wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	1A60
Title	:	NMR STRUCTURE OF A CLASSICAL PSEUDOKNOT: INTERPLAY OF SINGLE-AND DOUBLE-STRANDED RNA, 24 STRUCTURES
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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
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:

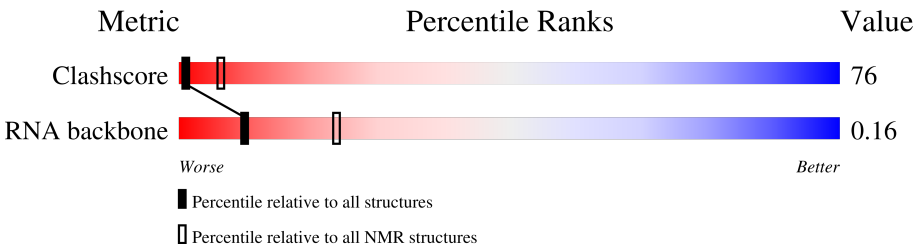
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.26
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
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
RNA backbone	4643	676

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	44	20% 48% 32%

2 Ensemble composition and analysis (i)

This entry contains 24 models. This entry does not contain polypeptide chains, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1400 atoms, of which 477 are hydrogens and 0 are deuteriums.

- Molecule 1 is a RNA chain called TYMV PSEUDOKNOT.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	P	
1	A	44	1400	414	477	159	307	43	0

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: TYMV PSEUDOKNOT

Chain A: 20% 48% 32%

G1 G2 G3 A4 G5 C6 U7 C8 A9 A10 C11 U12 C13 U14 C15 C16 C17 C18 C19 C20 C21 U22 U23 U24 U25 C26 C27 G28 A29 G30 G31 G32 U33 C34 A35 U36 C37 G38 G39 A40 A41 C42 C43 A44

4.2 Residue scores for the first model from the NMR ensemble

No representative models were identified. Colouring as in section 4.1 above.

• Molecule 1: TYMV PSEUDOKNOT

Chain A: • 25% 45% 27%

G1 G2 G3 A4 G5 C6 U7 C8 A9 A10 C11 U12 C13 U14 C15 C16 C17 C18 C19 C20 C21 U22 U23 U24 U25 C26 C27 G28 A29 G30 G31 G32 U33 C34 A35 U36 C37 G38 G39 A40 A41 C42 C43 A44

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *TORSION ANGLE DYNAMICS/ SIMULATED ANNEALING*.

Of the 140 calculated structures, 24 were deposited, based on the following criterion: *LEAST RESTRAINT VIOLATIONS*.

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

Software name	Classification	Version
X-PLOR	refinement	3.851
X-PLOR	structure solution	3.851

No chemical shift data was provided.

6 Model quality (i)

6.1 Standard geometry (i)

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	1.29±0.02	1±1/1028 (0.1± 0.1%)	2.09±0.03	60±5/1598 (3.7± 0.3%)
All	All	1.29	31/24672 (0.1%)	2.09	1432/38352 (3.7%)

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	14.0±2.3
All	All	0	337

All 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	35	A	N9-C8	-7.12	1.32	1.37	22	14
1	A	1	G	N9-C8	-5.64	1.33	1.37	8	11
1	A	40	A	C2'-C1'	-5.14	1.47	1.53	2	2
1	A	4	A	C2'-C1'	-5.08	1.47	1.53	10	3
1	A	20	C	N1-C6	-5.05	1.34	1.37	12	1

5 of 114 unique angle 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(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	32	G	N7-C8-N9	11.72	118.96	113.10	14	24
1	A	2	G	O4'-C1'-N9	11.58	117.47	108.20	12	13
1	A	3	G	N7-C8-N9	10.49	118.34	113.10	12	24
1	A	1	G	N7-C8-N9	10.28	118.24	113.10	14	24
1	A	35	A	N7-C8-N9	10.02	118.81	113.80	22	24

There are no chirality outliers.

5 of 23 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	13	C	Sidechain	24
1	A	32	G	Sidechain	24
1	A	5	G	Sidechain	22
1	A	29	A	Sidechain	22
1	A	15	C	Sidechain	21

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	923	477	477	107±24
All	All	22152	11448	11447	2559

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 76.

5 of 539 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:20:C:O2	1:A:35:A:C2	1.34	1.81	14	24
1:A:20:C:O2	1:A:35:A:N1	1.25	1.66	14	24
1:A:17:C:H6	1:A:17:C:P	1.23	1.56	15	1
1:A:19:C:O2'	1:A:20:C:O5'	1.23	1.57	14	1
1:A:39:G:H2'	1:A:40:A:N7	1.22	1.50	13	11

6.3 Torsion angles (i)

6.3.1 Protein backbone (i)

There are no protein molecules in this entry.

6.3.2 Protein sidechains (i)

There are no protein molecules in this entry.

6.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers	Suiteness
1	A	43/44 (98%)	13±3 (30±8%)	3±1 (6±3%)	0.16±0.05
All	All	1044/1056 (99%)	307 (29%)	67 (6%)	0.16

The overall RNA backbone suiteness is 0.16.

5 of 35 unique RNA backbone outliers are listed below:

Mol	Chain	Res	Type	Models (Total)
1	A	8	C	24
1	A	22	U	24
1	A	33	U	24
1	A	36	U	24
1	A	44	A	24

5 of 10 unique RNA pucker outliers are listed below:

Mol	Chain	Res	Type	Models (Total)
1	A	8	C	20
1	A	35	A	16
1	A	1	G	12
1	A	21	C	7
1	A	33	U	4

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