



Full wwPDB NMR Structure Validation Report ⓘ

May 29, 2020 – 06:37 am BST

PDB ID : 5B81
Title : Solution NMR structure of a 16-mer DNA duplex containing quadruple GC mismatches showing staggered base pairing, and consequent rescue of canonical double helical characteristics
Authors : De, M.; Chatterjee, S.
Deposited on : 2016-06-11

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

<https://www.wwpdb.org/validation/2017/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
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 : 2.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

2 Ensemble composition and analysis

This entry contains 20 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

There are 2 unique types of molecules in this entry. The entry contains 1010 atoms, of which 360 are hydrogens and 0 are deuteriums.

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

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		P
1	A	16	505	154	180	62	94	15	0

- Molecule 2 is a DNA chain called DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3').

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		P
2	B	16	505	154	180	62	94	15	0


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

Chain A: 



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B: 



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

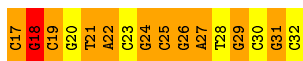
- Molecule 1: DNA (5'-D(*GP*CP*GP*CP*AP*TP*GP*CP*GP*CP*TP*AP*CP*GP*CP*G)-3')

Chain A: 



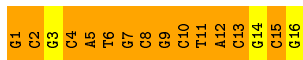
- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B: 



4.2.2 Score per residue for model 2

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



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

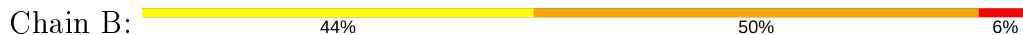


4.2.3 Score per residue for model 3

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



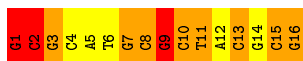
- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



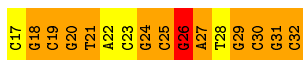
4.2.4 Score per residue for model 4

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





- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.5 Score per residue for model 5

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

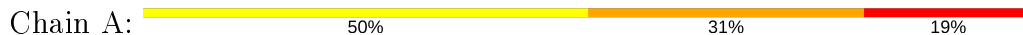


- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

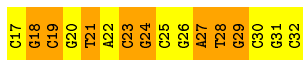
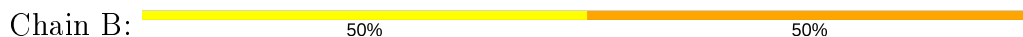


4.2.6 Score per residue for model 6

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



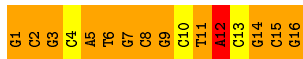
- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.7 Score per residue for model 7

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

Chain A:  19% 75% 6%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B:  25% 69% 6%



4.2.8 Score per residue for model 8

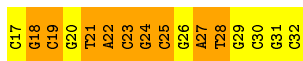
- Molecule 1: DNA (5'-D(*GP*CP*GP*CP*AP*TP*GP*CP*GP*CP*TP*AP*CP*GP*CP*G)-3')

Chain A:  25% 69% 6%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

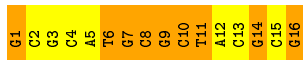
Chain B:  44% 56%




4.2.9 Score per residue for model 9

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

Chain A:  44% 56%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

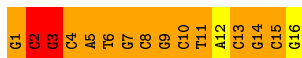
Chain B:  63% 38%



4.2.10 Score per residue for model 10

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

Chain A:  13% 75% 13%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B:  31% 69%



4.2.11 Score per residue for model 11

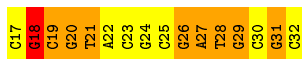
- Molecule 1: DNA (5'-D(*GP*CP*GP*CP*AP*TP*GP*CP*GP*CP*TP*AP*CP*GP*CP*G)-3')

Chain A:  38% 50% 13%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B:  44% 50% 6%



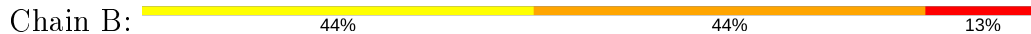
4.2.12 Score per residue for model 12

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

Chain A:  19% 63% 19%

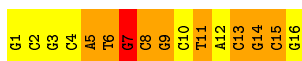


- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

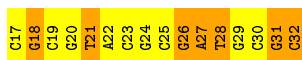


4.2.13 Score per residue for model 13

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

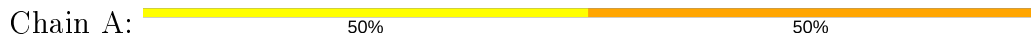


- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.14 Score per residue for model 14

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



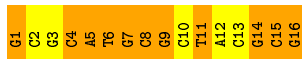
- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.15 Score per residue for model 15

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

Chain A:  31% 69%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

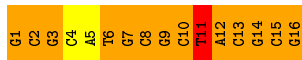
Chain B:  31% 69%



4.2.16 Score per residue for model 16

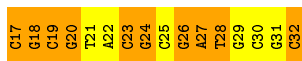
- Molecule 1: DNA (5'-D(*GP*CP*GP*CP*AP*TP*GP*CP*GP*CP*TP*AP*CP*GP*CP*G)-3')

Chain A:  13% 81% 6%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B:  38% 63%



4.2.17 Score per residue for model 17

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

Chain A:  31% 63% 6%



- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

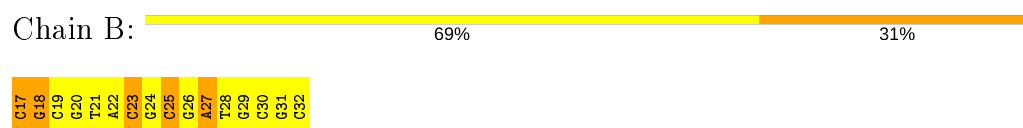


4.2.18 Score per residue for model 18

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

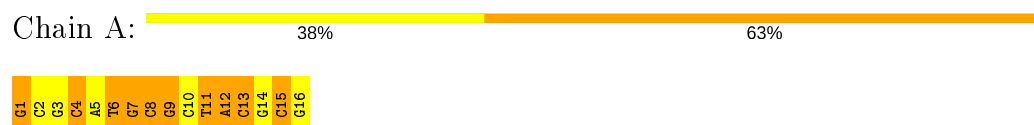


- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.19 Score per residue for model 19

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

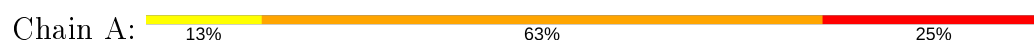


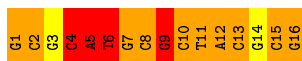
- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')



4.2.20 Score per residue for model 20

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





- Molecule 2: DNA (5'-D(*CP*GP*CP*GP*TP*AP*CP*GP*CP*GP*AP*TP*GP*CP*GP*C)-3')

Chain B:  38% 63%



5 Refinement protocol and experimental data overview (i)

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

Of the 20 calculated structures, 20 were deposited, based on the following criterion: *all calculated structures submitted*.

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

Software name	Classification	Version
AMBER	refinement	14
AMBER	structure calculation	14

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 6 of this report.

Chemical shift file(s)	input_cs.cif
Number of chemical shift lists	1
Total number of shifts	158
Number of shifts mapped to atoms	158
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	23%

No validations of the models with respect to experimental NMR restraints is performed at this time.

COVALENT-GEOMETRY INFOmissingINFO

5.1 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	325	180	172	1±1
2	B	325	180	174	0±0
All	All	13000	7200	6827	32

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:A:2:DC:H2'	1:A:3:DG:C8	0.60	2.32	16	2
1:A:5:DA:C4	1:A:6:DT:C5	0.53	2.96	20	1
1:A:8:DC:N3	1:A:9:DG:C5	0.53	2.77	6	1
1:A:4:DC:H2'	1:A:5:DA:C8	0.52	2.39	15	7
1:A:3:DG:H2'	1:A:4:DC:C6	0.49	2.43	1	1
1:A:11:DT:C5	1:A:12:DA:N7	0.48	2.82	16	1
1:A:2:DC:C2'	1:A:3:DG:C8	0.47	2.97	10	1
2:B:18:DG:C4	2:B:19:DC:C5	0.46	3.02	1	3
1:A:12:DA:C2	2:B:22:DA:C2	0.45	3.04	7	1
1:A:11:DT:C4	1:A:12:DA:N7	0.45	2.84	6	1
2:B:21:DT:C2	2:B:22:DA:C8	0.44	3.04	3	1
1:A:6:DT:C4	1:A:7:DG:C8	0.44	3.05	18	1
1:A:2:DC:H2''	1:A:3:DG:C8	0.44	2.47	5	1
1:A:14:DG:C2	1:A:15:DC:C2	0.43	3.06	15	1
1:A:9:DG:C2	1:A:10:DC:C2	0.42	3.07	20	2
1:A:9:DG:C2	2:B:26:DG:C2	0.42	3.07	4	1
1:A:15:DC:C2	1:A:16:DG:C8	0.42	3.07	8	1
1:A:1:DG:C4	1:A:2:DC:C5	0.42	3.08	4	1
2:B:26:DG:C4	2:B:27:DA:C8	0.42	3.08	12	1
1:A:6:DT:C5	1:A:7:DG:N7	0.41	2.88	13	1
1:A:11:DT:C2	1:A:12:DA:C8	0.41	3.09	11	1
1:A:8:DC:H2''	1:A:9:DG:O5'	0.41	2.16	12	1

5.2 Torsion angles [i](#)

5.2.1 Protein backbone [i](#)

There are no protein molecules in this entry.

5.2.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

5.2.3 RNA [i](#)

There are no RNA molecules in this entry.

5.3 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.4 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.5 Ligand geometry [i](#)

There are no ligands in this entry.

5.6 Other polymers [i](#)

There are no such molecules in this entry.

5.7 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 23% for the well-defined parts and 23% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *RESLISTMISMchemshift.txt*

6.1.1 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	158
Number of shifts mapped to atoms	158
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

6.1.2 Chemical shift referencing

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

6.1.3 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 23%, i.e. 146 atoms were assigned a chemical shift out of a possible 644. 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	146/644 (23%)	146/388 (38%)	0/212 (0%)	0/44 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 23%, i.e. 146 atoms were assigned a chemical shift out of a possible 644. 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	146/644 (23%)	146/388 (38%)	0/212 (0%)	0/44 (0%)

6.1.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

6.1.5 Random Coil Index (RCI) plots [i](#)

No *random coil index* (RCI) plot could be generated from the current chemical shift list (RESLIST-MISMchemshift.txt). RCI is only applicable to proteins.