Full wwPDB X-ray Structure Validation Report (i)

Sep 23, 2023 – 06:09 PM EDT

PDB ID	:	5T8Y
Title	:	Structure of epoxyqueuosine reductase from Bacillus subtilis with the Asp134 catalytic loop swung out of the active site.
Authors	:	Dowling, D.P.; Miles, Z.D.; Kohrer, C.; Maiocco, S.J.; Elliott, S.J.; Bandarian, V.; Drennan, C.L.
Deposited on	:	2016-09-08
Resolution	:	2.65 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 (i) 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 (1)) were used in the production of this report:

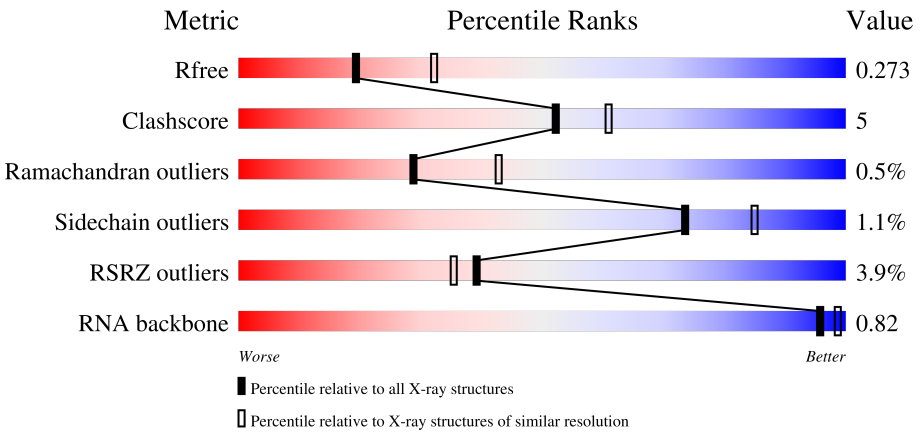
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 2.65 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	1332 (2.68-2.64)
Clashscore	141614	1374 (2.68-2.64)
Ramachandran outliers	138981	1349 (2.68-2.64)
Sidechain outliers	138945	1349 (2.68-2.64)
RSRZ outliers	127900	1318 (2.68-2.64)
RNA backbone	3102	1010 (2.96-2.36)

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% 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	437	3% 73% 12% 14%
1	B	437	3% 73% 12% 15%
2	X	17	12% 18% 71%

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 6241 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 Epoxyqueuosine reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	374	2942	1867	501	557	17	0	0	0
1	B	372	2929	1860	500	552	17	0	0	0

There are 102 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-27	MET	-	initiating methionine	UNP P97030
A	-26	ALA	-	expression tag	UNP P97030
A	-25	SER	-	expression tag	UNP P97030
A	-24	ARG	-	expression tag	UNP P97030
A	-23	GLY	-	expression tag	UNP P97030
A	-22	SER	-	expression tag	UNP P97030
A	-21	HIS	-	expression tag	UNP P97030
A	-20	HIS	-	expression tag	UNP P97030
A	-19	HIS	-	expression tag	UNP P97030
A	-18	HIS	-	expression tag	UNP P97030
A	-17	HIS	-	expression tag	UNP P97030
A	-16	HIS	-	expression tag	UNP P97030
A	-15	GLY	-	expression tag	UNP P97030
A	-14	ALA	-	expression tag	UNP P97030
A	-13	GLY	-	expression tag	UNP P97030
A	-12	ASP	-	expression tag	UNP P97030
A	-11	ARG	-	expression tag	UNP P97030
A	-10	GLY	-	expression tag	UNP P97030
A	-9	PRO	-	expression tag	UNP P97030
A	-8	GLU	-	expression tag	UNP P97030
A	-7	PHE	-	expression tag	UNP P97030
A	-6	GLU	-	expression tag	UNP P97030
A	-5	LEU	-	expression tag	UNP P97030
A	-4	GLY	-	expression tag	UNP P97030
A	-3	THR	-	expression tag	UNP P97030

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	ARG	-	expression tag	UNP P97030
A	-1	GLY	-	expression tag	UNP P97030
A	0	SER	-	expression tag	UNP P97030
A	387	GLY	-	expression tag	UNP P97030
A	388	SER	-	expression tag	UNP P97030
A	389	LEU	-	expression tag	UNP P97030
A	390	GLU	-	expression tag	UNP P97030
A	391	VAL	-	expression tag	UNP P97030
A	392	ASP	-	expression tag	UNP P97030
A	393	LEU	-	expression tag	UNP P97030
A	394	GLN	-	expression tag	UNP P97030
A	395	GLY	-	expression tag	UNP P97030
A	396	ASP	-	expression tag	UNP P97030
A	397	HIS	-	expression tag	UNP P97030
A	398	GLY	-	expression tag	UNP P97030
A	399	LEU	-	expression tag	UNP P97030
A	400	SER	-	expression tag	UNP P97030
A	401	ALA	-	expression tag	UNP P97030
A	402	TRP	-	expression tag	UNP P97030
A	403	SER	-	expression tag	UNP P97030
A	404	HIS	-	expression tag	UNP P97030
A	405	PRO	-	expression tag	UNP P97030
A	406	GLN	-	expression tag	UNP P97030
A	407	PHE	-	expression tag	UNP P97030
A	408	GLU	-	expression tag	UNP P97030
A	409	LYS	-	expression tag	UNP P97030
B	-27	MET	-	initiating methionine	UNP P97030
B	-26	ALA	-	expression tag	UNP P97030
B	-25	SER	-	expression tag	UNP P97030
B	-24	ARG	-	expression tag	UNP P97030
B	-23	GLY	-	expression tag	UNP P97030
B	-22	SER	-	expression tag	UNP P97030
B	-21	HIS	-	expression tag	UNP P97030
B	-20	HIS	-	expression tag	UNP P97030
B	-19	HIS	-	expression tag	UNP P97030
B	-18	HIS	-	expression tag	UNP P97030
B	-17	HIS	-	expression tag	UNP P97030
B	-16	HIS	-	expression tag	UNP P97030
B	-15	GLY	-	expression tag	UNP P97030
B	-14	ALA	-	expression tag	UNP P97030
B	-13	GLY	-	expression tag	UNP P97030
B	-12	ASP	-	expression tag	UNP P97030

Continued on next page...

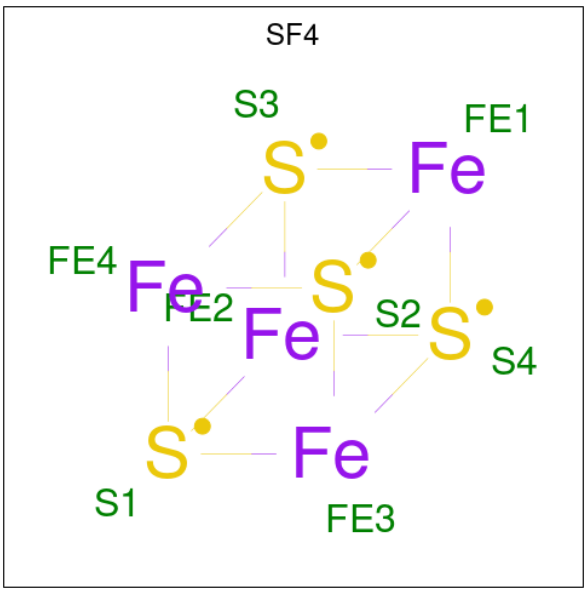
Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	-11	ARG	-	expression tag	UNP P97030
B	-10	GLY	-	expression tag	UNP P97030
B	-9	PRO	-	expression tag	UNP P97030
B	-8	GLU	-	expression tag	UNP P97030
B	-7	PHE	-	expression tag	UNP P97030
B	-6	GLU	-	expression tag	UNP P97030
B	-5	LEU	-	expression tag	UNP P97030
B	-4	GLY	-	expression tag	UNP P97030
B	-3	THR	-	expression tag	UNP P97030
B	-2	ARG	-	expression tag	UNP P97030
B	-1	GLY	-	expression tag	UNP P97030
B	0	SER	-	expression tag	UNP P97030
B	387	GLY	-	expression tag	UNP P97030
B	388	SER	-	expression tag	UNP P97030
B	389	LEU	-	expression tag	UNP P97030
B	390	GLU	-	expression tag	UNP P97030
B	391	VAL	-	expression tag	UNP P97030
B	392	ASP	-	expression tag	UNP P97030
B	393	LEU	-	expression tag	UNP P97030
B	394	GLN	-	expression tag	UNP P97030
B	395	GLY	-	expression tag	UNP P97030
B	396	ASP	-	expression tag	UNP P97030
B	397	HIS	-	expression tag	UNP P97030
B	398	GLY	-	expression tag	UNP P97030
B	399	LEU	-	expression tag	UNP P97030
B	400	SER	-	expression tag	UNP P97030
B	401	ALA	-	expression tag	UNP P97030
B	402	TRP	-	expression tag	UNP P97030
B	403	SER	-	expression tag	UNP P97030
B	404	HIS	-	expression tag	UNP P97030
B	405	PRO	-	expression tag	UNP P97030
B	406	GLN	-	expression tag	UNP P97030
B	407	PHE	-	expression tag	UNP P97030
B	408	GLU	-	expression tag	UNP P97030
B	409	LYS	-	expression tag	UNP P97030

- Molecule 2 is a RNA chain called RNA (5'-R(*GP*CP*AP*GP*AP*CP*UP*GP*UP*AP*AP*AP*UP*CP*UP*GP*C)-3').

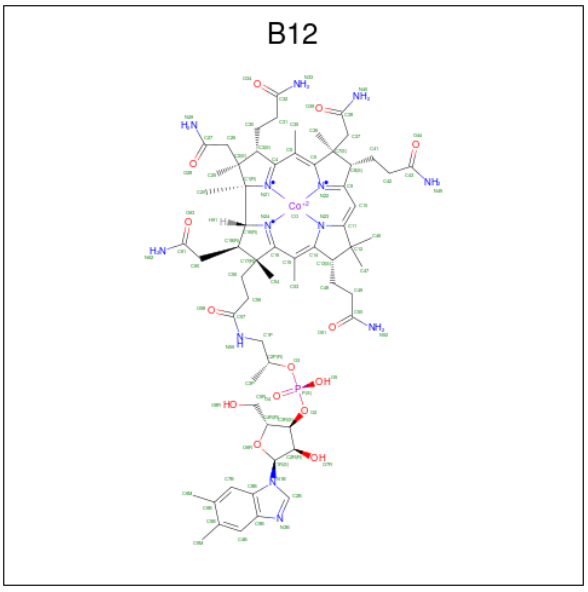
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	X	5	107	48	20	34	5	0	0	0

- Molecule 3 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe_4S_4).



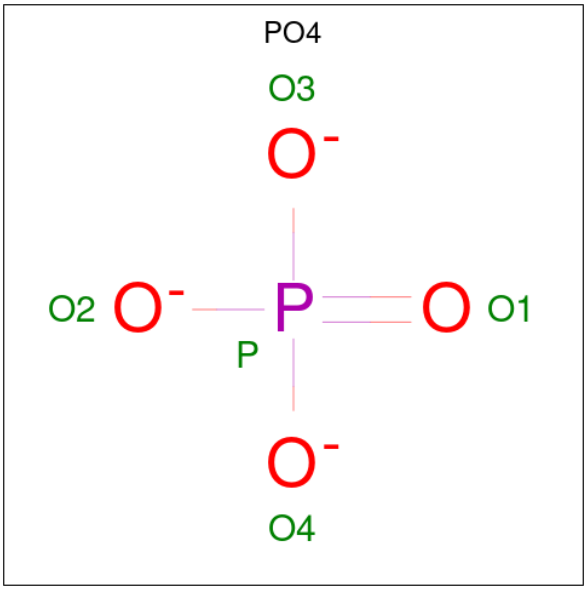
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	Fe	S		
3	A	1	8	4	4	0	0
			Total	Fe	S		
3	A	1	8	4	4	0	0
			Total	Fe	S		
3	B	1	8	4	4	0	0
			Total	Fe	S		
3	B	1	8	4	4	0	0

- Molecule 4 is COBALAMIN (three-letter code: B12) (formula: $C_{62}H_{89}CoN_{13}O_{14}P$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	Co	N	O	P		
4	A	1	91	62	1	13	14	1	0	0
4	B	1	91	62	1	13	14	1	0	0

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



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

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	A	9	9	9	0	0

Continued on next page...

Continued from previous page...

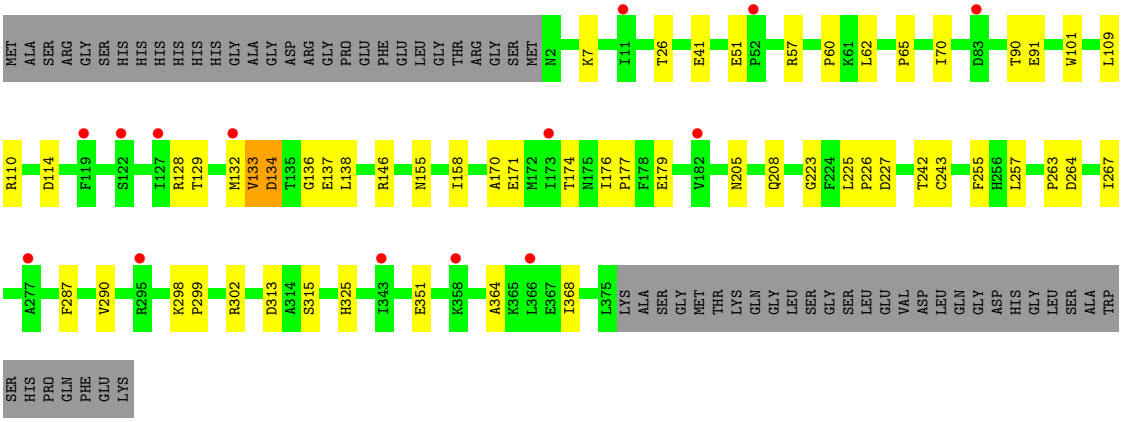
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	B	5	5	5	0	0

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 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.

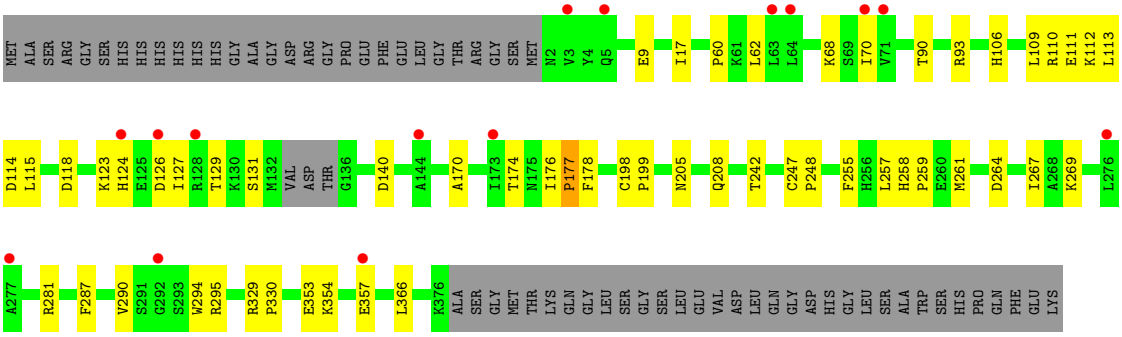
• Molecule 1: Epoxyqueuosine reductase

Chain A: 3% 73% 12% 14%



• Molecule 1: Epoxyqueuosine reductase

Chain B: 3% 73% 12% 15%



• Molecule 2: RNA (5'-R(*GP*CP*AP*GP*AP*CP*UP*GP*UP*AP*AP*AP*UP*CP*UP*GP*C)-3')

Chain X: 12% 18% 71%

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	44.76Å 111.03Å 95.97Å 90.00° 99.13° 90.00°	Depositor
Resolution (Å)	47.90 – 2.65 47.90 – 2.65	Depositor EDS
% Data completeness (in resolution range)	94.5 (47.90-2.65) 94.8 (47.90-2.65)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.70 (at 2.65Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.238 , 0.267 0.243 , 0.273	Depositor DCC
R_{free} test set	1259 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å^2)	59.7	Xtriage
Anisotropy	0.911	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 40.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	6241	wwPDB-VP
Average B, all atoms (Å^2)	71.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.06% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SF4, B12, 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	0.21	0/3001	0.37	0/4049
1	B	0.21	0/2987	0.37	0/4026
2	X	0.24	0/119	0.63	0/183
All	All	0.21	0/6107	0.38	0/8258

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 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	2942	0	2967	33	0
1	B	2929	0	2959	28	0
2	X	107	0	55	2	0
3	A	16	0	0	1	0
3	B	16	0	0	1	0
4	A	91	0	88	3	0
4	B	91	0	88	5	0
5	A	10	0	0	0	0
5	B	25	0	0	1	0
6	A	9	0	0	1	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	5	0	0	0	0
All	All	6241	0	6157	68	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 5.

All (68) 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:133:VAL:HG22	1:A:134:ASP:H	1.09	1.09
1:A:133:VAL:HG22	1:A:134:ASP:N	1.90	0.87
1:A:65:PRO:O	1:A:128:ARG:NH2	2.20	0.73
1:A:109:LEU:HD23	1:A:170:ALA:HB2	1.80	0.64
1:B:110:ARG:NH1	1:B:114:ASP:OD1	2.31	0.63
1:A:133:VAL:CG2	1:A:134:ASP:H	1.93	0.61
1:A:51:GLU:HG3	1:A:137:GLU:HA	1.83	0.60
1:B:109:LEU:HD23	1:B:170:ALA:HB2	1.82	0.60
1:A:110:ARG:NH1	1:A:114:ASP:OD1	2.35	0.60
1:A:223:GLY:O	1:A:302:ARG:NH1	2.33	0.59
1:B:9:GLU:OE1	1:B:123:LYS:NZ	2.36	0.59
1:A:41:GLU:HG3	1:B:366:LEU:HD21	1.87	0.57
1:B:258:HIS:HB2	1:B:261:MET:HE2	1.88	0.56
1:A:60:PRO:HB3	1:A:70:ILE:HD11	1.88	0.55
1:B:205:ASN:HB2	1:B:208:GLN:HB3	1.87	0.55
1:A:132:MET:HG3	1:A:138:LEU:HD12	1.88	0.55
1:A:158:ILE:N	6:A:601:HOH:O	2.39	0.54
1:B:113:LEU:HD13	1:B:131:SER:HB3	1.90	0.54
1:B:68:LYS:HD3	1:B:177:PRO:HG3	1.90	0.53
2:X:30:G:H2'	2:X:31:A:C8	2.45	0.52
1:B:129:THR:HG22	1:B:174:THR:HG22	1.93	0.50
1:A:132:MET:HB2	1:A:171:GLU:HG2	1.94	0.49
1:B:255:PHE:HB3	1:B:257:LEU:HG	1.95	0.49
4:B:503:B12:H301	4:B:503:B12:H253	1.69	0.49
1:B:60:PRO:HB3	1:B:70:ILE:HD11	1.95	0.48
1:A:313:ASP:OD1	1:A:315:SER:OG	2.29	0.48
1:B:176:ILE:O	1:B:178:PHE:N	2.45	0.48
1:A:101:TRP:HB3	1:A:263:PRO:HB3	1.95	0.47
1:A:155:ASN:ND2	1:A:243:CYS:O	2.46	0.47
1:A:242:THR:HB	3:A:502:SF4:S4	2.55	0.47
1:A:205:ASN:HB2	1:A:208:GLN:HB3	1.97	0.47
1:B:242:THR:HB	3:B:502:SF4:S4	2.55	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:264:ASP:HB3	1:A:267:ILE:HG12	1.97	0.46
1:A:51:GLU:HB2	1:A:57:ARG:HD2	1.97	0.46
1:B:354:LYS:HD2	5:B:504:PO4:O2	2.17	0.45
4:A:503:B12:H253	4:A:503:B12:H301	1.70	0.45
1:A:255:PHE:HB3	1:A:257:LEU:HG	1.99	0.44
1:A:90:THR:HG23	1:A:91:GLU:HG2	2.00	0.44
1:B:198:CYS:HA	1:B:199:PRO:HD3	1.86	0.44
1:B:247:CYS:HA	1:B:248:PRO:HD3	1.87	0.44
1:B:353:GLU:O	1:B:357:GLU:HG2	2.18	0.44
1:B:287:PHE:O	1:B:290:VAL:HG22	2.18	0.44
4:B:503:B12:H362	4:B:503:B12:H351	1.99	0.43
4:A:503:B12:H473	4:A:503:B12:H482	1.78	0.43
1:B:264:ASP:HB3	1:B:267:ILE:HG12	2.00	0.43
1:B:111:GLU:O	1:B:115:LEU:HG	2.19	0.43
4:B:503:B12:H262	4:B:503:B12:H91	1.87	0.42
1:B:124:HIS:HB2	1:B:127:ILE:HD11	2.00	0.42
1:A:325:HIS:NE2	1:A:351:GLU:HG3	2.34	0.42
1:B:281:ARG:HE	2:X:29:A:P	2.43	0.42
1:B:17:ILE:O	1:B:112:LYS:NZ	2.33	0.42
1:B:258:HIS:HA	1:B:259:PRO:HD3	1.83	0.42
1:A:133:VAL:HG13	1:A:134:ASP:N	2.35	0.42
1:A:129:THR:HG22	1:A:174:THR:HG22	2.00	0.42
1:B:93:ARG:NH1	1:B:269:LYS:O	2.49	0.41
1:A:7:LYS:NZ	1:A:179:GLU:O	2.52	0.41
4:A:503:B12:H351	4:A:503:B12:H362	2.02	0.41
1:B:329:ARG:HA	1:B:330:PRO:HD3	1.93	0.41
1:A:26:THR:O	1:A:146:ARG:NH2	2.53	0.41
1:A:225:LEU:HD12	1:A:226:PRO:HD2	2.01	0.41
1:B:140:ASP:OD2	4:B:503:B12:N29	2.54	0.41
1:A:176:ILE:HA	1:A:177:PRO:HD3	1.95	0.41
1:A:364:ALA:O	1:A:368:ILE:HG13	2.21	0.41
4:B:503:B12:H262	4:B:503:B12:H601	2.01	0.41
1:B:294:TRP:CE2	1:B:295:ARG:HG2	2.56	0.41
1:A:133:VAL:CG2	1:A:134:ASP:N	2.62	0.40
1:A:287:PHE:O	1:A:290:VAL:HG22	2.20	0.40
1:A:298:LYS:HB3	1:A:299:PRO:HD3	2.03	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	372/437 (85%)	361 (97%)	8 (2%)	3 (1%)	19	29
1	B	368/437 (84%)	356 (97%)	11 (3%)	1 (0%)	41	56
All	All	740/874 (85%)	717 (97%)	19 (3%)	4 (0%)	29	43

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	133	VAL
1	A	134	ASP
1	A	136	GLY
1	B	177	PRO

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	320/368 (87%)	318 (99%)	2 (1%)	86	92
1	B	318/368 (86%)	313 (98%)	5 (2%)	62	78
All	All	638/736 (87%)	631 (99%)	7 (1%)	73	85

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	LEU
1	A	227	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	62	LEU
1	B	90	THR
1	B	106	HIS
1	B	118	ASP
1	B	126	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	258	HIS

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	X	4/17 (23%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

13 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	$\#\|Z\| > 2$
4	B12	A	503	-	90,101,101	0.83	3 (3%)	137,166,166	1.06	13 (9%)
3	SF4	B	502	1	0,12,12	-	-	-		
5	PO4	B	504	-	4,4,4	0.92	0	6,6,6	0.40	0
5	PO4	A	505	-	4,4,4	0.89	0	6,6,6	0.49	0
5	PO4	B	506	-	4,4,4	0.89	0	6,6,6	0.46	0
5	PO4	B	507	-	4,4,4	0.89	0	6,6,6	0.46	0
3	SF4	A	501	1	0,12,12	-	-	-		
5	PO4	B	505	-	4,4,4	0.90	0	6,6,6	0.44	0
5	PO4	A	504	-	4,4,4	0.91	0	6,6,6	0.43	0
4	B12	B	503	-	90,101,101	0.81	3 (3%)	137,166,166	1.04	11 (8%)
3	SF4	B	501	1	0,12,12	-	-	-		
5	PO4	B	508	-	4,4,4	0.92	0	6,6,6	0.46	0
3	SF4	A	502	1	0,12,12	-	-	-		

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	B12	A	503	-	-	11/52/223/223	0/3/11/11
3	SF4	B	502	1	-	-	0/6/5/5
3	SF4	A	501	1	-	-	0/6/5/5
4	B12	B	503	-	-	13/52/223/223	0/3/11/11
3	SF4	B	501	1	-	-	0/6/5/5
3	SF4	A	502	1	-	-	0/6/5/5

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	503	B12	C14-N23	4.80	1.41	1.35
4	B	503	B12	C14-N23	4.57	1.40	1.35
4	A	503	B12	C16-C15	3.15	1.53	1.44
4	B	503	B12	C16-C15	2.95	1.52	1.44
4	B	503	B12	C1P-C2P	2.23	1.57	1.51
4	A	503	B12	C1P-C2P	2.12	1.57	1.51

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	503	B12	C20-C1-C19	-3.57	105.92	109.36

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	503	B12	C30-C3-C2	-3.55	111.58	119.09
4	B	503	B12	C30-C3-C2	-3.20	112.31	119.09
4	B	503	B12	C55-C17-C18	-2.85	105.63	111.15
4	A	503	B12	C20-C1-C19	-2.81	106.65	109.36
4	A	503	B12	C26-C2-C1	2.76	114.31	110.01
4	A	503	B12	C55-C17-C18	-2.76	105.81	111.15
4	A	503	B12	C35-C5-C6	2.67	126.68	122.43
4	A	503	B12	C15-C16-N24	-2.65	118.61	122.42
4	B	503	B12	C15-C16-N24	-2.64	118.62	122.42
4	B	503	B12	C35-C5-C6	2.60	126.57	122.43
4	A	503	B12	C1-C19-C18	-2.56	117.68	121.88
4	B	503	B12	C10-C9-N22	2.54	128.65	125.73
4	B	503	B12	C1-C19-C18	-2.45	117.86	121.88
4	A	503	B12	C10-C9-N22	2.45	128.54	125.73
4	B	503	B12	C17-C18-C19	2.42	106.06	102.36
4	A	503	B12	C17-C18-C19	2.30	105.87	102.36
4	B	503	B12	P-O2-C3R	2.12	127.11	119.41
4	B	503	B12	C35-C5-C4	-2.08	112.55	116.79
4	A	503	B12	C17-C16-N24	2.06	114.32	111.15
4	A	503	B12	C35-C5-C4	-2.06	112.60	116.79
4	A	503	B12	P-O2-C3R	2.05	126.88	119.41
4	A	503	B12	C2-C1-N21	2.01	104.57	101.77
4	B	503	B12	C17-C16-N24	2.00	114.23	111.15

There are no chirality outliers.

All (24) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	503	B12	C14-C13-C48-C49
4	A	503	B12	C1P-C2P-O3-P
4	B	503	B12	C14-C13-C48-C49
4	B	503	B12	C1P-C2P-O3-P
4	B	503	B12	C3P-C2P-O3-P
4	B	503	B12	C2-C3-C30-C31
4	A	503	B12	C2P-O3-P-O2
4	B	503	B12	C4-C3-C30-C31
4	A	503	B12	C2R-C3R-O2-P
4	B	503	B12	C2R-C3R-O2-P
4	B	503	B12	C2P-O3-P-O2
4	B	503	B12	C25-C2-C26-C27
4	B	503	B12	C3-C2-C26-C27
4	A	503	B12	C4R-C3R-O2-P

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
4	B	503	B12	C4R-C3R-O2-P
4	A	503	B12	C3P-C2P-O3-P
4	A	503	B12	C2-C3-C30-C31
4	B	503	B12	C2P-O3-P-O4
4	A	503	B12	C25-C2-C26-C27
4	A	503	B12	C4-C3-C30-C31
4	B	503	B12	C3R-O2-P-O4
4	B	503	B12	C3R-O2-P-O5
4	A	503	B12	C42-C41-C8-C9
4	A	503	B12	C3-C2-C26-C27

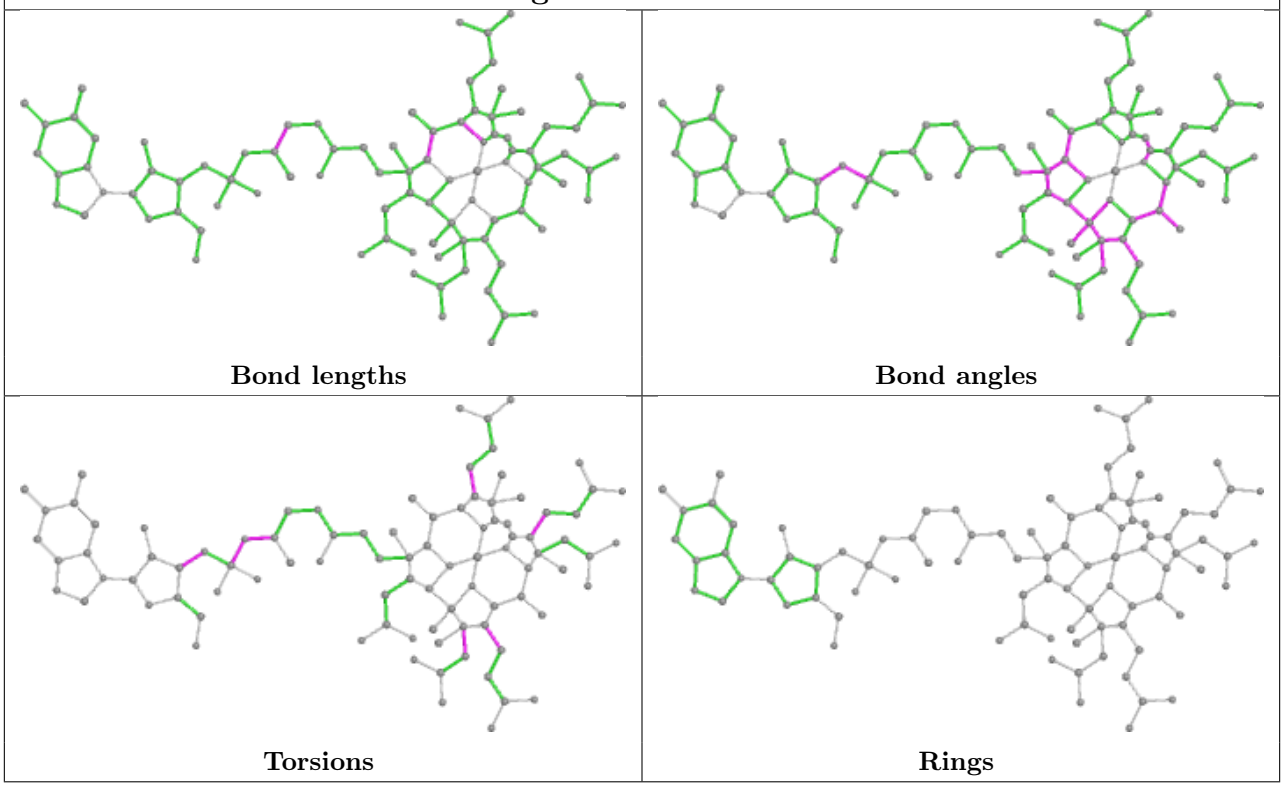
There are no ring outliers.

5 monomers are involved in 11 short contacts:

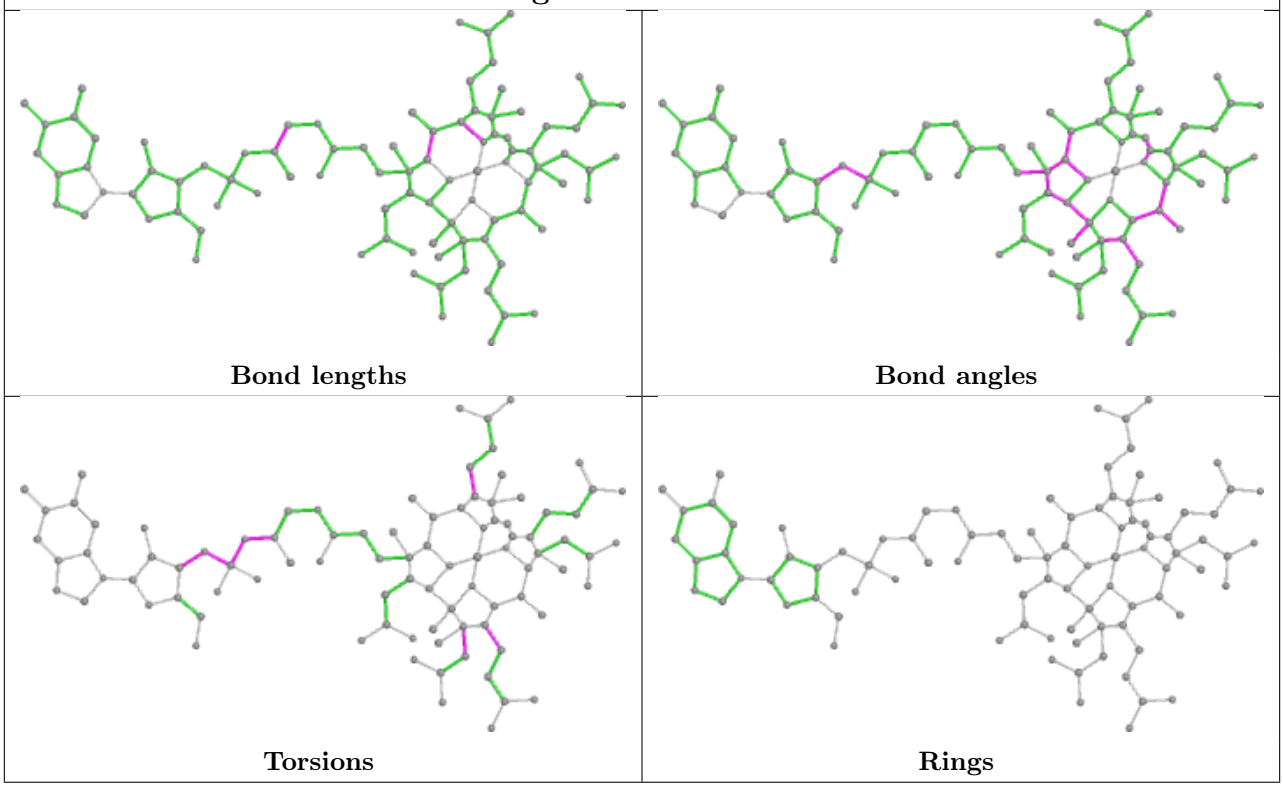
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	503	B12	3	0
3	B	502	SF4	1	0
5	B	504	PO4	1	0
4	B	503	B12	5	0
3	A	502	SF4	1	0

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 then 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.

Ligand B12 A 503



Ligand B12 B 503



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 (i)

6.1 Protein, DNA and RNA chains (i)

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	374/437 (85%)	0.54	14 (3%) 41 38	61, 67, 75, 81	0
1	B	372/437 (85%)	0.61	15 (4%) 38 34	66, 73, 83, 91	0
2	X	5/17 (29%)	0.75	0 100 100	89, 89, 92, 95	0
All	All	751/891 (84%)	0.57	29 (3%) 39 35	61, 71, 81, 95	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	277	ALA	4.0
1	B	277	ALA	3.9
1	B	5	GLN	3.6
1	A	132	MET	3.5
1	A	127	ILE	3.5
1	A	173	ILE	3.2
1	B	173	ILE	3.1
1	B	126	ASP	3.1
1	B	144	ALA	3.1
1	B	276	LEU	2.7
1	B	128	ARG	2.6
1	A	343	ILE	2.6
1	A	182	VAL	2.5
1	A	83	ASP	2.5
1	B	63	LEU	2.5
1	B	64	LEU	2.5
1	B	71	VAL	2.5
1	A	366	LEU	2.5
1	A	122	SER	2.4
1	B	124	HIS	2.4
1	B	70	ILE	2.3
1	A	11	ILE	2.2
1	B	292	GLY	2.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	119	PHE	2.2
1	A	295	ARG	2.2
1	A	358	LYS	2.1
1	A	52	PRO	2.1
1	B	357	GLU	2.1
1	B	3	VAL	2.0

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

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

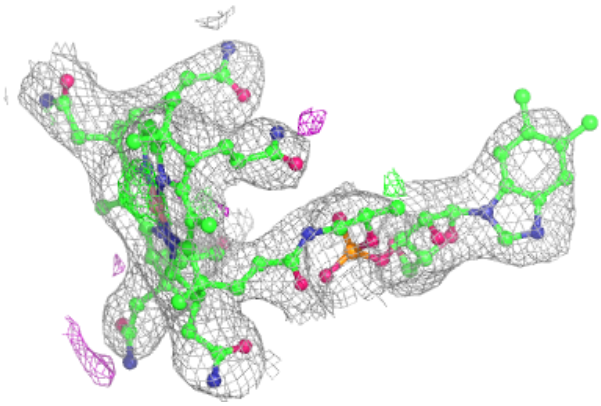
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

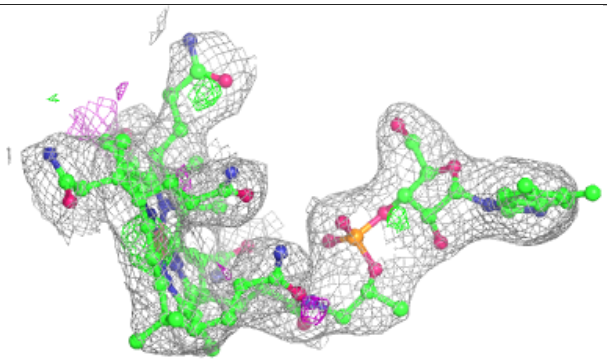
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	PO4	B	506	5/5	0.80	0.16	92,97,99,99	0
5	PO4	B	507	5/5	0.86	0.16	85,89,90,91	0
5	PO4	B	505	5/5	0.92	0.09	105,106,108,109	0
5	PO4	A	505	5/5	0.95	0.25	63,64,65,67	5
5	PO4	B	508	5/5	0.95	0.23	68,70,70,73	5
5	PO4	A	504	5/5	0.96	0.19	64,65,65,66	0
4	B12	A	503	91/91	0.96	0.21	58,61,66,67	0
4	B12	B	503	91/91	0.96	0.23	66,69,75,76	0
3	SF4	B	501	8/8	0.97	0.17	83,85,86,91	8
5	PO4	B	504	5/5	0.97	0.17	68,69,69,71	0
3	SF4	A	501	8/8	0.98	0.15	75,76,80,82	0
3	SF4	B	502	8/8	0.99	0.24	68,70,72,75	0
3	SF4	A	502	8/8	0.99	0.23	59,63,64,64	0

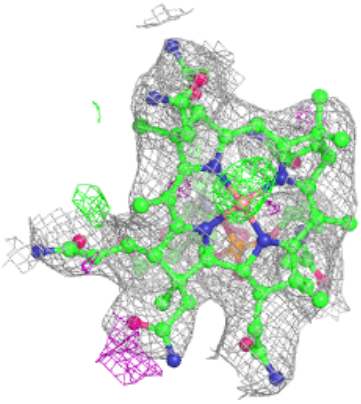
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around B12 A 503:

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

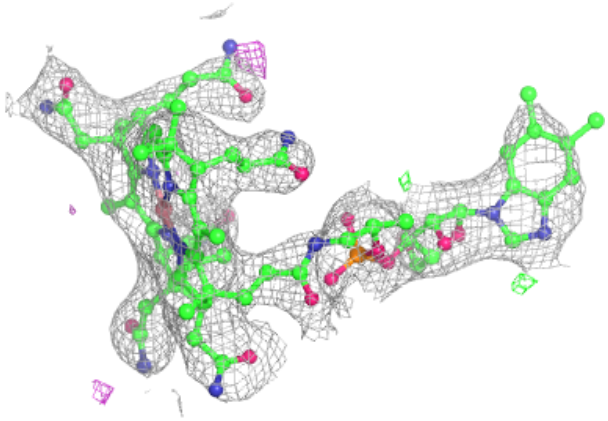


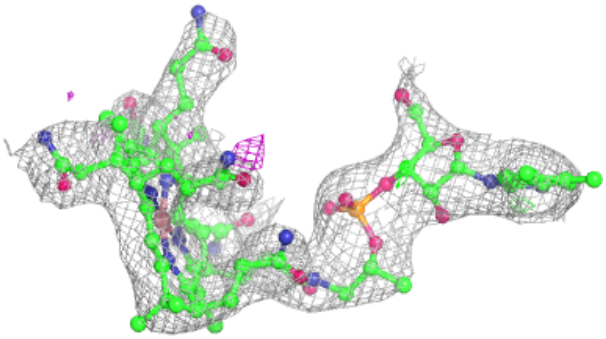


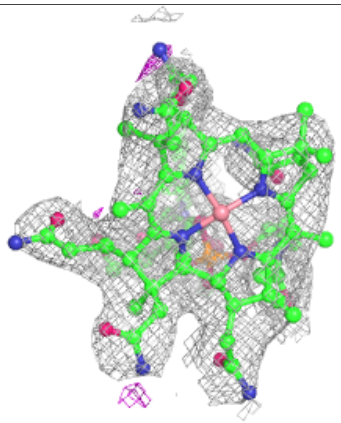


Electron density around B12 B 503:

$2mF_o$-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.