



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 1, 2026 – 07:26 PM UTC

PDB ID : 1DDU / pdb_00001ddu
Title : E. COLI THYMIDYLATE SYNTHASE IN COMPLEX WITH CB3717 AND
2',5'-DIDEOXYURIDINE (DDURD)
Authors : Stout, T.J.; Sage, C.R.; Stroud, R.M.
Deposited on : 1997-06-26
Resolution : 2.10 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**
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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) : 2.49

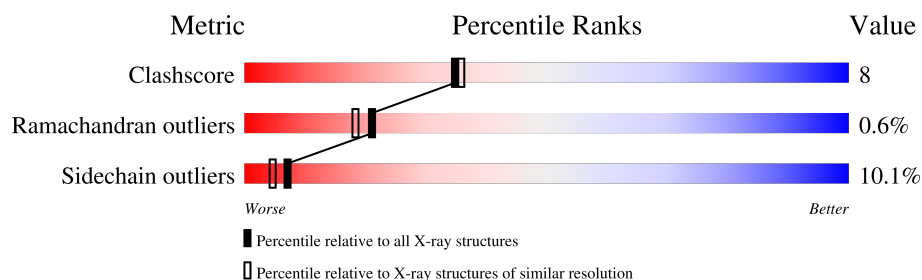
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	265	66% 29% . .
1	B	265	63% 30% 6%

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
2	PO4	A	530	-	X	-	-
2	PO4	B	531	-	X	-	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4482 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 protein called THYMIDYLATE SYNTHASE.

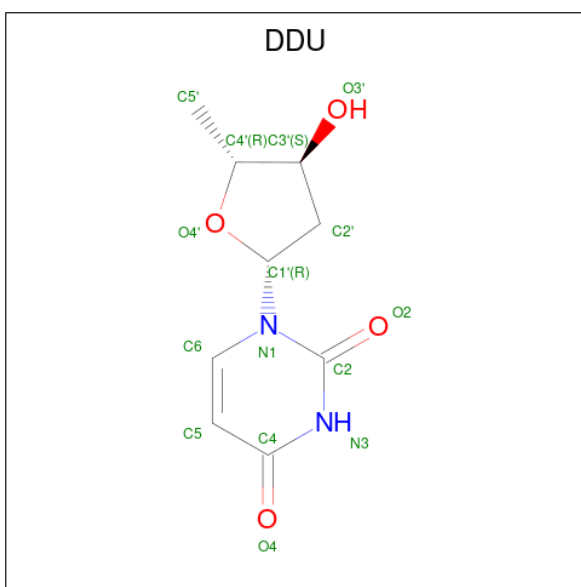
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	265	Total	C	N	O	S	0	0	0
			2153	1375	371	395	12			
1	B	265	Total	C	N	O	S	0	0	0
			2153	1375	371	395	12			

- Molecule 2 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



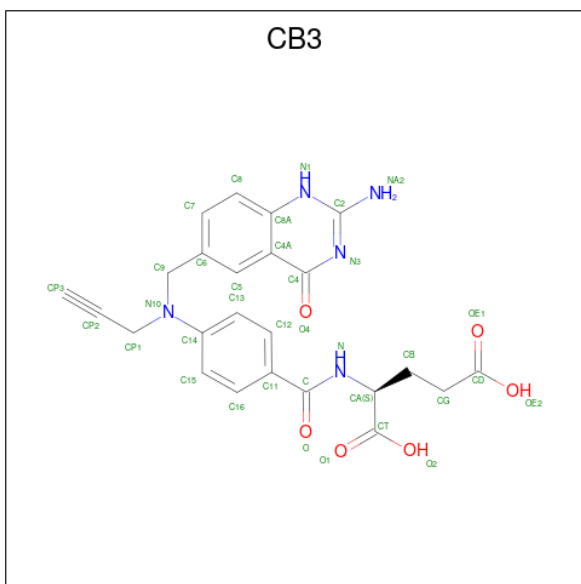
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	P	0	0
			5	4	1		
2	B	1	Total	O	P	0	0
			5	4	1		

- Molecule 3 is 2'-5'DIDEOXYURIDINE (CCD ID: DDU) (formula: C₉H₁₂N₂O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			15	9	2	4		
3	B	1	Total	C	N	O	0	0
			15	9	2	4		

- Molecule 4 is 10-PROPARGYL-5,8-DIDEAZAFOLIC ACID (CCD ID: CB3) (formula: $C_{24}H_{23}N_5O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			35	24	5	6		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	N	O	0	0
			35	24	5	6		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	39	Total	O	0	0
			39	39		
5	B	27	Total	O	0	0
			27	27		

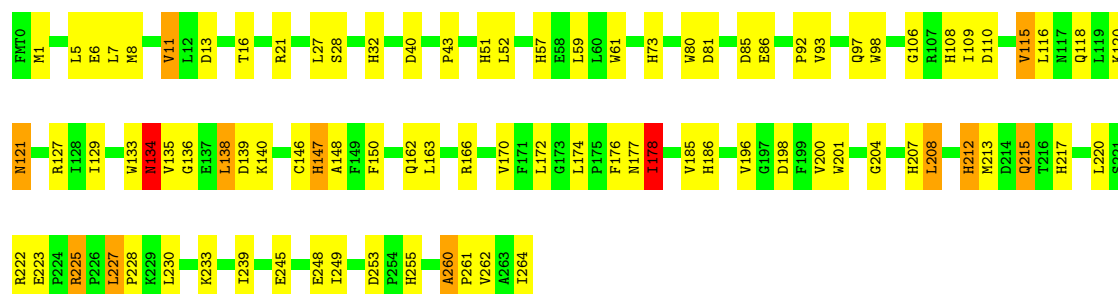
3 Residue-property plots

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.

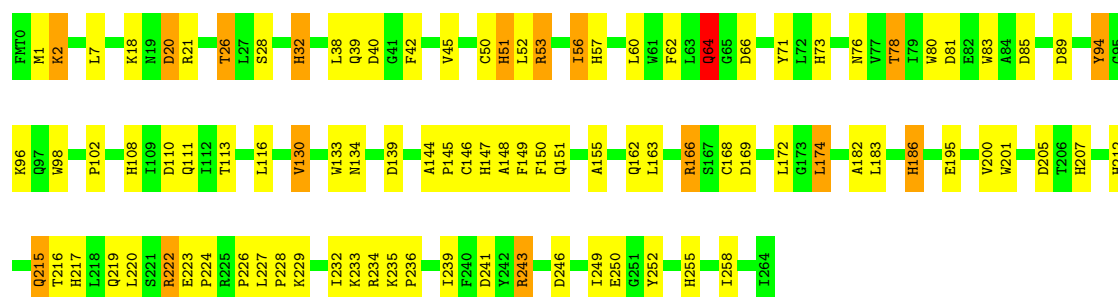
• Molecule 1: THYMIDYLATE SYNTHASE

Chain A: 



• Molecule 1: THYMIDYLATE SYNTHASE

Chain B: 



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, α , β , γ	127.41 Å 127.41 Å 68.20 Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	8.00 – 2.10	Depositor
% Data completeness (in resolution range)	78.4 (8.00-2.10)	Depositor
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
Refinement program	X-PLOR 3.843	Depositor
R, R_{free}	0.188 , 0.272	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4482	wwPDB-VP
Average B, all atoms (Å ²)	24.0	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: DDU, CB3, FMT, PO4

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	1.07	16/2210 (0.7%)	1.79	42/3000 (1.4%)
1	B	1.03	12/2210 (0.5%)	1.76	49/3000 (1.6%)
All	All	1.05	28/4420 (0.6%)	1.77	91/6000 (1.5%)

All (28) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	11	VAL	CA-CB	7.44	1.64	1.54
1	A	32	HIS	CD2-NE2	-7.09	1.30	1.37
1	B	57	HIS	CD2-NE2	-6.99	1.30	1.37
1	B	207	HIS	CD2-NE2	-6.96	1.30	1.37
1	B	73	HIS	CD2-NE2	-6.94	1.30	1.37
1	A	255	HIS	CD2-NE2	-6.76	1.30	1.37
1	B	130	VAL	CA-CB	6.70	1.63	1.54
1	A	217	HIS	CD2-NE2	-6.62	1.30	1.37
1	B	108	HIS	CD2-NE2	-6.54	1.30	1.37
1	A	207	HIS	CD2-NE2	-6.42	1.30	1.37
1	B	255	HIS	CD2-NE2	-6.36	1.30	1.37
1	B	147	HIS	CD2-NE2	-6.29	1.30	1.37
1	B	186	HIS	CD2-NE2	-6.23	1.30	1.37
1	A	73	HIS	CD2-NE2	-6.17	1.31	1.37
1	B	212	HIS	CD2-NE2	-6.14	1.31	1.37
1	B	32	HIS	CD2-NE2	-6.07	1.31	1.37
1	A	51	HIS	CD2-NE2	-6.01	1.31	1.37
1	A	212	HIS	CD2-NE2	-5.95	1.31	1.37
1	B	51	HIS	CD2-NE2	-5.87	1.31	1.37
1	A	32	HIS	CG-ND1	-5.85	1.31	1.38
1	A	186	HIS	CD2-NE2	-5.83	1.31	1.37
1	B	217	HIS	CD2-NE2	-5.83	1.31	1.37
1	A	147	HIS	CD2-NE2	-5.82	1.31	1.37
1	A	108	HIS	CD2-NE2	-5.59	1.31	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	57	HIS	CD2-NE2	-5.23	1.32	1.37
1	A	108	HIS	CG-ND1	-5.16	1.32	1.38
1	A	255	HIS	CG-ND1	-5.12	1.32	1.38
1	A	178	ILE	CA-CB	5.02	1.61	1.54

All (91) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	149	PHE	CA-CB-CG	10.09	123.89	113.80
1	B	150	PHE	CA-CB-CG	9.23	123.03	113.80
1	B	85	ASP	CA-CB-CG	8.90	121.50	112.60
1	A	57	HIS	CA-CB-CG	-8.61	105.19	113.80
1	A	147	HIS	CA-CB-CG	8.58	122.38	113.80
1	B	81	ASP	N-CA-C	8.54	120.21	111.07
1	A	150	PHE	CA-CB-CG	8.17	121.97	113.80
1	B	233	LYS	N-CA-C	8.00	122.14	112.38
1	B	110	ASP	CA-CB-CG	7.85	120.45	112.60
1	A	198	ASP	CA-CB-CG	7.76	120.36	112.60
1	A	85	ASP	CA-CB-CG	7.72	120.32	112.60
1	B	62	PHE	CA-CB-CG	7.72	121.52	113.80
1	B	147	HIS	CA-CB-CG	7.39	121.19	113.80
1	A	134	ASN	CA-CB-CG	7.31	119.91	112.60
1	B	64	GLN	CB-CG-CD	7.22	124.88	112.60
1	A	134	ASN	CB-CG-ND2	7.09	127.03	116.40
1	A	134	ASN	OD1-CG-ND2	-7.01	115.59	122.60
1	A	139	ASP	CA-CB-CG	6.87	119.47	112.60
1	B	201	TRP	CG-CD2-CE3	6.80	140.70	133.90
1	A	148	ALA	N-CA-C	6.79	120.78	112.23
1	A	213	MET	N-CA-C	6.78	118.47	111.14
1	B	20	ASP	CA-CB-CG	6.62	119.22	112.60
1	B	174	LEU	CA-C-N	6.59	126.53	119.28
1	B	174	LEU	C-N-CA	6.59	126.53	119.28
1	B	66	ASP	CA-CB-CG	6.55	119.15	112.60
1	B	53	ARG	CA-CB-CG	6.53	127.15	114.10
1	A	11	VAL	N-CA-C	-6.47	102.77	111.44
1	A	178	ILE	CB-CG1-CD1	-6.47	100.22	113.80
1	A	28	SER	N-CA-C	6.43	120.08	108.69
1	A	98	TRP	N-CA-C	6.43	118.37	111.36
1	A	73	HIS	CB-CG-CD2	-6.43	122.84	131.20
1	B	148	ALA	N-CA-C	6.33	121.19	112.90
1	B	28	SER	N-CA-C	6.31	119.77	109.24
1	B	78	THR	N-CA-C	6.29	120.66	112.92

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	57	HIS	CB-CG-CD2	-6.28	123.03	131.20
1	A	52	LEU	CB-CA-C	-6.16	100.21	110.68
1	B	134	ASN	CB-CG-ND2	6.13	125.59	116.40
1	B	94	TYR	N-CA-C	6.12	123.83	110.80
1	B	139	ASP	CA-CB-CG	6.11	118.71	112.60
1	B	32	HIS	CB-CG-CD2	-6.05	123.33	131.20
1	B	147	HIS	CB-CG-CD2	-6.05	123.34	131.20
1	B	201	TRP	CB-CG-CD1	-6.00	117.90	126.90
1	A	97	GLN	OE1-CD-NE2	-5.92	116.68	122.60
1	B	134	ASN	OD1-CG-ND2	-5.91	116.69	122.60
1	A	225	ARG	CA-C-N	5.88	126.22	119.93
1	A	225	ARG	C-N-CA	5.88	126.22	119.93
1	B	89	ASP	CA-CB-CG	5.86	118.46	112.60
1	A	13	ASP	CA-CB-CG	5.70	118.30	112.60
1	B	102	PRO	N-CA-C	5.69	119.54	110.21
1	A	253	ASP	CA-CB-CG	5.69	118.29	112.60
1	B	78	THR	N-CA-CB	-5.65	102.31	110.56
1	B	26	THR	N-CA-CB	-5.62	101.08	111.53
1	A	51	HIS	CB-CG-CD2	-5.61	123.91	131.20
1	A	261	PRO	N-CA-C	5.59	120.09	111.21
1	B	111	GLN	N-CA-C	5.48	118.01	111.71
1	B	169	ASP	N-CA-C	-5.47	99.61	108.41
1	B	21	ARG	N-CA-C	5.46	119.44	112.34
1	B	40	ASP	CA-CB-CG	5.46	118.06	112.60
1	A	81	ASP	N-CA-C	5.42	117.89	111.33
1	B	76	ASN	N-CA-C	5.41	119.17	112.47
1	B	83	TRP	CE2-CD2-CG	-5.35	100.78	107.20
1	A	217	HIS	CB-CG-CD2	-5.33	124.27	131.20
1	A	121	ASN	N-CA-C	5.30	120.03	113.50
1	A	32	HIS	CB-CG-CD2	-5.29	124.33	131.20
1	B	217	HIS	CB-CG-CD2	-5.28	124.34	131.20
1	B	207	HIS	CB-CG-CD2	-5.26	124.36	131.20
1	B	108	HIS	CB-CG-CD2	-5.25	124.38	131.20
1	B	201	TRP	CE2-CD2-CG	-5.24	100.91	107.20
1	B	235	LYS	CA-C-N	5.23	125.52	119.92
1	B	235	LYS	C-N-CA	5.23	125.52	119.92
1	B	144	ALA	CA-C-N	5.20	125.49	119.93
1	B	144	ALA	C-N-CA	5.20	125.49	119.93
1	B	98	TRP	CG-CD2-CE3	5.19	139.09	133.90
1	A	133	TRP	CG-CD2-CE3	5.18	139.08	133.90
1	B	89	ASP	N-CA-C	5.14	117.89	110.28
1	A	80	TRP	CE2-CD2-CG	-5.14	101.03	107.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	185	VAL	CA-C-O	-5.14	115.07	120.57
1	B	205	ASP	CA-CB-CG	5.13	117.73	112.60
1	A	129	ILE	N-CA-C	5.12	115.96	108.53
1	A	61	TRP	CE2-CD2-CG	-5.09	101.09	107.20
1	A	98	TRP	CE2-CD2-CG	-5.09	101.10	107.20
1	A	40	ASP	N-CA-C	5.08	118.74	112.54
1	A	110	ASP	CA-CB-CG	5.07	117.67	112.60
1	A	207	HIS	N-CA-C	5.07	116.69	109.14
1	B	80	TRP	CE2-CD2-CG	-5.07	101.12	107.20
1	A	260	ALA	CA-C-N	5.03	124.96	119.78
1	A	260	ALA	C-N-CA	5.03	124.96	119.78
1	B	133	TRP	CE2-CD2-CG	-5.02	101.18	107.20
1	A	109	ILE	CA-C-N	-5.01	116.33	122.84
1	A	109	ILE	C-N-CA	-5.01	116.33	122.84
1	A	201	TRP	CG-CD2-CE3	5.01	138.91	133.90

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	2153	0	2080	33	0
1	B	2153	0	2080	29	0
2	A	5	0	0	1	0
2	B	5	0	0	1	0
3	A	15	0	12	2	0
3	B	15	0	12	3	0
4	A	35	0	21	2	0
4	B	35	0	21	4	0
5	A	39	0	0	4	0
5	B	27	0	0	2	0
All	All	4482	0	4226	65	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 8.

All (65) 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:215:GLN:HE21	1:B:215:GLN:H	1.32	0.78
1:A:8:MET:HE3	1:A:220:LEU:HD13	1.74	0.68
1:A:264:ILE:HA	5:A:585:HOH:O	1.93	0.68
1:A:170:VAL:HB	1:A:208:LEU:HD13	1.76	0.68
1:B:168:CYS:SG	1:B:174:LEU:HD13	2.36	0.65
1:A:215:GLN:HE21	1:A:215:GLN:H	1.44	0.65
1:A:1:MET:HE1	1:A:178:ILE:HD11	1.77	0.65
1:A:92:PRO:HG2	1:A:140:LYS:HE3	1.80	0.63
4:B:535:CB3:CP2	4:B:535:CB3:H13	2.29	0.62
1:A:135:VAL:HA	1:A:138:LEU:HD22	1.81	0.62
1:A:43:PRO:HB2	1:A:178:ILE:HD11	1.82	0.61
1:A:172:LEU:HD21	1:A:262:VAL:HG22	1.82	0.61
1:B:7:LEU:HD13	1:B:32:HIS:CD2	2.34	0.61
1:B:45:VAL:CG2	1:B:50:CYS:SG	2.89	0.61
1:B:228:PRO:HB3	1:B:252:TYR:HB2	1.86	0.57
1:B:234:ARG:O	1:B:236:PRO:HD3	2.04	0.57
4:A:534:CB3:CP2	4:A:534:CB3:H15	2.35	0.57
1:A:21:ARG:HD3	2:A:530:PO4:O4	2.06	0.56
1:A:215:GLN:H	1:A:215:GLN:NE2	2.04	0.55
1:A:16:THR:HG21	1:B:155:ALA:HB1	1.89	0.55
1:B:145:PRO:O	1:B:166:ARG:HD2	2.06	0.55
1:B:39:GLN:HE22	1:B:195:GLU:HG2	1.73	0.54
1:A:227:LEU:HD12	1:A:228:PRO:HD2	1.91	0.53
1:A:5:LEU:HD23	1:A:8:MET:HE2	1.91	0.52
1:B:64:GLN:HG2	5:B:571:HOH:O	2.09	0.52
1:A:174:LEU:O	1:A:178:ILE:HG23	2.11	0.51
1:B:2:LYS:H	1:B:2:LYS:HD2	1.76	0.51
2:B:531:PO4:O4	3:B:533:DDU:H5'3	2.10	0.50
1:A:146:CYS:SG	3:A:532:DDU:H2'1	2.52	0.50
1:B:182:ALA:O	1:B:186:HIS:HD2	1.96	0.49
1:B:146:CYS:HA	1:B:166:ARG:HD3	1.95	0.48
1:A:208:LEU:HA	5:A:540:HOH:O	2.13	0.48
1:B:232:ILE:HA	1:B:246:ASP:O	2.14	0.47
1:B:146:CYS:SG	3:B:533:DDU:C6	3.03	0.46
1:B:42:PHE:HB3	1:B:228:PRO:HG2	1.97	0.46
1:A:120:LYS:HG3	1:A:121:ASN:OD1	2.16	0.45
1:A:147:HIS:HB2	1:A:163:LEU:HD11	1.98	0.45
1:A:115:VAL:HA	1:A:118:GLN:HE21	1.82	0.45
1:A:134:ASN:HD22	1:A:136:GLY:H	1.64	0.45
1:B:52:LEU:O	1:B:56:ILE:HG22	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:212:HIS:CD2	1:A:260:ALA:HB1	2.53	0.44
1:A:116:LEU:HD11	1:A:239:ILE:HG21	1.99	0.44
1:A:127:ARG:HG3	1:B:166:ARG:NH2	2.33	0.44
1:B:229:LYS:HB2	1:B:250:GLU:HG3	1.99	0.43
1:A:233:LYS:HE3	1:A:248:GLU:HB2	2.00	0.43
1:B:113:THR:HG21	5:B:554:HOH:O	2.17	0.43
1:A:106:GLY:HA3	5:A:555:HOH:O	2.18	0.43
1:B:216:THR:O	1:B:220:LEU:HB2	2.19	0.43
1:B:45:VAL:HG22	1:B:50:CYS:SG	2.58	0.43
1:B:223:GLU:HA	1:B:224:PRO:HD3	1.85	0.43
1:B:45:VAL:HG23	1:B:50:CYS:SG	2.59	0.42
1:B:71:TYR:OH	1:B:243:ARG:NH2	2.53	0.42
1:B:219:GLN:HA	1:B:222:ARG:HG3	2.01	0.42
1:A:120:LYS:HG3	1:A:121:ASN:CG	2.44	0.42
1:A:204:GLY:HA3	1:B:151:GLN:HE22	1.84	0.42
1:A:177:ASN:HD21	4:A:534:CB3:CP3	2.32	0.42
1:B:56:ILE:O	1:B:60:LEU:HG	2.20	0.41
1:A:146:CYS:SG	3:A:532:DDU:C6	3.08	0.41
1:A:208:LEU:HD12	5:A:540:HOH:O	2.19	0.41
1:B:162:GLN:HA	1:B:200:VAL:O	2.21	0.41
1:A:86:GLU:H	1:A:86:GLU:CD	2.28	0.41
4:B:535:CB3:CP2	4:B:535:CB3:C13	2.96	0.41
1:A:162:GLN:HA	1:A:200:VAL:O	2.21	0.41
3:B:533:DDU:O4	4:B:535:CB3:CP3	2.69	0.41
4:B:535:CB3:H13	4:B:535:CB3:CP3	2.51	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	263/265 (99%)	247 (94%)	15 (6%)	1 (0%)	30 28

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	263/265 (99%)	247 (94%)	14 (5%)	2 (1%)	16	12
All	All	526/530 (99%)	494 (94%)	29 (6%)	3 (1%)	21	18

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	94	TYR
1	B	258	ILE
1	A	93	VAL

5.3.2 Protein sidechains ⓘ

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	233/233 (100%)	212 (91%)	21 (9%)	9	6
1	B	233/233 (100%)	207 (89%)	26 (11%)	6	3
All	All	466/466 (100%)	419 (90%)	47 (10%)	7	5

All (47) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	GLU
1	A	7	LEU
1	A	11	VAL
1	A	27	LEU
1	A	59	LEU
1	A	115	VAL
1	A	134	ASN
1	A	138	LEU
1	A	166	ARG
1	A	176	PHE
1	A	178	ILE
1	A	196	VAL
1	A	208	LEU

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Mol	Chain	Res	Type
1	A	215	GLN
1	A	222	ARG
1	A	223	GLU
1	A	225	ARG
1	A	227	LEU
1	A	230	LEU
1	A	245	GLU
1	A	249	ILE
1	B	1	MET
1	B	2	LYS
1	B	18	LYS
1	B	20	ASP
1	B	26	THR
1	B	38	LEU
1	B	51	HIS
1	B	53	ARG
1	B	56	ILE
1	B	64	GLN
1	B	78	THR
1	B	96	LYS
1	B	116	LEU
1	B	130	VAL
1	B	163	LEU
1	B	166	ARG
1	B	172	LEU
1	B	183	LEU
1	B	215	GLN
1	B	222	ARG
1	B	226	PRO
1	B	227	LEU
1	B	239	ILE
1	B	241	ASP
1	B	243	ARG
1	B	249	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	97	GLN
1	A	117	ASN
1	A	118	GLN
1	A	134	ASN

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Mol	Chain	Res	Type
1	A	190	GLN
1	A	215	GLN
1	A	217	HIS
1	B	97	GLN
1	B	117	ASN
1	B	151	GLN
1	B	186	HIS
1	B	215	GLN
1	B	219	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

6 ligands 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	$\# Z > 2$
3	DDU	B	533	-	16,16,16	1.61	3 (18%)	22,23,23	1.95	1 (4%)
2	PO4	A	530	-	4,4,4	3.20	4 (100%)	6,6,6	2.05	3 (50%)
4	CB3	B	535	-	37,37,37	2.08	9 (24%)	50,51,51	1.34	5 (10%)
2	PO4	B	531	-	4,4,4	2.66	2 (50%)	6,6,6	2.36	5 (83%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	CB3	A	534	-	37,37,37	2.06	8 (21%)	50,51,51	1.48	6 (12%)
3	DDU	A	532	-	16,16,16	1.29	4 (25%)	22,23,23	1.46	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
3	DDU	B	533	-	-	0/4/16/16	0/2/2/2
4	CB3	A	534	-	-	16/27/28/28	0/3/3/3
3	DDU	A	532	-	-	0/4/16/16	0/2/2/2
4	CB3	B	535	-	-	11/27/28/28	0/3/3/3

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	535	CB3	O4-C4	8.64	1.38	1.23
4	A	534	CB3	O4-C4	8.22	1.37	1.23
2	A	530	PO4	P-O1	5.04	1.62	1.50
4	A	534	CB3	C4A-C4	-4.86	1.39	1.48
4	B	535	CB3	C4A-C4	-4.51	1.40	1.48
3	B	533	DDU	O4'-C1'	4.38	1.52	1.42
2	B	531	PO4	P-O1	3.83	1.59	1.50
4	B	535	CB3	CA-N	3.42	1.53	1.45
4	A	534	CB3	CA-N	3.27	1.52	1.45
4	B	535	CB3	C11-C	-2.97	1.43	1.50
3	B	533	DDU	C6-N1	-2.62	1.31	1.38
3	A	532	DDU	O4'-C1'	2.56	1.48	1.42
3	B	533	DDU	C6-C5	2.50	1.40	1.35
2	A	530	PO4	P-O4	-2.49	1.47	1.54
4	B	535	CB3	C8A-N1	-2.46	1.35	1.39
4	A	534	CB3	C8A-N1	-2.44	1.35	1.39
4	A	534	CB3	C4-N3	-2.38	1.33	1.38
2	B	531	PO4	P-O4	-2.36	1.47	1.54
4	B	535	CB3	O2-CT	-2.35	1.23	1.30
4	A	534	CB3	O2-CT	-2.27	1.23	1.30
4	A	534	CB3	OE2-CD	-2.23	1.23	1.30
2	A	530	PO4	P-O3	-2.18	1.48	1.54
2	A	530	PO4	P-O2	-2.16	1.48	1.54
3	A	532	DDU	C6-C5	2.14	1.40	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	535	CB3	OE2-CD	-2.14	1.23	1.30
4	A	534	CB3	C9-N10	2.13	1.49	1.46
3	A	532	DDU	C6-N1	-2.12	1.33	1.38
4	B	535	CB3	C-N	2.11	1.39	1.34
4	B	535	CB3	C4-N3	-2.04	1.34	1.38
3	A	532	DDU	C5'-C4'	2.02	1.56	1.51

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	533	DDU	O4'-C1'-N1	7.72	121.56	107.86
4	A	534	CB3	CP2-CP1-N10	-5.01	108.83	113.45
3	A	532	DDU	O4'-C1'-N1	4.77	116.33	107.86
4	B	535	CB3	CP2-CP1-N10	-4.33	109.45	113.45
4	A	534	CB3	CT-CA-N	3.90	119.62	110.57
4	A	534	CB3	CP1-CP2-CP3	-3.52	171.93	177.63
4	B	535	CB3	CP1-CP2-CP3	-3.07	172.66	177.63
2	B	531	PO4	O4-P-O1	-2.89	100.74	110.95
4	A	534	CB3	C8A-C4A-C4	-2.78	117.11	120.11
4	B	535	CB3	C8A-C4A-C4	-2.54	117.37	120.11
2	A	530	PO4	O3-P-O2	2.52	115.76	107.91
3	A	532	DDU	C6-N1-C2	2.45	123.98	121.00
2	B	531	PO4	O3-P-O2	2.38	115.31	107.91
2	B	531	PO4	O4-P-O2	2.37	115.30	107.91
2	B	531	PO4	O4-P-O3	2.34	115.20	107.91
4	A	534	CB3	C9-N10-C14	2.31	124.73	120.72
4	B	535	CB3	C16-C11-C12	2.31	121.50	118.57
2	B	531	PO4	O2-P-O1	-2.27	102.92	110.95
2	A	530	PO4	O4-P-O3	2.24	114.89	107.91
4	B	535	CB3	C9-C6-C7	-2.23	116.65	120.75
4	A	534	CB3	CP1-N10-C9	-2.09	115.09	117.19
3	A	532	DDU	C2'-C3'-C4'	-2.07	98.61	102.81
2	A	530	PO4	O3-P-O1	-2.03	103.78	110.95

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	534	CB3	CT-CA-N-C
4	A	534	CB3	N-CA-CB-CG
4	A	534	CB3	O-C-N-CA
4	A	534	CB3	C11-C-N-CA

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Mol	Chain	Res	Type	Atoms
4	B	535	CB3	C13-C14-N10-C9
4	B	535	CB3	C13-C14-N10-CP1
4	B	535	CB3	C15-C14-N10-C9
4	B	535	CB3	C15-C14-N10-CP1
4	A	534	CB3	CT-CA-CB-CG
4	A	534	CB3	CA-CB-CG-CD
4	A	534	CB3	C15-C14-N10-C9
4	A	534	CB3	C15-C14-N10-CP1
4	B	535	CB3	CA-CB-CG-CD
4	A	534	CB3	C13-C14-N10-CP1
4	A	534	CB3	C13-C14-N10-C9
4	A	534	CB3	N-CA-CT-O1
4	A	534	CB3	N-CA-CT-O2
4	B	535	CB3	CT-CA-CB-CG
4	B	535	CB3	N-CA-CB-CG
4	A	534	CB3	CB-CA-CT-O1
4	A	534	CB3	CB-CA-CT-O2
4	A	534	CB3	OE2-CD-CG-CB
4	A	534	CB3	OE1-CD-CG-CB
4	B	535	CB3	N-C-C11-C12
4	B	535	CB3	N-C-C11-C16
4	B	535	CB3	OE1-CD-CG-CB
4	B	535	CB3	OE2-CD-CG-CB

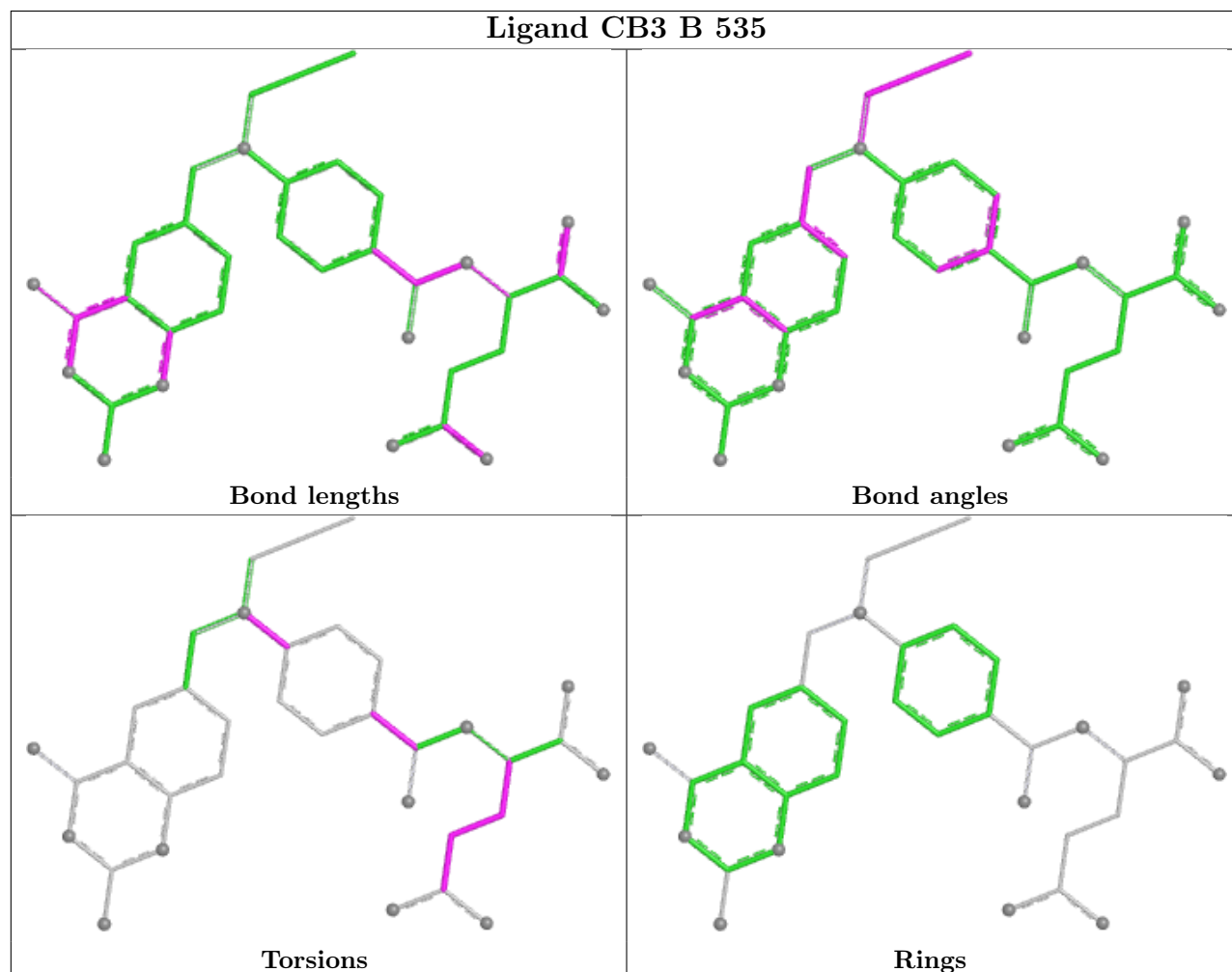
There are no ring outliers.

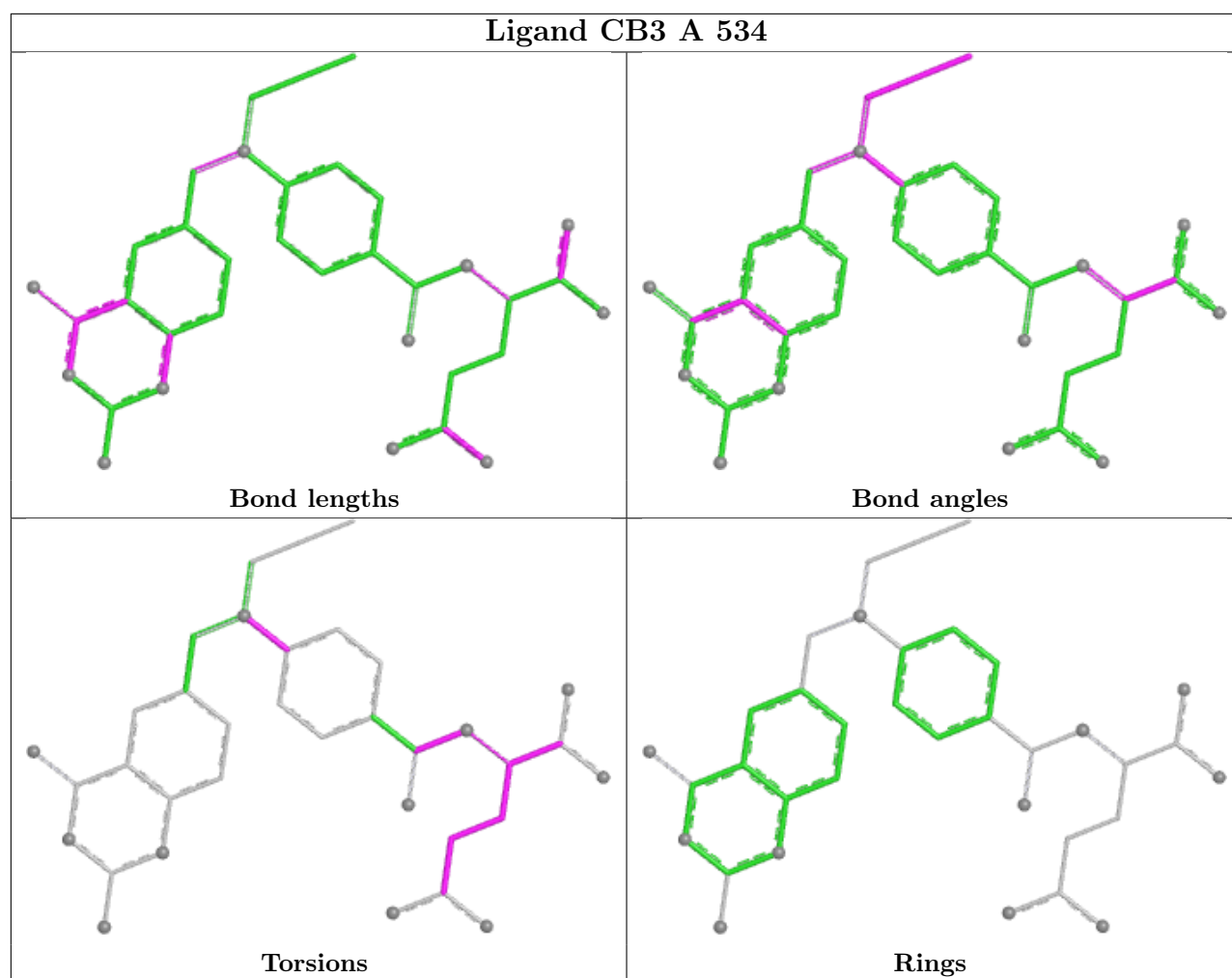
6 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	533	DDU	3	0
2	A	530	PO4	1	0
4	B	535	CB3	4	0
2	B	531	PO4	1	0
4	A	534	CB3	2	0
3	A	532	DDU	2	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

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.