wwPDB NMR Structure Validation Summary Report

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PDB ID	:	2KKR
BMRB ID	:	16397
Title	:	Solution structure of SCA7 zinc finger domain from human ataxin-7 protein
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Deposited on	:	2009-06-29

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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

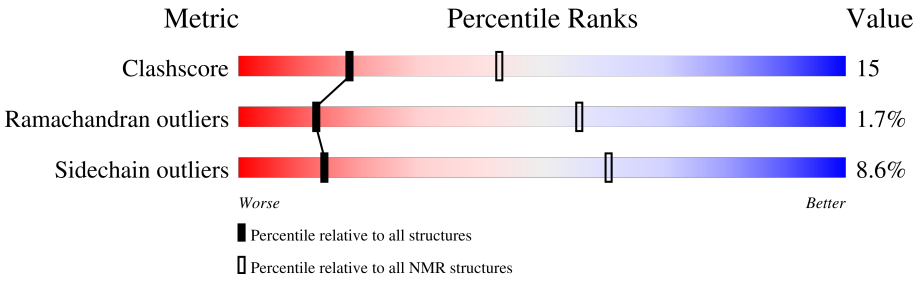
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 51%.

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	74	47% 22% • 7% 20%

2 Ensemble composition and analysis

This entry contains 20 models. Model 6 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:341-A:394 (54)	0.41	6

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 2 single-model clusters were found.

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

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 986 atoms, of which 499 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Ataxin-7.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	59	985	296	499	99	88	3	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	328	GLY	-	expression tag	UNP O15265
A	329	SER	-	expression tag	UNP O15265

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	
			Total	Zn
2	A	1	1	1

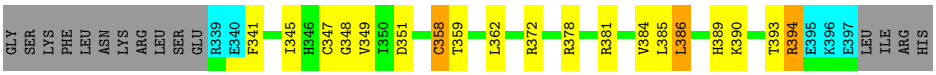
4 Residue-property plots

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: Ataxin-7

Chain A:



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

The representative model is number 6. Colouring as in section 4.1 above.

- Molecule 1: Ataxin-7

Chain A:

5 Refinement protocol and experimental data overview

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

Of the 64 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
X-PLOR NIH	structure solution	
X-PLOR NIH	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)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	540
Number of shifts mapped to atoms	433
Number of unparsed shifts	0
Number of shifts with mapping errors	107
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	51%

6 Model quality

6.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN

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	1.25±0.05	2±1/446 (0.4± 0.3%)	0.94±0.02	0±0/598 (0.0± 0.0%)
All	All	1.25	38/8920 (0.4%)	0.94	0/11960 (0.0%)

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	0.4±0.6
All	All	0	8

5 of 7 unique bond 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(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	346	HIS	CG-CD2	-9.88	1.19	1.35	19	1
1	A	358	CYS	N-CA	-7.14	1.32	1.46	19	20
1	A	358	CYS	CA-CB	-6.08	1.40	1.53	19	10
1	A	393	THR	C-N	-5.48	1.21	1.34	16	3
1	A	358	CYS	C-N	-5.27	1.22	1.34	19	2

There are no bond-angle outliers.

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	372	ARG	Sidechain	4

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	379	ARG	Sidechain	3
1	A	373	ARG	Sidechain	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	439	455	454	13±3
All	All	8800	9100	9073	263

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 15.

5 of 59 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:389:HIS:CE1	1:A:393:THR:HB	0.83	2.09	9	20
1:A:349:VAL:O	1:A:358:CYS:HB2	0.76	1.80	1	18
1:A:390:LYS:O	1:A:394:ARG:HB3	0.75	1.82	11	15
1:A:362:LEU:HD22	1:A:385:LEU:HD11	0.66	1.66	19	5
1:A:381:ARG:O	1:A:384:VAL:HG12	0.61	1.95	18	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	54/74 (73%)	45±1 (83±2%)	8±1 (15±2%)	1±1 (2±2%)	13	56
All	All	1080/1480 (73%)	897 (83%)	165 (15%)	18 (2%)	13	56

All 4 unique Ramachandran outliers are listed below. They are sorted by the frequency of occur-

rence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	394	ARG	11
1	A	364	CYS	4
1	A	377	GLY	2
1	A	357	PRO	1

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	50/69 (72%)	46±1 (91±3%)	4±1 (9±3%)	14	61
All	All	1000/1380 (72%)	914 (91%)	86 (9%)	14	61

5 of 16 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	372	ARG	20
1	A	386	LEU	20
1	A	345	ILE	19
1	A	359	THR	7
1	A	352	LEU	4

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

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

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 51% for the well-defined parts and 50% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

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	540
Number of shifts mapped to atoms	433
Number of unparsed shifts	0
Number of shifts with mapping errors	107
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	2

The following assigned chemical shifts were not mapped to the molecules present in the coordinate file.

- No matching atom found in the structure. First 5 (of 107) occurrences are reported below.

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	330	LYS	H	8.502	0.020	1
1	A	330	LYS	HA	4.272	0.020	1
1	A	330	LYS	HB2	1.849	0.020	2
1	A	330	LYS	HB3	1.661	0.020	2
1	A	330	LYS	HD2	1.836	0.020	2
1	A	330	LYS	HD3	1.651	0.020	2
1	A	330	LYS	HE2	3.208	0.020	2
1	A	330	LYS	HE3	2.98	0.020	2
1	A	330	LYS	HG2	1.447	0.020	2
1	A	330	LYS	HG3	1.295	0.020	2
1	A	331	PHE	H	8.255	0.020	1
1	A	331	PHE	HA	4.617	0.020	1
1	A	331	PHE	HB2	3.155	0.020	2
1	A	331	PHE	HB3	2.987	0.020	2

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List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	331	PHE	HD1	7.259	0.020	3
1	A	331	PHE	HD2	7.259	0.020	3
1	A	331	PHE	HE1	7.376	0.020	3
1	A	331	PHE	HE2	7.376	0.020	3
1	A	331	PHE	HZ	7.335	0.020	1
1	A	332	LEU	H	8.122	0.020	1
1	A	332	LEU	HA	4.303	0.020	1
1	A	332	LEU	HB2	1.608	0.020	2
1	A	332	LEU	HB3	1.549	0.020	2
1	A	332	LEU	HD11	0.922	0.020	.
1	A	332	LEU	HD12	0.922	0.020	.
1	A	332	LEU	HD13	0.922	0.020	.
1	A	332	LEU	HD21	0.864	0.020	.
1	A	332	LEU	HD22	0.864	0.020	.
1	A	332	LEU	HD23	0.864	0.020	.
1	A	332	LEU	HG	1.666	0.020	1
1	A	333	ASN	H	8.342	0.020	1
1	A	333	ASN	HA	4.634	0.020	1
1	A	333	ASN	HB2	2.86	0.020	2
1	A	333	ASN	HB3	2.752	0.020	2
1	A	333	ASN	HD21	7.668	0.020	2
1	A	333	ASN	HD22	6.97	0.020	2
1	A	334	LYS	H	8.25	0.020	1
1	A	334	LYS	HA	4.28	0.020	1
1	A	334	LYS	HB2	1.851	0.020	2
1	A	334	LYS	HB3	1.76	0.020	2
1	A	334	LYS	HD2	1.687	0.020	2
1	A	334	LYS	HD3	1.687	0.020	2
1	A	334	LYS	HG2	1.407	0.020	2
1	A	334	LYS	HG3	1.453	0.020	2
1	A	335	ARG	H	8.411	0.020	1
1	A	335	ARG	HA	4.316	0.020	1
1	A	335	ARG	HB2	2.077	0.020	2
1	A	335	ARG	HB3	1.888	0.020	2
1	A	335	ARG	HG2	1.788	0.020	2
1	A	335	ARG	HG3	1.626	0.020	2
1	A	336	LEU	H	8.335	0.020	1
1	A	336	LEU	HA	4.29	0.020	1
1	A	336	LEU	HB2	1.703	0.020	2
1	A	336	LEU	HB3	1.65	0.020	2
1	A	336	LEU	HD11	0.939	0.020	.

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List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	336	LEU	HD12	0.939	0.020	.
1	A	336	LEU	HD13	0.939	0.020	.
1	A	336	LEU	HD21	0.882	0.020	.
1	A	336	LEU	HD22	0.882	0.020	.
1	A	336	LEU	HD23	0.882	0.020	.
1	A	336	LEU	HG	1.55	0.020	1
1	A	337	SER	H	8.283	0.020	1
1	A	337	SER	HA	4.462	0.020	1
1	A	337	SER	HB2	3.929	0.020	2
1	A	337	SER	HB3	3.876	0.020	2
1	A	338	GLU	H	8.305	0.020	1
1	A	338	GLU	HA	4.357	0.020	1
1	A	338	GLU	HB2	2.12	0.020	2
1	A	338	GLU	HB3	1.988	0.020	2
1	A	338	GLU	HG2	2.298	0.020	2
1	A	338	GLU	HG3	2.269	0.020	2
1	A	398	LEU	H	8.099	0.020	1
1	A	398	LEU	HA	4.312	0.020	1
1	A	398	LEU	HB2	1.664	0.020	2
1	A	398	LEU	HB3	1.582	0.020	2
1	A	398	LEU	HD11	0.925	0.020	.
1	A	398	LEU	HD12	0.925	0.020	.
1	A	398	LEU	HD13	0.925	0.020	.
1	A	398	LEU	HD21	0.869	0.020	.
1	A	398	LEU	HD22	0.869	0.020	.
1	A	398	LEU	HD23	0.869	0.020	.
1	A	398	LEU	HG	1.547	0.020	1
1	A	399	ILE	H	7.985	0.020	1
1	A	399	ILE	HA	4.116	0.020	1
1	A	399	ILE	HB	1.825	0.020	1
1	A	399	ILE	HD11	0.853	0.020	.
1	A	399	ILE	HD12	0.853	0.020	.
1	A	399	ILE	HD13	0.853	0.020	.
1	A	399	ILE	HG12	1.466	0.020	2
1	A	399	ILE	HG13	1.186	0.020	2
1	A	399	ILE	HG21	0.797	0.020	.
1	A	399	ILE	HG22	0.797	0.020	.
1	A	399	ILE	HG23	0.797	0.020	.
1	A	400	ARG	H	8.324	0.020	1
1	A	400	ARG	HA	4.346	0.020	1
1	A	400	ARG	HB2	1.835	0.020	2

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List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	400	ARG	HB3	1.72	0.020	2
1	A	400	ARG	HD2	3.192	0.020	2
1	A	400	ARG	HD3	3.192	0.020	2
1	A	400	ARG	HG2	1.635	0.020	2
1	A	400	ARG	HG3	1.59	0.020	2
1	A	401	HIS	H	8.076	0.020	1
1	A	401	HIS	HA	4.462	0.020	1
1	A	401	HIS	HB2	3.2	0.020	2
1	A	401	HIS	HB3	3.057	0.020	2
1	A	401	HIS	HD2	7.153	0.020	1
1	A	401	HIS	HE1	8.262	0.020	1

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 51%, i.e. 396 atoms were assigned a chemical shift out of a possible 781. 0 out of 8 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	108/268 (40%)	108/108 (100%)	0/108 (0%)	0/52 (0%)
Sidechain	273/471 (58%)	273/301 (91%)	0/140 (0%)	0/30 (0%)
Aromatic	15/42 (36%)	15/22 (68%)	0/16 (0%)	0/4 (0%)
Overall	396/781 (51%)	396/431 (92%)	0/264 (0%)	0/86 (0%)

7.1.4 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.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	359	THR	HG1	7.73	0.08 – 2.19	31.2
1	A	342	ASP	H	11.16	5.52 – 11.08	5.2

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.If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A: