



Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2020 – 10:58 pm BST

PDB ID : 3TI0
Title : Crystal Structure of Bacillus DNA Polymerase I Large Fragment Bound to DNA and ddGTP-dC in Closed Conformation
Authors : Wang, W.; Beese, L.S.
Deposited on : 2011-08-19
Resolution : 1.62 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

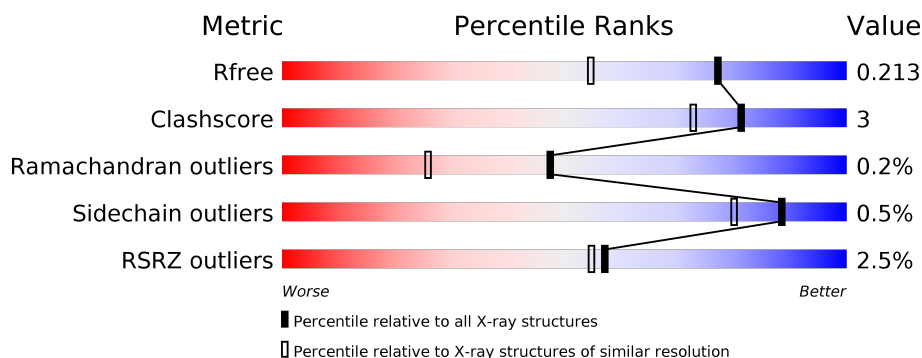
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.62 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))
R_{free}	130704	4693 (1.64-1.60)
Clashscore	141614	5002 (1.64-1.60)
Ramachandran outliers	138981	4888 (1.64-1.60)
Sidechain outliers	138945	4887 (1.64-1.60)
RSRZ outliers	127900	4609 (1.64-1.60)

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 on 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	592	<div> <div>5%</div> <div> <div></div> <div>91%</div> <div>6%</div> <div></div> </div> </div>
1	D	592	<div> <div></div> <div> <div>92%</div> <div>6%</div> <div></div> </div> </div>
2	B	9	<div> <div></div> <div> <div>56%</div> <div>22%</div> <div>22%</div> </div> </div>
2	E	9	<div> <div></div> <div> <div>56%</div> <div>44%</div> </div> </div>
3	C	13	<div> <div></div> <div> <div>62%</div> <div>31%</div> <div>8%</div> </div> </div>
3	F	13	<div> <div></div> <div> <div>62%</div> <div>31%</div> <div>8%</div> </div> </div>

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 21902 atoms, of which 9966 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 protein called DNA polymerase I.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	579	Total	C	H	N	O	S	0	2	0
			9378	2959	4724	809	869	17			
1	D	579	Total	C	H	N	O	S	0	10	0
			9427	2971	4748	813	878	17			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	456	GLU	ALA	SEE REMARK 999	UNP C9RTX7
A	505	LYS	GLU	SEE REMARK 999	UNP C9RTX7
A	598	ALA	ASP	ENGINEERED MUTATION	UNP C9RTX7
A	710	TYR	PHE	ENGINEERED MUTATION	UNP C9RTX7
A	823	HIS	ARG	SEE REMARK 999	UNP C9RTX7
D	456	GLU	ALA	SEE REMARK 999	UNP C9RTX7
D	505	LYS	GLU	SEE REMARK 999	UNP C9RTX7
D	598	ALA	ASP	ENGINEERED MUTATION	UNP C9RTX7
D	710	TYR	PHE	ENGINEERED MUTATION	UNP C9RTX7
D	823	HIS	ARG	SEE REMARK 999	UNP C9RTX7

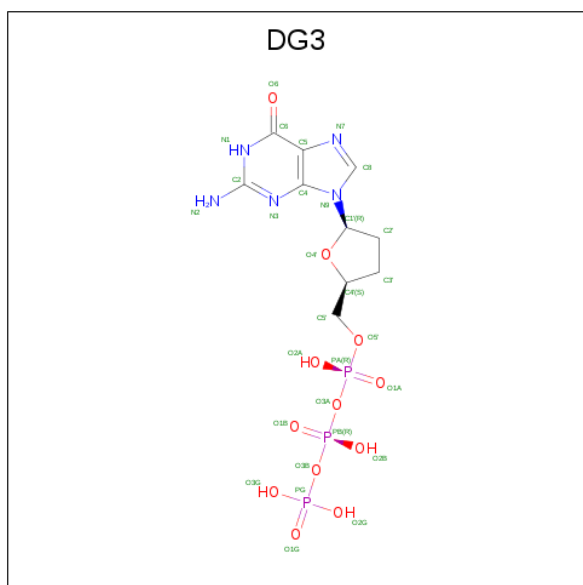
- Molecule 2 is a DNA chain called 5'-D(*CP*CP*TP*GP*AP*CP*TP*CP*(DDG))-3'.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	9	Total	C	H	N	O	P	0	0	0
			278	86	101	31	52	8			
2	E	9	Total	C	H	N	O	P	0	0	0
			278	86	101	31	52	8			

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

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	12	Total	C	H	N	O	P	0	0	0
			380	117	135	48	69	11			
3	F	12	Total	C	H	N	O	P	0	0	0
			380	117	135	48	69	11			

- Molecule 4 is 2'-3'-DIDEOXYGUANOSINE-5'-TRIPHOSPHATE (three-letter code: DG3) (formula: C₁₀H₁₆N₅O₁₂P₃).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	A	1	Total	C	H	N	O	P	0	0
			41	10	11	5	12	3		
4	D	1	Total	C	H	N	O	P	0	0
			41	10	11	5	12	3		

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Mg	0	0
			1	1		
5	D	1	Total	Mg	0	0
			1	1		

- Molecule 6 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	O	S	0	0
			5	4	1		
6	D	1	Total	O	S	0	0
			5	4	1		

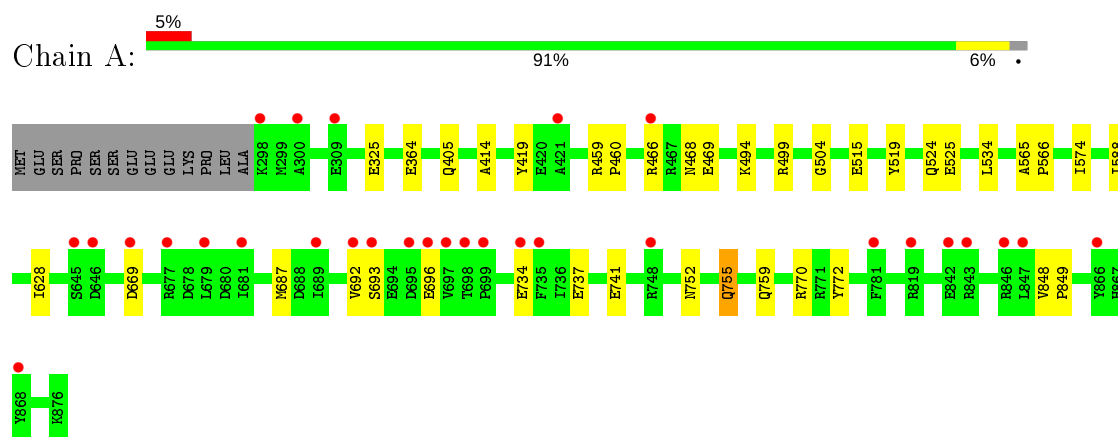
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	587	Total	O	0	0
			587	587		
7	D	854	Total	O	0	0
			854	854		
7	B	38	Total	O	0	0
			38	38		
7	C	78	Total	O	0	0
			78	78		
7	E	40	Total	O	0	0
			40	40		
7	F	90	Total	O	0	0
			90	90		

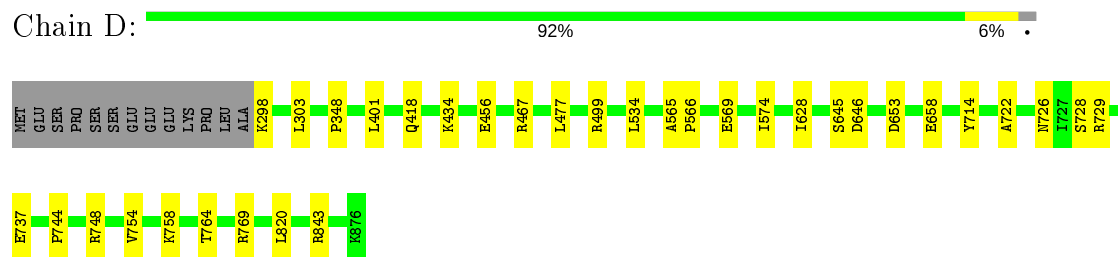
3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

- Molecule 1: DNA polymerase I



- Molecule 1: DNA polymerase I



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



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



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

Chain C:  62% 31% 8%



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

Chain F:  62% 31% 8%



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	93.50Å 108.92Å 149.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.96 – 1.62 42.96 – 1.62	Depositor EDS
% Data completeness (in resolution range)	93.4 (42.96-1.62) 93.4 (42.96-1.62)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.61 (at 1.62Å)	Xtriage
Refinement program	PHENIX 1.7.1 _743	Depositor
R, R_{free}	0.187 , 0.215 0.185 , 0.213	Depositor DCC
R_{free} test set	8205 reflections (4.54%)	wwPDB-VP
Wilson B-factor (Å ²)	17.5	Xtriage
Anisotropy	0.112	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 47.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	21902	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.99% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: DG3, MG, DDG, SO4

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	0.34	0/4747	0.49	0/6416
1	D	0.45	0/4802	0.60	0/6488
2	B	0.83	0/173	1.79	5/264 (1.9%)
2	E	1.01	0/173	1.77	4/264 (1.5%)
3	C	0.83	0/275	1.56	2/423 (0.5%)
3	F	0.96	0/275	1.63	4/423 (0.9%)
All	All	0.47	0/10445	0.73	15/14278 (0.1%)

There are no bond length outliers.

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	8	DT	O4'-C1'-N1	-11.17	100.18	108.00
2	E	23	DT	O4'-C1'-N1	-10.57	100.60	108.00
2	B	26	DC	O4'-C1'-N1	9.09	114.36	108.00
2	B	23	DT	O4'-C1'-N1	-9.04	101.67	108.00
3	F	8	DT	O4'-C1'-N1	-8.86	101.80	108.00
3	F	2	DT	O4'-C1'-N1	8.19	113.73	108.00
3	C	2	DT	O4'-C1'-N1	6.60	112.62	108.00
3	F	5	DG	O4'-C4'-C3'	-6.56	101.88	104.50
2	E	27	DT	O4'-C4'-C3'	-5.76	102.20	104.50
2	E	25	DA	O4'-C4'-C3'	-5.66	102.23	104.50
3	F	9	DC	O4'-C1'-N1	-5.40	104.22	108.00
2	B	27	DT	O4'-C4'-C3'	-5.38	102.35	104.50
2	B	26	DC	N1-C1'-C2'	-5.36	102.41	112.60
2	B	28	DC	C4'-C3'-C2'	-5.33	98.31	103.10
2	E	28	DC	C4'-C3'-C2'	-5.19	98.43	103.10

There are no chirality outliers.

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	4654	4724	4703	26	0
1	D	4679	4748	4694	25	0
2	B	177	101	103	1	0
2	E	177	101	103	0	0
3	C	245	135	136	1	0
3	F	245	135	136	0	0
4	A	30	11	12	0	0
4	D	30	11	12	1	0
5	A	1	0	0	0	0
5	D	1	0	0	0	0
6	A	5	0	0	0	0
6	D	5	0	0	0	0
7	A	587	0	0	8	0
7	B	38	0	0	0	0
7	C	78	0	0	0	0
7	D	854	0	0	15	0
7	E	40	0	0	0	0
7	F	90	0	0	0	0
All	All	11936	9966	9899	53	0

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 3.

All (53) 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:752:ASN:O	1:A:755:GLN:HG3	1.92	0.69
1:A:499:ARG:NE	7:A:1008:HOH:O	2.28	0.66
1:A:405:GLN:NE2	7:A:1672:HOH:O	2.31	0.63
1:A:848:VAL:HB	1:A:849:PRO:HD3	1.81	0.61
1:D:434:LYS:NZ	7:D:1040:HOH:O	2.34	0.60
1:A:466:ARG:HD2	7:A:1627:HOH:O	2.02	0.59
3:C:9:DC:H2"	3:C:10:DA:C8	2.38	0.58
1:A:459:ARG:HB3	1:A:460:PRO:HD3	1.86	0.58
1:D:653:ASP:OD2	7:D:1686:HOH:O	2.17	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:748:ARG:HD3	7:D:1129:HOH:O	2.06	0.55
1:D:499:ARG:NH2	7:D:1527:HOH:O	2.39	0.55
1:D:569:GLU:CD	7:D:1107:HOH:O	2.45	0.54
1:D:418:GLN:HA	7:D:1059:HOH:O	2.07	0.54
1:D:754:VAL:CG1	1:D:758:LYS:HE2	2.38	0.53
1:A:770:ARG:HD3	1:A:772:TYR:CZ	2.43	0.53
1:D:754:VAL:HG12	1:D:758:LYS:HE2	1.90	0.52
1:D:348:PRO:HB2	7:D:1161:HOH:O	2.09	0.52
1:A:692:VAL:O	1:A:693:SER:OG	2.22	0.51
1:D:645:SER:O	1:D:646:ASP:HB2	2.13	0.49
1:D:744:PRO:O	1:D:748:ARG:HG3	2.13	0.48
1:A:459:ARG:NH2	7:A:1550:HOH:O	2.46	0.47
1:D:714:TYR:HB3	7:D:1032:HOH:O	2.14	0.47
1:A:692:VAL:HG22	1:A:696:GLU:HB2	1.96	0.47
1:D:298:LYS:HB2	7:D:1586:HOH:O	2.14	0.47
1:A:414:ALA:HB1	1:A:419:TYR:HB3	1.97	0.46
1:D:456:GLU:HG3	7:D:1175:HOH:O	2.16	0.46
1:D:534:LEU:HD11	1:D:574:ILE:HD13	1.97	0.46
1:A:325:GLU:CD	1:A:325:GLU:H	2.19	0.45
1:A:499:ARG:CZ	7:A:1008:HOH:O	2.64	0.45
1:D:565:ALA:N	1:D:566:PRO:CD	2.80	0.45
1:A:687:MET:HG2	1:A:693:SER:C	2.38	0.44
1:A:565:ALA:N	1:A:566:PRO:CD	2.81	0.44
1:A:759:GLN:HG2	7:D:1465:HOH:O	2.18	0.43
1:A:534:LEU:HD11	1:A:574:ILE:HD13	2.01	0.43
1:A:504:GLY:HA2	1:A:588:ILE:HD12	2.01	0.43
1:D:653:ASP:HB2	7:D:1687:HOH:O	2.18	0.43
2:B:26:DC:H2''	2:B:27:DT:O5'	2.19	0.42
1:D:737:GLU:HG3	7:D:1493:HOH:O	2.19	0.42
1:A:524:GLN:HG2	1:A:525:GLU:O	2.20	0.42
1:D:658:GLU:CD	4:D:202:DG3:H2'1	2.40	0.42
1:A:364:GLU:HG3	7:A:207:HOH:O	2.20	0.41
1:A:515:GLU:HG2	1:A:519:TYR:CE2	2.55	0.41
1:A:494:LYS:NZ	7:A:1331:HOH:O	2.53	0.41
1:D:467:ARG:NH2	7:D:1626:HOH:O	2.27	0.41
1:D:764:THR:HA	1:D:769:ARG:O	2.20	0.41
1:D:820:LEU:HD21	1:D:843:ARG:CZ	2.50	0.41
1:A:468:ASN:O	1:A:469:GLU:HB2	2.21	0.41
1:D:722:ALA:HB2	1:D:729:ARG:HA	2.03	0.41
1:D:726:ASN:HB2	7:D:1121:HOH:O	2.21	0.41
1:D:401:LEU:HD23	1:D:401:LEU:HA	1.93	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:499:ARG:CG	7:A:1008:HOH:O	2.68	0.40
1:A:737:GLU:O	1:A:741:GLU:HG3	2.21	0.40
1:A:734:GLU:HA	1:A:734:GLU:OE1	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	579/592 (98%)	561 (97%)	17 (3%)	1 (0%)	47 26
1	D	587/592 (99%)	574 (98%)	12 (2%)	1 (0%)	47 26
All	All	1166/1184 (98%)	1135 (97%)	29 (2%)	2 (0%)	47 26

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	628	ILE
1	A	628	ILE

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	497/507 (98%)	495 (100%)	2 (0%)	91 84

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	505/507 (100%)	502 (99%)	3 (1%)	86	76
All	All	1002/1014 (99%)	997 (100%)	5 (0%)	88	80

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	669	ASP
1	A	755	GLN
1	D	303	LEU
1	D	477	LEU
1	D	728	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 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$
2	DDG	E	29	3,2	17,23,24	1.33	2 (11%)	15,33,36	2.96	4 (26%)
2	DDG	B	29	3,2	17,23,24	1.59	1 (5%)	15,33,36	3.18	4 (26%)

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
2	DDG	E	29	3,2	-	0/3/18/19	0/3/3/3
2	DDG	B	29	3,2	-	0/3/18/19	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	29	DDG	C6-N1	5.33	1.42	1.33
2	E	29	DDG	C6-N1	4.26	1.40	1.33
2	E	29	DDG	C8-N7	-2.35	1.30	1.34

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	29	DDG	C5-C6-N1	-9.26	110.76	123.43
2	E	29	DDG	C5-C6-N1	-8.53	111.77	123.43
2	B	29	DDG	C6-N1-C2	5.92	125.33	115.93
2	E	29	DDG	C6-N1-C2	5.75	125.07	115.93
2	B	29	DDG	C2-N3-C4	-3.22	111.67	115.36
2	E	29	DDG	N3-C2-N1	-2.99	123.24	127.22
2	B	29	DDG	N3-C2-N1	-2.79	123.50	127.22
2	E	29	DDG	C2-N3-C4	-2.38	112.64	115.36

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 for Mogul analysis.

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$
4	DG3	D	202	5	25,32,32	1.78	4 (16%)	28,50,50	1.76	8 (28%)
6	SO4	D	1	-	4,4,4	0.14	0	6,6,6	0.29	0
6	SO4	A	2	-	4,4,4	0.16	0	6,6,6	0.09	0
4	DG3	A	201	5	25,32,32	2.09	4 (16%)	28,50,50	1.94	9 (32%)

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
4	DG3	D	202	5	-	4/18/31/31	0/3/3/3
4	DG3	A	201	5	-	6/18/31/31	0/3/3/3

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	201	DG3	C2-N2	7.06	1.48	1.33
4	D	202	DG3	C2-N2	5.97	1.45	1.33
4	A	201	DG3	O6-C6	5.07	1.37	1.24
4	D	202	DG3	O6-C6	3.63	1.33	1.24
4	D	202	DG3	C1'-N9	-2.83	1.41	1.49
4	A	201	DG3	C1'-N9	-2.71	1.41	1.49
4	A	201	DG3	C2'-C3'	-2.66	1.46	1.54
4	D	202	DG3	C2'-C3'	-2.18	1.48	1.54

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	202	DG3	C6-C5-C4	-4.93	116.09	120.80
4	A	201	DG3	C2'-C1'-N9	-3.70	105.52	112.48
4	A	201	DG3	C2-N3-C4	3.65	119.52	115.36
4	D	202	DG3	C2'-C1'-N9	-3.63	105.65	112.48
4	A	201	DG3	C6-C5-C4	-3.59	117.37	120.80
4	A	201	DG3	N3-C2-N1	-3.54	122.50	127.22
4	A	201	DG3	C6-N1-C2	3.00	120.69	115.93
4	A	201	DG3	C5-C6-N1	-2.95	119.40	123.43
4	A	201	DG3	O2G-PG-O3B	2.93	114.45	104.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	201	DG3	C4-C5-N7	-2.87	106.41	109.40
4	A	201	DG3	PA-O3A-PB	-2.68	123.63	132.83
4	D	202	DG3	O4'-C1'-C2'	-2.26	104.22	106.67
4	D	202	DG3	N3-C2-N1	-2.23	124.25	127.22
4	D	202	DG3	C5-C6-N1	-2.22	120.40	123.43
4	D	202	DG3	O2G-PG-O3B	2.19	111.97	104.64
4	D	202	DG3	PA-O3A-PB	-2.15	125.45	132.83
4	D	202	DG3	C6-N1-C2	2.10	119.26	115.93

There are no chirality outliers.

All (10) torsion outliers are listed below:

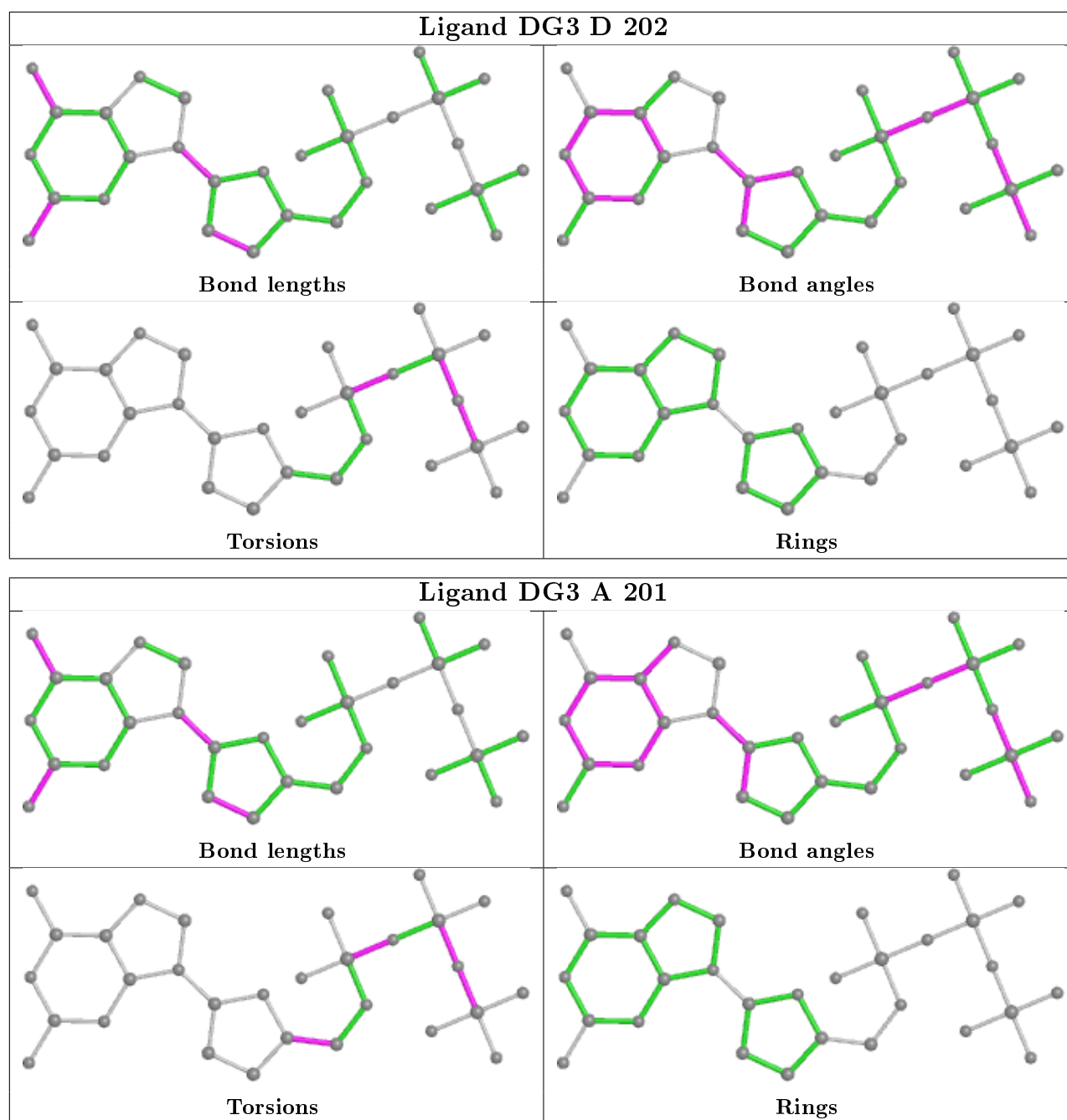
Mol	Chain	Res	Type	Atoms
4	D	202	DG3	PB-O3B-PG-O1G
4	D	202	DG3	PG-O3B-PB-O2B
4	D	202	DG3	PB-O3A-PA-O2A
4	A	201	DG3	PB-O3A-PA-O2A
4	A	201	DG3	PG-O3B-PB-O2B
4	A	201	DG3	PG-O3B-PB-O1B
4	A	201	DG3	O4'-C4'-C5'-O5'
4	D	202	DG3	PB-O3A-PA-O1A
4	A	201	DG3	PB-O3A-PA-O1A
4	A	201	DG3	PB-O3B-PG-O1G

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	202	DG3	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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 ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	579/592 (97%)	0.17	30 (5%)	27 24	14, 28, 49, 61	0
1	D	579/592 (97%)	-0.11	0	100 100	8, 18, 34, 47	0
2	B	8/9 (88%)	-0.28	0	100 100	15, 17, 31, 33	0
2	E	8/9 (88%)	-0.32	0	100 100	12, 17, 29, 33	0
3	C	12/13 (92%)	-0.31	0	100 100	14, 20, 40, 59	0
3	F	12/13 (92%)	-0.25	0	100 100	11, 16, 35, 53	0
All	All	1198/1228 (97%)	0.02	30 (2%)	57 55	8, 22, 44, 61	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	695	ASP	4.2
1	A	692	VAL	4.1
1	A	298	LYS	3.8
1	A	819	ARG	3.7
1	A	693	SER	3.6
1	A	677	ARG	3.5
1	A	697	VAL	3.4
1	A	681	ILE	3.0
1	A	847	LEU	3.0
1	A	735	PHE	3.0
1	A	734	GLU	2.9
1	A	669	ASP	2.9
1	A	842	GLU	2.9
1	A	696	GLU	2.8
1	A	843	ARG	2.8
1	A	846	ARG	2.7
1	A	699	PRO	2.6
1	A	868	TYR	2.6
1	A	866	TYR	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	748	ARG	2.5
1	A	689	ILE	2.5
1	A	646	ASP	2.4
1	A	698	THR	2.4
1	A	300	ALA	2.4
1	A	466	ARG	2.3
1	A	679	LEU	2.3
1	A	421	ALA	2.2
1	A	781	PHE	2.1
1	A	645	SER	2.0
1	A	309	GLU	2.0

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	DDG	B	29	21/22	0.97	0.10	12,18,22,26	0
2	DDG	E	29	21/22	0.99	0.11	7,10,14,15	0

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	SO4	D	1	5/5	0.95	0.09	28,36,45,47	0
4	DG3	A	201	30/30	0.95	0.10	16,21,28,33	0
6	SO4	A	2	5/5	0.96	0.10	35,47,51,52	0
4	DG3	D	202	30/30	0.98	0.11	9,13,16,20	0
5	MG	A	1	1/1	0.98	0.12	25,25,25,25	0

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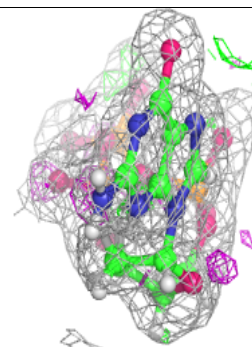
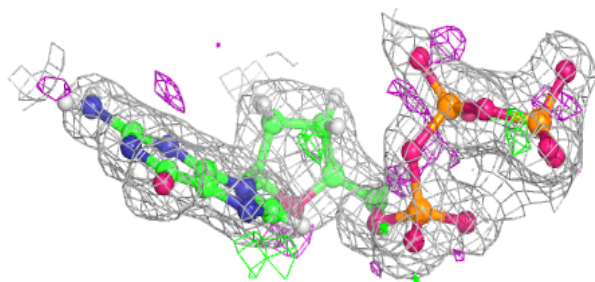
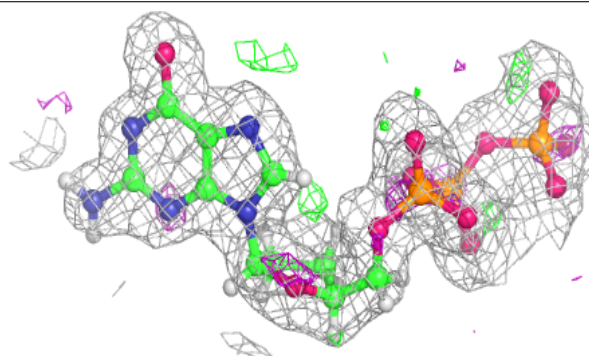
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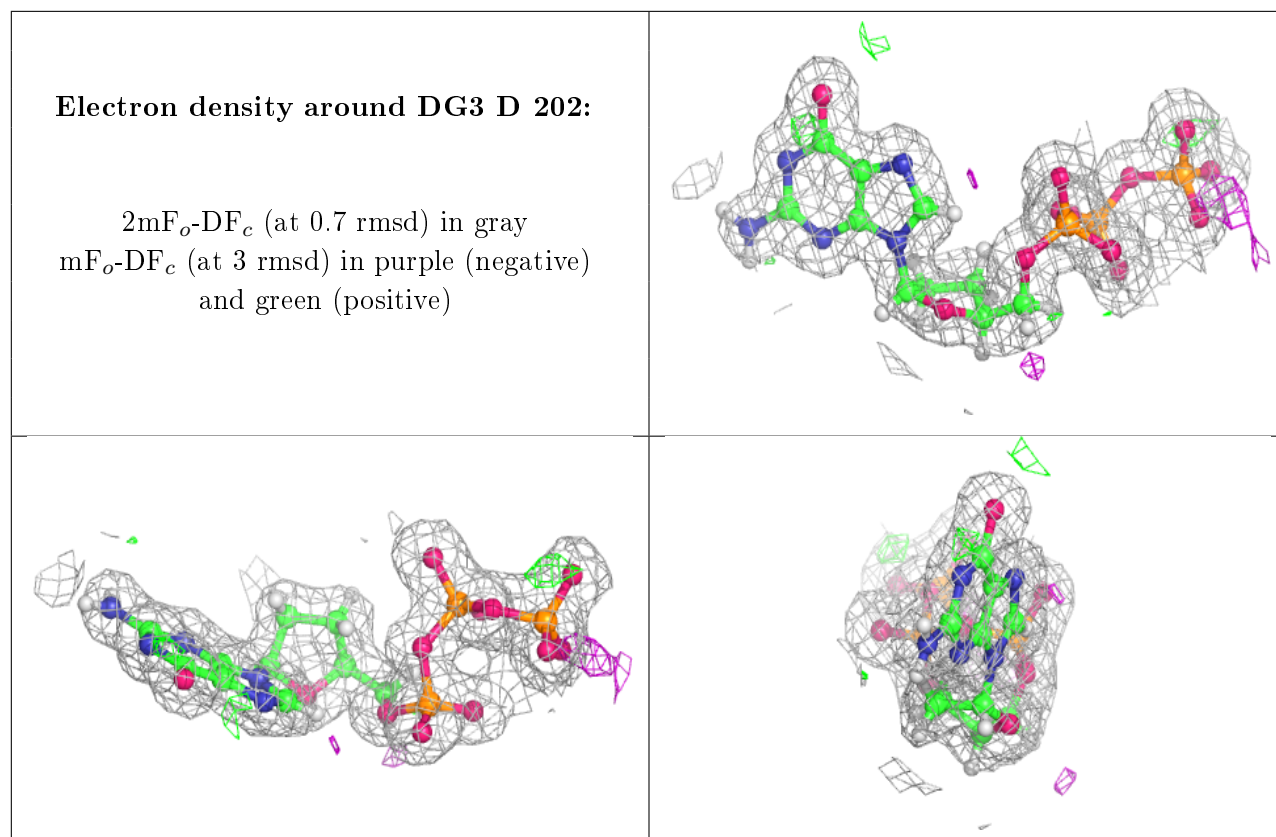
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
5	MG	D	2	1/1	1.00	0.14	13,13,13,13	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around DG3 A 201:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.