wwPDB NMR Structure Validation Summary Report (i)

Feb 20, 2022 – 12:27 AM EST

PDB ID	:	1T1H
Title	:	NMR solution structure of the U box domain from AtPUB14, an armadillo repeat containing protein from Arabidopsis thaliana
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Deposited on	:	2004-04-16

This is a wwPDB NMR Structure Validation Summary 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 (i) symbol.

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

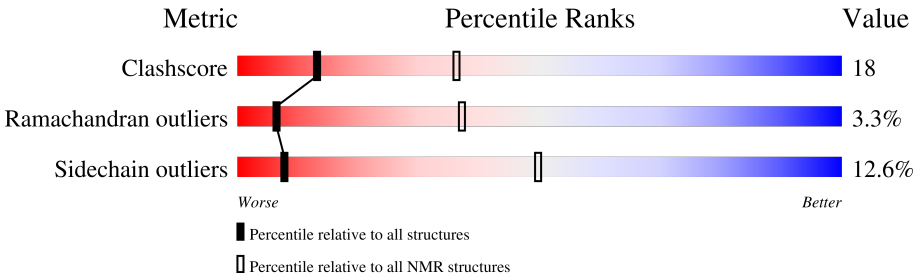
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.26
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.26

1 Overall quality at a glance (i)

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	78	49% 37% • 10%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 10 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:252-A:321 (70)	0.40	10

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 2 clusters. No single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1225 atoms, of which 610 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called armadillo repeat containing protein.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	78	1225	393	610	100	118	4	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	244	GLY	-	cloning artifact	UNP Q8VZ40
A	245	SER	-	cloning artifact	UNP Q8VZ40
A	246	PRO	-	cloning artifact	UNP Q8VZ40
A	247	GLU	-	cloning artifact	UNP Q8VZ40
A	248	PHE	-	cloning artifact	UNP Q8VZ40

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: armadillo repeat containing protein

Chain A: 49% 37% • 10%

G244 S245 P246 E247 F248 P249 E250 Y251 F252 R253 C254 L258 E259 L260 M261 K262 D263 P264 V265 I266 V267 S268 T269 G270 Q271 T272 Y273 E274 I278 W281 C289 P290 K291 S292 Q293 E294 T295 L296 L297 N304 Y305 V306 L307 L310 I311 A312 L313 W314 C315 I320 E321

4.2 Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 10. Colouring as in section 4.1 above.

- Molecule 1: armadillo repeat containing protein

Chain A: 50% 32% 8% 10%

G244 S245 P246 E247 F248 P249 E250 Y251 F252 R253 C254 P255 I256 S257 L258 E259 L260 M261 K262 D263 P264 V265 I266 V267 S268 Q271 T272 Y273 E274 S277 I278 Q279 K280 W281 C289 Q293 L297 N304 Y305 V306 L307 L310 I311 A312 L313 W314 C315 I320 E321

5 Refinement protocol and experimental data overview (i)

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

Of the 200 calculated structures, 20 were deposited, based on the following criterion: *structures with favorable non-bond energy, structures with the least restraint violations.*

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

Software name	Classification	Version
CYANA	structure solution	
X-PLOR	structure solution	V3.840
CNS	refinement	1.1

No chemical shift data was provided.

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	550	556	556	20±5
All	All	11000	11120	11120	404

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 18.

5 of 186 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:260:LEU:HB2	1:A:320:ILE:HG21	0.81	1.50	12	1
1:A:261:MET:HB3	1:A:274:GLU:HB2	0.81	1.51	9	9
1:A:256:ILE:HG21	1:A:277:SER:HB3	0.74	1.57	13	6
1:A:261:MET:HG2	1:A:274:GLU:HB2	0.73	1.57	12	4
1:A:310:LEU:O	1:A:313:LEU:HG	0.72	1.84	13	14

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	69/78 (88%)	58±2 (83±2%)	9±1 (13±2%)	2±1 (3±2%)	6 37
All	All	1380/1560 (88%)	1151 (83%)	183 (13%)	46 (3%)	6 37

5 of 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	295	THR	10
1	A	260	LEU	9
1	A	261	MET	7
1	A	297	LEU	6
1	A	298	HIS	4

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	63/70 (90%)	55±2 (87±3%)	8±2 (13±3%)	8 50
All	All	1260/1400 (90%)	1101 (87%)	159 (13%)	8 50

5 of 30 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	281	TRP	20
1	A	262	LYS	16
1	A	258	LEU	11
1	A	266	ILE	10
1	A	260	LEU	9

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)

There are no chain breaks in this entry.

7 Chemical shift validation (i)

No chemical shift data were provided