Full wwPDB X-ray Structure Validation Report ⓘ

Sep 14, 2026 – 04:05 PM EDT

PDB ID	:	1D97 / pdb_00001d97
Title	:	CHIRAL PHOSPHOROTHIOATE ANALOGUES OF B-DNA: THE CRYSTAL STRUCTURE OF RP-D(GP(S) CPGP(S)CPGP(S)C)
Authors	:	Cruse, W.B.T.; Salisbury, S.A.; Brown, T.; Cosstick, R.; Eckstein, F.; Kennard, O.
Deposited on	:	1992-10-17
Resolution	:	2.17 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ 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 ⓘ) were used in the production of this report:

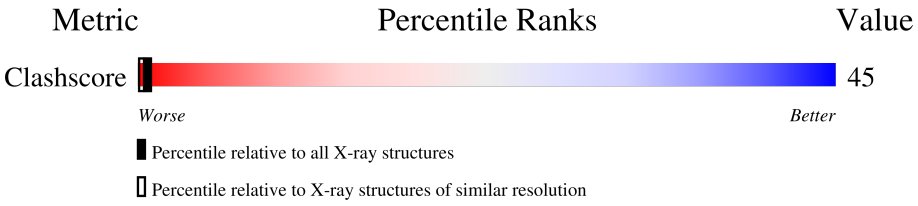
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.17 Å.

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)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	9786 (2.20-2.16)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. 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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	6	17% 67% 17%
1	B	6	50% 50%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
1	SC	A	6	X	-	-	-

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 312 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(RP*GP*(SC)P*GP*(SC)P*GP*(SC))-3').

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	6	Total	C	N	O	P	S	0	0	0
			120	57	24	31	5	3			
1	B	6	Total	C	N	O	P	S	0	0	0
			120	57	24	31	5	3			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	33	Total	O	0	0
			33	33		
2	B	39	Total	O	0	0
			39	39		

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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(RP*GP*(SC)P*GP*(SC)P*GP*(SC))-3')

Chain A:



- Molecule 1: DNA (5'-D(RP*GP*(SC)P*GP*(SC)P*GP*(SC))-3')

Chain B:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	34.90Å 39.15Å 20.64Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.17	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-2.17)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	NUCLSQ	Depositor
R, R_{free}	0.145 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	312	wwPDB-VP
Average B, all atoms (Å^2)	10.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	0.87	0/69	1.47	0/101
1	B	0.74	0/69	1.49	1/101 (1.0%)
All	All	0.80	0/138	1.48	1/202 (0.5%)

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	1	0

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	9	DG	C4'-C3'-O3'	5.46	118.19	110.00

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	6	SC	C4'

There are no planarity outliers.

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	120	0	67	5	1
1	B	120	0	68	12	0
2	A	33	0	0	5	2
2	B	39	0	0	10	0
All	All	312	0	135	17	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 45.

All (17) 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:A:3:DG:H2'	2:A:58:HOH:O	1.72	0.89
1:B:10:SC:H3'	2:B:40:HOH:O	1.81	0.80
1:B:8:SC:H5'	2:B:28:HOH:O	1.84	0.76
1:A:2:SC:S2P	2:A:79:HOH:O	2.43	0.76
1:B:9:DG:OP2	2:B:36:HOH:O	2.03	0.76
1:A:4:SC:H6	2:A:59:HOH:O	1.87	0.74
1:B:9:DG:H2'	2:B:16:HOH:O	1.91	0.70
1:B:11:DG:OP1	2:B:56:HOH:O	2.12	0.66
1:A:1:DG:H3'	2:A:43:HOH:O	1.99	0.61
1:B:12:SC:OP1	2:B:57:HOH:O	2.19	0.52
1:B:10:SC:H6	2:B:39:HOH:O	2.09	0.52
1:B:7:DG:O4'	2:B:75:HOH:O	2.19	0.51
1:B:7:DG:H2'	1:B:8:SC:H5	1.97	0.47
1:B:12:SC:P	2:B:57:HOH:O	2.75	0.45
1:B:7:DG:H2"	1:B:8:SC:C6	2.48	0.44
1:B:7:DG:C1'	2:B:75:HOH:O	2.67	0.42
1:A:2:SC:H6	2:A:41:HOH:O	2.21	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:6:SC:OP1	2:A:41:HOH:O[3_555]	1.92	0.28
2:A:59:HOH:O	2:A:79:HOH:O[2_454]	2.00	0.20

5.3 Torsion angles

5.3.1 Protein backbone

There are no protein molecules in this entry.

5.3.2 Protein sidechains

There are no protein molecules in this entry.

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

6 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
1	SC	B	8	1	17,20,21	0.93	1 (5%)	23,28,31	1.32	2 (8%)
1	SC	B	10	1	17,20,21	0.85	1 (5%)	23,28,31	1.17	2 (8%)
1	SC	A	4	1	17,20,21	0.58	0	23,28,31	0.83	0
1	SC	B	12	1	17,20,21	0.76	0	23,28,31	0.69	0
1	SC	A	2	1	17,20,21	0.58	0	23,28,31	0.73	0
1	SC	A	6	1	17,20,21	0.75	0	23,28,31	1.17	3 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	SC	B	8	1	-	0/7/21/22	0/2/2/2
1	SC	B	10	1	-	0/7/21/22	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	SC	A	4	1	-	1/7/21/22	0/2/2/2
1	SC	B	12	1	-	1/7/21/22	0/2/2/2
1	SC	A	2	1	-	4/7/21/22	0/2/2/2
1	SC	A	6	1	1/1/4/4	0/7/21/22	0/2/2/2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	8	SC	O4'-C1'	2.58	1.48	1.42
1	B	10	SC	O4'-C1'	2.08	1.47	1.42

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	8	SC	O4'-C1'-N1	-4.19	100.43	107.86
1	A	6	SC	C5'-C4'-C3'	3.29	133.06	114.64
1	B	10	SC	C2'-C1'-N1	3.19	121.80	113.81
1	B	10	SC	O4'-C1'-N1	-2.76	102.96	107.86
1	B	8	SC	O4'-C4'-C5'	2.70	117.99	109.33
1	A	6	SC	O4'-C4'-C3'	2.39	111.10	105.65
1	A	6	SC	C4'-O4'-C1'	-2.36	103.91	109.51

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	6	SC	C4'

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	2	SC	O4'-C4'-C5'-O5'
1	A	2	SC	C2'-C1'-N1-C6
1	A	2	SC	C3'-C4'-C5'-O5'
1	B	12	SC	O4'-C4'-C5'-O5'
1	A	2	SC	O4'-C1'-N1-C6
1	A	4	SC	C2'-C1'-N1-C6

There are no ring outliers.

6 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	8	SC	3	0
1	B	10	SC	2	0
1	A	4	SC	1	0
1	B	12	SC	2	0
1	A	2	SC	2	0
1	A	6	SC	0	1

5.5 Carbohydrates (i)

There are no oligosaccharides 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.