wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	1V86
Title	:	Solution structure of the ubiquitin domain from mouse D7Wsu128e protein
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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
http://wwpdb.org/validation/2016/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:

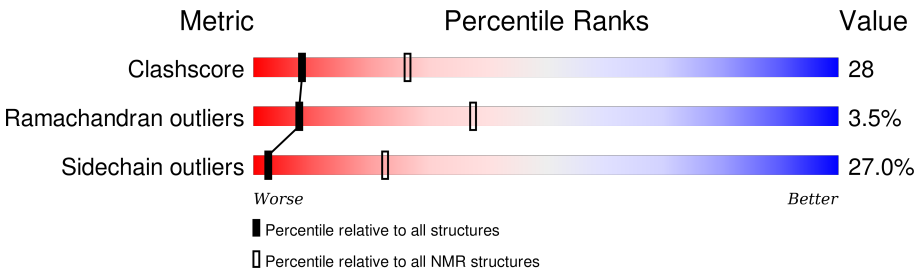
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Mogul	:	unknown
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	rb-20027457
Ideal 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 (i)

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment is 94%.

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	95	26% 43% • 26%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 17 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:16-A:85 (70)	0.20	17

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 and 7 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1410 atoms, of which 724 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called DNA segment, Chr 7, Wayne State University 128, expressed.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	95	1410	430	724	118	135	3	0

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	CLONING ARTIFACT	GB 20070398
A	2	SER	-	CLONING ARTIFACT	GB 20070398
A	3	SER	-	CLONING ARTIFACT	GB 20070398
A	4	GLY	-	CLONING ARTIFACT	GB 20070398
A	5	SER	-	CLONING ARTIFACT	GB 20070398
A	6	SER	-	CLONING ARTIFACT	GB 20070398
A	7	GLY	-	CLONING ARTIFACT	GB 20070398
A	90	SER	-	CLONING ARTIFACT	GB 20070398
A	91	GLY	-	CLONING ARTIFACT	GB 20070398
A	92	PRO	-	CLONING ARTIFACT	GB 20070398
A	93	SER	-	CLONING ARTIFACT	GB 20070398
A	94	SER	-	CLONING ARTIFACT	GB 20070398
A	95	GLY	-	CLONING ARTIFACT	GB 20070398

4 Residue-property plots (i)

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: DNA segment, Chr 7, Wayne State University 128, expressed

Chain A: 26% 43% • 26%

G1 S2 S3 G4 S5 S6 G7 D8 A9 G10 G11 G12 V13 G14 K15 E16 L17 V18 D19 L20 K21 I22 I23 W24 N25 K26 T27 K28 V31 K32 V33 P34 L35 D36 S37 T38 G39 S40 E41 L42 K43 Q44 K45 I46 H47 S48 I49 T50 G51 L52 M56 Q57 K58 Y61 L64 V65

D68 K69 T70 L71 R72 E73 I74 K75 V76 A80 K81 I82 M83 V84 V85 G86 S87 T88 I89 S90 G91 P92 S93 S94 G95

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

The representative model is number 17. Colouring as in section 4.1 above.

- Molecule 1: DNA segment, Chr 7, Wayne State University 128, expressed

Chain A: 37% 31% 5% • 26%

G1 S2 S3 G4 S5 S6 G7 D8 A9 G10 G11 G12 V13 G14 K15 E16 L17 V18 D19 L20 K21 I22 N25 K26 T27 K28 V31 K32 V33 P34 L35 D36 S37 T38 E41 L42 I46 H47 S48 I49 L52 K58 L64 V65 D68 K69 T70 L71 I74 K75 V76

A80 K81 I82 M83 V84 V85 G86 S87 T88 I89 S90 G91 P92 S93 S94 G95

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *torsion angle dynamics, restrainted molecular dynamics.*

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *structures with the least restraint violations, structures with the lowest energy, target function.*

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

Software name	Classification	Version
CYANA	structure solution	1.0.7
CYANA	refinement	1.0.7

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)	BMRB entry 10112
Number of chemical shift lists	1
Total number of shifts	1158
Number of shifts mapped to atoms	1158
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	94%

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	547	598	598	32±5
All	All	10940	11960	11960	647

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 28.

5 of 148 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:31:VAL:HG11	1:A:49:ILE:HD13	1.07	1.22	9	20
1:A:42:LEU:HD11	1:A:71:LEU:HD21	1.04	1.20	19	19
1:A:20:LEU:HD22	1:A:80:ALA:HB3	0.95	1.37	20	12
1:A:42:LEU:HD11	1:A:71:LEU:CD2	0.93	1.93	18	18
1:A:70:THR:O	1:A:74:ILE:HG23	0.89	1.67	6	19

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	70/95 (74%)	61±1 (87±2%)	7±2 (9±2%)	2±1 (4±1%)	8 37
All	All	1400/1900 (74%)	1219 (87%)	132 (9%)	49 (4%)	8 37

All 5 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	26	LYS	18
1	A	75	LYS	15
1	A	17	LEU	10
1	A	25	ASN	4
1	A	39	GLY	2

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	64/78 (82%)	47±2 (73±4%)	17±2 (27±4%)	2 22
All	All	1280/1560 (82%)	934 (73%)	346 (27%)	2 22

5 of 35 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	64	LEU	20
1	A	52	LEU	20
1	A	74	ILE	20
1	A	17	LEU	18
1	A	47	HIS	16

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 carbohydrates 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)

The completeness of assignment taking into account all chemical shift lists is 94% for the well-defined parts and 95% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 10112

Chemical shift list name: *assigned_ chem_ shift_ list_ 1*

7.1.1 Bookkeeping (i)

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	1158
Number of shifts mapped to atoms	1158
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

7.1.2 Chemical shift referencing (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	95	-0.17 ± 0.21	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	81	0.22 ± 0.13	None needed (< 0.5 ppm)
$^{13}C'$	93	-0.19 ± 0.14	None needed (< 0.5 ppm)
^{15}N	88	0.30 ± 0.35	None needed (< 0.5 ppm)

7.1.3 Completeness of resonance assignments (i)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 94%, i.e. 831 atoms were assigned a chemical shift out of a possible 881. 0 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	341/342 (100%)	136/136 (100%)	139/140 (99%)	66/66 (100%)
Sidechain	462/505 (91%)	282/295 (96%)	176/193 (91%)	4/17 (24%)

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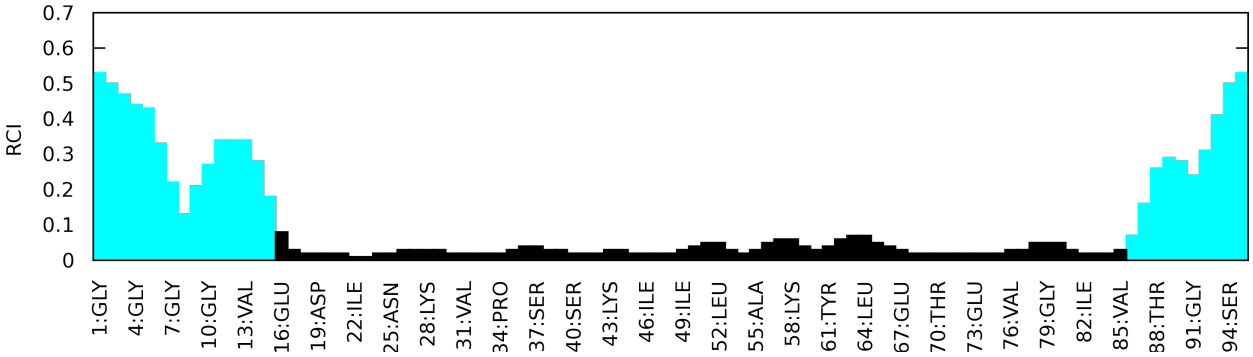
	Total	^{1}H	^{13}C	^{15}N
Aromatic	28/34 (82%)	14/18 (78%)	13/13 (100%)	1/3 (33%)
Overall	831/881 (94%)	432/449 (96%)	328/346 (95%)	71/86 (83%)

7.1.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

7.1.5 Random Coil Index (RCI) plots (i)

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: