



# Full wwPDB X-ray Structure Validation Report ⓘ

May 17, 2020 – 11:56 am BST

PDB ID : 1D31  
Title : THE THREE-DIMENSIONAL STRUCTURES OF BULGE-CONTAINING  
DNA FRAGMENTS  
Authors : Joshua-Tor, L.; Frolow, F.; Appella, E.; Hope, H.; Rabinovich, D.; Sussman,  
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Deposited on : 1991-04-25  
Resolution : 2.60 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11



## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 551 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	13	Total	C	N	O	P	0	0	0
			264	126	51	75	12			
1	B	13	Total	C	N	O	P	0	0	0
			264	126	51	75	12			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	12	Total	O	0	0
			12	12		
2	B	11	Total	O	0	0
			11	11		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-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 outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

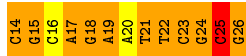
- Molecule 1: DNA (5'-D(\*CP\*GP\*CP\*AP\*GP\*AP\*AP\*TP\*TP\*CP\*GP\*CP\*G)-3')

Chain A: 



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

Chain B: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	78.48Å 42.84Å 25.16Å 90.00° 99.36° 90.00°	Depositor
Resolution (Å)	10.00 – 2.60	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.60)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	NUCLSQ, X-PLOR	Depositor
R, $R_{free}$	0.186 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	551	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	wwPDB-VP

## 5 Model quality [i](#)

### 5.1 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 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	1.48	1/296 (0.3%)	3.15	56/455 (12.3%)
1	B	1.64	2/296 (0.7%)	3.16	50/455 (11.0%)
All	All	1.56	3/592 (0.5%)	3.15	106/910 (11.6%)

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 outliers	#Planarity outliers
1	A	0	1
1	B	1	1
All	All	1	2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	22	DT	C2'-C1'	-6.73	1.45	1.52
1	A	13	DG	P-O5'	5.74	1.65	1.59
1	B	18	DG	C2'-C1'	-5.36	1.46	1.52

All (106) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	5	DG	O4'-C1'-N9	16.74	119.72	108.00
1	B	17	DA	P-O3'-C3'	15.76	138.61	119.70
1	B	22	DT	O4'-C1'-N1	14.86	118.40	108.00
1	A	12	DC	P-O3'-C3'	12.96	135.25	119.70
1	A	10	DC	P-O3'-C3'	11.38	133.36	119.70
1	B	18	DG	OP1-P-OP2	-10.85	103.32	119.60
1	A	8	DT	C2-N3-C4	-10.15	121.11	127.20
1	A	9	DT	OP1-P-OP2	-9.21	105.78	119.60
1	B	25	DC	OP1-P-OP2	-8.99	106.11	119.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	17	DA	O4'-C1'-N9	8.89	114.22	108.00
1	B	22	DT	N1-C1'-C2'	8.79	129.30	112.60
1	A	12	DC	O4'-C1'-N1	8.47	113.93	108.00
1	A	2	DG	O4'-C1'-N9	-8.33	102.17	108.00
1	A	6	DA	OP1-P-OP2	-8.18	107.34	119.60
1	A	11	DG	P-O3'-C3'	8.02	129.33	119.70
1	B	22	DT	P-O3'-C3'	7.98	129.27	119.70
1	B	20	DA	OP1-P-OP2	-7.94	107.70	119.60
1	B	22	DT	O4'-C1'-C2'	7.87	112.20	105.90
1	A	8	DT	N3-C4-C5	7.83	119.90	115.20
1	A	8	DT	C5-C4-O4	-7.82	119.43	124.90
1	A	11	DG	C6-N1-C2	-7.81	120.41	125.10
1	B	24	DG	OP1-P-OP2	-7.77	107.94	119.60
1	B	16	DC	OP1-P-OP2	-7.74	107.99	119.60
1	B	18	DG	N9-C1'-C2'	7.57	126.99	112.60
1	A	2	DG	OP1-P-OP2	-7.46	108.41	119.60
1	A	7	DA	OP1-P-OP2	-7.30	108.65	119.60
1	B	21	DT	OP1-P-OP2	-7.29	108.66	119.60
1	A	7	DA	C5-C6-N1	-7.23	114.08	117.70
1	B	23	DC	OP1-P-OP2	-7.21	108.78	119.60
1	A	4	DA	OP1-P-OP2	-7.20	108.79	119.60
1	B	21	DT	O4'-C1'-N1	7.16	113.01	108.00
1	A	5	DG	P-O3'-C3'	-7.05	111.23	119.70
1	B	22	DT	C5'-C4'-C3'	-7.04	101.42	114.10
1	B	26	DG	C5'-C4'-C3'	-7.02	101.46	114.10
1	B	23	DC	P-O3'-C3'	7.02	128.12	119.70
1	A	8	DT	N1-C2-N3	6.95	118.77	114.60
1	A	5	DG	OP1-P-OP2	-6.89	109.27	119.60
1	B	14	DC	O4'-C1'-N1	6.87	112.81	108.00
1	A	1	DC	C5'-C4'-C3'	-6.82	101.82	114.10
1	B	15	DG	C5'-C4'-C3'	-6.72	102.00	114.10
1	B	25	DC	C5'-C4'-C3'	-6.71	102.02	114.10
1	A	11	DG	C5-C6-N1	6.70	114.85	111.50
1	B	17	DA	OP1-P-OP2	-6.68	109.58	119.60
1	A	6	DA	N1-C2-N3	-6.59	126.00	129.30
1	A	8	DT	OP1-P-OP2	-6.59	109.72	119.60
1	B	23	DC	C5'-C4'-C3'	-6.50	102.39	114.10
1	B	19	DA	OP1-P-OP2	-6.44	109.94	119.60
1	B	17	DA	C5-C6-N1	-6.43	114.48	117.70
1	A	12	DC	C2-N3-C4	6.38	123.09	119.90
1	B	23	DC	N3-C4-C5	-6.37	119.35	121.90
1	B	22	DT	N1-C2-N3	6.32	118.39	114.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	14	DC	C5'-C4'-C3'	-6.31	102.74	114.10
1	B	23	DC	C2-N3-C4	6.29	123.05	119.90
1	A	13	DG	C5'-C4'-C3'	-6.28	102.79	114.10
1	B	15	DG	O3'-P-O5'	6.27	115.91	104.00
1	B	18	DG	C8-N9-C4	-6.26	103.90	106.40
1	A	7	DA	N1-C2-N3	-6.26	126.17	129.30
1	A	5	DG	C5-C6-N1	6.20	114.60	111.50
1	A	9	DT	C2-N3-C4	-6.19	123.48	127.20
1	A	8	DT	O4'-C1'-N1	6.18	112.33	108.00
1	A	7	DA	C6-N1-C2	6.17	122.30	118.60
1	B	22	DT	C6-N1-C2	-6.05	118.27	121.30
1	B	22	DT	C2-N3-C4	-6.04	123.57	127.20
1	A	10	DC	C5'-C4'-C3'	-5.97	103.36	114.10
1	A	10	DC	OP1-P-OP2	-5.94	110.69	119.60
1	A	6	DA	C5-C6-N1	-5.92	114.74	117.70
1	A	1	DC	N3-C4-C5	-5.87	119.55	121.90
1	A	1	DC	C2-N3-C4	5.86	122.83	119.90
1	B	15	DG	C6-N1-C2	-5.82	121.61	125.10
1	A	2	DG	C6-N1-C2	-5.79	121.63	125.10
1	B	15	DG	C5-C6-N1	5.77	114.39	111.50
1	A	12	DC	N3-C4-C5	-5.70	119.62	121.90
1	A	13	DG	OP1-P-OP2	-5.61	111.19	119.60
1	A	3	DC	C2-N3-C4	5.60	122.70	119.90
1	B	17	DA	N1-C2-N3	-5.59	126.51	129.30
1	A	5	DG	C8-N9-C4	-5.59	104.17	106.40
1	A	2	DG	C5'-C4'-C3'	-5.59	104.05	114.10
1	A	6	DA	C5'-C4'-C3'	-5.58	104.06	114.10
1	B	26	DG	C5-C6-N1	5.57	114.28	111.50
1	B	24	DG	O4'-C1'-C2'	-5.56	101.45	105.90
1	A	11	DG	OP1-P-OP2	-5.55	111.28	119.60
1	A	6	DA	C6-N1-C2	5.53	121.92	118.60
1	B	17	DA	C5'-C4'-C3'	-5.53	104.15	114.10
1	A	9	DT	C5'-C4'-C3'	-5.50	104.19	114.10
1	B	21	DT	N1-C2-N3	5.43	117.86	114.60
1	A	4	DA	C5'-C4'-C3'	-5.41	104.36	114.10
1	B	19	DA	C5'-C4'-C3'	-5.40	104.37	114.10
1	A	5	DG	C6-N1-C2	-5.38	121.88	125.10
1	A	13	DG	C6-N1-C2	-5.37	121.88	125.10
1	A	3	DC	N3-C4-C5	-5.37	119.75	121.90
1	A	3	DC	OP1-P-OP2	-5.35	111.58	119.60
1	B	24	DG	C6-N1-C2	-5.34	121.90	125.10
1	A	2	DG	C5-C6-N1	5.32	114.16	111.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	18	DG	O4'-C1'-N9	5.29	111.70	108.00
1	A	4	DA	C5-C6-N1	-5.27	115.06	117.70
1	A	11	DG	C5'-C4'-C3'	-5.26	104.63	114.10
1	B	24	DG	C5-C6-N1	5.26	114.13	111.50
1	A	12	DC	OP1-P-O3'	5.26	116.76	105.20
1	B	20	DA	P-O3'-C3'	5.24	125.98	119.70
1	A	9	DT	N1-C2-N3	5.19	117.71	114.60
1	B	14	DC	N3-C4-C5	-5.13	119.85	121.90
1	B	26	DG	C6-N1-C2	-5.10	122.04	125.10
1	B	25	DC	O4'-C1'-C2'	5.10	109.98	105.90
1	B	19	DA	C5-C6-N1	-5.09	115.16	117.70
1	A	3	DC	C5'-C4'-C3'	-5.07	104.98	114.10
1	B	21	DT	O3'-P-O5'	5.04	113.58	104.00

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	B	22	DT	C1'

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	2	DG	Sidechain
1	B	25	DC	Sidechain

## 5.2 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 the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	264	0	147	17	1
1	B	264	0	147	21	1
2	A	12	0	0	2	0
2	B	11	0	0	4	1
All	All	551	0	294	38	2

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 58.

All (38) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:22:DT:H2''	1:B:23:DC:H5''	1.36	1.03
1:B:22:DT:C2'	1:B:23:DC:H5''	1.88	1.03
1:A:12:DC:H2''	1:A:13:DG:C8	2.01	0.95
1:B:21:DT:OP2	2:B:47:HOH:O	1.92	0.87
1:A:12:DC:H2''	1:A:13:DG:N7	1.89	0.86
1:B:17:DA:P	1:B:17:DA:H3'	2.17	0.84
1:B:14:DC:H2''	1:B:15:DG:N7	1.98	0.79
1:A:1:DC:O5'	1:A:1:DC:O2	2.01	0.78
1:B:26:DG:OP1	2:B:41:HOH:O	2.01	0.78
1:B:22:DT:C2'	1:B:23:DC:C5'	2.64	0.74
1:A:3:DC:H2'	1:A:4:DA:C8	2.30	0.66
1:A:8:DT:H2''	1:A:9:DT:O5'	1.96	0.64
1:A:11:DG:OP2	2:A:33:HOH:O	2.15	0.63
1:A:10:DC:H1'	1:A:11:DG:O5'	1.99	0.63
1:A:1:DC:O2	1:A:1:DC:C5'	2.48	0.62
1:A:10:DC:O5'	1:A:10:DC:H2'	2.01	0.60
1:B:15:DG:H8	1:B:15:DG:O5'	1.85	0.60
1:A:9:DT:H2''	1:A:10:DC:O5'	2.01	0.59
1:B:17:DA:H3'	1:B:17:DA:OP1	2.01	0.59
1:B:15:DG:O5'	1:B:15:DG:C8	2.57	0.58
1:A:13:DG:H8	1:A:13:DG:OP2	1.85	0.58
1:B:26:DG:H5'	2:B:41:HOH:O	2.06	0.55
1:A:3:DC:H2'	1:A:4:DA:N7	2.23	0.54
1:B:18:DG:H2''	1:B:19:DA:C5'	2.39	0.52
1:A:2:DG:H8	1:A:2:DG:O5'	1.93	0.51
1:B:18:DG:H2''	1:B:19:DA:H5'	1.91	0.51
1:A:1:DC:O2	1:A:1:DC:O4'	2.25	0.51
1:A:10:DC:H2''	2:A:33:HOH:O	2.11	0.50
1:A:10:DC:C2'	1:A:10:DC:O5'	2.59	0.49
1:B:18:DG:H2''	1:B:19:DA:O5'	2.12	0.49
1:B:22:DT:H2''	1:B:23:DC:C5'	2.25	0.49
1:B:26:DG:C5'	2:B:41:HOH:O	2.61	0.48
1:B:22:DT:C3'	1:B:23:DC:H5''	2.34	0.47
1:B:21:DT:H2''	1:B:22:DT:C6	2.50	0.46
1:B:24:DG:H1'	1:B:25:DC:C6	2.51	0.46
1:B:26:DG:O5'	1:B:26:DG:H2'	2.18	0.44
1:A:9:DT:H1'	1:A:10:DC:H5'	2.00	0.42
1:B:22:DT:H2'	1:B:23:DC:C5'	2.49	0.41

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:41:HOH:O	2:B:41:HOH:O[2_555]	1.24	0.96
1:A:1:DC:O5'	1:B:14:DC:O4'[3_444]	2.15	0.05

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

### 5.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.