.33	17	4
1:A:10:VAL:HG22	1:A:34:LEU:HD21	0.44	1.90	7	1
1:A:51:ALA:CA	1:A:136:ARG:HB3	0.43	2.43	6	1
1:A:12:PHE:HA	1:A:152:ALA:O	0.43	2.12	6	1
1:A:61:CYS:SG	1:A:124:LEU:HD13	0.43	2.53	4	4
1:A:20:ALA:HB3	1:A:158:TYR:CD1	0.43	2.48	8	1
1:A:55:ASN:HB2	1:A:130:THR:HG22	0.43	1.90	6	4
1:A:25:ALA:HA	1:A:28:VAL:HG22	0.43	1.91	3	2
1:A:112:THR:HB	1:A:117:THR:OG1	0.42	2.13	6	1
1:A:24:ASP:O	1:A:28:VAL:HG13	0.42	2.13	4	2
1:A:51:ALA:HB2	1:A:136:ARG:HB3	0.42	1.92	15	1
1:A:5:VAL:HG22	1:A:37:VAL:HG12	0.42	1.92	6	2
1:A:98:ASN:HA	1:A:140:THR:OG1	0.42	2.14	13	1
1:A:129:ASN:N	1:A:129:ASN:HD22	0.41	2.13	19	1
1:A:10:VAL:O	1:A:31:THR:HA	0.41	2.15	19	1
1:A:21:CYS:HA	1:A:60:ASP:O	0.41	2.16	4	1
1:A:13:LYS:HB3	1:A:153:THR:HG22	0.41	1.93	6	1
1:A:86:LEU:HD22	1:A:113:LEU:CD1	0.41	2.46	16	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:20:ALA:HB2	1:A:65:VAL:HG13	0.40	1.93	17	1
1:A:89:GLN:HG2	1:A:149:ASN:O	0.40	2.16	10	1
1:A:46:GLY:HA2	1:A:138:PHE:CZ	0.40	2.51	19	1
1:A:9:THR:HA	1:A:32:VAL:O	0.40	2.17	12	1
1:A:6:ASN:N	1:A:6:ASN:HD22	0.40	2.14	11	1
1:A:86:LEU:HD21	1:A:152:ALA:HB2	0.40	1.92	4	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	150/159 (94%)	134±2 (89±1%)	16±2 (11±1%)	0±0 (0±0%)	100	100
All	All	3000/3180 (94%)	2678 (89%)	322 (11%)	0 (0%)	100	100

There are no Ramachandran outliers.

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	108/112 (96%)	99±1 (91±1%)	9±1 (9±1%)	18	63
All	All	2160/2240 (96%)	1976 (91%)	184 (9%)	18	63

All 29 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	86	LEU	20
1	A	97	THR	20

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Mol	Chain	Res	Type	Models (Total)
1	A	68	LYS	20
1	A	10	VAL	20
1	A	99	VAL	20
1	A	158	TYR	13
1	A	105	ASP	11
1	A	125	ASN	9
1	A	130	THR	6
1	A	21	CYS	6
1	A	156	VAL	5
1	A	71	VAL	5
1	A	83	THR	4
1	A	149	ASN	4
1	A	55	ASN	3
1	A	31	THR	3
1	A	129	ASN	2
1	A	155	LYS	2
1	A	61	CYS	1
1	A	44	GLN	1
1	A	18	ASN	1
1	A	136	ARG	1
1	A	95	SER	1
1	A	76	THR	1
1	A	45	GLU	1
1	A	6	ASN	1
1	A	102	GLN	1
1	A	38	ARG	1
1	A	13	LYS	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 ⓘ

There are no carbohydrates in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

There are no such molecules in this entry.

6.8 Polymer linkage issues

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 27% for the well-defined parts and 26% for the entire structure.

7.1 Chemical shift list 1

File name: 2m5g_cs.str

Chemical shift list name: *assigned_chem_shift_list_1*

7.1.1 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	668
Number of shifts mapped to atoms	668
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	4

7.1.2 Chemical shift referencing

No chemical shift referencing corrections were calculated (not enough data).

7.1.3 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 27%, i.e. 420 atoms were assigned a chemical shift out of a possible 1579. 0 out of 25 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	0/746 (0%)	0/298 (0%)	0/300 (0%)	0/148 (0%)
Sidechain	382/740 (52%)	382/417 (92%)	0/291 (0%)	0/32 (0%)
Aromatic	38/93 (41%)	38/51 (75%)	0/40 (0%)	0/2 (0%)
Overall	420/1579 (27%)	420/766 (55%)	0/631 (0%)	0/182 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 26%, i.e. 434 atoms were assigned a chemical shift out of a possible 1652. 0 out of 25 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	0/791 (0%)	0/316 (0%)	0/318 (0%)	0/157 (0%)
Sidechain	396/768 (52%)	396/433 (91%)	0/302 (0%)	0/33 (0%)
Aromatic	38/93 (41%)	38/51 (75%)	0/40 (0%)	0/2 (0%)
Overall	434/1652 (26%)	434/800 (54%)	0/660 (0%)	0/192 (0%)

7.1.4 Statistically unusual chemical shifts [i](#)

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, <i>ppm</i>	Expected range, <i>ppm</i>	Z-score
1	A	133	PHE	HB2	0.40	4.85 – 1.15	-7.0
1	A	72	ALA	HB1	-0.12	2.61 – 0.11	-5.9
1	A	72	ALA	HB2	-0.12	2.61 – 0.11	-5.9
1	A	72	ALA	HB3	-0.12	2.61 – 0.11	-5.9

7.1.5 Random Coil Index (RCI) plots [i](#)

No *random coil index* (RCI) plot could be generated from the current chemical shift list (assigned_chem_shift_list_1). RCI is only applicable to proteins.