Full wwPDB X-ray Structure Validation Report ⓘ

Jul 29, 2025 – 02:17 PM JST

PDB ID	:	9JQM / pdb_00009jqm
Title	:	X-ray structure of cytochrome P450 OleT from Lacicoccus alkaliphilus in complex with icosanoic acid
Authors	:	Phaisan, S.; Phintha, A.; Trisrivirat, D.; Charoenpol, A.; Tanaka, H.; Kurisu, G.; Watthaisong, P.; Sucharitakul, J.; Chaiyen, P.
Deposited on	:	2024-09-27
Resolution	:	2.44 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

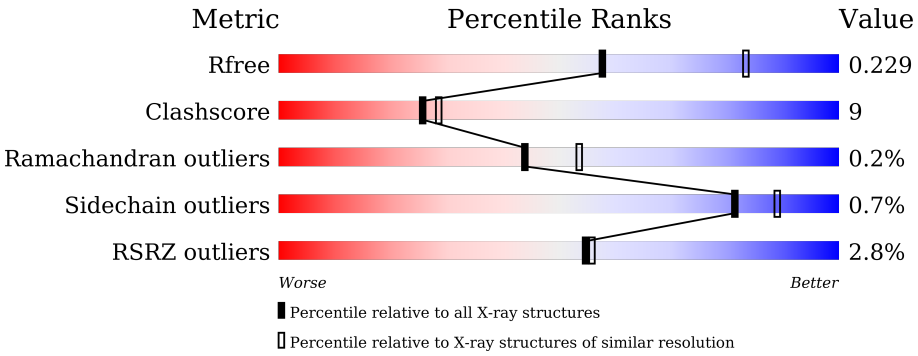
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.45.1

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 2.44 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}	164625	2124 (2.46-2.42)
Clashscore	180529	2259 (2.46-2.42)
Ramachandran outliers	177936	2244 (2.46-2.42)
Sidechain outliers	177891	2244 (2.46-2.42)
RSRZ outliers	164620	2124 (2.46-2.42)

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	432	3% 79% 19%
1	B	432	2% 82% 17%

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	GOL	A	505	-	-	X	-
4	GOL	B	505	-	X	X	-

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 7629 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.

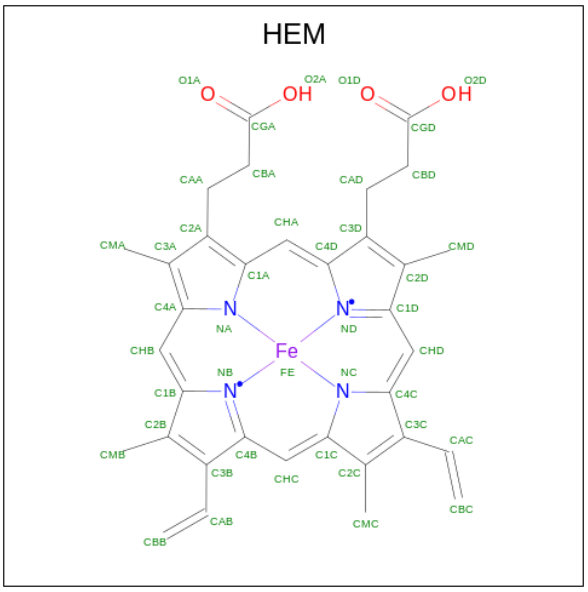
- Molecule 1 is a protein called Fatty-acid peroxygenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	428	Total	C	N	O	S	0	0	0
			3465	2210	603	634	18			
1	A	427	Total	C	N	O	S	0	0	0
			3441	2192	598	633	18			

There are 16 discrepancies between the modelled and reference sequences:

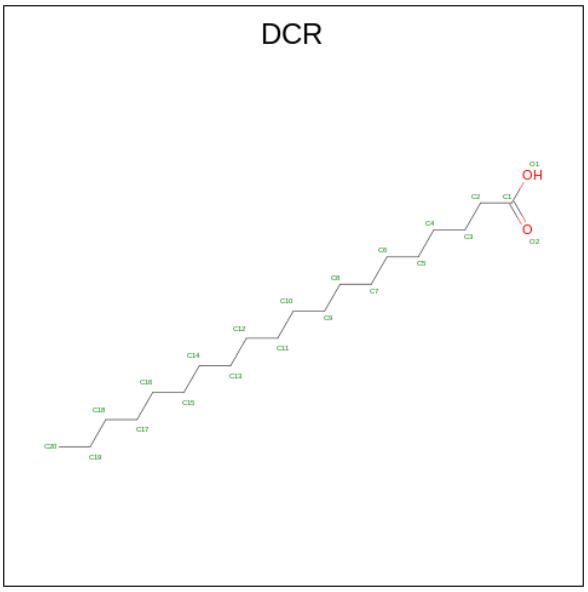
Chain	Residue	Modelled	Actual	Comment	Reference
B	425	LEU	-	expression tag	UNP A0A1M7CBV6
B	426	GLU	-	expression tag	UNP A0A1M7CBV6
B	427	HIS	-	expression tag	UNP A0A1M7CBV6
B	428	HIS	-	expression tag	UNP A0A1M7CBV6
B	429	HIS	-	expression tag	UNP A0A1M7CBV6
B	430	HIS	-	expression tag	UNP A0A1M7CBV6
B	431	HIS	-	expression tag	UNP A0A1M7CBV6
B	432	HIS	-	expression tag	UNP A0A1M7CBV6
A	425	LEU	-	expression tag	UNP A0A1M7CBV6
A	426	GLU	-	expression tag	UNP A0A1M7CBV6
A	427	HIS	-	expression tag	UNP A0A1M7CBV6
A	428	HIS	-	expression tag	UNP A0A1M7CBV6
A	429	HIS	-	expression tag	UNP A0A1M7CBV6
A	430	HIS	-	expression tag	UNP A0A1M7CBV6
A	431	HIS	-	expression tag	UNP A0A1M7CBV6
A	432	HIS	-	expression tag	UNP A0A1M7CBV6

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is icosanoic acid (CCD ID: DCR) (formula: $C_{20}H_{40}O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			22	20	2		

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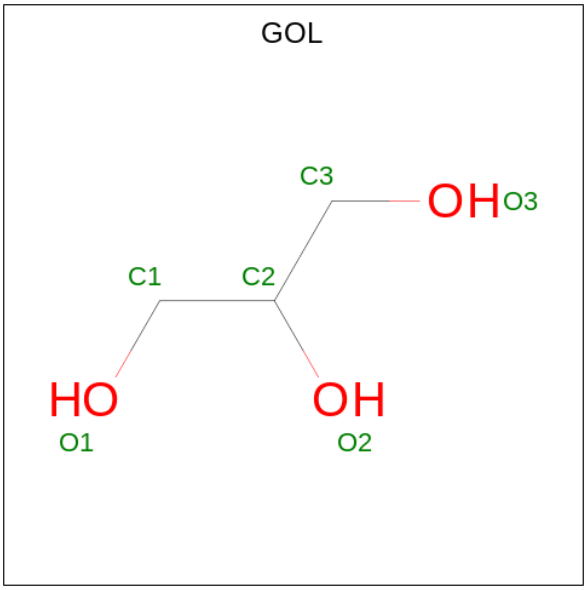
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 22 20 2	0	0

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total C O 6 3 3	0	0
4	B	1	Total C O 6 3 3	0	0
4	B	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0

- Molecule 5 is water.

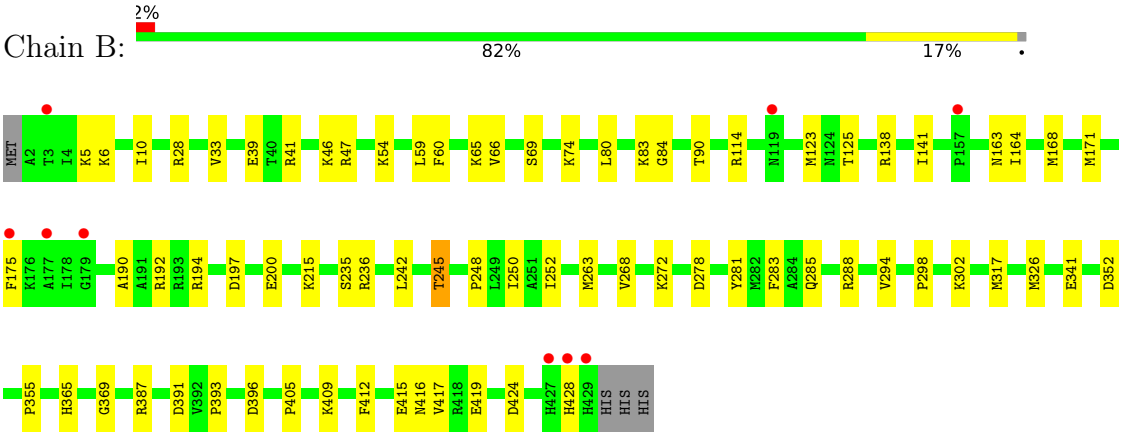
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	291	Total O 291 291	0	0
5	A	266	Total O 266 266	0	0

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.

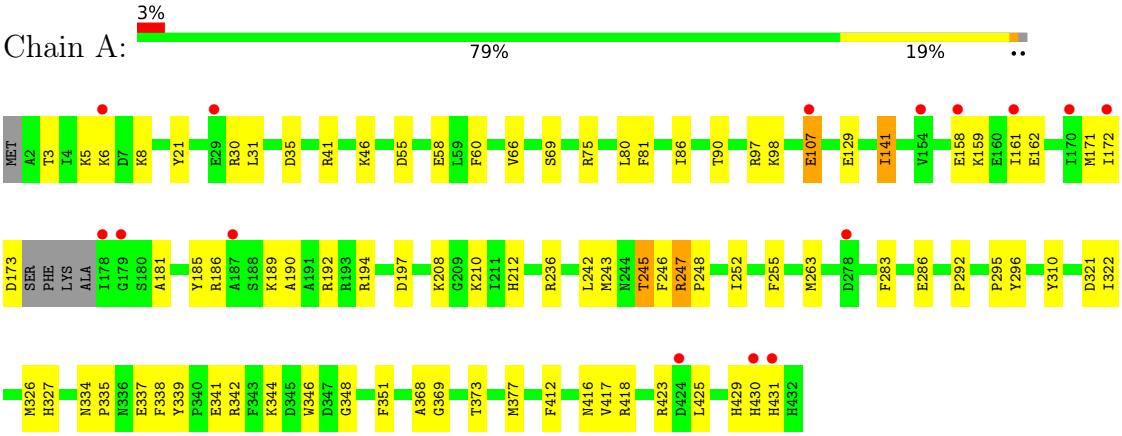
• Molecule 1: Fatty-acid peroxygenase

Chain B:



• Molecule 1: Fatty-acid peroxygenase

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	82.80Å 188.86Å 198.31Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.63 – 2.44 42.63 – 2.44	Depositor EDS
% Data completeness (in resolution range)	99.0 (42.63-2.44) 98.8 (42.63-2.44)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.08 (at 2.45Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.182 , 0.230 0.182 , 0.229	Depositor DCC
R_{free} test set	2895 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	70.6	Xtriage
Anisotropy	0.173	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 63.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.018 for -h,-l,-k	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7629	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 4.90% 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: HEM, GOL, DCR

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	0.38	0/3521	0.59	3/4754 (0.1%)
1	B	0.37	0/3547	0.54	0/4787
All	All	0.37	0/7068	0.57	3/9541 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	246	PHE	CA-C-N	-6.66	111.77	120.09
1	A	246	PHE	C-N-CA	-6.66	111.77	120.09
1	A	107	GLU	CA-CB-CG	5.16	124.42	114.10

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3441	0	3349	70	2
1	B	3465	0	3399	54	0
2	A	43	0	30	7	0
2	B	43	0	30	9	0
3	A	22	0	39	4	0
3	B	22	0	39	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	18	0	23	5	0
4	B	18	0	24	6	0
5	A	266	0	0	6	1
5	B	291	0	0	8	0
All	All	7629	0	6933	131	3

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 9.

All (131) 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:247:ARG:HH21	3:A:502:DCR:H2A	1.45	0.80
1:A:416:ASN:HA	4:A:505:GOL:H32	1.64	0.79
1:B:5:LYS:HD2	1:B:33:VAL:HG12	1.67	0.76
1:B:83:LYS:HE3	1:B:84:GLY:H	1.51	0.74
1:A:30:ARG:HG2	1:A:30:ARG:HH11	1.55	0.71
1:B:163:ASN:ND2	5:B:602:HOH:O	2.22	0.71
1:B:272:LYS:NZ	1:B:341:GLU:OE2	2.25	0.70
1:B:28:ARG:HE	4:B:504:GOL:H2	1.58	0.69
3:B:502:DCR:H3	5:B:601:HOH:O	1.95	0.67
4:B:505:GOL:H2	5:B:617:HOH:O	1.95	0.67
1:A:5:LYS:HB3	1:A:31:LEU:HD23	1.77	0.66
1:B:416:ASN:HA	4:B:505:GOL:H12	1.76	0.66
1:A:248:PRO:HB2	2:A:501:HEM:C4B	2.32	0.65
1:B:65:LYS:NZ	5:B:604:HOH:O	2.26	0.64
2:A:501:HEM:HHD	2:A:501:HEM:HBC2	1.81	0.63
1:B:248:PRO:HB2	2:B:501:HEM:C4B	2.34	0.62
1:A:416:ASN:H	4:A:505:GOL:H11	1.65	0.62
2:B:501:HEM:HHC	2:B:501:HEM:HBB2	1.80	0.61
1:A:129:GLU:O	4:A:505:GOL:H2	1.99	0.61
1:A:373:THR:O	1:A:377:MET:HG3	1.99	0.61
1:A:3:THR:O	5:A:601:HOH:O	2.16	0.61
1:A:6:LYS:HD2	1:A:8:LYS:HA	1.82	0.61
1:B:39:GLU:CD	1:B:47:ARG:HE	2.08	0.60
1:A:341:GLU:O	1:A:344:LYS:HG2	2.02	0.60
1:A:416:ASN:N	4:A:505:GOL:H11	2.17	0.59
1:B:326:MET:HE1	1:B:355:PRO:HB3	1.84	0.59
1:A:296:TYR:HB3	1:A:321:ASP:HA	1.84	0.59
1:B:417:VAL:N	4:B:505:GOL:H31	2.17	0.59
1:A:247:ARG:NH2	3:A:502:DCR:H2A	2.18	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:242:LEU:O	1:B:245:THR:HB	2.05	0.56
1:A:75:ARG:NH2	1:A:181:ALA:HB2	2.20	0.56
2:B:501:HEM:HBC2	2:B:501:HEM:HHD	1.87	0.54
1:B:168:MET:HG3	1:B:250:ILE:HD13	1.90	0.54
1:A:242:LEU:O	1:A:245:THR:HB	2.07	0.54
1:A:171:MET:CE	1:A:192:ARG:HD2	2.39	0.52
1:A:192:ARG:NH2	5:A:605:HOH:O	2.28	0.52
1:B:164:ILE:O	1:B:168:MET:HG2	2.10	0.52
1:B:268:VAL:HG22	1:B:272:LYS:HD2	1.92	0.52
1:A:243:MET:HE2	1:A:247:ARG:HD3	1.91	0.52
1:A:80:LEU:HD21	3:A:502:DCR:H8	1.92	0.52
1:B:298:PRO:HD3	3:B:502:DCR:H13	1.90	0.52
1:A:55:ASP:N	1:A:55:ASP:OD1	2.41	0.52
1:A:425:LEU:HD12	1:A:429:HIS:HB2	1.92	0.52
1:B:285:GLN:OE1	1:B:288:ARG:NH1	2.43	0.51
1:A:252:ILE:HD11	2:A:501:HEM:CBB	2.41	0.51
1:B:294:VAL:HG21	2:B:501:HEM:HMD1	1.92	0.51
1:A:186:ARG:NH2	5:A:621:HOH:O	2.43	0.51
1:B:369:GLY:HA3	2:B:501:HEM:C2B	2.45	0.51
1:B:6:LYS:NZ	5:B:610:HOH:O	2.40	0.50
1:B:396:ASP:OD2	1:B:409:LYS:HG2	2.12	0.50
1:A:208:LYS:HD2	1:A:210:LYS:HD2	1.92	0.50
1:A:334:ASN:HB3	1:A:337:GLU:OE1	2.11	0.50
1:B:197:ASP:OD1	1:B:236:ARG:NH1	2.44	0.50
1:A:30:ARG:HG2	1:A:30:ARG:NH1	2.25	0.50
2:A:501:HEM:HBB2	2:A:501:HEM:HHC	1.93	0.50
1:A:286:GLU:HG3	1:A:338:PHE:CE1	2.47	0.50
1:A:327:HIS:HA	1:A:335:PRO:HB2	1.94	0.50
1:B:417:VAL:H	4:B:505:GOL:H31	1.76	0.49
1:B:60:PHE:HA	1:B:66:VAL:HG21	1.94	0.49
1:A:6:LYS:O	1:A:31:LEU:HD21	2.13	0.49
1:A:369:GLY:HA3	2:A:501:HEM:C2B	2.48	0.48
1:A:322:ILE:HG22	1:A:326:MET:HE2	1.95	0.48
1:A:377:MET:HE2	1:A:377:MET:HB3	1.67	0.48
1:B:28:ARG:HE	4:B:504:GOL:C2	2.26	0.48
1:A:21:TYR:CE2	1:A:292:PRO:HB2	2.48	0.48
1:A:346:TRP:CZ2	1:A:348:GLY:HA2	2.50	0.47
1:B:80:LEU:O	1:B:192:ARG:NH2	2.47	0.47
1:A:141:ILE:HD11	1:A:172:ILE:HD13	1.95	0.47
1:A:339:TYR:HD2	1:A:342:ARG:HB3	1.80	0.47
1:B:424:ASP:OD2	1:B:424:ASP:N	2.44	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:69:SER:HB3	1:B:90:THR:HB	1.95	0.47
3:B:502:DCR:O1	5:B:601:HOH:O	2.20	0.46
1:A:69:SER:HB2	1:A:90:THR:HB	1.97	0.46
1:B:54:LYS:HG2	1:B:352:ASP:HB3	1.97	0.46
1:A:197:ASP:OD1	1:A:236:ARG:NH1	2.38	0.46
1:B:281:TYR:HB2	1:A:431:HIS:HA	1.98	0.46
1:A:159:LYS:HA	1:A:162:GLU:OE1	2.16	0.46
1:A:171:MET:HE3	1:A:192:ARG:HA	1.98	0.46
1:B:114:ARG:NH1	5:B:605:HOH:O	2.30	0.46
1:A:243:MET:C	1:A:245:THR:H	2.22	0.46
1:A:423:ARG:NH2	5:A:631:HOH:O	2.47	0.46
1:A:46:LYS:HE3	1:A:46:LYS:HB3	1.41	0.46
1:A:190:ALA:HB1	1:A:194:ARG:HH12	1.81	0.46
1:B:138:ARG:O	1:B:141:ILE:HG22	2.16	0.46
1:B:278:ASP:OD1	1:A:430:HIS:HB2	2.16	0.45
1:A:171:MET:HE3	1:A:192:ARG:HD2	1.98	0.45
1:B:28:ARG:HG2	1:B:33:VAL:CG2	2.47	0.45
1:A:171:MET:HE1	1:A:243:MET:HE1	1.99	0.44
1:A:41:ARG:HA	1:A:46:LYS:O	2.17	0.44
3:A:502:DCR:H5	3:A:502:DCR:H2	1.62	0.44
1:B:317:MET:HE3	1:B:317:MET:HB2	1.84	0.44
1:A:58:GLU:HA	1:A:351:PHE:CE1	2.53	0.44
1:A:75:ARG:HG2	1:A:185:TYR:CE1	2.54	0.43
1:A:247:ARG:HG2	1:A:248:PRO:HD3	2.00	0.43
1:B:215:LYS:HE3	1:B:215:LYS:HB3	1.79	0.43
1:A:80:LEU:HG	1:A:81:PHE:CE1	2.53	0.43
1:B:171:MET:SD	1:B:192:ARG:HA	2.58	0.43
1:A:98:LYS:HE3	1:A:368:ALA:HB2	2.00	0.43
1:B:175:PHE:CZ	1:B:405:PRO:HB3	2.53	0.43
1:B:200:GLU:OE2	1:B:235:SER:OG	2.34	0.43
1:B:369:GLY:HA3	2:B:501:HEM:C3B	2.54	0.43
1:A:35:ASP:OD2	1:A:310:TYR:OH	2.32	0.42
1:A:60:PHE:HA	1:A:66:VAL:HG21	2.01	0.42
1:A:86:ILE:HD13	1:A:97:ARG:HB3	2.01	0.42
1:B:190:ALA:HB1	1:B:194:ARG:HH12	1.83	0.42
1:B:59:LEU:CD1	1:B:65:LYS:HD3	2.49	0.42
1:B:123:MET:HE3	1:B:123:MET:HB3	1.85	0.42
1:A:263:MET:HG3	1:A:283:PHE:CZ	2.55	0.42
1:A:8:LYS:N	5:A:637:HOH:O	2.53	0.42
1:B:263:MET:HG3	1:B:283:PHE:CZ	2.55	0.42
1:A:172:ILE:HG13	1:A:173:ASP:N	2.35	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:501:HEM:C4C	3:B:502:DCR:H2	2.55	0.41
1:B:74:LYS:HA	1:B:74:LYS:HD2	1.85	0.41
1:B:391:ASP:HB2	1:B:415:GLU:HG3	2.03	0.41
1:B:125:THR:HG21	1:B:419:GLU:HB2	2.01	0.41
1:A:255:PHE:HB3	1:A:377:MET:CE	2.51	0.41
1:A:417:VAL:O	4:A:505:GOL:H31	2.19	0.41
1:A:158:GLU:O	1:A:161:ILE:N	2.53	0.41
1:B:41:ARG:HA	1:B:46:LYS:O	2.20	0.41
1:B:302:LYS:NZ	5:B:631:HOH:O	2.54	0.41
1:A:252:ILE:HD11	2:A:501:HEM:HBB1	2.03	0.41
1:A:295:PRO:HB2	1:A:296:TYR:CE2	2.56	0.41
1:B:252:ILE:HD11	2:B:501:HEM:CBB	2.51	0.40
1:A:369:GLY:HA3	2:A:501:HEM:C3B	2.55	0.40
1:B:10:ILE:H	1:B:10:ILE:HD12	1.86	0.40
1:B:393:PRO:HD3	1:B:415:GLU:HG2	2.03	0.40
1:A:6:LYS:NZ	1:A:41:ARG:HG3	2.36	0.40
1:B:365:HIS:HA	2:B:501:HEM:O1A	2.22	0.40
1:B:387:ARG:HA	1:B:387:ARG:HD2	1.76	0.40
1:A:186:ARG:NE	5:A:621:HOH:O	2.54	0.40
1:A:189:LYS:O	1:A:192:ARG:HB3	2.22	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:212:HIS:O	1:A:418:ARG:NH2[8_565]	2.08	0.12
5:A:817:HOH:O	5:A:817:HOH:O[7_556]	2.11	0.09
1:A:107:GLU:OE2	1:A:430:HIS:NE2[8_565]	2.19	0.01

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	423/432 (98%)	407 (96%)	15 (4%)	1 (0%)	44	53
1	B	426/432 (99%)	409 (96%)	16 (4%)	1 (0%)	44	53
All	All	849/864 (98%)	816 (96%)	31 (4%)	2 (0%)	44	53

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	412	PHE
1	A	412	PHE

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	357/373 (96%)	354 (99%)	3 (1%)	79	87
1	B	362/373 (97%)	360 (99%)	2 (1%)	84	90
All	All	719/746 (96%)	714 (99%)	5 (1%)	81	89

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

Mol	Chain	Res	Type
1	B	245	THR
1	B	428	HIS
1	A	141	ILE
1	A	245	THR
1	A	247	ARG

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	402	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

10 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	GOL	A	504	-	5,5,5	0.78	0	5,5,5	1.04	0
3	DCR	B	502	-	21,21,21	0.70	1 (4%)	21,21,21	0.97	0
4	GOL	B	503	-	5,5,5	0.93	0	5,5,5	0.99	0
3	DCR	A	502	-	21,21,21	0.69	0	21,21,21	0.70	0
2	HEM	B	501	1	41,50,50	1.59	6 (14%)	45,82,82	1.91	13 (28%)
2	HEM	A	501	1	41,50,50	1.68	6 (14%)	45,82,82	1.75	11 (24%)
4	GOL	B	505	-	5,5,5	1.56	2 (40%)	5,5,5	0.63	0
4	GOL	A	505	-	5,5,5	0.96	0	5,5,5	0.98	0
4	GOL	A	503	-	5,5,5	1.16	1 (20%)	5,5,5	1.00	0
4	GOL	B	504	-	5,5,5	0.88	0	5,5,5	1.01	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
4	GOL	A	504	-	-	2/4/4/4	-
3	DCR	B	502	-	-	7/19/19/19	-
4	GOL	B	503	-	-	1/4/4/4	-
3	DCR	A	502	-	-	10/19/19/19	-
2	HEM	B	501	1	-	4/12/54/54	-
2	HEM	A	501	1	-	2/12/54/54	-
4	GOL	B	505	-	-	4/4/4/4	-
4	GOL	A	505	-	-	2/4/4/4	-
4	GOL	A	503	-	-	0/4/4/4	-
4	GOL	B	504	-	-	4/4/4/4	-

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	HEM	C3C-C2C	-5.38	1.32	1.40
2	B	501	HEM	C3C-C2C	-4.49	1.34	1.40
2	A	501	HEM	FE-ND	3.45	2.13	1.96
2	A	501	HEM	C3C-CAC	3.38	1.54	1.47
2	B	501	HEM	C3C-CAC	3.32	1.54	1.47
2	B	501	HEM	FE-NB	3.22	2.12	1.96
2	A	501	HEM	CAB-C3B	2.70	1.54	1.47
2	B	501	HEM	CAB-C3B	2.61	1.54	1.47
2	B	501	HEM	FE-ND	2.51	2.09	1.96
2	B	501	HEM	CMB-C2B	2.43	1.55	1.50
4	B	505	GOL	C1-C2	2.40	1.61	1.51
2	A	501	HEM	CMB-C2B	2.29	1.55	1.50
4	A	503	GOL	O2-C2	-2.22	1.36	1.43
3	B	502	DCR	O2-C1	2.12	1.29	1.22
2	A	501	HEM	FE-NB	2.07	2.07	1.96
4	B	505	GOL	C3-C2	2.02	1.60	1.51

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	501	HEM	C4C-CHD-C1D	4.26	128.19	122.56
2	A	501	HEM	C4C-CHD-C1D	4.17	128.06	122.56
2	B	501	HEM	C1B-NB-C4B	3.99	109.19	105.07
2	B	501	HEM	CHC-C4B-C3B	3.82	130.42	124.57
2	A	501	HEM	CHC-C4B-C3B	3.63	130.13	124.57
2	A	501	HEM	C1B-NB-C4B	3.54	108.72	105.07
2	B	501	HEM	CBA-CAA-C2A	-3.47	106.69	112.62

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	501	HEM	C2C-C3C-C4C	3.19	109.13	106.90
2	B	501	HEM	CAD-CBD-CGD	-3.15	106.82	113.60
2	B	501	HEM	C4D-ND-C1D	3.13	108.30	105.07
2	A	501	HEM	CAD-CBD-CGD	-3.09	106.95	113.60
2	A	501	HEM	C4D-ND-C1D	3.04	108.21	105.07
2	B	501	HEM	C4B-CHC-C1C	2.89	126.37	122.56
2	B	501	HEM	C4B-C3B-C2B	2.76	109.30	107.11
2	A	501	HEM	C2D-C1D-ND	-2.53	106.85	109.88
2	A	501	HEM	C4B-CHC-C1C	2.36	125.67	122.56
2	B	501	HEM	C3C-C4C-NC	-2.35	106.50	110.94
2	A	501	HEM	C2C-C3C-C4C	2.34	108.53	106.90
2	A	501	HEM	CHD-C1D-C2D	2.22	128.44	124.98
2	A	501	HEM	C3C-C4C-NC	-2.21	106.77	110.94
2	B	501	HEM	CAB-C3B-C2B	-2.12	121.63	128.60
2	B	501	HEM	C2D-C1D-ND	-2.12	107.34	109.88
2	B	501	HEM	CHD-C1D-C2D	2.02	128.14	124.98
2	A	501	HEM	CMA-C3A-C4A	-2.01	125.37	128.46

There are no chirality outliers.

All (36) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	504	GOL	C1-C2-C3-O3
4	B	505	GOL	C1-C2-C3-O3
4	A	504	GOL	O1-C1-C2-C3
3	B	502	DCR	C2-C3-C4-C5
3	A	502	DCR	C2-C3-C4-C5
3	A	502	DCR	C3-C4-C5-C6
4	B	504	GOL	O1-C1-C2-C3
4	B	505	GOL	O1-C1-C2-C3
3	B	502	DCR	C1-C2-C3-C4
3	A	502	DCR	C11-C10-C9-C8
4	B	504	GOL	O2-C2-C3-O3
4	B	505	GOL	O1-C1-C2-O2
4	A	504	GOL	O1-C1-C2-O2
3	A	502	DCR	C14-C15-C16-C17
3	A	502	DCR	C7-C8-C9-C10
2	B	501	HEM	C4B-C3B-CAB-CBB
3	A	502	DCR	C1-C2-C3-C4
3	A	502	DCR	C4-C5-C6-C7
3	B	502	DCR	C13-C14-C15-C16
4	A	505	GOL	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
3	B	502	DCR	C12-C13-C14-C15
3	B	502	DCR	C14-C15-C16-C17
4	B	505	GOL	O2-C2-C3-O3
4	B	504	GOL	O1-C1-C2-O2
4	A	505	GOL	O1-C1-C2-C3
3	B	502	DCR	C6-C7-C8-C9
3	A	502	DCR	C6-C7-C8-C9
3	A	502	DCR	O2-C1-C2-C3
2	B	501	HEM	CAA-CBA-CGA-O2A
4	B	503	GOL	C1-C2-C3-O3
3	B	502	DCR	C4-C5-C6-C7
3	A	502	DCR	O1-C1-C2-C3
2	B	501	HEM	CAA-CBA-CGA-O1A
2	A	501	HEM	CAA-CBA-CGA-O2A
2	A	501	HEM	CAA-CBA-CGA-O1A
2	B	501	HEM	CAD-CBD-CGD-O2D

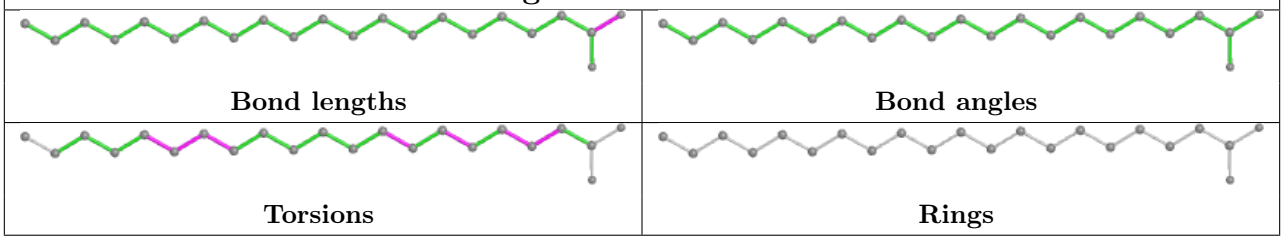
There are no ring outliers.

7 monomers are involved in 34 short contacts:

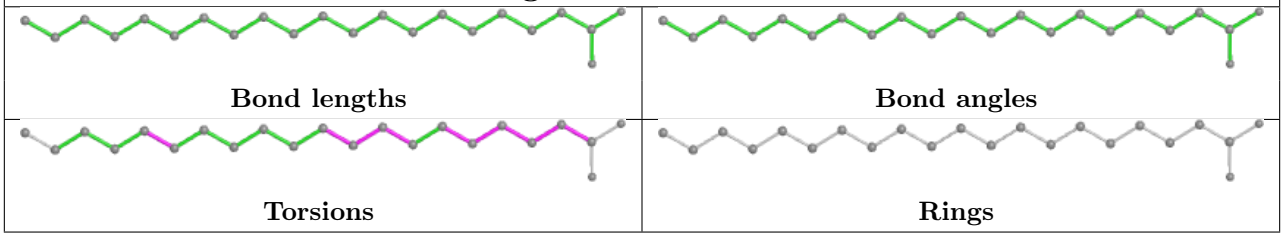
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	502	DCR	4	0
3	A	502	DCR	4	0
2	B	501	HEM	9	0
2	A	501	HEM	7	0
4	B	505	GOL	4	0
4	A	505	GOL	5	0
4	B	504	GOL	2	0

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.

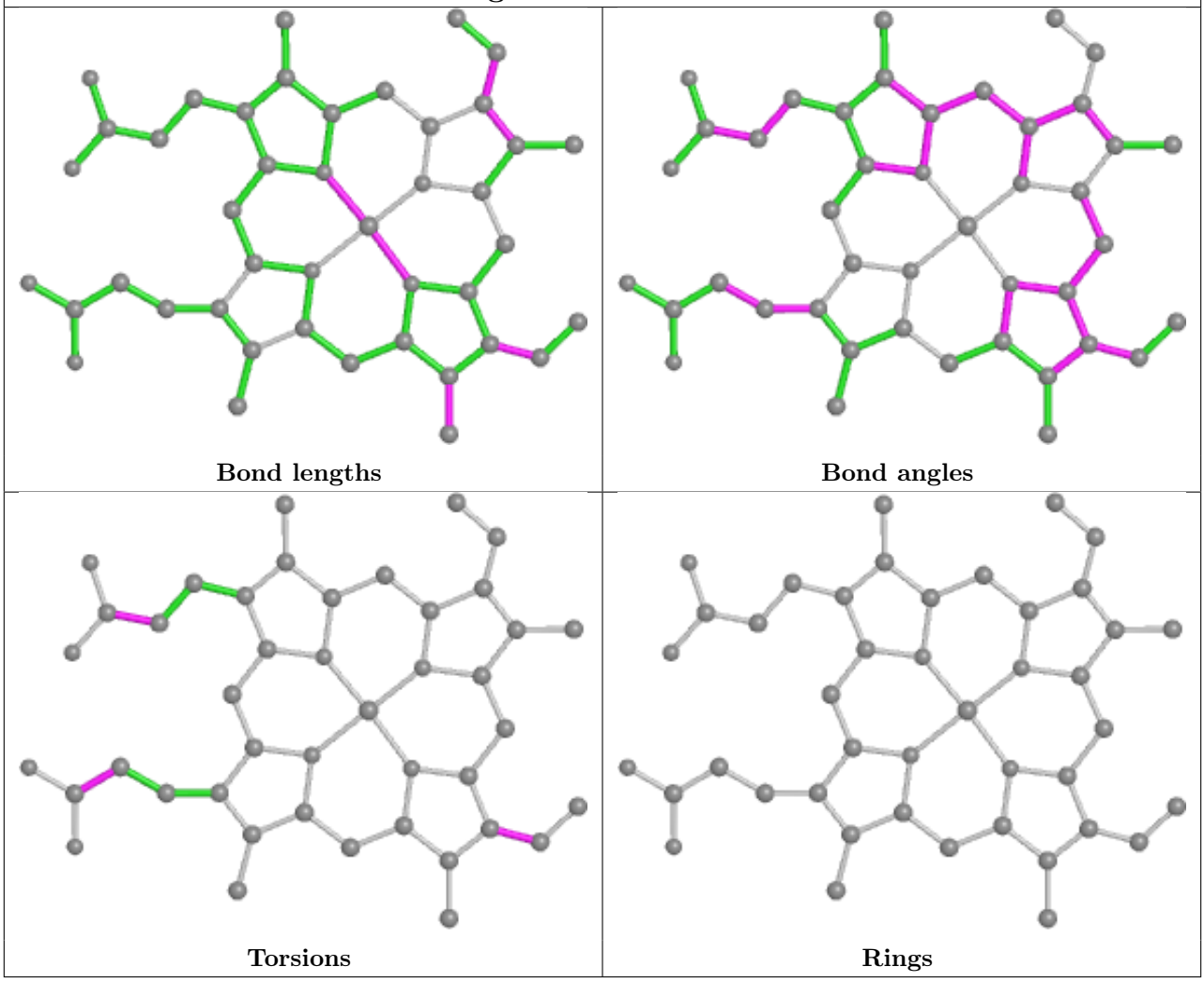
Ligand DCR B 502



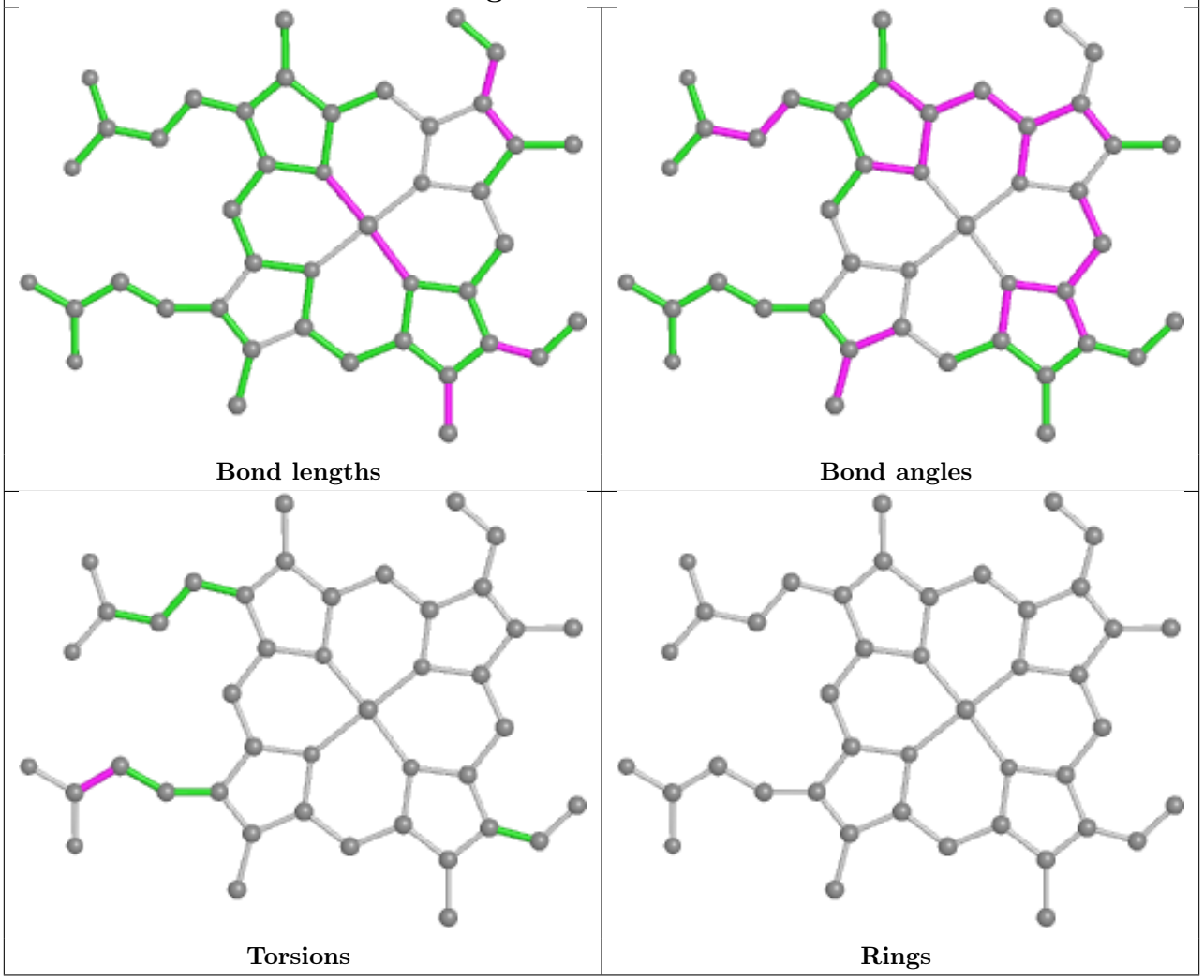
Ligand DCR A 502



Ligand HEM B 501



Ligand HEM A 501



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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(Å^2)	Q<0.9
1	A	427/432 (98%)	0.08	15 (3%) 47 47	53, 73, 95, 113	0
1	B	428/432 (99%)	-0.13	9 (2%) 63 65	50, 66, 82, 104	0
All	All	855/864 (98%)	-0.02	24 (2%) 55 56	50, 69, 92, 113	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	161	ILE	4.6
1	B	427	HIS	3.8
1	B	175	PHE	3.3
1	A	179	GLY	3.3
1	A	172	ILE	3.0
1	A	278	ASP	2.9
1	A	187	ALA	2.8
1	A	154	VAL	2.7
1	A	158	GLU	2.6
1	A	107	GLU	2.5
1	A	178	ILE	2.5
1	B	429	HIS	2.4
1	B	177	ALA	2.4
1	B	428	HIS	2.4
1	A	170	ILE	2.4
1	B	157	PRO	2.3
1	A	430	HIS	2.2
1	A	431	HIS	2.2
1	A	424	ASP	2.2
1	A	6	LYS	2.2
1	B	179	GLY	2.1
1	A	29	GLU	2.1
1	B	3	THR	2.1
1	B	119	ASN	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 oligosaccharides in this entry.

6.4 Ligands (i)

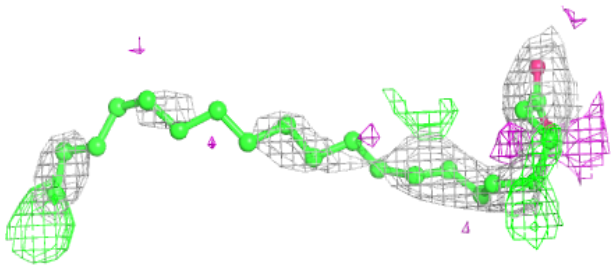
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

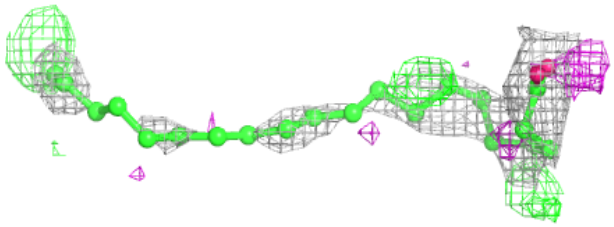
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	GOL	B	505	6/6	0.84	0.14	69,74,76,81	0
4	GOL	A	505	6/6	0.85	0.11	75,75,81,86	0
3	DCR	A	502	22/22	0.89	0.22	66,79,86,88	0
4	GOL	B	504	6/6	0.89	0.13	73,76,81,84	0
4	GOL	A	504	6/6	0.91	0.11	82,84,84,88	0
3	DCR	B	502	22/22	0.94	0.16	58,66,71,74	0
4	GOL	B	503	6/6	0.97	0.09	66,68,71,73	0
4	GOL	A	503	6/6	0.97	0.07	69,73,75,81	0
2	HEM	B	501	43/43	0.98	0.07	47,54,63,66	0
2	HEM	A	501	43/43	0.98	0.07	50,58,66,67	0

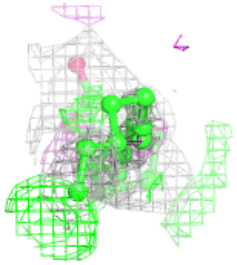
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around DCR A 502:

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

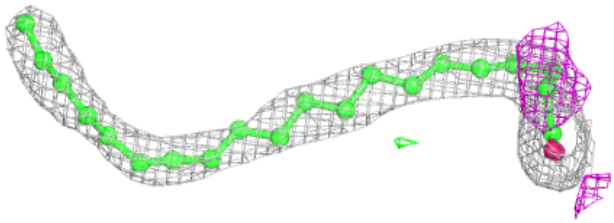


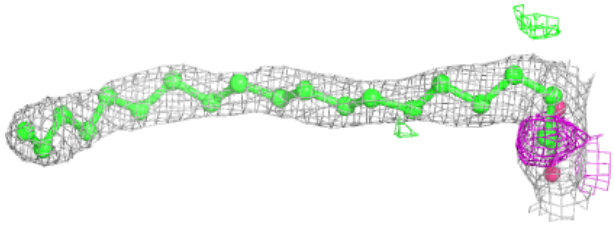


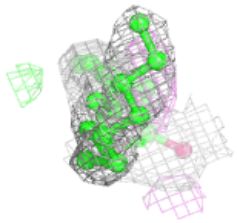


Electron density around DCR B 502:

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

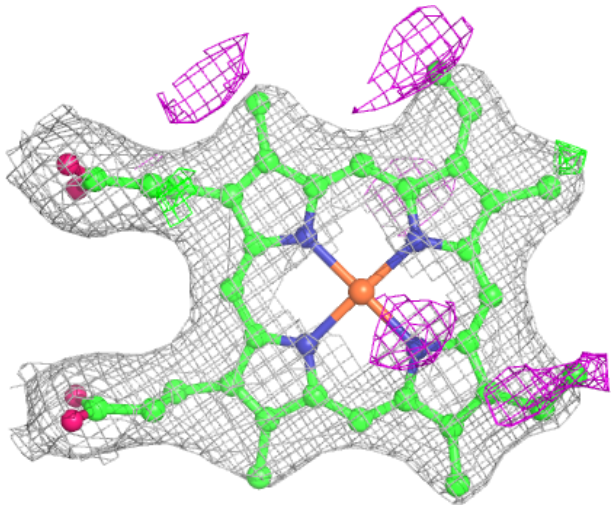


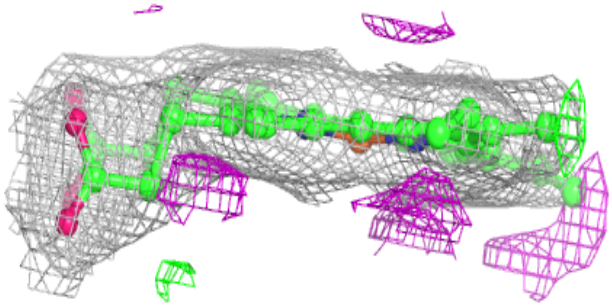


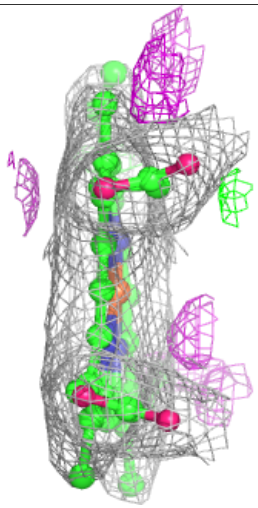


Electron density around HEM B 501:

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

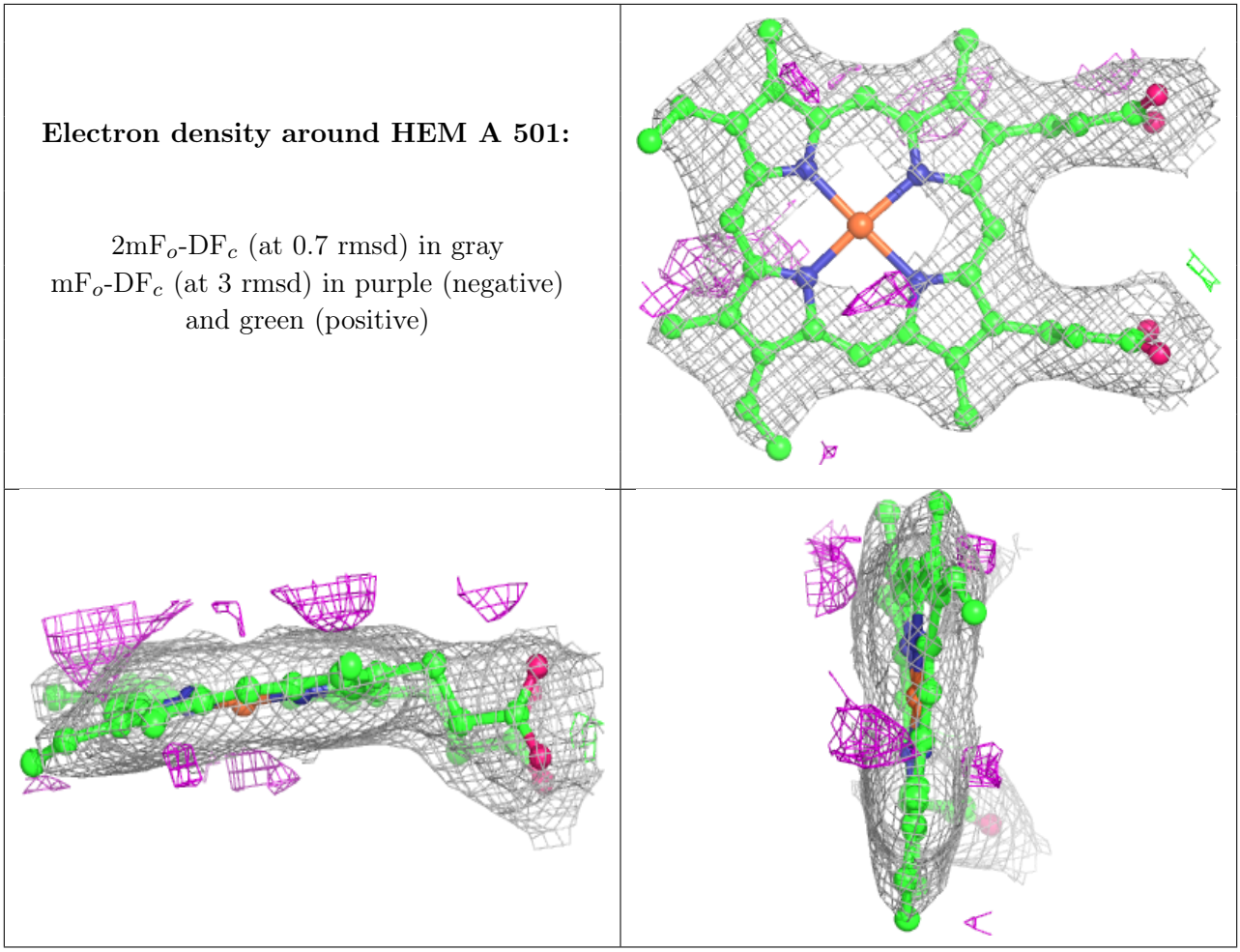






Electron density around HEM A 501:

$2mF_o$-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.