Full wwPDB X-ray Structure Validation Report (i)

Dec 14, 2023 – 11:22 am GMT

PDB ID	:	2YHI
Title	:	Trypanosoma brucei PTR1 in complex with inhibitor WH16
Authors	:	Nerini, E.; Dawson, A.; Hunter, W.N.; Costi, M.P.
Deposited on	:	2011-05-03
Resolution	:	1.80 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 (i)) were used in the production of this report:

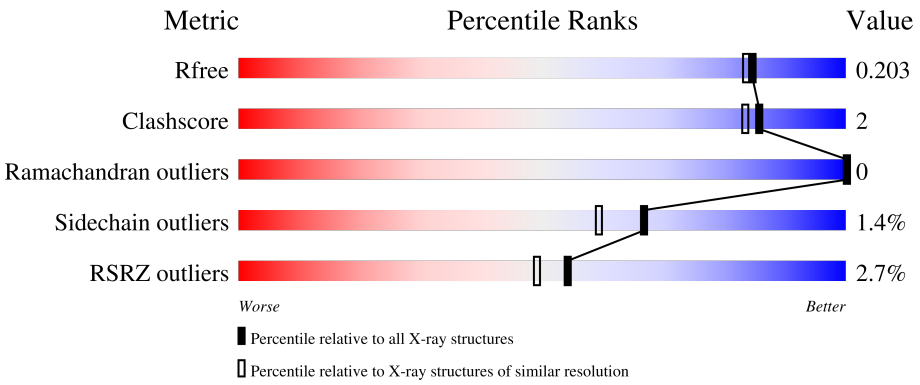
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.80 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	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	288	2% 79% 7% 14%
1	C	288	4% 81% 5% 14%
2	B	288	2% 82% • 14%
2	D	288	2% 81% 5% 14%

2 Entry composition (i)

There are 9 unique types of molecules in this entry. The entry contains 8283 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 PTERIDINE REDUCTASE, PUTATIVE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	249	1866	1172	328	354	12	0	3	0
1	C	249	1871	1175	329	355	12	0	4	0

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	expression tag	UNP Q581W1
A	-18	GLY	-	expression tag	UNP Q581W1
A	-17	SER	-	expression tag	UNP Q581W1
A	-16	SER	-	expression tag	UNP Q581W1
A	-15	HIS	-	expression tag	UNP Q581W1
A	-14	HIS	-	expression tag	UNP Q581W1
A	-13	HIS	-	expression tag	UNP Q581W1
A	-12	HIS	-	expression tag	UNP Q581W1
A	-11	HIS	-	expression tag	UNP Q581W1
A	-10	HIS	-	expression tag	UNP Q581W1
A	-9	SER	-	expression tag	UNP Q581W1
A	-8	SER	-	expression tag	UNP Q581W1
A	-7	GLY	-	expression tag	UNP Q581W1
A	-6	LEU	-	expression tag	UNP Q581W1
A	-5	VAL	-	expression tag	UNP Q581W1
A	-4	PRO	-	expression tag	UNP Q581W1
A	-3	ARG	-	expression tag	UNP Q581W1
A	-2	GLY	-	expression tag	UNP Q581W1
A	-1	SER	-	expression tag	UNP Q581W1
A	0	HIS	-	expression tag	UNP Q581W1
C	-19	MET	-	expression tag	UNP Q581W1
C	-18	GLY	-	expression tag	UNP Q581W1
C	-17	SER	-	expression tag	UNP Q581W1
C	-16	SER	-	expression tag	UNP Q581W1
C	-15	HIS	-	expression tag	UNP Q581W1

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-14	HIS	-	expression tag	UNP Q581W1
C	-13	HIS	-	expression tag	UNP Q581W1
C	-12	HIS	-	expression tag	UNP Q581W1
C	-11	HIS	-	expression tag	UNP Q581W1
C	-10	HIS	-	expression tag	UNP Q581W1
C	-9	SER	-	expression tag	UNP Q581W1
C	-8	SER	-	expression tag	UNP Q581W1
C	-7	GLY	-	expression tag	UNP Q581W1
C	-6	LEU	-	expression tag	UNP Q581W1
C	-5	VAL	-	expression tag	UNP Q581W1
C	-4	PRO	-	expression tag	UNP Q581W1
C	-3	ARG	-	expression tag	UNP Q581W1
C	-2	GLY	-	expression tag	UNP Q581W1
C	-1	SER	-	expression tag	UNP Q581W1
C	0	HIS	-	expression tag	UNP Q581W1

- Molecule 2 is a protein called PTERIDINE REDUCTASE, PUTATIVE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	249	1871	1178	328	353	12	0	4	0
			Total	C	N	O	S			
2	D	249	1871	1175	329	355	12	0	4	0

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	MET	-	expression tag	UNP Q581W1
B	-18	GLY	-	expression tag	UNP Q581W1
B	-17	SER	-	expression tag	UNP Q581W1
B	-16	SER	-	expression tag	UNP Q581W1
B	-15	HIS	-	expression tag	UNP Q581W1
B	-14	HIS	-	expression tag	UNP Q581W1
B	-13	HIS	-	expression tag	UNP Q581W1
B	-12	HIS	-	expression tag	UNP Q581W1
B	-11	HIS	-	expression tag	UNP Q581W1
B	-10	HIS	-	expression tag	UNP Q581W1
B	-9	SER	-	expression tag	UNP Q581W1
B	-8	SER	-	expression tag	UNP Q581W1
B	-7	GLY	-	expression tag	UNP Q581W1
B	-6	LEU	-	expression tag	UNP Q581W1
B	-5	VAL	-	expression tag	UNP Q581W1

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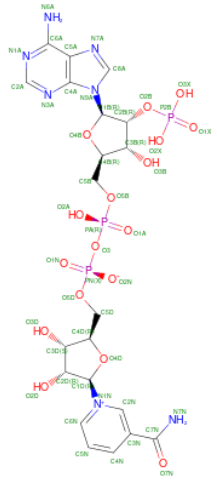
Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	PRO	-	expression tag	UNP Q581W1
B	-3	ARG	-	expression tag	UNP Q581W1
B	-2	GLY	-	expression tag	UNP Q581W1
B	-1	SER	-	expression tag	UNP Q581W1
B	0	HIS	-	expression tag	UNP Q581W1
D	-19	MET	-	expression tag	UNP Q581W1
D	-18	GLY	-	expression tag	UNP Q581W1
D	-17	SER	-	expression tag	UNP Q581W1
D	-16	SER	-	expression tag	UNP Q581W1
D	-15	HIS	-	expression tag	UNP Q581W1
D	-14	HIS	-	expression tag	UNP Q581W1
D	-13	HIS	-	expression tag	UNP Q581W1
D	-12	HIS	-	expression tag	UNP Q581W1
D	-11	HIS	-	expression tag	UNP Q581W1
D	-10	HIS	-	expression tag	UNP Q581W1
D	-9	SER	-	expression tag	UNP Q581W1
D	-8	SER	-	expression tag	UNP Q581W1
D	-7	GLY	-	expression tag	UNP Q581W1
D	-6	LEU	-	expression tag	UNP Q581W1
D	-5	VAL	-	expression tag	UNP Q581W1
D	-4	PRO	-	expression tag	UNP Q581W1
D	-3	ARG	-	expression tag	UNP Q581W1
D	-2	GLY	-	expression tag	UNP Q581W1
D	-1	SER	-	expression tag	UNP Q581W1
D	0	HIS	-	expression tag	UNP Q581W1

- Molecule 3 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: $C_{21}H_{28}N_7O_{17}P_3$).

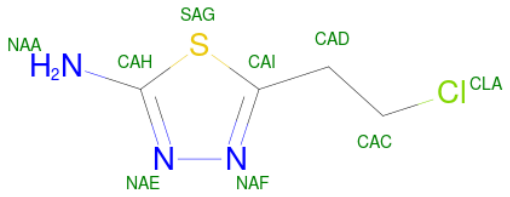
NAP



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
3	A	1	48	21	7	17	3	0	0
			Total	C	N	O	P		
3	B	1	48	21	7	17	3	0	0
			Total	C	N	O	P		
3	C	1	48	21	7	17	3	0	0
			Total	C	N	O	P		
3	D	1	48	21	7	17	3	0	0

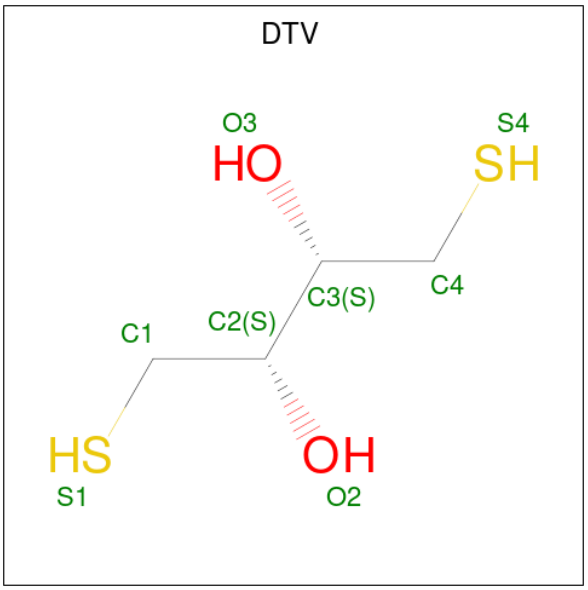
- Molecule 4 is 5-(2-CHLOROETHYL)-1,3,4-THIADIAZOL-2-AMINE (three-letter code: W16) (formula: $C_4H_6ClN_3S$).

W16



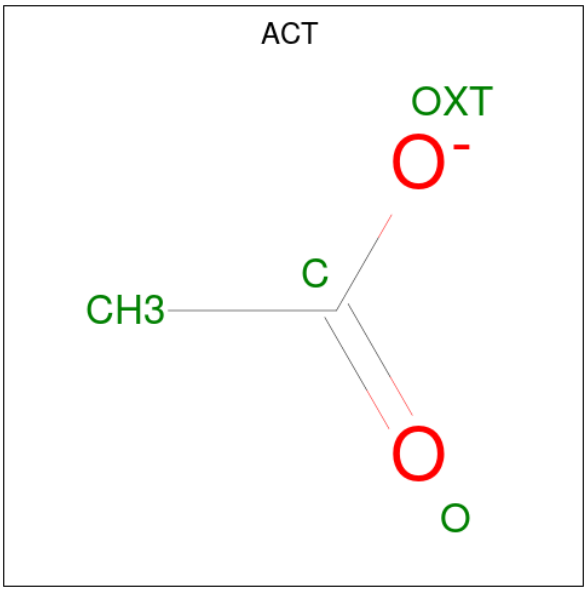
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	S		
4	A	1	9	4	1	3	1	0	0
4	B	1	9	4	1	3	1	0	0
4	C	1	9	4	1	3	1	0	0
4	D	1	9	4	1	3	1	0	0

- Molecule 5 is (2S,3S)-1,4-DIMERCAPTOBUTANE-2,3-DIOL (three-letter code: DTV) (formula: $C_4H_{10}O_2S_2$).



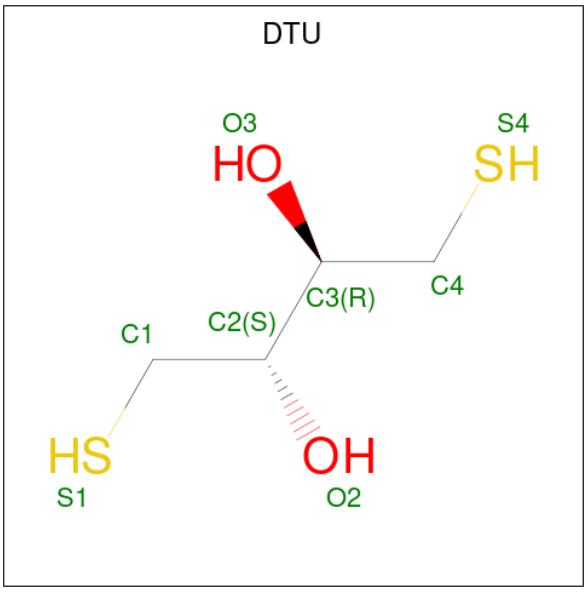
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
5	A	1	8	4	2	2	0	0

- Molecule 6 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).



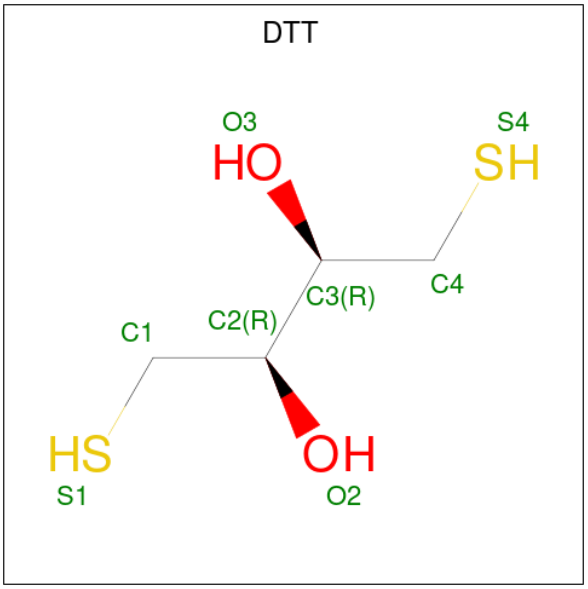
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 4 2 2	0	0
6	D	1	Total C O 4 2 2	0	0

- Molecule 7 is (2R,3S)-1,4-DIMERCAPTOBUTANE-2,3-DIOL (three-letter code: DTU) (formula: $C_4H_{10}O_2S_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total C O S 8 4 2 2	0	0

- Molecule 8 is 2,3-DIHYDROXY-1,4-DITHIOBUTANE (three-letter code: DTT) (formula: $C_4H_{10}O_2S_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
8	C	1	8	4	2	2	0	0
			Total	C	O	S		
8	D	1	8	4	2	2	0	0

- Molecule 9 is water.

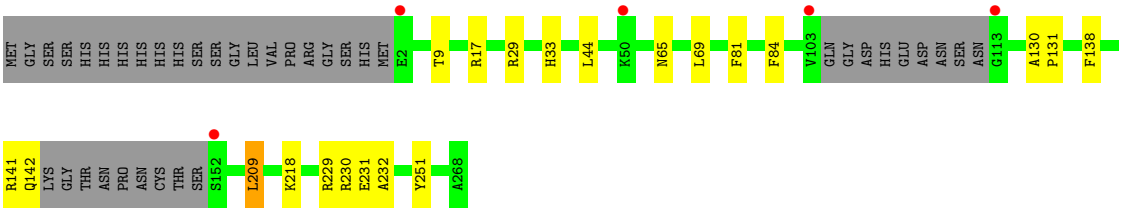
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
9	A	157	157	157	0	0
			Total	O		
9	B	152	152	152	0	0
			Total	O		
9	C	101	101	101	0	0
			Total	O		
9	D	126	126	126	0	0

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.

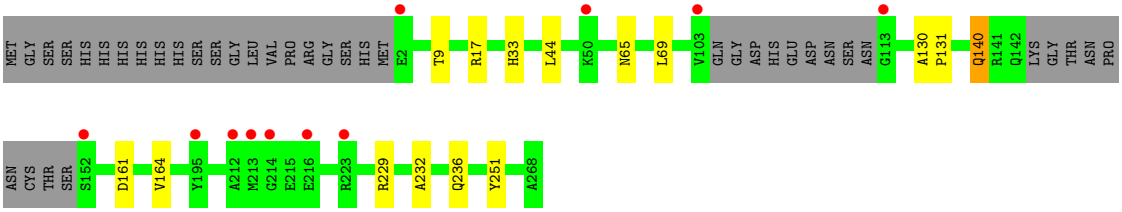
• Molecule 1: PTERIDINE REDUCTASE, PUTATIVE

Chain A:



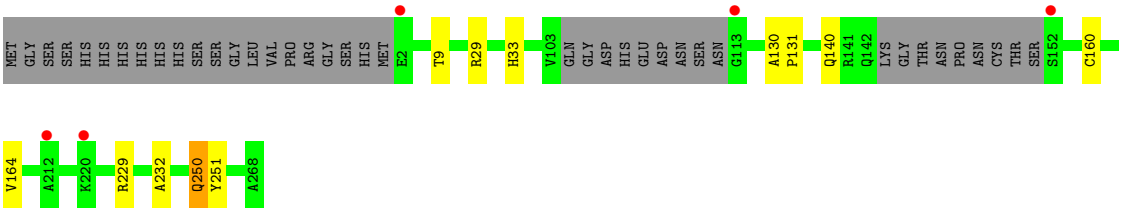
• Molecule 1: PTERIDINE REDUCTASE, PUTATIVE

Chain C:



• Molecule 2: PTERIDINE REDUCTASE, PUTATIVE

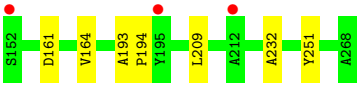
Chain B:



• Molecule 2: PTERIDINE REDUCTASE, PUTATIVE

Chain D:

MET GLY SER SER HIS HIS HIS HIS HIS HIS HIS SER SER GLY LEU VAL PRO ARG GLY SER HIS MET E2 T9 I15 H33 N78 R82 V103 GLN GLY ASP HIS GLU ASP ASN SER ASN G113 A130 P131 Q140 R141 Q142 LYS GLY THR ASN PRO ASN CYS THR SER


S152 D161 V164 A193 P194 Y195 L209 A212 A232 Y251 A268

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	74.28Å 90.74Å 84.29Å 90.00° 115.66° 90.00°	Depositor
Resolution (Å)	31.41 – 1.80 30.83 – 1.80	Depositor EDS
% Data completeness (in resolution range)	94.2 (31.41-1.80) 94.2 (30.83-1.80)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.69 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.179 , 0.207 0.174 , 0.203	Depositor DCC
R_{free} test set	4413 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	19.1	Xtriage
Anisotropy	0.766	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 39.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.021 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8283	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 33.21 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.3015e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: DTV, NAP, CSX, DTU, DTT, W16, ACT

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	0.39	0/1897	0.50	0/2571
1	C	0.39	0/1906	0.51	0/2583
2	B	0.40	0/1912	0.51	0/2594
2	D	0.39	0/1914	0.50	0/2596
All	All	0.39	0/7629	0.51	0/10344

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	1866	0	1885	11	0
1	C	1871	0	1889	11	0
2	B	1871	0	1901	7	0
2	D	1871	0	1887	10	0
3	A	48	0	25	0	0
3	B	48	0	25	0	0
3	C	48	0	25	0	0
3	D	48	0	25	1	0
4	A	9	0	4	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	9	0	4	0	0
4	C	9	0	4	0	0
4	D	9	0	4	0	0
5	A	8	0	9	0	0
6	A	4	0	3	0	0
6	D	4	0	3	0	0
7	B	8	0	7	0	0
8	C	8	0	9	0	0
8	D	8	0	9	0	0
9	A	157	0	0	1	0
9	B	152	0	0	1	0
9	C	101	0	0	0	0
9	D	126	0	0	0	0
All	All	8283	0	7718	34	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 2.

All (34) 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)
2:D:9:THR:HA	2:D:33:HIS:HB3	1.90	0.54
1:A:9:THR:HA	1:A:33:HIS:HB3	1.92	0.51
1:C:9:THR:HA	1:C:33:HIS:HB3	1.92	0.51
2:D:78[B]:ASN:OD1	2:D:141:ARG:NH2	2.44	0.50
1:C:65:ASN:HA	1:C:69:LEU:HD22	1.93	0.49
4:A:1270:W16:SAG	9:A:2011:HOH:O	2.60	0.49
2:B:9:THR:HA	2:B:33:HIS:HB3	1.95	0.48
1:A:65:ASN:HA	1:A:69:LEU:HD22	1.95	0.47
1:C:161:ASP:HB3	1:C:164:VAL:HG13	1.95	0.47
1:A:17:ARG:HG3	1:A:44:LEU:HD22	1.97	0.47
1:C:130:ALA:HB3	1:C:131:PRO:HD3	1.97	0.46
2:B:232:ALA:HB2	1:C:251:TYR:CE2	2.51	0.46
2:D:78[B]:ASN:HD21	2:D:82:ARG:NH2	2.14	0.45
1:A:29:ARG:HD2	1:A:84:PHE:CD1	2.51	0.45
1:A:230:ARG:HG2	1:A:231:GLU:N	2.32	0.45
2:B:251:TYR:CE2	1:C:232:ALA:HB2	2.51	0.45
1:A:130:ALA:HB3	1:A:131:PRO:HD3	1.98	0.44
1:A:251:TYR:CE2	2:D:232:ALA:HB2	2.52	0.44
1:A:232:ALA:HB2	2:D:251:TYR:CE2	2.52	0.44
1:A:138:PHE:O	1:A:142:GLN:HG2	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:130:ALA:HB3	2:B:131:PRO:HD3	1.99	0.43
2:B:160:CYS:HB3	9:B:2090:HOH:O	2.16	0.43
1:C:17:ARG:HG3	1:C:44:LEU:HD22	2.00	0.43
2:B:250[B]:GLN:CG	1:C:236:GLN:HE21	2.31	0.43
1:A:209:LEU:HG	1:A:218:LYS:HG2	2.01	0.42
2:D:161:ASP:HB3	2:D:164:VAL:HG13	2.00	0.42
2:D:15:ILE:HB	3:D:1269:NAP:H51N	2.01	0.42
2:D:130:ALA:HB3	2:D:131:PRO:HD3	2.01	0.42
2:D:193:ALA:N	2:D:194:PRO:HD2	2.35	0.42
2:B:250[B]:GLN:HG3	1:C:236:GLN:NE2	2.36	0.41
1:A:81:PHE:CE1	1:A:141:ARG:HG2	2.56	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	245/288 (85%)	236 (96%)	9 (4%)	0	100	100
1	C	246/288 (85%)	237 (96%)	9 (4%)	0	100	100
2	B	247/288 (86%)	240 (97%)	7 (3%)	0	100	100
2	D	247/288 (86%)	238 (96%)	9 (4%)	0	100	100
All	All	985/1152 (86%)	951 (96%)	34 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	199/230 (86%)	197 (99%)	2 (1%)	76	71
1	C	200/230 (87%)	197 (98%)	3 (2%)	65	56
2	B	201/231 (87%)	195 (97%)	6 (3%)	41	27
2	D	201/231 (87%)	198 (98%)	3 (2%)	65	56
All	All	801/922 (87%)	787 (98%)	14 (2%)	67	51

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	209	LEU
1	A	229	ARG
2	B	29	ARG
2	B	140	GLN
2	B	164	VAL
2	B	229	ARG
2	B	250[A]	GLN
2	B	250[B]	GLN
1	C	140[A]	GLN
1	C	140[B]	GLN
1	C	229	ARG
2	D	140[A]	GLN
2	D	140[B]	GLN
2	D	209	LEU

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

Mol	Chain	Res	Type
1	C	236	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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	$\#\|Z\| > 2$
1	CSX	C	59	1	3,6,7	0.86	0	1,6,8	0.22	0
1	CSX	A	59	1	3,6,7	0.80	0	1,6,8	0.08	0

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	CSX	C	59	1	-	0/1/5/7	-
1	CSX	A	59	1	-	0/1/5/7	-

There are no bond length outliers.

There are no bond angle outliers.

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

14 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	NAP	D	1269	-	45,52,52	1.63	7 (15%)	56,80,80	1.11	4 (7%)
5	DTV	A	1271	1	7,7,7	0.61	0	4,8,8	0.72	0
3	NAP	C	1269	-	45,52,52	1.58	7 (15%)	56,80,80	1.16	3 (5%)
4	W16	C	1270	-	6,9,9	3.56	2 (33%)	1,11,11	0.53	0
7	DTU	B	1271	2	7,7,7	0.68	0	4,8,8	1.14	0
3	NAP	A	1269	-	45,52,52	1.68	7 (15%)	56,80,80	1.16	4 (7%)
4	W16	D	1270	-	6,9,9	3.43	2 (33%)	1,11,11	1.10	0
8	DTT	C	1271	1	7,7,7	0.57	0	4,8,8	0.22	0
4	W16	B	1270	-	6,9,9	3.65	2 (33%)	1,11,11	0.73	0
4	W16	A	1270	-	6,9,9	3.43	2 (33%)	1,11,11	1.09	0
6	ACT	A	1272	-	3,3,3	0.77	0	3,3,3	1.36	0
8	DTT	D	1271	2	7,7,7	0.58	0	4,8,8	0.52	0
6	ACT	D	1272	-	3,3,3	0.79	0	3,3,3	1.39	0
3	NAP	B	1269	-	45,52,52	1.65	6 (13%)	56,80,80	1.05	1 (1%)

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	NAP	D	1269	-	-	0/31/67/67	0/5/5/5
5	DTV	A	1271	1	-	1/8/8/8	-
3	NAP	C	1269	-	-	0/31/67/67	0/5/5/5
4	W16	C	1270	-	-	1/2/3/3	0/1/1/1
3	NAP	A	1269	-	-	0/31/67/67	0/5/5/5
4	W16	D	1270	-	-	1/2/3/3	0/1/1/1
8	DTT	C	1271	1	-	2/8/8/8	-
4	W16	B	1270	-	-	1/2/3/3	0/1/1/1
4	W16	A	1270	-	-	1/2/3/3	0/1/1/1
8	DTT	D	1271	2	-	2/8/8/8	-
7	DTU	B	1271	2	-	6/8/8/8	-
3	NAP	B	1269	-	-	0/31/67/67	0/5/5/5

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	1270	W16	NAE-NAF	-6.29	1.25	1.37
4	B	1270	W16	NAE-NAF	-6.25	1.25	1.37
4	A	1270	W16	NAE-NAF	-6.22	1.25	1.37
4	D	1270	W16	NAE-NAF	-6.20	1.25	1.37
4	B	1270	W16	CAD-CAI	6.12	1.53	1.49
3	A	1269	NAP	O7N-C7N	5.84	1.35	1.24
3	B	1269	NAP	O7N-C7N	5.75	1.35	1.24
4	C	1270	W16	CAD-CAI	5.72	1.53	1.49
3	C	1269	NAP	O7N-C7N	5.60	1.34	1.24
3	D	1269	NAP	C2N-N1N	5.57	1.41	1.35
3	B	1269	NAP	C2N-N1N	5.51	1.41	1.35
3	D	1269	NAP	O7N-C7N	5.41	1.34	1.24
3	C	1269	NAP	C2N-N1N	5.39	1.41	1.35
4	D	1270	W16	CAD-CAI	5.29	1.52	1.49
3	A	1269	NAP	C2N-N1N	5.29	1.41	1.35
4	A	1270	W16	CAD-CAI	5.23	1.52	1.49
3	D	1269	NAP	P2B-O1X	3.77	1.62	1.50
3	A	1269	NAP	P2B-O2B	3.68	1.66	1.59
3	B	1269	NAP	P2B-O2B	3.53	1.66	1.59
3	A	1269	NAP	P2B-O1X	3.30	1.61	1.50
3	D	1269	NAP	O4D-C1D	3.14	1.45	1.41
3	B	1269	NAP	O4D-C1D	3.01	1.45	1.41
3	B	1269	NAP	P2B-O1X	2.87	1.59	1.50
3	A	1269	NAP	O4D-C1D	2.69	1.44	1.41
3	C	1269	NAP	P2B-O1X	2.68	1.59	1.50
3	C	1269	NAP	P2B-O2B	2.54	1.64	1.59
3	D	1269	NAP	C3N-C7N	2.46	1.54	1.50
3	B	1269	NAP	C6N-N1N	2.41	1.41	1.35
3	C	1269	NAP	O4D-C1D	2.34	1.44	1.41
3	C	1269	NAP	C6N-N1N	2.20	1.40	1.35
3	D	1269	NAP	C6N-N1N	2.18	1.40	1.35
3	A	1269	NAP	C3N-C7N	2.16	1.53	1.50
3	A	1269	NAP	C6N-N1N	2.13	1.40	1.35
3	C	1269	NAP	P2B-O2X	2.05	1.62	1.54
3	D	1269	NAP	P2B-O2B	2.02	1.63	1.59

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	1269	NAP	N3A-C2A-N1A	-4.89	121.04	128.68
3	A	1269	NAP	N3A-C2A-N1A	-4.84	121.11	128.68
3	D	1269	NAP	N3A-C2A-N1A	-4.71	121.32	128.68
3	B	1269	NAP	N3A-C2A-N1A	-4.71	121.32	128.68

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	1269	NAP	PN-O3-PA	-2.52	124.18	132.83
3	A	1269	NAP	PN-O3-PA	-2.31	124.89	132.83
3	C	1269	NAP	C1B-N9A-C4A	-2.23	122.72	126.64
3	A	1269	NAP	C6N-N1N-C2N	-2.19	119.97	121.97
3	D	1269	NAP	C4A-C5A-N7A	-2.17	107.14	109.40
3	A	1269	NAP	O4B-C4B-C3B	-2.16	100.85	105.11
3	D	1269	NAP	O3X-P2B-O2X	2.05	115.49	107.64
3	D	1269	NAP	PN-O3-PA	-2.05	125.81	132.83

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1270	W16	CLA-CAC-CAD-CAI
4	B	1270	W16	CLA-CAC-CAD-CAI
4	C	1270	W16	CLA-CAC-CAD-CAI
4	D	1270	W16	CLA-CAC-CAD-CAI
7	B	1271	DTU	C1-C2-C3-O3
7	B	1271	DTU	C1-C2-C3-C4
7	B	1271	DTU	O2-C2-C3-O3
7	B	1271	DTU	O2-C2-C3-C4
7	B	1271	DTU	O3-C3-C4-S4
8	C	1271	DTT	S1-C1-C2-O2
8	C	1271	DTT	S1-C1-C2-C3
8	D	1271	DTT	O3-C3-C4-S4
8	D	1271	DTT	S1-C1-C2-O2
7	B	1271	DTU	C2-C3-C4-S4
5	A	1271	DTV	C1-C2-C3-C4

There are no ring outliers.

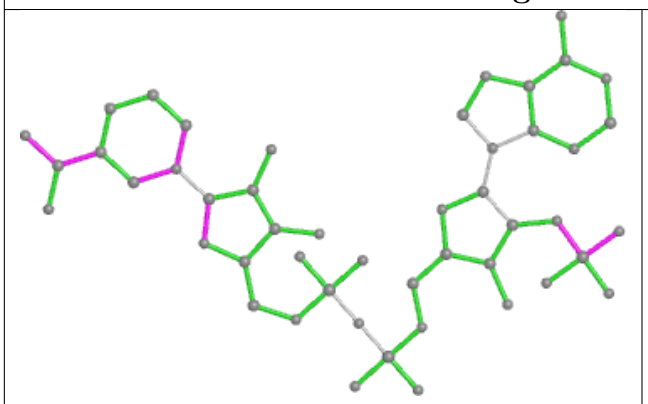
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	1269	NAP	1	0
4	A	1270	W16	1	0

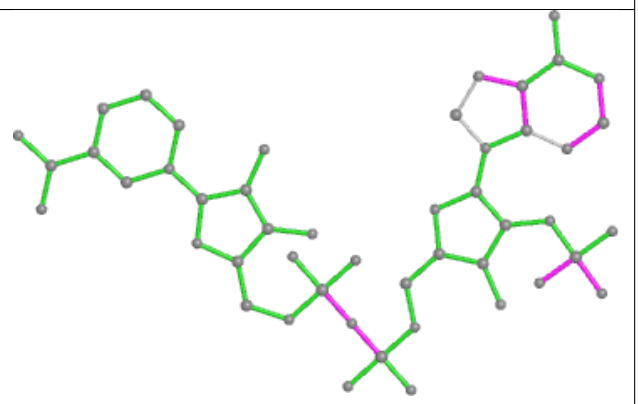
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

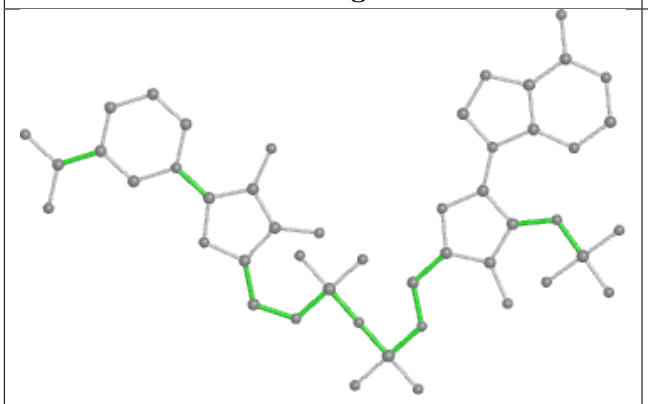
Ligand NAP D 1269



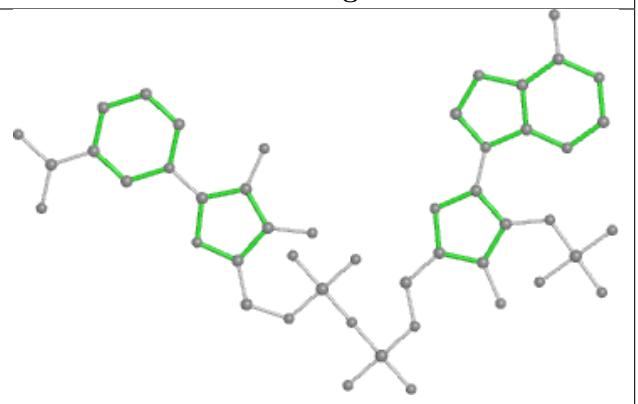
Bond lengths



Bond angles

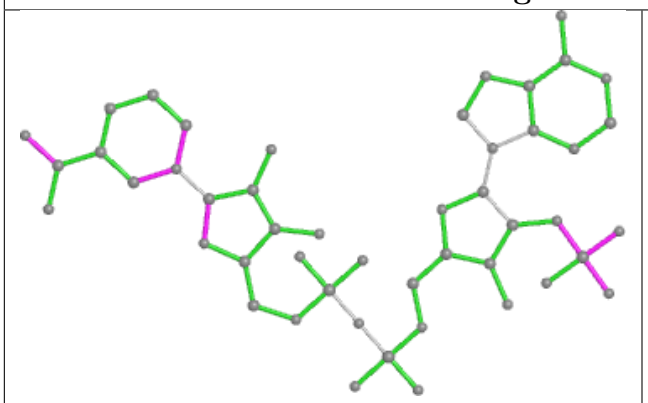


Torsions

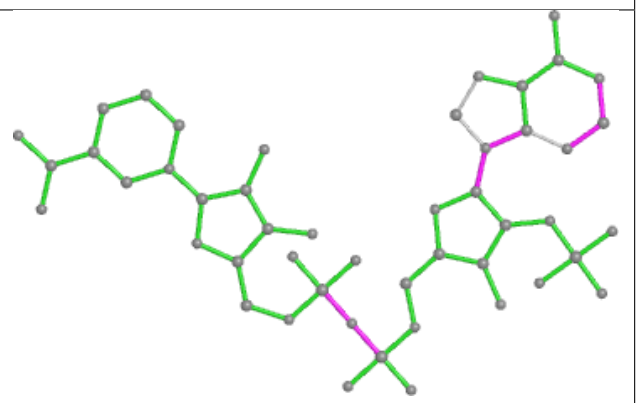


Rings

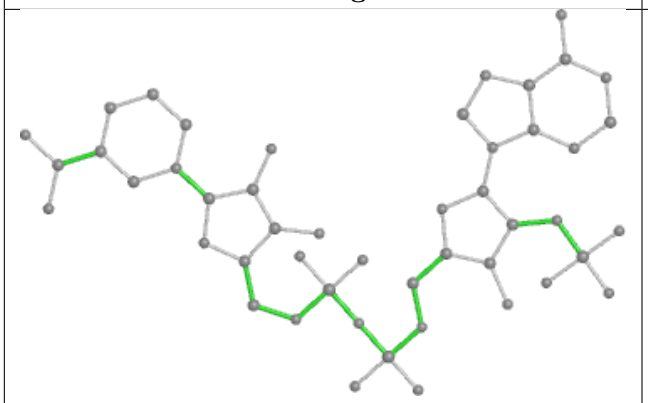
Ligand NAP C 1269



Bond lengths



Bond angles



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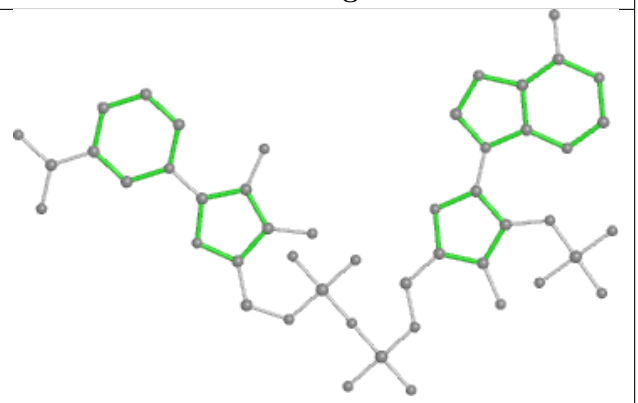
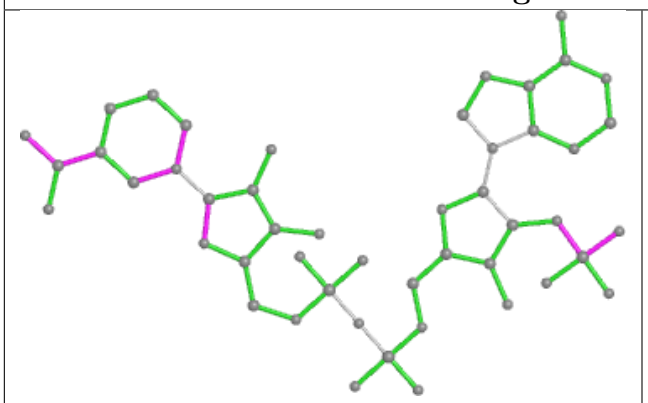
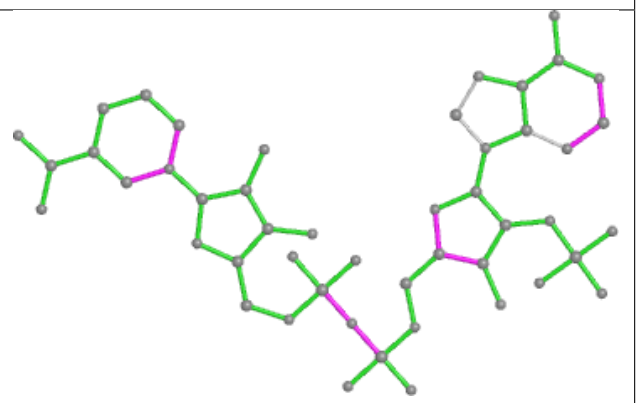


Rings

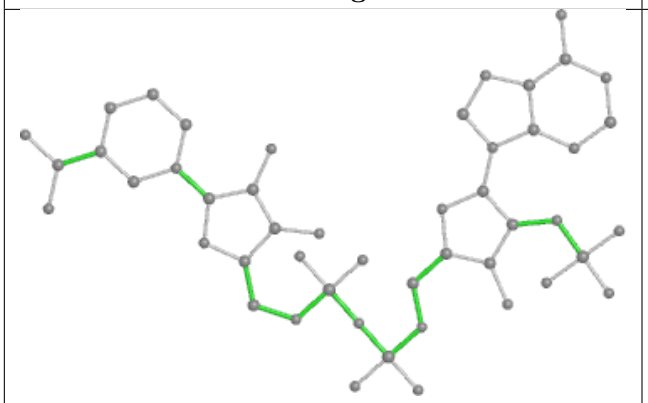
Ligand NAP A 1269



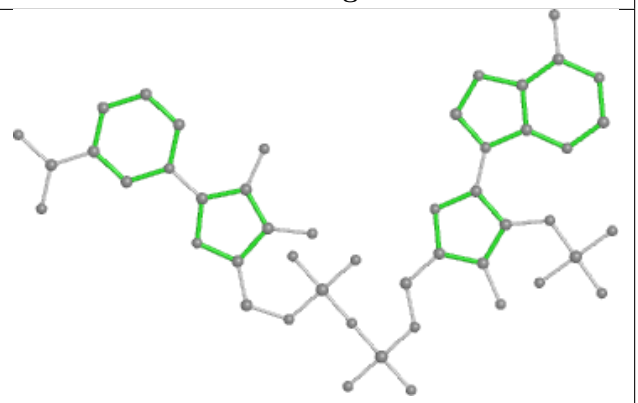
Bond lengths



Bond angles

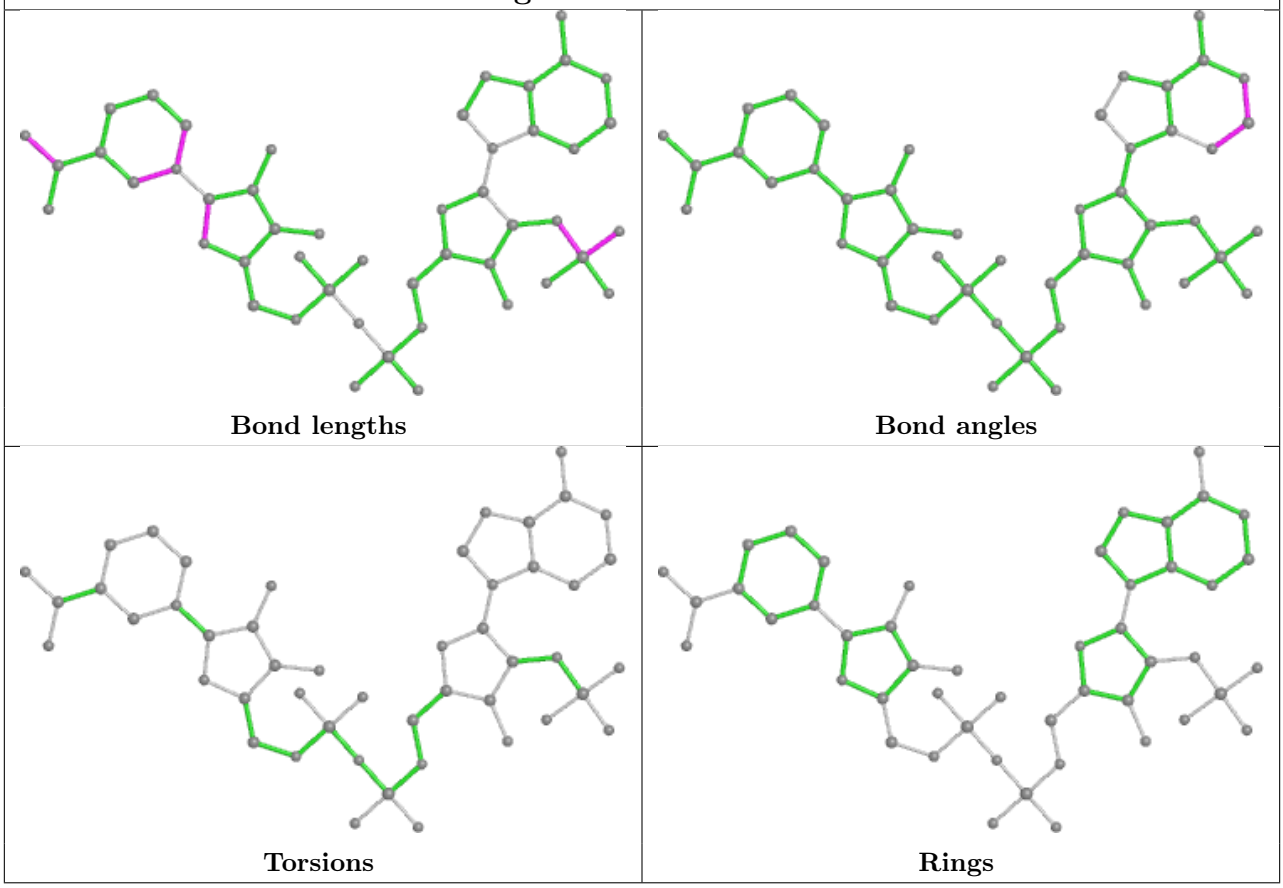


Torsions



Rings

Ligand NAP B 1269



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	248/288 (86%)	-0.14	5 (2%)	65	61	11, 18, 28, 32	3 (1%)
1	C	248/288 (86%)	-0.01	11 (4%)	34	28	11, 18, 32, 45	2 (0%)
2	B	249/288 (86%)	-0.12	5 (2%)	65	61	11, 18, 28, 35	0
2	D	249/288 (86%)	-0.15	6 (2%)	59	54	11, 17, 28, 33	2 (0%)
All	All	994/1152 (86%)	-0.11	27 (2%)	54	49	11, 17, 29, 45	7 (0%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	113	GLY	6.8
1	C	212	ALA	6.7
1	A	113	GLY	6.1
2	B	212	ALA	5.5
2	D	113	GLY	5.3
2	B	113	GLY	5.2
2	D	152	SER	4.0
1	A	2	GLU	3.9
1	A	152	SER	3.6
2	B	152	SER	3.5
1	C	152	SER	3.3
2	B	2	GLU	3.2
1	A	50	LYS	3.1
1	C	216	GLU	3.1
1	C	195	TYR	2.8
2	D	2	GLU	2.7
1	A	103	VAL	2.7
1	C	2	GLU	2.7
1	C	50	LYS	2.6
1	C	213	MET	2.4
1	C	103	VAL	2.4

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Mol	Chain	Res	Type	RSRZ
2	D	195	TYR	2.3
1	C	214	GLY	2.3
2	D	212	ALA	2.3
2	B	220	LYS	2.3
2	D	103	VAL	2.1
1	C	223	ARG	2.1

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
1	CSX	C	59	7/8	0.96	0.07	21,21,24,25	0
1	CSX	A	59	7/8	0.98	0.07	21,21,22,24	0

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
4	W16	D	1270	9/9	0.46	0.23	44,45,47,50	0
4	W16	B	1270	9/9	0.53	0.25	47,48,49,51	0
4	W16	A	1270	9/9	0.53	0.24	47,48,50,51	0
6	ACT	D	1272	4/4	0.57	0.20	32,32,33,33	0
4	W16	C	1270	9/9	0.62	0.21	44,46,49,52	0
6	ACT	A	1272	4/4	0.87	0.12	37,37,37,37	0
7	DTU	B	1271	8/8	0.89	0.29	35,41,43,46	0
8	DTT	C	1271	8/8	0.92	0.23	36,42,44,46	0
5	DTV	A	1271	8/8	0.95	0.13	34,38,39,40	0
8	DTT	D	1271	8/8	0.95	0.15	32,37,39,41	0

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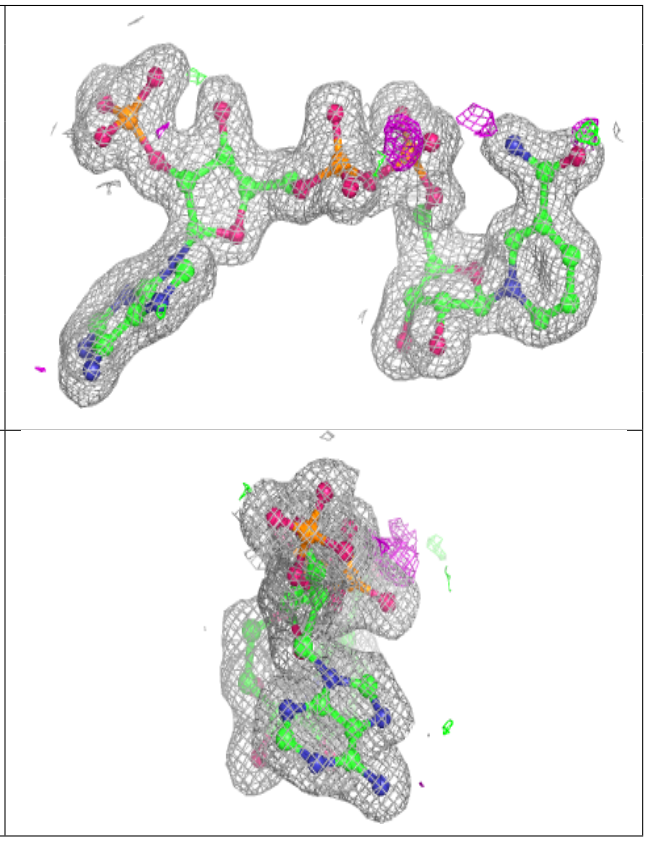
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	NAP	C	1269	48/48	0.97	0.08	13,16,19,21	0
3	NAP	D	1269	48/48	0.97	0.08	13,15,16,17	0
3	NAP	B	1269	48/48	0.97	0.08	13,16,18,19	0
3	NAP	A	1269	48/48	0.98	0.07	12,16,19,19	0

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.

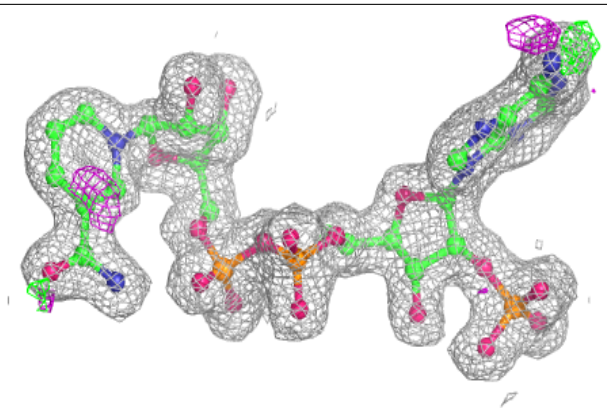
Electron density around NAP C 1269:

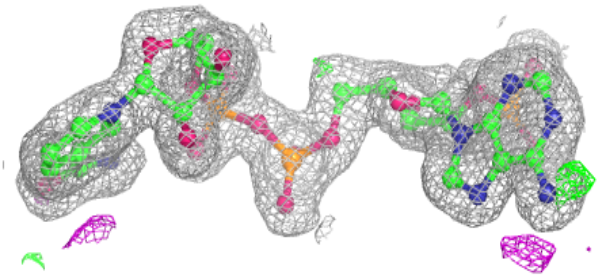
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

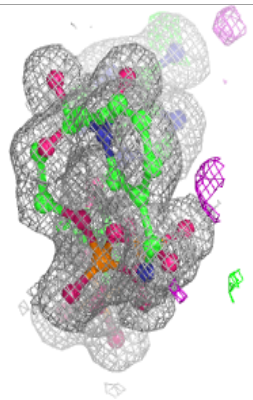


Electron density around NAP D 1269:

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

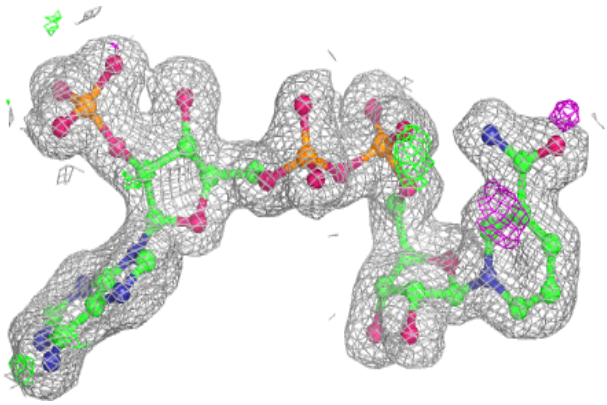


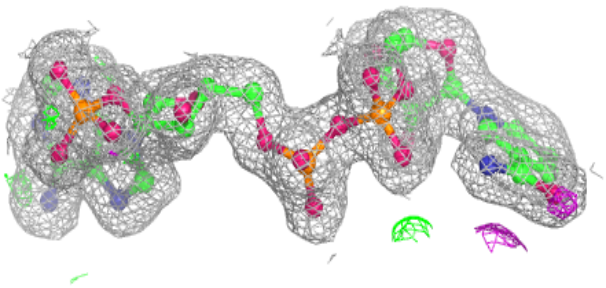


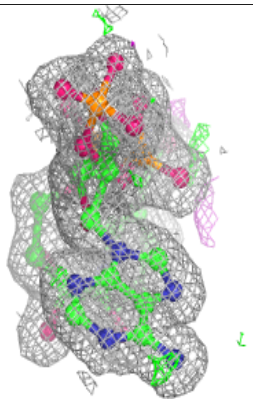


Electron density around NAP B 1269:

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

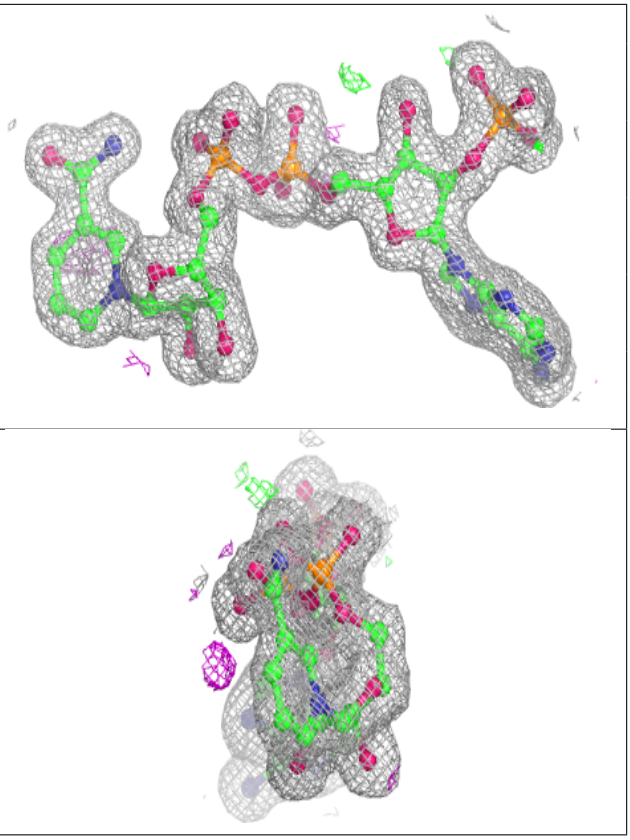






Electron density around NAP A 1269:

$2mF_o$-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.