



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 03:45 PM BST

PDB ID : 1NAJ
Title : High resolution NMR Structure Of DNA Dodecamer Determined In Aqueous Dilute Liquid Crystalline Phase
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Deposited on : 2002-11-27

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

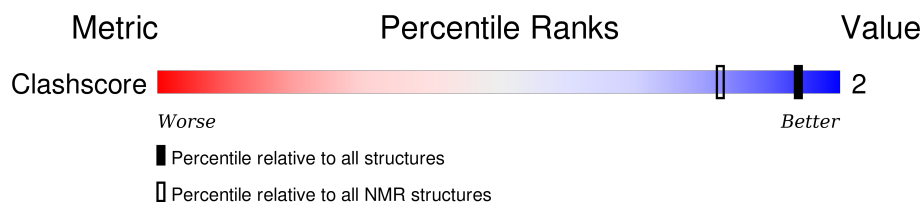
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

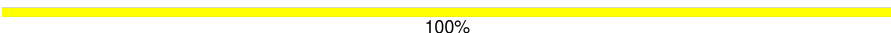
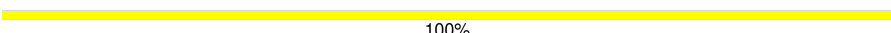
The overall completeness of chemical shifts assignment was not calculated.

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	114402	11133

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	12	 100%
1	B	12	 100%

2 Ensemble composition and analysis ⓘ

This entry contains 5 models. This entry does not contain protein, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 758 atoms, of which 272 are hydrogens and 0 are deuteriums.

- Molecule 1 is a DNA chain called 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'.

Mol	Chain	Residues	Atoms						Trace
1	A	12	Total	C	H	N	O	P	0
			379	116	136	46	70	11	
1	B	12	Total	C	H	N	O	P	0
			379	116	136	46	70	11	

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: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  100%

C1 G2 C3 G4 A5 A6 T7 T8 C9 G10 C11 G12

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  100%


G13 G14 C15 G16 A17 A18 T19 T20 C21 G22 C23 G24

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: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  58% 42%

C1 G2 C3 G4 A5 A6 T7 T8 C9 G10 C11 G12

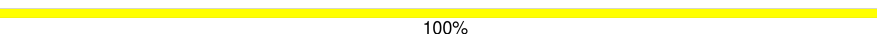
- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  58% 42%

G13 G14 C15 G16 A17 A18 T19 T20 C21 G22 C23 G24

4.2.2 Score per residue for model 2

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  100%

G1 G2 G3 G4 A5 A6 T7 T8 G9 G10 C11 G12

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  100%

C13 G14 C15 G16 A17 A18 T19 T20 C21 G22 C23 G24

4.2.3 Score per residue for model 3

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  100%

G1 G2 G3 G4 A5 A6 T7 T8 G9 G10 C11 G12

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  100%

C13 G14 C15 G16 A17 A18 T19 T20 C21 G22 C23 G24

4.2.4 Score per residue for model 4

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  100%

G1 G2 G3 G4 A5 A6 T7 T8 G9 G10 C11 G12


- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  100%

C13 G14 C15 G16 A17 A18 T19 T20 C21 G22 C23 G24


4.2.5 Score per residue for model 5

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain A:  100%

C1
G2
C3
G4
A5
A6
T7
T8
C9
G10
C11
G12

- Molecule 1: 5'-D(*CP*GP*CP*GP*AP*AP*TP*TP*CP*GP*CP*G)-3'

Chain B:  100%

C13
G14
C15
G16
A17
A18
T19
T20
C21
G22
C23
G24

5 Refinement protocol and experimental data overview

The models were refined using the following method: *SIMULATED ANNEALING, MOLECULAR DYNAMICS*.

Of the 20 calculated structures, 5 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	refinement	3.841

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 5671
Number of chemical shift lists	2
Total number of shifts	22
Number of shifts mapped to atoms	0
Number of unparsed shifts	0
Number of shifts with mapping errors	22
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	0%

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)

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	1.04±0.01	0±0/272 (0.1±0.2%)	1.94±0.01	15±0/418 (3.5±0.1%)
1	B	1.04±0.02	1±0/272 (0.2±0.2%)	1.95±0.02	15±0/418 (3.5±0.1%)
All	All	1.04	5/2720 (0.2%)	1.94	146/4180 (3.5%)

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	7	DT	C5-C7	5.25	1.53	1.50	3	2
1	B	19	DT	C5-C7	5.22	1.53	1.50	3	3

All 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(°)	Ideal(°)	Models	
								Worst	Total
1	B	13	DC	C4'-C3'-C2'	8.02	110.32	103.10	4	5
1	A	1	DC	C4'-C3'-C2'	7.89	110.20	103.10	2	5
1	B	23	DC	C4'-C3'-C2'	7.63	109.97	103.10	2	5
1	A	11	DC	C4'-C3'-C2'	7.55	109.89	103.10	2	5
1	B	24	DG	C4'-C3'-C2'	7.54	109.88	103.10	3	5
1	A	12	DG	C4'-C3'-C2'	7.53	109.87	103.10	3	5
1	A	3	DC	C4'-C3'-C2'	7.48	109.84	103.10	2	5
1	B	15	DC	C4'-C3'-C2'	7.44	109.80	103.10	1	5
1	A	8	DT	C4'-C3'-C2'	7.21	109.59	103.10	1	5
1	B	20	DT	C4'-C3'-C2'	7.17	109.55	103.10	3	5
1	A	7	DT	C4'-C3'-C2'	7.04	109.43	103.10	5	5
1	B	19	DT	C4'-C3'-C2'	6.98	109.38	103.10	2	5
1	A	9	DC	C4'-C3'-C2'	6.89	109.30	103.10	1	5
1	B	21	DC	C4'-C3'-C2'	6.86	109.28	103.10	1	5
1	A	6	DA	C4'-C3'-C2'	6.73	109.16	103.10	2	5
1	B	18	DA	C4'-C3'-C2'	6.72	109.15	103.10	2	5

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	B	19	DT	C6-C5-C7	-6.57	118.96	122.90	1	5
1	A	2	DG	C4'-C3'-C2'	6.37	108.83	103.10	1	5
1	A	7	DT	C6-C5-C7	-6.32	119.11	122.90	1	5
1	B	20	DT	C6-C5-C7	-6.27	119.14	122.90	2	5
1	B	14	DG	C4'-C3'-C2'	6.24	108.72	103.10	5	5
1	A	4	DG	C4'-C3'-C2'	6.11	108.60	103.10	2	5
1	B	16	DG	C4'-C3'-C2'	6.08	108.57	103.10	2	5
1	A	10	DG	C4'-C3'-C2'	6.05	108.55	103.10	4	5
1	A	8	DT	C6-C5-C7	-6.04	119.28	122.90	2	5
1	B	22	DG	C4'-C3'-C2'	6.02	108.52	103.10	2	5
1	B	17	DA	C4'-C3'-C2'	5.98	108.48	103.10	1	5
1	A	5	DA	C4'-C3'-C2'	5.88	108.39	103.10	2	5
1	B	19	DT	C4-C5-C6	5.07	121.04	118.00	1	3
1	A	7	DT	C4-C5-C6	5.06	121.03	118.00	1	3

There are no chirality outliers.

There are no planarity outliers.

6.2 Too-close contacts ⓘ

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	243	136	136	1±2
1	B	243	136	136	1±2
All	All	2430	1360	1360	6

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 2.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:B:18:DA:C2	1:B:19:DT:C2	0.46	3.03	1	1
1:A:2:DG:C2	1:A:3:DC:C2	0.46	3.03	1	1
1:A:6:DA:C2	1:A:7:DT:C2	0.45	3.04	1	1
1:A:6:DA:C2	1:B:20:DT:O2	0.44	2.71	1	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:8:DT:O2	1:B:18:DA:C2	0.43	2.71	1	1
1:B:14:DG:C2	1:B:15:DC:C2	0.41	3.08	1	1

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](#)

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

The completeness of assignment taking into account all chemical shift lists is 0% for the well-defined parts and 0% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 5671

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	11
Number of shifts mapped to atoms	0
Number of unparsed shifts	0
Number of shifts with mapping errors	11
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

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

- Chain not found in structure. All 11 occurrences are reported below.

Chain	Res	Type	Atom	Shift Data		
				Value	Uncertainty	Ambiguity
UNMAPPED	2	DG	P	-8.447	2.0	1
UNMAPPED	8	DT	P	47.785	2.0	1
UNMAPPED	7	DT	P	34.758	2.0	1
UNMAPPED	6	DA	P	-18.054	2.0	1
UNMAPPED	9	DC	P	52.721	2.0	1
UNMAPPED	5	DA	P	-45.291	2.0	1
UNMAPPED	12	DG	P	47.102	2.0	1
UNMAPPED	11	DC	P	51.021	2.0	1
UNMAPPED	4	DG	P	-20.919	2.0	1
UNMAPPED	3	DC	P	-9.414	2.0	1
UNMAPPED	10	DG	P	39.862	2.0	1

7.1.2 Chemical shift referencing [i](#)

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

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 0%, i.e. 0 atoms were assigned a chemical shift out of a possible 480. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	0/480 (0%)	0/288 (0%)	0/160 (0%)	0/32 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 0%, i.e. 0 atoms were assigned a chemical shift out of a possible 480. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	0/480 (0%)	0/288 (0%)	0/160 (0%)	0/32 (0%)

7.1.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

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.

7.2 Chemical shift list 2

File name: BMRB entry 5671

Chemical shift list name: *assigned_chem_shift_list_2*

7.2.1 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	11
Number of shifts mapped to atoms	0
Number of unparsed shifts	0
Number of shifts with mapping errors	11
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

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

- Chain not found in structure. All 11 occurrences are reported below.

Chain	Res	Type	Atom	Shift Data		
				Value	Uncertainty	Ambiguity
UNMAPPED	2	DG	P	-8.447	2.0	1
UNMAPPED	8	DT	P	47.785	2.0	1
UNMAPPED	7	DT	P	34.758	2.0	1
UNMAPPED	6	DA	P	-18.054	2.0	1
UNMAPPED	9	DC	P	52.721	2.0	1
UNMAPPED	5	DA	P	-45.291	2.0	1
UNMAPPED	12	DG	P	47.102	2.0	1
UNMAPPED	11	DC	P	51.021	2.0	1
UNMAPPED	4	DG	P	-20.919	2.0	1
UNMAPPED	3	DC	P	-9.414	2.0	1
UNMAPPED	10	DG	P	39.862	2.0	1

7.2.2 Chemical shift referencing [i](#)

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

7.2.3 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 0%, i.e. 0 atoms were assigned a chemical shift out of a possible 480. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)

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	Total	¹H	¹³C	¹⁵N
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	0/480 (0%)	0/288 (0%)	0/160 (0%)	0/32 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 0%, i.e. 0 atoms were assigned a chemical shift out of a possible 480. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	0/480 (0%)	0/288 (0%)	0/160 (0%)	0/32 (0%)

7.2.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

7.2.5 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_2). RCI is only applicable to proteins.