Full wwPDB X-ray Structure Validation Report ⓘ

Apr 27, 2024 – 09:51 pm BST

PDB ID	:	1UUM
Title	:	Rat dihydroorotate dehydrogenase (DHOD)in complex with atovaquone
Authors	:	Hansen, M.; Le Nours, J.; Johansson, E.; Antal, T.; Ullrich, A.; Loffler, M.; Larsen, S.
Deposited on	:	2004-01-06
Resolution	:	2.30 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

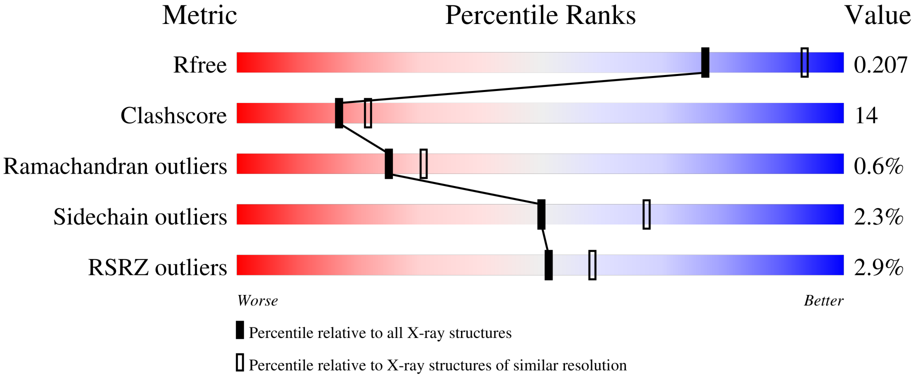
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

1 Overall quality at a glance

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

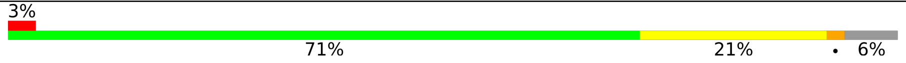
The reported resolution of this entry is 2.30 Å.

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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	372	
1	B	372	

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
4	AFI	A	400	X	-	-	-
4	AFI	B	400	X	-	-	-

2 Entry composition ⓘ

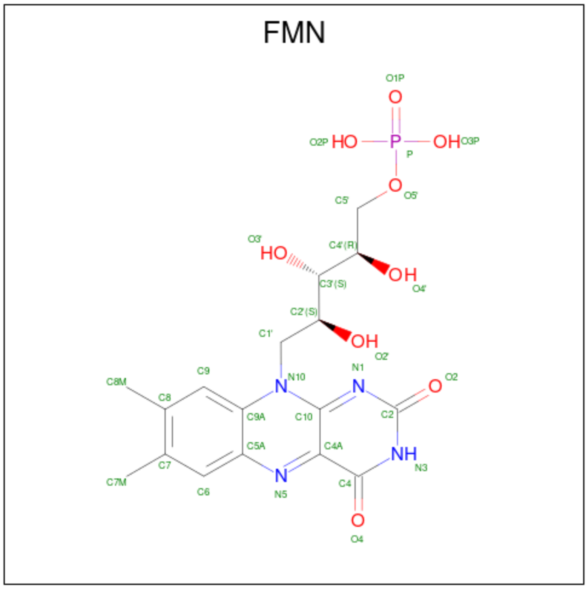
There are 6 unique types of molecules in this entry. The entry contains 5697 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 DIHYDROOROTATE DEHYDROGENASE.

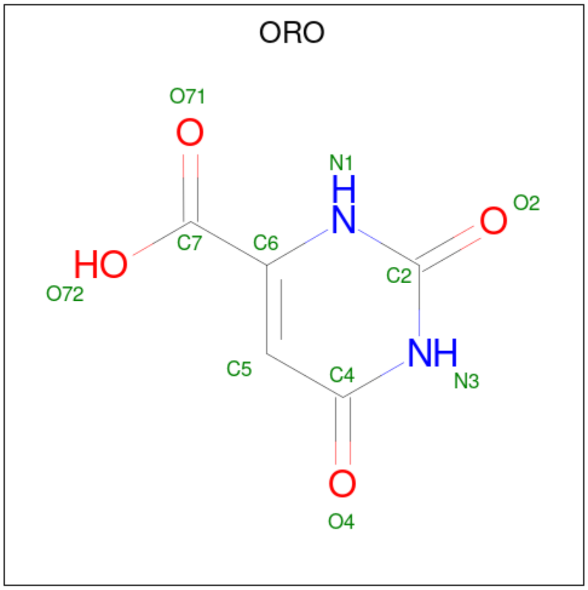
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	350	Total 2658	C 1670	N 484	O 501	S 3	0	0	0
1	B	350	Total 2658	C 1670	N 484	O 501	S 3	0	0	0

- Molecule 2 is FLAVIN MONONUCLEOTIDE (three-letter code: FMN) (formula: $C_{17}H_{21}N_4O_9P$).



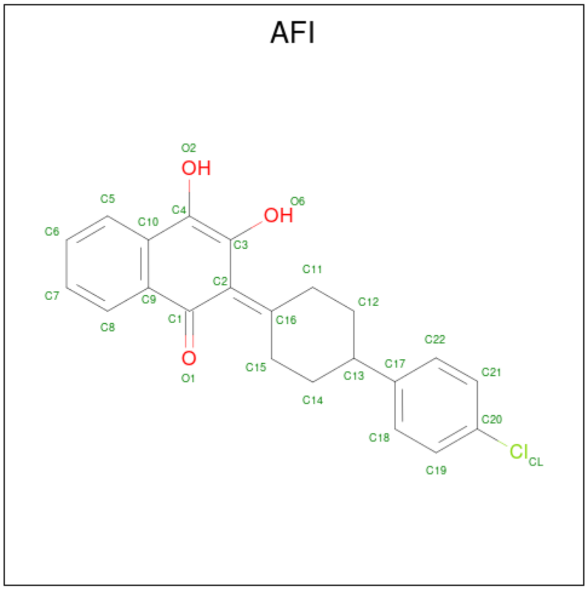
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 31	C 17	N 4	O 9	P 1	0	0
2	B	1	Total 31	C 17	N 4	O 9	P 1	0	0

- Molecule 3 is OROTIC ACID (three-letter code: ORO) (formula: $C_5H_4N_2O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N O 11 5 2 4	0	0
3	B	1	Total C N O 11 5 2 4	0	0

- Molecule 4 is 2-[4-(4-CHLOROPHENYL)CYCLOHEXYLIDENE]-3,4-DIHYDROXY-1(2H)-NAPHTHALENONE (three-letter code: AFI) (formula: $C_{22}H_{19}ClO_3$).



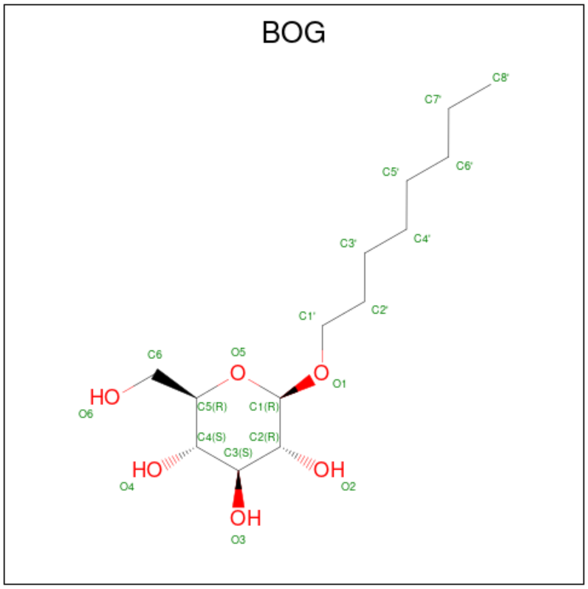
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C Cl O 26 22 1 3	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total C Cl O 26 22 1 3	0	0

- Molecule 5 is octyl beta-D-glucopyranoside (three-letter code: BOG) (formula: $C_{14}H_{28}O_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 20 14 6	0	0
5	B	1	Total C O 20 14 6	0	0

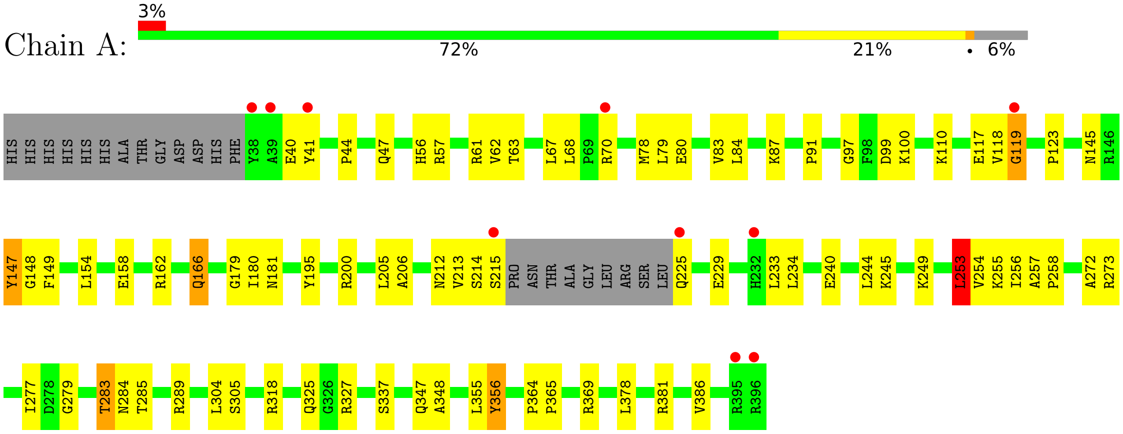
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	99	Total O 99 99	0	0
6	B	106	Total O 106 106	0	0

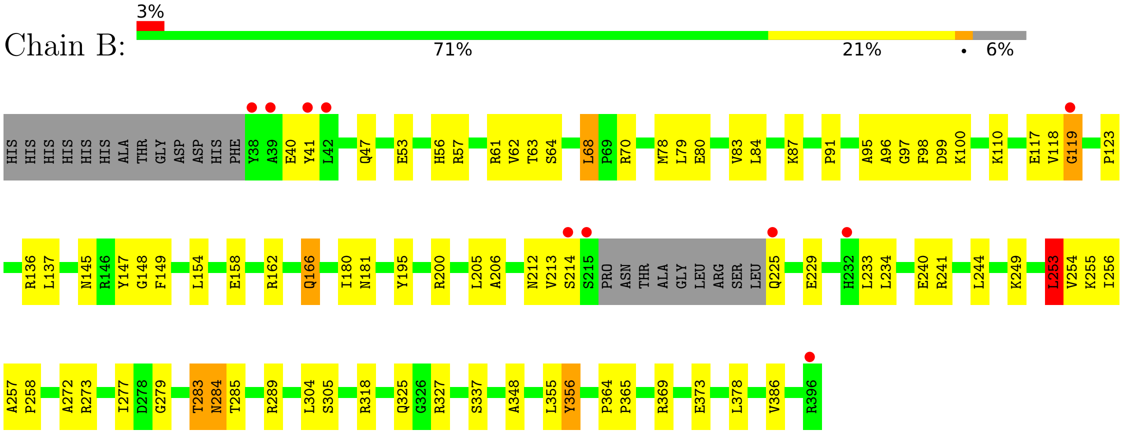
3 Residue-property plots ⓘ

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 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: DIHYDROOROTATE DEHYDROGENASE



- Molecule 1: DIHYDROOROTATE DEHYDROGENASE



4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 3	Depositor
Cell constants a, b, c, α, β, γ	133.15Å 133.15Å 50.13Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 2.30 27.73 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (30.00-2.30) 99.8 (27.73-2.30)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.50 (at 2.31Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.216 , 0.242 0.207 , 0.207	Depositor DCC
R_{free} test set	2218 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	26.3	Xtriage
Anisotropy	0.013	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 21.9	EDS
L-test for twinning[2]	$< \vert L \vert > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.487 for -h,-k,l 0.024 for h,-h-k,-l 0.025 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	5697	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.47% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: FMN, ORO, AFI, BOG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| >5$	RMSZ	$\#\|Z\| >5$
1	A	0.34	0/2697	0.65	2/3650 (0.1%)
1	B	0.34	0/2697	0.65	3/3650 (0.1%)
All	All	0.34	0/5394	0.65	5/7300 (0.1%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	253	LEU	CA-CB-CG	5.41	127.74	115.30
1	A	213	VAL	N-CA-C	-5.39	96.45	111.00
1	B	213	VAL	N-CA-C	-5.31	96.66	111.00
1	A	253	LEU	CA-CB-CG	5.18	127.21	115.30
1	B	284	ASN	N-CA-C	-5.06	97.33	111.00

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	2658	0	2731	75	0
1	B	2658	0	2731	81	0
2	A	31	0	19	0	0
2	B	31	0	19	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	11	0	3	2	0
3	B	11	0	3	2	0
4	A	26	0	18	3	0
4	B	26	0	18	3	0
5	A	20	0	28	1	0
5	B	20	0	28	1	0
6	A	99	0	0	0	0
6	B	106	0	0	3	0
All	All	5697	0	5598	156	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 14.

All (156) 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:100:LYS:HA	1:B:119:GLY:HA3	1.47	0.96
1:B:145:ASN:HD21	3:B:399:ORO:HN1	1.14	0.95
1:B:234:LEU:HD13	1:B:277:ILE:HD11	1.51	0.92
1:A:145:ASN:HD21	3:A:399:ORO:HN1	1.17	0.91
1:A:234:LEU:HD13	1:A:277:ILE:HD11	1.54	0.89
1:A:100:LYS:HA	1:A:119:GLY:HA3	1.57	0.87
1:B:40:GLU:O	1:B:41:TYR:HB3	1.82	0.79
1:A:166:GLN:H	1:A:166:GLN:CD	1.86	0.79
1:B:166:GLN:H	1:B:166:GLN:CD	1.86	0.79
1:A:40:GLU:O	1:A:41:TYR:HB3	1.84	0.77
1:A:273:ARG:HH21	1:A:327:ARG:HH11	1.33	0.77
1:A:62:VAL:HG12	1:A:68:LEU:HD11	1.70	0.74
1:B:244:LEU:O	1:B:249:LYS:HE2	1.88	0.73
1:B:68:LEU:HD12	1:B:68:LEU:H	1.54	0.71
1:B:62:VAL:HG12	1:B:68:LEU:HD11	1.74	0.70
1:A:68:LEU:HD12	1:A:68:LEU:H	1.56	0.69
1:B:273:ARG:HH21	1:B:327:ARG:HH11	1.39	0.69
1:A:318:ARG:HG2	1:A:348:ALA:HB1	1.74	0.68
1:B:180:ILE:HD12	1:B:206:ALA:HB2	1.76	0.67
1:A:244:LEU:O	1:A:249:LYS:HE2	1.93	0.67
1:A:180:ILE:HD12	1:A:206:ALA:HB2	1.76	0.66
1:B:100:LYS:HA	1:B:119:GLY:CA	2.24	0.66
1:B:68:LEU:HD12	1:B:68:LEU:N	2.12	0.65
1:A:214:SER:HB3	1:A:257:ALA:N	2.12	0.64
1:B:57:ARG:NH1	6:B:2006:HOH:O	2.29	0.64

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:318:ARG:HG2	1:B:348:ALA:HB1	1.78	0.64
1:A:80:GLU:OE2	1:A:87:LYS:HD2	1.97	0.64
1:A:195:TYR:HD1	1:A:233:LEU:HD11	1.63	0.64
1:B:253:LEU:HD13	1:B:279:GLY:HA3	1.79	0.63
1:B:214:SER:HB3	1:B:257:ALA:N	2.13	0.63
1:A:68:LEU:HD12	1:A:68:LEU:N	2.14	0.63
1:B:195:TYR:HD1	1:B:233:LEU:HD11	1.65	0.61
1:B:80:GLU:OE2	1:B:87:LYS:HD2	2.01	0.61
1:A:273:ARG:NH2	1:A:327:ARG:HH11	1.98	0.60
1:A:273:ARG:HH21	1:A:327:ARG:NH1	1.97	0.60
1:B:273:ARG:HH21	1:B:327:ARG:NH1	1.99	0.59
1:A:253:LEU:HD13	1:A:279:GLY:HA3	1.82	0.59
1:B:273:ARG:NH2	1:B:327:ARG:HH11	2.00	0.59
1:B:78:MET:O	1:B:386:VAL:HG23	2.03	0.58
1:B:272:ALA:HA	1:B:277:ILE:HD12	1.86	0.58
1:A:100:LYS:HA	1:A:119:GLY:CA	2.31	0.58
1:A:234:LEU:HD13	1:A:277:ILE:CD1	2.32	0.57
1:A:78:MET:O	1:A:386:VAL:HG23	2.05	0.56
1:B:337:SER:O	1:B:369:ARG:NH2	2.39	0.56
1:B:162:ARG:HG2	1:B:205:LEU:HD21	1.88	0.55
1:B:234:LEU:HD13	1:B:277:ILE:CD1	2.29	0.55
1:A:162:ARG:HG2	1:A:205:LEU:HD21	1.89	0.54
1:A:62:VAL:HG12	1:A:68:LEU:CD1	2.37	0.54
1:B:356:TYR:OH	4:B:400:AFI:H7	2.08	0.54
1:B:97:GLY:H	1:B:119:GLY:HA2	1.74	0.53
1:A:337:SER:O	1:A:369:ARG:NH2	2.42	0.53
1:A:56:HIS:HD2	1:A:147:TYR:OH	1.91	0.53
1:B:255:LYS:NZ	1:B:284:ASN:HA	2.23	0.53
1:A:325:GLN:HB2	1:A:327:ARG:HD2	1.90	0.53
1:A:356:TYR:OH	4:A:400:AFI:H7	2.09	0.52
1:A:256:ILE:O	1:A:283:THR:HA	2.10	0.52
1:A:162:ARG:HG3	1:A:205:LEU:HD11	1.90	0.52
1:A:347:GLN:HE22	1:A:381:ARG:HH11	1.56	0.52
1:B:225:GLN:HG2	1:B:229:GLU:OE2	2.11	0.51
1:A:195:TYR:CD1	1:A:233:LEU:HD11	2.45	0.51
1:A:255:LYS:NZ	1:A:284:ASN:HA	2.25	0.51
1:A:225:GLN:HG2	1:A:229:GLU:OE2	2.11	0.51
1:A:97:GLY:H	1:A:119:GLY:HA2	1.75	0.50
1:A:258:PRO:HD3	1:A:283:THR:HG23	1.94	0.50
1:B:162:ARG:HG3	1:B:205:LEU:HD11	1.92	0.50
1:A:166:GLN:H	1:A:166:GLN:NE2	2.08	0.50

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:272:ALA:HA	1:A:277:ILE:HD12	1.94	0.50
1:B:61:ARG:NH2	5:B:401:BOG:O6	2.46	0.49
1:A:70:ARG:HG3	1:A:110:LYS:HG3	1.95	0.49
1:B:378:LEU:HD11	1:B:386:VAL:HG22	1.94	0.49
1:B:62:VAL:HG12	1:B:68:LEU:CD1	2.42	0.49
1:B:79:LEU:HA	1:B:386:VAL:CG2	2.43	0.49
1:A:61:ARG:NH2	5:A:401:BOG:O6	2.45	0.49
1:B:79:LEU:HA	1:B:386:VAL:HG23	1.94	0.49
1:B:256:ILE:O	1:B:283:THR:HA	2.12	0.49
1:B:118:VAL:O	1:B:119:GLY:O	2.30	0.49
1:B:195:TYR:CD1	1:B:233:LEU:HD11	2.46	0.49
1:A:378:LEU:HD11	1:A:386:VAL:HG22	1.93	0.49
1:B:258:PRO:HD3	1:B:283:THR:HG23	1.95	0.48
1:B:241:ARG:C	1:B:241:ARG:HD2	2.34	0.48
1:A:200:ARG:HG2	1:A:240:GLU:OE2	2.14	0.48
1:B:56:HIS:HD2	1:B:147:TYR:OH	1.97	0.48
1:B:253:LEU:HD13	1:B:279:GLY:CA	2.44	0.47
1:B:369:ARG:O	1:B:373:GLU:HG3	2.14	0.47
1:B:364:PRO:N	1:B:365:PRO:CD	2.77	0.47
1:A:123:PRO:HA	1:A:154:LEU:HG	1.97	0.47
1:B:166:GLN:H	1:B:166:GLN:NE2	2.12	0.47
1:B:325:GLN:HB2	1:B:327:ARG:HD2	1.95	0.47
1:B:254:VAL:HG21	1:B:277:ILE:HD13	1.97	0.47
1:A:364:PRO:N	1:A:365:PRO:CD	2.77	0.46
1:B:356:TYR:C	1:B:356:TYR:CD2	2.89	0.46
1:B:285:THR:HG22	1:B:305:SER:HB3	1.98	0.46
1:B:212:ASN:HB2	6:B:2052:HOH:O	2.14	0.46
1:B:149:PHE:CE2	3:B:399:ORO:H5	2.50	0.46
1:A:355:LEU:HD12	1:A:355:LEU:C	2.37	0.46
1:A:79:LEU:HA	1:A:386:VAL:HG23	1.97	0.46
1:A:118:VAL:O	1:A:119:GLY:O	2.34	0.45
1:A:289:ARG:NH1	1:A:304:LEU:HB2	2.31	0.45
1:B:70:ARG:HG3	1:B:110:LYS:HG3	1.98	0.45
1:A:273:ARG:HE	1:A:327:ARG:HD3	1.81	0.45
1:A:356:TYR:C	1:A:356:TYR:CD2	2.90	0.45
1:A:212:ASN:ND2	1:A:255:LYS:HB3	2.31	0.45
1:A:79:LEU:HA	1:A:386:VAL:CG2	2.47	0.44
1:A:149:PHE:CE2	3:A:399:ORO:H5	2.53	0.44
1:B:56:HIS:HE1	1:B:98:PHE:O	2.01	0.44
1:B:212:ASN:ND2	1:B:255:LYS:HB3	2.33	0.44
1:B:99:ASP:O	1:B:119:GLY:N	2.47	0.44

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:96:ALA:HB2	1:B:117:GLU:OE1	2.17	0.44
1:A:57:ARG:O	1:A:61:ARG:HG3	2.18	0.43
1:A:214:SER:CB	1:A:257:ALA:N	2.80	0.43
1:A:63:THR:HA	1:A:68:LEU:CD1	2.48	0.43
1:A:148:GLY:O	1:A:149:PHE:HB2	2.18	0.43
1:B:356:TYR:C	1:B:356:TYR:HD2	2.21	0.43
1:B:47:GLN:HG3	4:B:400:AFI:H152	2.00	0.43
1:A:254:VAL:HG21	1:A:277:ILE:HD13	2.00	0.43
1:A:117:GLU:HA	1:A:179:GLY:O	2.19	0.43
1:B:47:GLN:HG3	4:B:400:AFI:O6	2.19	0.43
1:B:63:THR:HA	1:B:68:LEU:CD1	2.49	0.43
1:A:285:THR:HG22	1:A:305:SER:HB3	2.01	0.42
1:B:95:ALA:HB3	1:B:356:TYR:HB2	2.01	0.42
1:B:148:GLY:O	1:B:149:PHE:HB2	2.18	0.42
1:B:273:ARG:HE	1:B:327:ARG:HD3	1.84	0.42
1:B:355:LEU:HD12	1:B:355:LEU:C	2.39	0.42
1:A:254:VAL:CG2	1:A:277:ILE:HD13	2.50	0.42
1:A:356:TYR:C	1:A:356:TYR:HD2	2.23	0.42
1:B:289:ARG:NH1	1:B:304:LEU:HB2	2.34	0.42
1:A:62:VAL:HG13	1:A:67:LEU:HB2	2.01	0.42
1:B:200:ARG:HG2	1:B:240:GLU:OE2	2.20	0.42
1:B:255:LYS:HZ1	1:B:284:ASN:HA	1.84	0.42
1:A:44:PRO:HG3	4:A:400:AFI:H19	2.02	0.42
1:B:158:GLU:OE2	1:B:162:ARG:NE	2.53	0.42
1:A:289:ARG:HH11	1:A:304:LEU:HB2	1.84	0.42
1:B:273:ARG:HH21	1:B:327:ARG:HD3	1.85	0.42
1:A:253:LEU:HD13	1:A:279:GLY:CA	2.48	0.42
1:A:47:GLN:HG3	4:A:400:AFI:H152	2.02	0.41
1:B:254:VAL:CG2	1:B:277:ILE:HD13	2.50	0.41
1:A:214:SER:HB3	1:A:256:ILE:HA	2.01	0.41
1:B:214:SER:CB	1:B:257:ALA:N	2.83	0.41
1:A:123:PRO:HA	1:A:154:LEU:CD1	2.50	0.41
1:B:214:SER:HB3	1:B:256:ILE:C	2.40	0.41
1:B:289:ARG:HH11	1:B:304:LEU:HB2	1.85	0.41
1:A:99:ASP:O	1:A:119:GLY:N	2.52	0.41
1:B:123:PRO:HA	1:B:154:LEU:HG	2.02	0.41
1:B:53:GLU:O	1:B:57:ARG:HG3	2.20	0.41
1:A:83:VAL:HG22	1:A:84:LEU:N	2.36	0.41
1:A:158:GLU:OE2	1:A:162:ARG:NE	2.54	0.41
1:A:273:ARG:HH21	1:A:327:ARG:HD3	1.86	0.41
1:B:64:SER:HA	6:B:2024:HOH:O	2.21	0.40

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:68:LEU:H	1:B:68:LEU:CD1	2.30	0.40
1:A:70:ARG:HB2	1:A:110:LYS:HE3	2.02	0.40
1:B:283:THR:CG2	1:B:284:ASN:O	2.69	0.40
1:A:214:SER:O	1:A:215:SER:C	2.60	0.40
1:B:83:VAL:HG22	1:B:84:LEU:HG	2.02	0.40
1:B:369:ARG:NH1	1:B:373:GLU:OE2	2.54	0.40
1:A:83:VAL:HG22	1:A:84:LEU:HG	2.04	0.40
1:B:136:ARG:C	1:B:137:LEU:HD12	2.41	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	346/372 (93%)	334 (96%)	10 (3%)	2 (1%)	25	31
1	B	346/372 (93%)	332 (96%)	12 (4%)	2 (1%)	25	31
All	All	692/744 (93%)	666 (96%)	22 (3%)	4 (1%)	25	31

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	119	GLY
1	B	119	GLY
1	A	283	THR
1	B	283	THR

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	282/301 (94%)	275 (98%)	7 (2%)	47	65
1	B	282/301 (94%)	276 (98%)	6 (2%)	53	70
All	All	564/602 (94%)	551 (98%)	13 (2%)	50	67

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	91	PRO
1	A	147	TYR
1	A	166	GLN
1	A	181	ASN
1	A	245	LYS
1	A	253	LEU
1	A	356	TYR
1	B	68	LEU
1	B	91	PRO
1	B	166	GLN
1	B	181	ASN
1	B	253	LEU
1	B	356	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	47	GLN
1	A	56	HIS
1	A	74	GLN
1	A	145	ASN
1	A	166	GLN
1	A	181	ASN
1	A	212	ASN
1	A	294	GLN
1	A	347	GLN
1	A	354	GLN
1	B	47	GLN
1	B	56	HIS
1	B	145	ASN
1	B	166	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	181	ASN
1	B	212	ASN
1	B	294	GLN
1	B	354	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

8 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	$\#\|Z\| > 2$
2	FMN	B	398	-	33,33,33	1.34	4 (12%)	48,50,50	1.30	5 (10%)
4	AFI	A	400	-	29,29,29	3.77	20 (68%)	38,42,42	1.15	4 (10%)
4	AFI	B	400	-	29,29,29	3.73	19 (65%)	38,42,42	1.16	4 (10%)
5	BOG	B	401	-	20,20,20	1.08	2 (10%)	25,25,25	0.69	0
5	BOG	A	401	-	20,20,20	1.11	2 (10%)	25,25,25	0.70	0
3	ORO	A	399	-	9,11,11	2.13	2 (22%)	8,15,15	3.16	4 (50%)
2	FMN	A	398	-	33,33,33	1.26	4 (12%)	48,50,50	1.29	6 (12%)
3	ORO	B	399	-	9,11,11	2.08	2 (22%)	8,15,15	3.23	4 (50%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FMN	B	398	-	-	5/18/18/18	0/3/3/3
4	AFI	A	400	-	1/1/6/6	4/8/38/38	0/4/4/4
4	AFI	B	400	-	1/1/6/6	4/8/38/38	0/4/4/4
5	BOG	B	401	-	-	2/11/31/31	0/1/1/1
5	BOG	A	401	-	-	2/11/31/31	0/1/1/1
3	ORO	A	399	-	-	4/4/4/4	0/1/1/1
2	FMN	A	398	-	-	5/18/18/18	0/3/3/3
3	ORO	B	399	-	-	4/4/4/4	0/1/1/1

All (55) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	400	AFI	C3-C4	10.66	1.46	1.36
4	B	400	AFI	C3-C4	10.31	1.46	1.36
4	B	400	AFI	C16-C2	6.51	1.51	1.35
4	A	400	AFI	C16-C2	6.45	1.51	1.35
4	B	400	AFI	C15-C16	5.97	1.61	1.51
4	A	400	AFI	C15-C16	5.86	1.61	1.51
4	A	400	AFI	C21-C20	4.84	1.47	1.38
4	B	400	AFI	C21-C20	4.81	1.47	1.38
4	A	400	AFI	C11-C16	4.70	1.59	1.51
4	B	400	AFI	C11-C16	4.69	1.59	1.51
4	A	400	AFI	C2-C1	4.58	1.57	1.46
4	B	400	AFI	C2-C1	4.54	1.57	1.46
4	A	400	AFI	C10-C9	4.27	1.47	1.40
4	B	400	AFI	C10-C9	4.24	1.47	1.40
2	B	398	FMN	C6-C5A	4.22	1.46	1.40
4	A	400	AFI	C18-C17	4.18	1.45	1.39
4	B	400	AFI	C10-C4	4.16	1.52	1.45
4	A	400	AFI	C22-C17	4.15	1.45	1.39
2	A	398	FMN	C6-C5A	4.14	1.46	1.40
4	B	400	AFI	C18-C17	4.12	1.45	1.39
3	A	399	ORO	C4-N3	4.10	1.40	1.33
3	B	399	ORO	C4-N3	4.08	1.40	1.33
4	B	400	AFI	C22-C17	4.03	1.45	1.39
4	A	400	AFI	C10-C4	3.89	1.52	1.45
3	A	399	ORO	C6-N1	3.75	1.39	1.34

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	399	ORO	C6-N1	3.47	1.39	1.34
4	A	400	AFI	C19-C20	3.37	1.44	1.38
4	B	400	AFI	C19-C20	3.37	1.44	1.38
4	A	400	AFI	C19-C18	3.17	1.44	1.38
4	B	400	AFI	C19-C18	3.17	1.44	1.38
4	A	400	AFI	C8-C9	3.05	1.44	1.39
4	B	400	AFI	C8-C9	3.03	1.44	1.39
4	A	400	AFI	O6-C3	2.99	1.43	1.33
4	A	400	AFI	C22-C21	2.99	1.44	1.38
4	B	400	AFI	C22-C21	2.94	1.44	1.38
5	A	401	BOG	O5-C1	2.91	1.49	1.41
4	B	400	AFI	O6-C3	2.83	1.43	1.33
4	A	400	AFI	C6-C5	2.76	1.44	1.38
4	B	400	AFI	C6-C5	2.68	1.44	1.38
5	B	401	BOG	O5-C1	2.67	1.48	1.41
2	B	398	FMN	C9A-C5A	2.65	1.45	1.41
4	A	400	AFI	C5-C10	2.64	1.44	1.39
4	B	400	AFI	C5-C10	2.63	1.44	1.39
5	A	401	BOG	O1-C1	2.51	1.44	1.40
2	A	398	FMN	C9A-C5A	2.46	1.45	1.41
2	B	398	FMN	C8-C7	2.32	1.46	1.40
4	B	400	AFI	C14-C15	2.27	1.58	1.52
5	B	401	BOG	O1-C1	2.25	1.44	1.40
4	A	400	AFI	C14-C15	2.23	1.57	1.52
2	A	398	FMN	C8-C7	2.22	1.46	1.40
2	A	398	FMN	C2-N3	2.19	1.44	1.39
4	B	400	AFI	O2-C4	-2.14	1.27	1.33
4	A	400	AFI	O2-C4	-2.13	1.27	1.33
2	B	398	FMN	C2-N3	2.08	1.43	1.39
4	A	400	AFI	O1-C1	2.01	1.27	1.23

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	399	ORO	C5-C4-N3	-7.75	115.03	124.08
3	A	399	ORO	C5-C4-N3	-7.61	115.20	124.08
2	B	398	FMN	C10-N1-C2	3.03	122.95	116.90
2	A	398	FMN	C10-N1-C2	2.81	122.52	116.90
3	A	399	ORO	O72-C7-C6	-2.75	108.42	114.69
3	B	399	ORO	C6-C5-C4	2.75	118.51	116.73
3	A	399	ORO	O72-C7-O71	2.64	129.21	123.35
3	B	399	ORO	O72-C7-C6	-2.60	108.77	114.69

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	398	FMN	C9A-C9-C8	2.58	124.49	119.30
3	B	399	ORO	O72-C7-O71	2.55	129.01	123.35
4	B	400	AFI	O6-C3-C4	-2.55	117.23	122.86
4	A	400	AFI	O6-C3-C4	-2.51	117.30	122.86
2	B	398	FMN	C9A-C9-C8	2.48	124.29	119.30
2	B	398	FMN	P-O5'-C5'	2.47	125.10	118.30
4	B	400	AFI	C18-C19-C20	-2.40	116.71	119.24
3	A	399	ORO	C6-C5-C4	2.38	118.27	116.73
4	A	400	AFI	C18-C19-C20	-2.35	116.76	119.24
2	B	398	FMN	C9-C9A-N10	2.29	124.93	121.84
4	B	400	AFI	O2-C4-C10	2.25	119.46	115.53
2	A	398	FMN	P-O5'-C5'	2.23	124.43	118.30
2	B	398	FMN	C4-C4A-N5	2.20	121.36	118.23
2	A	398	FMN	C4-C4A-N5	2.16	121.30	118.23
4	A	400	AFI	O2-C4-C10	2.12	119.23	115.53
4	B	400	AFI	C22-C21-C20	-2.09	117.04	119.24
4	A	400	AFI	C22-C21-C20	-2.06	117.07	119.24
2	A	398	FMN	C9-C9A-N10	2.05	124.61	121.84
2	A	398	FMN	C6-C5A-N5	2.01	122.02	118.51

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	400	AFI	C16
4	B	400	AFI	C16

All (30) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	399	ORO	N1-C6-C7-O71
3	A	399	ORO	N1-C6-C7-O72
3	A	399	ORO	C5-C6-C7-O71
3	A	399	ORO	C5-C6-C7-O72
3	B	399	ORO	N1-C6-C7-O71
3	B	399	ORO	N1-C6-C7-O72
3	B	399	ORO	C5-C6-C7-O71
3	B	399	ORO	C5-C6-C7-O72
4	A	400	AFI	C11-C16-C2-C1
4	A	400	AFI	C15-C16-C2-C1
4	A	400	AFI	C11-C16-C2-C3
4	A	400	AFI	C15-C16-C2-C3
4	B	400	AFI	C11-C16-C2-C1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
4	B	400	AFI	C15-C16-C2-C1
4	B	400	AFI	C11-C16-C2-C3
4	B	400	AFI	C15-C16-C2-C3
5	B	401	BOG	O5-C5-C6-O6
2	A	398	FMN	O3'-C3'-C4'-C5'
2	A	398	FMN	O3'-C3'-C4'-O4'
2	A	398	FMN	C2'-C3'-C4'-O4'
5	A	401	BOG	O5-C5-C6-O6
2	B	398	FMN	C2'-C3'-C4'-O4'
5	B	401	BOG	C4-C5-C6-O6
2	A	398	FMN	C2'-C3'-C4'-C5'
2	A	398	FMN	C4'-C5'-O5'-P
2	B	398	FMN	C4'-C5'-O5'-P
5	A	401	BOG	C4-C5-C6-O6
2	B	398	FMN	O3'-C3'-C4'-O4'
2	B	398	FMN	O3'-C3'-C4'-C5'
2	B	398	FMN	C2'-C3'-C4'-C5'

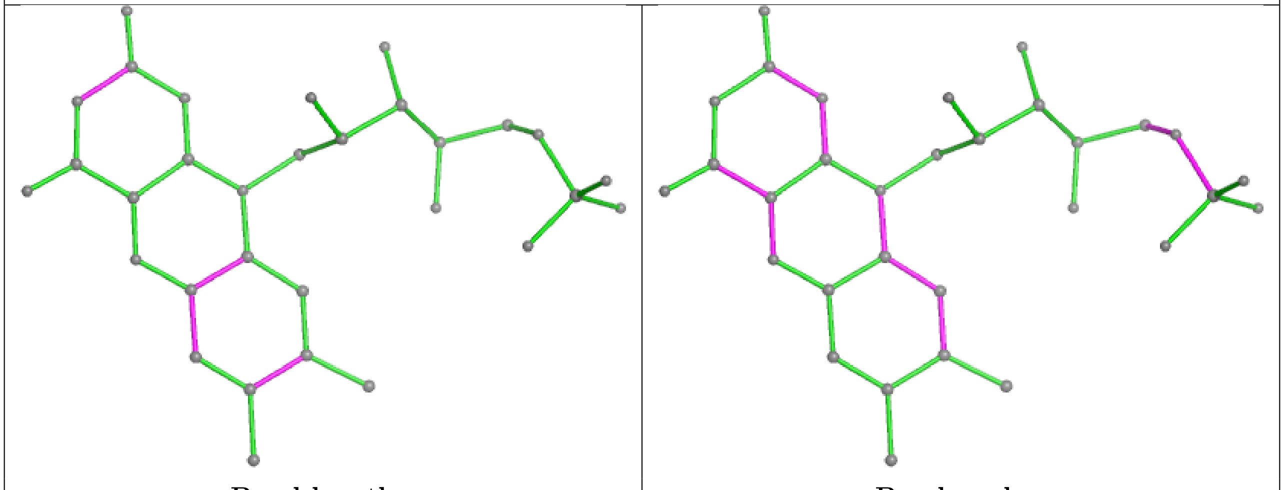
There are no ring outliers.

6 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	400	AFI	3	0
4	B	400	AFI	3	0
5	B	401	BOG	1	0
5	A	401	BOG	1	0
3	A	399	ORO	2	0
3	B	399	ORO	2	0

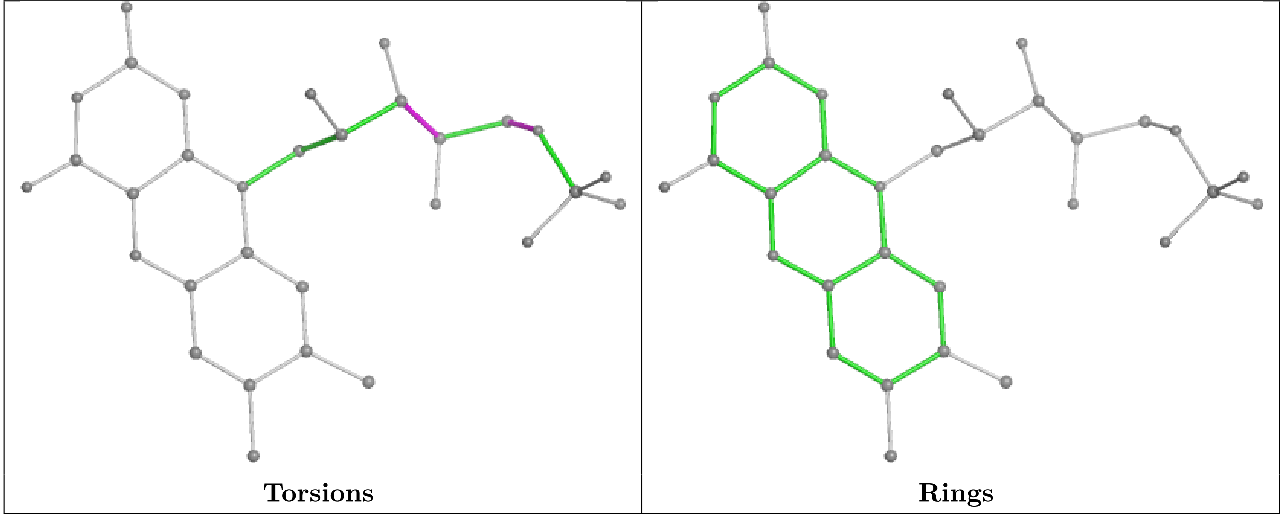
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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 FMN B 398



Bond lengths

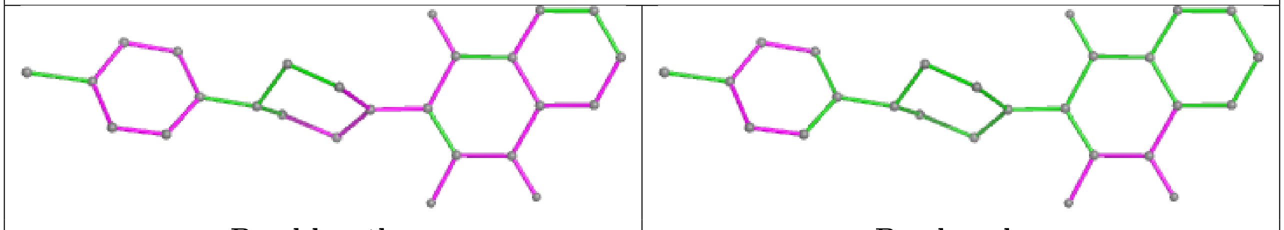
Bond angles



Torsions

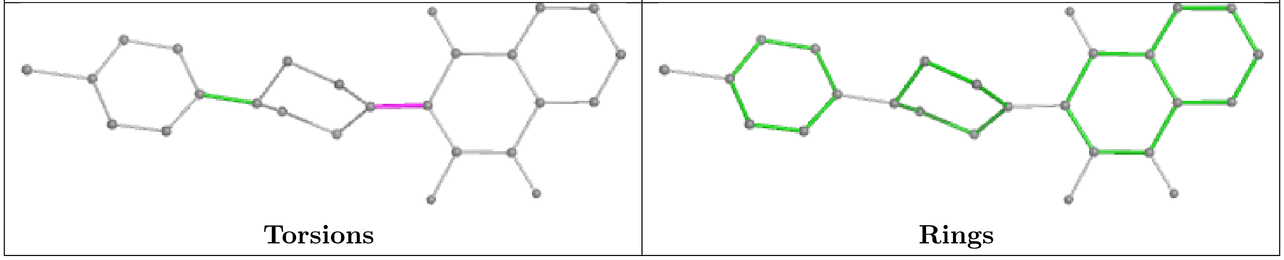
Rings

Ligand AFI A 400



Bond lengths

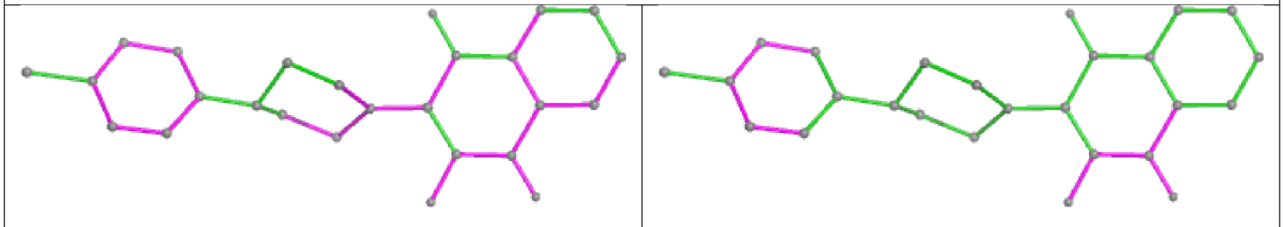
Bond angles



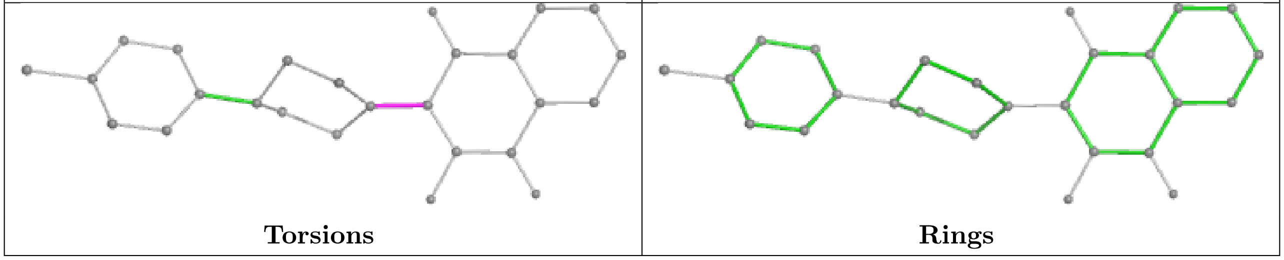
Torsions

Rings

Ligand AFI B 400

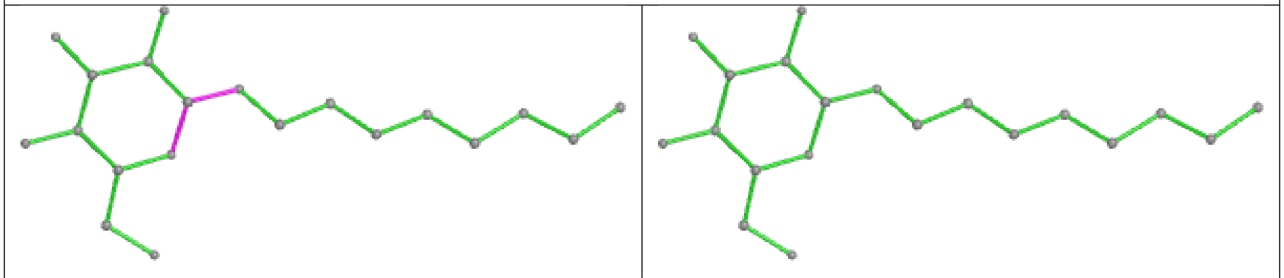

Bond lengths

Bond angles

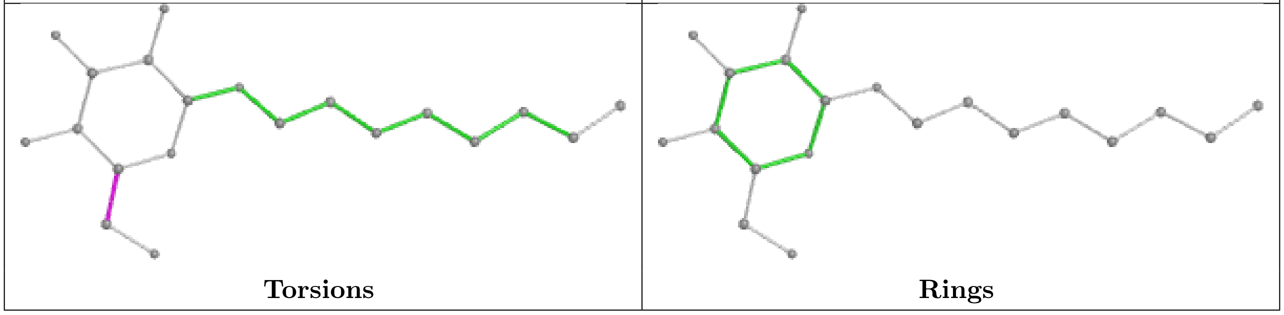

Torsions

Rings

Ligand BOG B 401

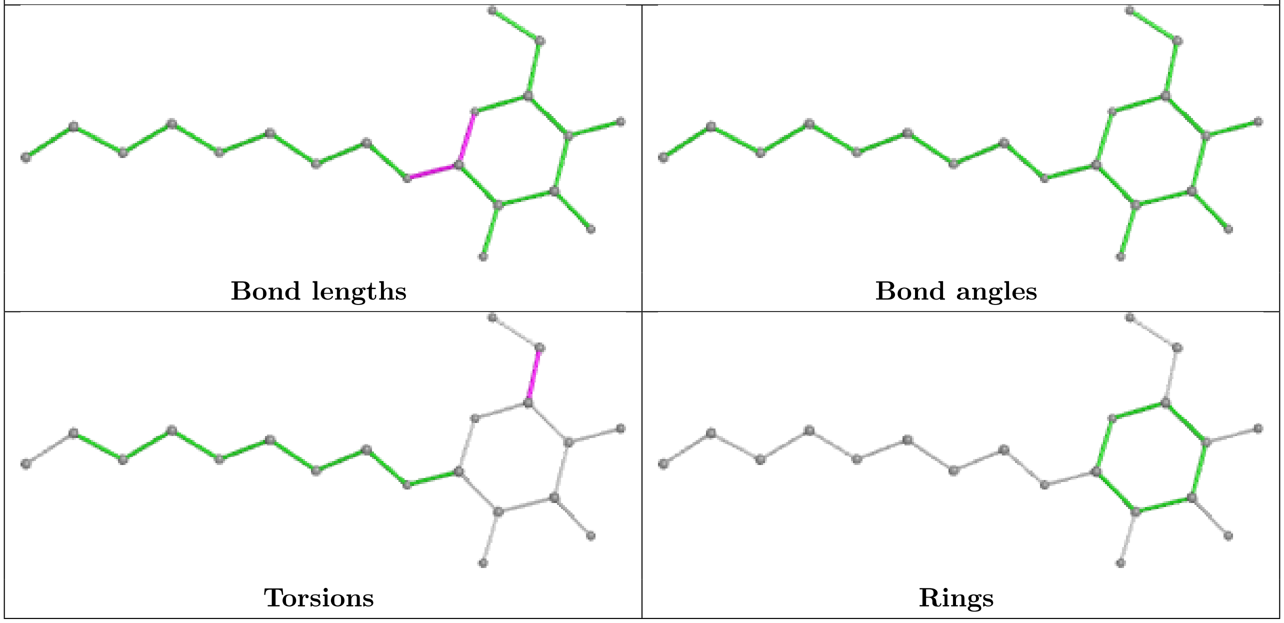

Bond lengths

Bond angles


Torsions

Rings

Ligand BOG A 401



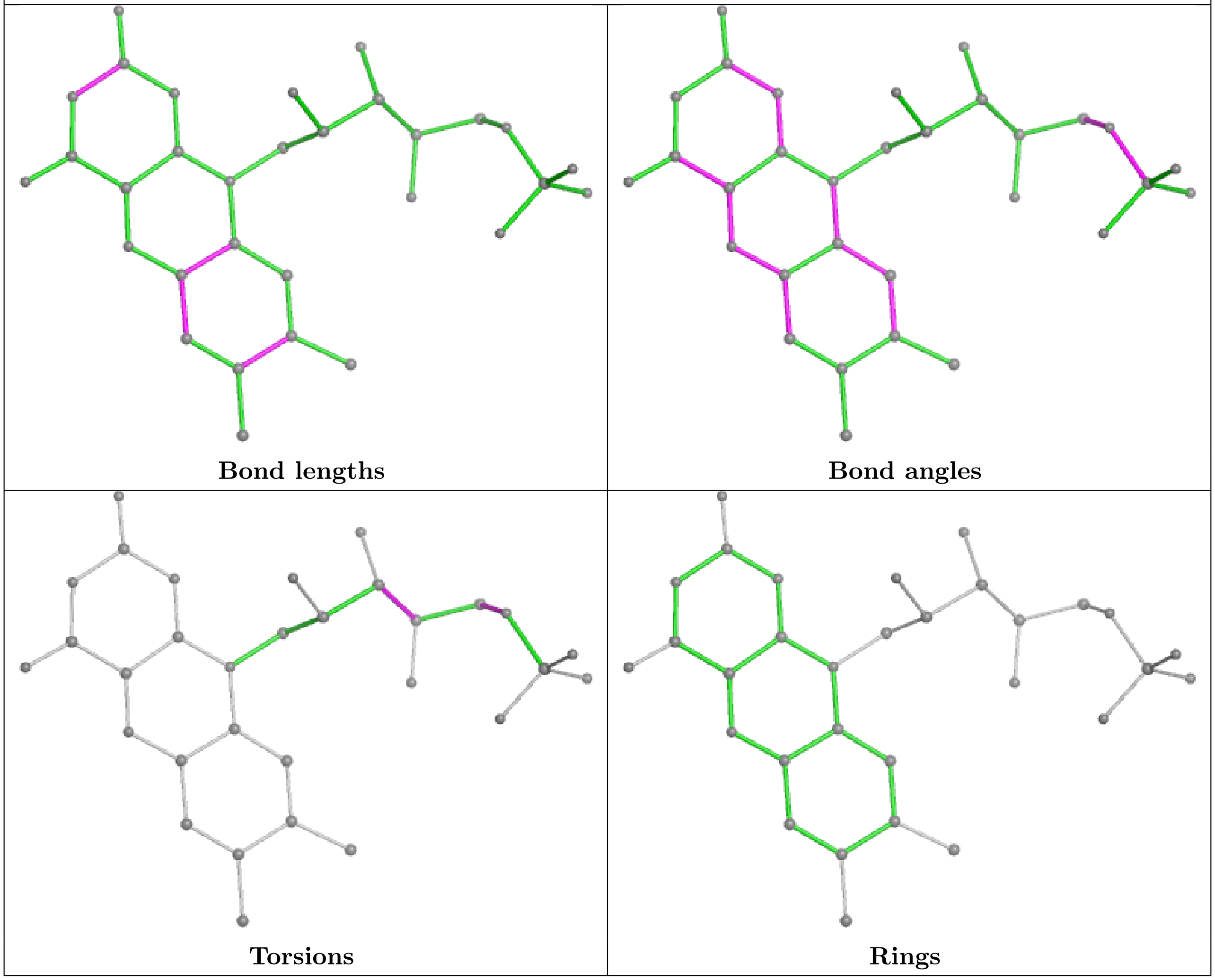
Bond lengths

Bond angles

Torsions

Rings

Ligand FMN A 398



Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} 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($\AA^2$)	Q<0.9
1	A	350/372 (94%)	-0.17	10 (2%)	51	58	14, 24, 50, 75	0
1	B	350/372 (94%)	-0.18	10 (2%)	51	58	13, 24, 50, 75	0
All	All	700/744 (94%)	-0.17	20 (2%)	51	58	13, 24, 50, 75	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	396	ARG	7.1
1	B	396	ARG	6.8
1	A	41	TYR	6.1
1	B	41	TYR	5.2
1	B	38	TYR	5.0
1	A	38	TYR	4.8
1	A	119	GLY	4.3
1	A	215	SER	4.3
1	B	215	SER	3.6
1	B	39	ALA	3.6
1	A	39	ALA	3.0
1	A	225	GLN	2.9
1	B	119	GLY	2.8
1	B	225	GLN	2.5
1	B	214	SER	2.4
1	A	70	ARG	2.4
1	B	42	LEU	2.3
1	A	232	HIS	2.1
1	B	232	HIS	2.0
1	A	395	ARG	2.0

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

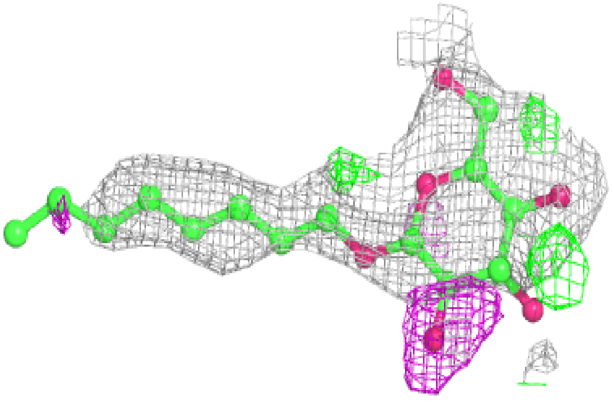
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

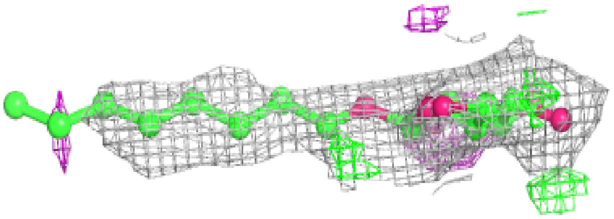
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	BOG	A	401	20/20	0.65	0.36	54,61,64,65	0
5	BOG	B	401	20/20	0.66	0.30	54,61,63,64	0
4	AFI	A	400	26/26	0.81	0.19	32,37,43,44	0
4	AFI	B	400	26/26	0.85	0.19	30,36,43,44	0
3	ORO	A	399	11/11	0.97	0.10	11,13,16,17	0
3	ORO	B	399	11/11	0.97	0.09	10,12,14,14	0
2	FMN	A	398	31/31	0.98	0.11	11,16,17,18	0
2	FMN	B	398	31/31	0.98	0.11	11,15,17,18	0

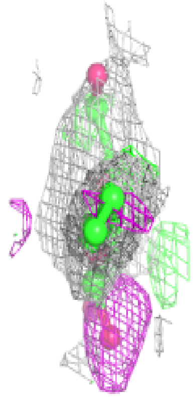
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around BOG A 401:

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

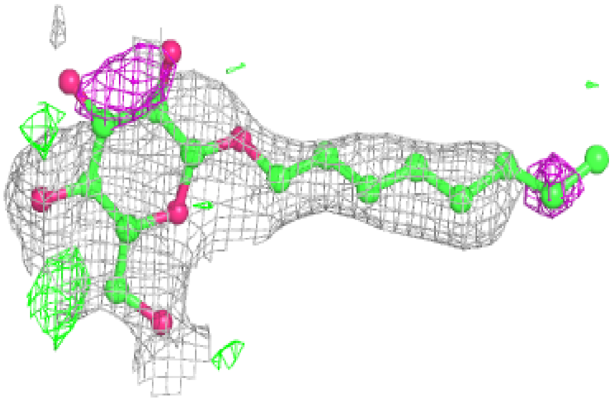


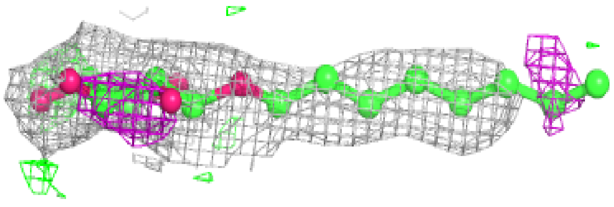


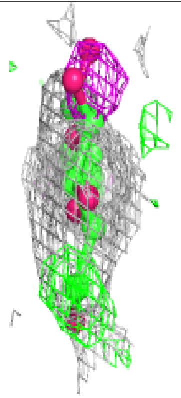


Electron density around BOG B 401:

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

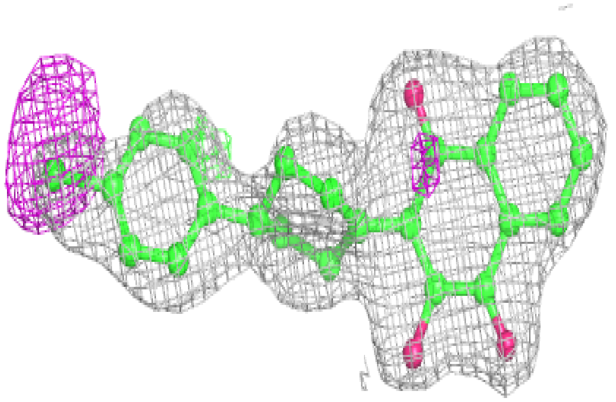


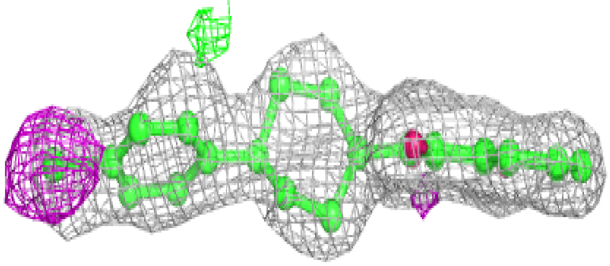


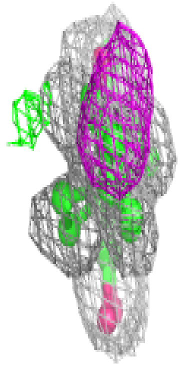


Electron density around AFI A 400:

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

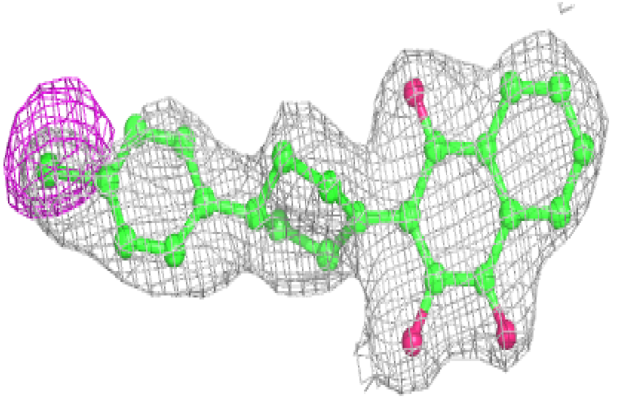


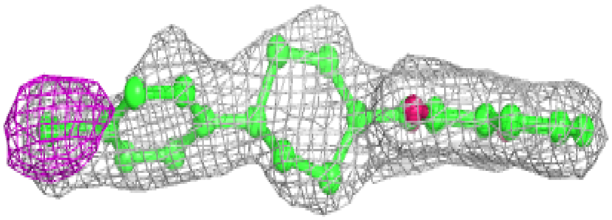


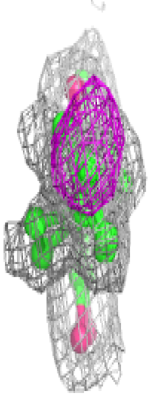


Electron density around AFI B 400:

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

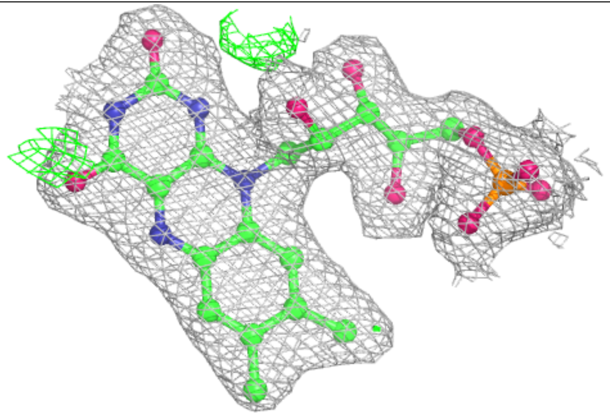


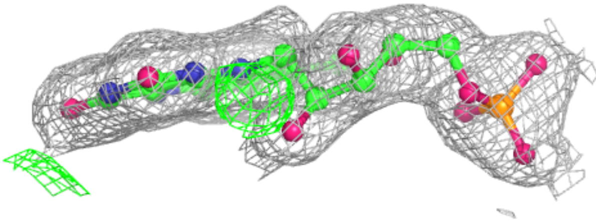


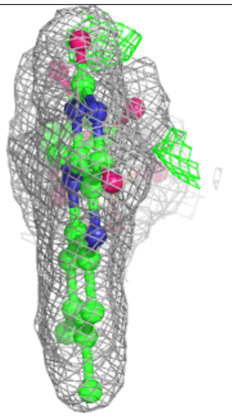


Electron density around FMN A 398:

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

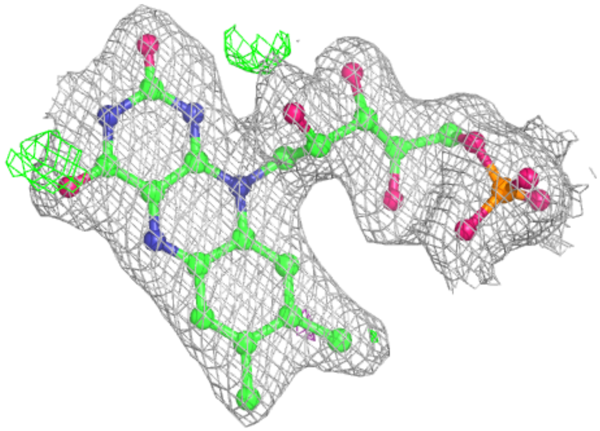


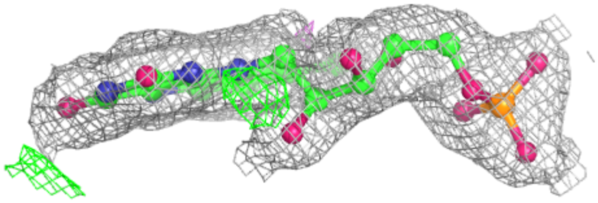


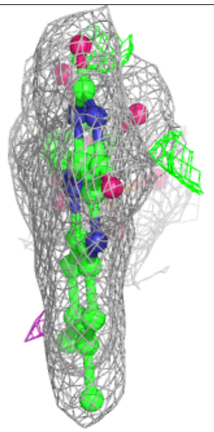


Electron density around FMN B 398:

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

There are no such residues in this entry.