Full wwPDB X-ray Structure Validation Report (i)

Jun 13, 2024 – 12:59 PM EDT

PDB ID	:	1MMW
Title	:	Rat neuronal NOS heme domain with vinyl-L-NIO bound
Authors	:	Bretscher, L.E.; Li, H.; Poulos, T.L.; Griffith, O.W.
Deposited on	:	2002-09-04
Resolution	:	2.00 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:

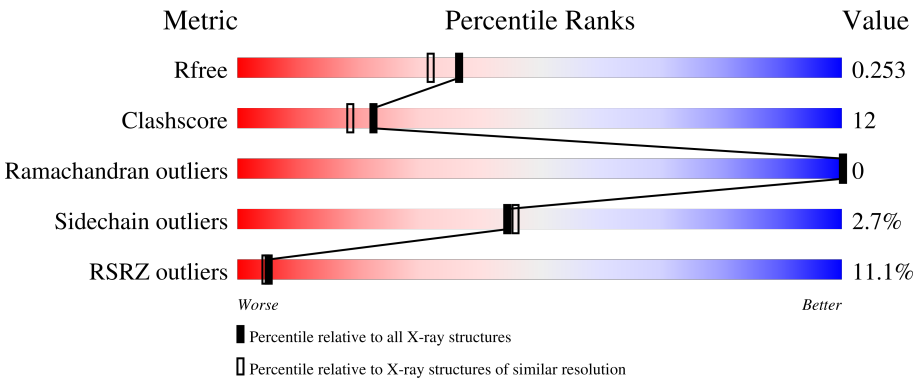
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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	419	15% 71% 24%
1	B	419	7% 77% 20%

2 Entry composition (i)

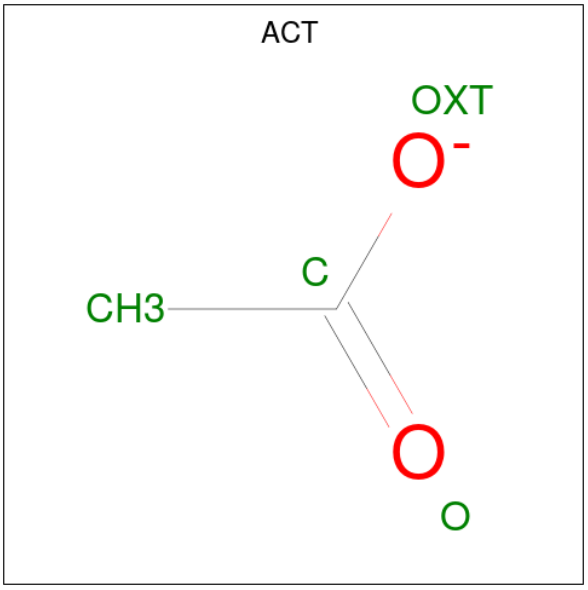
There are 7 unique types of molecules in this entry. The entry contains 7270 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 nitric-oxide synthase, brain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	407	3313	2121	566	605	21	0	0	0
1	B	410	3341	2138	573	609	21	0	0	0

- Molecule 2 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).

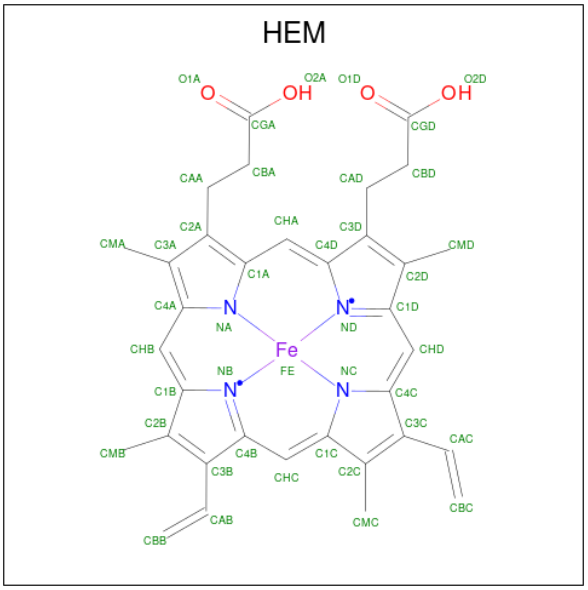


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	4	2	2	0	0
2	B	1	4	2	2	0	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

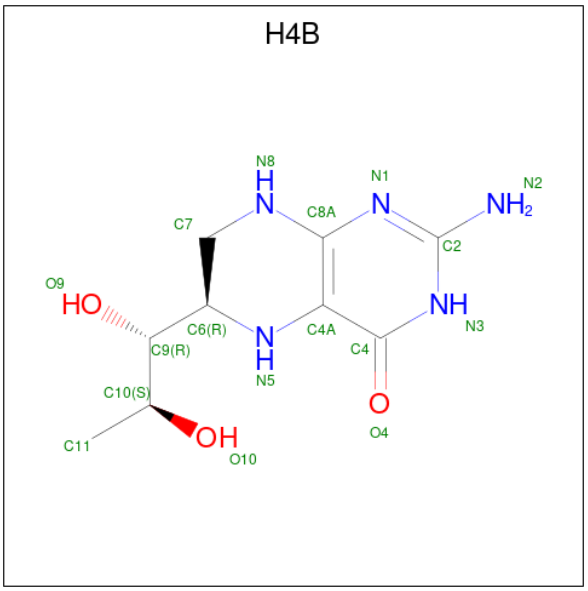
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	A	1	1	1	0	0

- Molecule 4 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



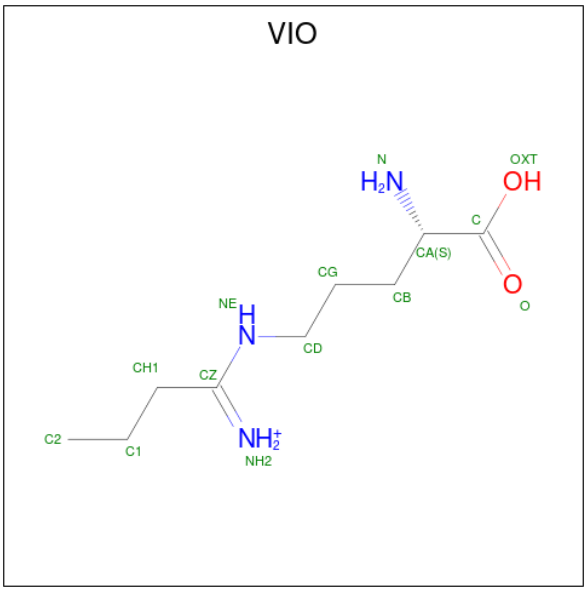
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	N	O		
4	A	1	43	34	1	4	4	0	0
			Total	C	Fe	N	O		
4	B	1	43	34	1	4	4	0	0

- Molecule 5 is 5,6,7,8-TETRAHYDROBIOPTERIN (three-letter code: H4B) (formula: $C_9H_{15}N_5O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
5	A	1	17	9	5	3	0	0
5	B	1	17	9	5	3	0	0

- Molecule 6 is N5-(1-IMINO-3-BUTENYL)-L-ORNITHINE (three-letter code: VIO) (formula: $C_9H_{20}N_3O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
6	A	1	14	9	3	2	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
6	B	1	14	9	3	2	0	0

- Molecule 7 is water.

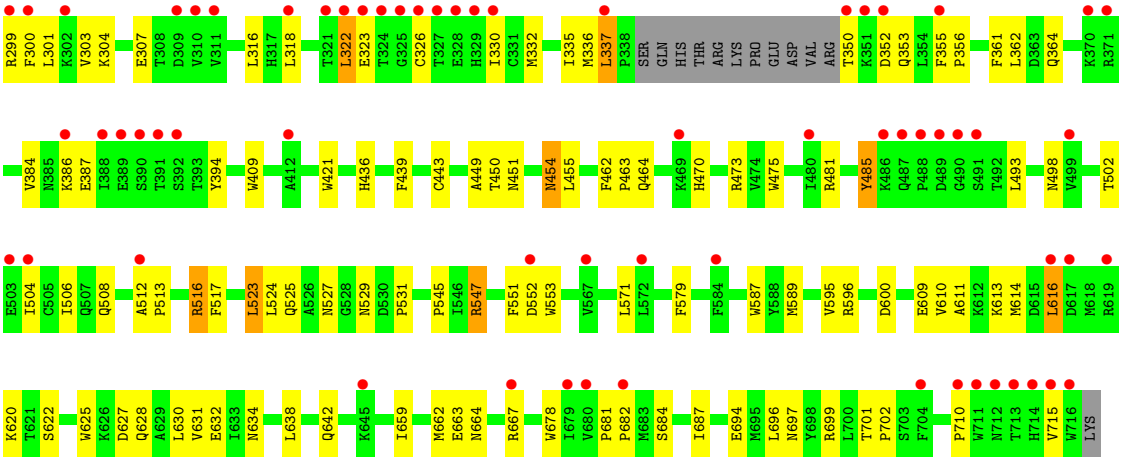
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	203	203	203	0	0
			Total	O		
7	B	256	256	256	0	0

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.

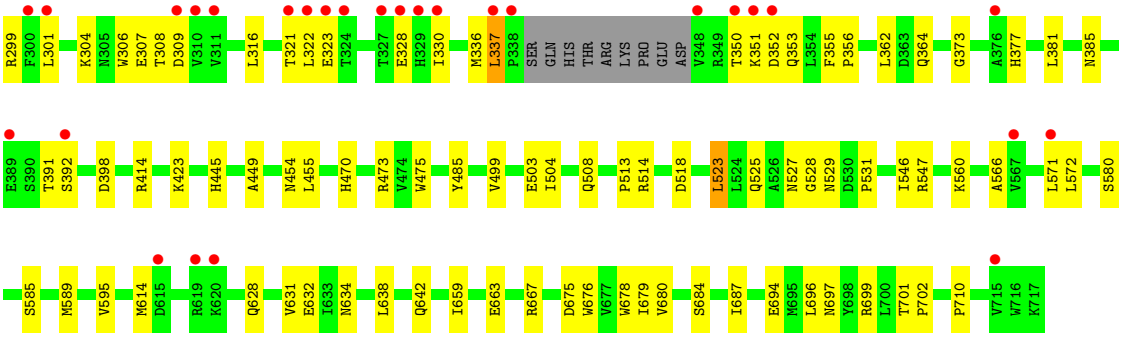
- Molecule 1: nitric-oxide synthase, brain

Chain A:



- Molecule 1: nitric-oxide synthase, brain

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	51.69Å 109.98Å 164.54Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.25 – 2.00 34.25 – 2.00	Depositor EDS
% Data completeness (in resolution range)	92.9 (34.25-2.00) 92.9 (34.25-2.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	2.36 (at 2.00Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.231 , 0.266 0.220 , 0.253	Depositor DCC
R_{free} test set	3015 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	30.5	Xtriage
Anisotropy	0.575	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 54.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	7270	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.07% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

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

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: VIO, HEM, ZN, ACT, H4B

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	0.32	0/3406	0.58	1/4621 (0.0%)
1	B	0.35	0/3434	0.61	1/4656 (0.0%)
All	All	0.33	0/6840	0.60	2/9277 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	589	MET	N-CA-C	-5.86	95.19	111.00
1	A	589	MET	N-CA-C	-5.72	95.56	111.00

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	3313	0	3221	92	0
1	B	3341	0	3256	72	0
2	A	4	0	3	0	0
2	B	4	0	3	0	0
3	A	1	0	0	0	0
4	A	43	0	30	2	0
4	B	43	0	30	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	17	0	15	1	0
5	B	17	0	15	0	0
6	A	14	0	19	0	0
6	B	14	0	19	0	0
7	A	203	0	0	5	0
7	B	256	0	0	5	0
All	All	7270	0	6611	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 12.

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:322:LEU:HB2	1:B:699:ARG:HH11	1.14	1.05
1:B:373:GLY:H	1:B:377:HIS:HD2	1.06	0.98
1:B:523:LEU:HD22	1:B:531:PRO:HB2	1.46	0.94
1:A:523:LEU:HD22	1:A:531:PRO:HB2	1.51	0.92
1:A:322:LEU:HD13	1:A:323:GLU:H	1.36	0.91
1:A:322:LEU:HB2	1:A:699:ARG:HH11	1.36	0.90
1:B:322:LEU:HD13	1:B:323:GLU:H	1.38	0.88
1:B:322:LEU:HG	1:B:699:ARG:HD3	1.59	0.84
1:B:322:LEU:HB2	1:B:699:ARG:NH1	1.94	0.83
1:A:506:ILE:HD11	1:A:512:ALA:HB2	1.64	0.80
1:A:330:ILE:HD11	1:B:696:LEU:HD22	1.66	0.77
1:B:322:LEU:HD13	1:B:323:GLU:N	1.99	0.76
1:B:350:THR:HB	1:B:353:GLN:OE1	1.86	0.76
1:A:436:HIS:ND1	7:A:2053:HOH:O	2.20	0.74
1:A:659:ILE:O	1:A:663:GLU:HG3	1.88	0.73
1:A:628:GLN:HG2	1:B:631:VAL:HG11	1.70	0.73
1:A:322:LEU:CB	1:A:699:ARG:HD3	2.19	0.72
1:A:616:LEU:HD13	1:A:625:TRP:HB2	1.71	0.71
1:A:350:THR:HB	1:A:353:GLN:HG3	1.72	0.71
1:B:322:LEU:CB	1:B:699:ARG:HH11	1.98	0.71
1:A:350:THR:HG22	1:A:352:ASP:H	1.56	0.71
1:A:664:ASN:HA	1:A:667:ARG:NH1	2.06	0.70
7:A:1879:HOH:O	1:B:337:LEU:HD23	1.91	0.70
1:B:373:GLY:H	1:B:377:HIS:CD2	1.98	0.70
1:B:322:LEU:CG	1:B:699:ARG:HD3	2.20	0.70
1:A:322:LEU:HD13	1:A:323:GLU:N	2.07	0.69
1:B:684:SER:HB3	1:B:687:ILE:HD11	1.74	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:322:LEU:HG	1:A:699:ARG:HD3	1.76	0.68
1:A:638:LEU:O	1:A:642:GLN:HG3	1.95	0.66
1:B:322:LEU:CB	1:B:699:ARG:HD3	2.26	0.65
1:A:470:HIS:HB3	1:A:527:ASN:ND2	2.11	0.64
1:A:304:LYS:O	1:A:694:GLU:HG3	1.98	0.64
1:A:303:VAL:HG13	1:A:694:GLU:HB2	1.81	0.63
1:A:595:VAL:HG23	1:A:634:ASN:HD21	1.63	0.63
4:A:1750:HEM:HMC1	4:A:1750:HEM:HBC2	1.82	0.62
1:A:595:VAL:HG11	1:A:682:PRO:HB2	1.82	0.61
1:B:659:ILE:O	1:B:663:GLU:HG3	2.00	0.61
1:A:322:LEU:CG	1:A:699:ARG:HD3	2.32	0.60
1:A:322:LEU:HB3	1:A:699:ARG:HD3	1.84	0.60
1:A:682:PRO:HG3	7:A:1862:HOH:O	2.02	0.59
1:A:684:SER:HB3	1:A:687:ILE:CG1	2.33	0.59
1:A:361:PHE:O	1:A:364:GLN:HG2	2.03	0.58
1:B:475:TRP:HB2	1:B:523:LEU:HB3	1.84	0.58
1:B:499:VAL:O	1:B:503:GLU:HG3	2.05	0.57
1:A:620:LYS:HE3	1:A:622:SER:OG	2.04	0.57
1:B:336:MET:HE1	7:B:2968:HOH:O	2.05	0.57
1:A:504:ILE:O	1:A:508:GLN:HB2	2.05	0.56
1:B:337:LEU:HD23	1:B:337:LEU:N	2.19	0.56
1:B:595:VAL:HG23	1:B:634:ASN:HD21	1.71	0.56
1:B:684:SER:HB3	1:B:687:ILE:CG1	2.36	0.56
1:B:391:THR:O	1:B:392:SER:HB2	2.04	0.56
1:A:609:GLU:HG3	7:A:2060:HOH:O	2.06	0.56
1:B:663:GLU:O	1:B:667:ARG:HD2	2.06	0.55
1:A:473:ARG:NH2	1:A:710:PRO:HD3	2.22	0.55
1:A:475:TRP:HB2	1:A:523:LEU:HB3	1.87	0.55
1:A:451:ASN:HB3	1:A:454:ASN:O	2.06	0.55
1:B:638:LEU:O	1:B:642:GLN:HG3	2.06	0.55
1:B:355:PHE:N	1:B:356:PRO:HD2	2.22	0.54
1:A:684:SER:HB3	1:A:687:ILE:HG12	1.90	0.54
1:A:524:LEU:O	1:A:531:PRO:HA	2.08	0.54
1:B:684:SER:HB3	1:B:687:ILE:CD1	2.37	0.54
1:A:350:THR:HB	1:A:353:GLN:CG	2.38	0.53
1:B:299:ARG:HB3	1:B:299:ARG:HH11	1.73	0.53
1:B:513:PRO:HG2	1:B:518:ASP:CG	2.28	0.53
1:A:335:ILE:HD13	1:B:694:GLU:HB3	1.90	0.53
1:A:409:TRP:CE3	1:A:421:TRP:HA	2.44	0.52
1:B:299:ARG:HB3	1:B:299:ARG:NH1	2.24	0.52
1:B:675:ASP:O	1:B:679:ILE:HG12	2.10	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:485:TYR:CE2	1:A:512:ALA:HB1	2.45	0.51
1:B:525:GLN:HG3	1:B:529:ASN:O	2.10	0.51
1:A:684:SER:HB3	1:A:687:ILE:HD11	1.91	0.51
1:A:715:VAL:O	1:A:715:VAL:HG23	2.11	0.51
1:B:398:ASP:HB2	7:B:3027:HOH:O	2.10	0.50
1:B:504:ILE:O	1:B:508:GLN:HG2	2.12	0.50
1:B:473:ARG:NH2	1:B:710:PRO:HD3	2.27	0.50
1:B:322:LEU:HG	1:B:699:ARG:CD	2.38	0.50
1:B:546:ILE:HG12	1:B:560:LYS:HA	1.93	0.50
1:A:614:MET:CE	1:A:632:GLU:HG3	2.42	0.50
1:A:330:ILE:CD1	1:B:696:LEU:HD22	2.40	0.50
1:B:304:LYS:O	1:B:694:GLU:HG3	2.13	0.49
1:A:696:LEU:HD22	1:B:330:ILE:HD11	1.94	0.49
1:A:355:PHE:N	1:A:356:PRO:HD2	2.28	0.48
1:B:470:HIS:HA	1:B:528:GLY:HA3	1.95	0.48
1:B:414:ARG:HD3	1:B:678:TRP:CD2	2.48	0.48
1:A:596:ARG:O	1:A:600:ASP:HB2	2.13	0.48
1:B:566:ALA:HB2	1:B:585:SER:HB3	1.96	0.48
1:A:485:TYR:HE2	1:A:512:ALA:HB1	1.78	0.48
1:A:322:LEU:CD1	1:A:323:GLU:N	2.76	0.47
1:B:307:GLU:HG3	7:B:2989:HOH:O	2.13	0.47
1:A:667:ARG:HD3	7:A:1988:HOH:O	2.14	0.47
1:B:364:GLN:NE2	7:B:3057:HOH:O	2.47	0.47
1:B:321:THR:HG23	1:B:322:LEU:N	2.30	0.47
1:B:322:LEU:HB3	1:B:699:ARG:HD3	1.97	0.47
1:A:322:LEU:HB2	1:A:699:ARG:NH1	2.18	0.47
1:A:337:LEU:HD12	1:A:337:LEU:O	2.16	0.46
4:B:2750:HEM:CMC	4:B:2750:HEM:HBC2	2.45	0.46
1:A:299:ARG:O	1:A:318:LEU:HD21	2.16	0.46
1:B:308:THR:O	1:B:309:ASP:HB2	2.15	0.46
1:A:506:ILE:C	1:A:508:GLN:H	2.18	0.46
1:A:627:ASP:O	1:A:631:VAL:HG23	2.16	0.45
1:B:350:THR:HG22	1:B:352:ASP:H	1.80	0.45
1:A:684:SER:HB3	1:A:687:ILE:CD1	2.45	0.45
1:A:614:MET:HE1	1:A:632:GLU:HG3	1.99	0.45
1:A:332:MET:HB3	1:A:335:ILE:HG13	1.97	0.45
1:A:462:PHE:HB3	1:A:463:PRO:CD	2.47	0.45
4:B:2750:HEM:HBC2	4:B:2750:HEM:HMC1	1.98	0.45
1:A:450:THR:HA	1:A:455:LEU:HD22	1.98	0.45
1:A:303:VAL:CG1	1:A:694:GLU:O	2.66	0.44
1:B:362:LEU:HD12	1:B:381:LEU:HD23	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:355:PHE:CE1	1:B:385:ASN:HB2	2.52	0.44
1:A:630:LEU:HD22	1:B:687:ILE:HD13	1.99	0.44
1:A:631:VAL:HG11	1:B:628:GLN:HG2	1.99	0.44
1:B:470:HIS:HB3	1:B:527:ASN:ND2	2.32	0.44
1:A:610:VAL:O	1:A:614:MET:HG3	2.16	0.44
1:A:506:ILE:C	1:A:508:GLN:N	2.71	0.44
1:A:696:LEU:HB3	1:B:330:ILE:HD11	1.99	0.44
1:A:512:ALA:HA	1:A:513:PRO:HD3	1.87	0.43
1:B:701:THR:HA	1:B:702:PRO:C	2.39	0.43
1:A:336:MET:HB3	1:B:306:TRP:CZ2	2.53	0.43
1:B:350:THR:HG22	1:B:351:LYS:N	2.33	0.43
1:A:330:ILE:HD13	1:B:301:LEU:HD13	2.01	0.43
1:B:571:LEU:HD12	1:B:572:LEU:N	2.32	0.43
1:A:303:VAL:HG11	1:A:694:GLU:O	2.19	0.43
1:A:362:LEU:HD11	1:A:384:VAL:HG21	2.00	0.43
1:A:545:PRO:HG2	1:A:547:ARG:NH1	2.33	0.43
1:A:525:GLN:HG3	1:A:529:ASN:O	2.18	0.43
4:A:1750:HEM:HBC2	4:A:1750:HEM:CMC	2.48	0.43
1:A:386:LYS:HD3	1:A:386:LYS:HA	1.86	0.42
1:A:481:ARG:HD3	1:A:498:ASN:HD21	1.84	0.42
1:A:553:TRP:CE3	1:A:613:LYS:HD3	2.53	0.42
1:A:307:GLU:HG3	7:B:2916:HOH:O	2.18	0.42
1:A:439:PHE:CZ	1:A:443:CYS:SG	3.13	0.42
1:A:502:THR:O	1:A:506:ILE:HG12	2.18	0.42
1:A:301:LEU:CD1	1:B:330:ILE:HD13	2.49	0.42
1:A:571:LEU:C	1:A:571:LEU:HD23	2.40	0.42
1:A:455:LEU:HD12	1:A:587:TRP:HB3	2.02	0.42
1:B:445:HIS:CD2	1:B:445:HIS:C	2.94	0.42
1:A:516:ARG:HG2	1:A:517:PHE:CE1	2.55	0.42
1:A:678:TRP:HA	5:A:1760:H4B:N1	2.34	0.41
1:A:701:THR:HA	1:A:702:PRO:C	2.40	0.41
1:A:462:PHE:HB3	1:A:463:PRO:HD2	2.03	0.41
1:B:485:TYR:CE1	1:B:514:ARG:HA	2.55	0.41
1:B:614:MET:CE	1:B:632:GLU:HG3	2.51	0.41
1:B:322:LEU:HD12	1:B:323:GLU:O	2.20	0.41
1:A:387:GLU:OE2	1:A:394:TYR:HA	2.21	0.41
1:A:300:PHE:CD1	1:A:300:PHE:N	2.88	0.41
1:A:449:ALA:O	1:A:455:LEU:HA	2.21	0.41
1:A:611:ALA:HB1	1:A:616:LEU:HD11	2.02	0.41
1:B:676:TRP:CZ2	1:B:680:VAL:HG21	2.56	0.41
1:A:464:GLN:HB3	1:A:579:PHE:CE2	2.55	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:322:LEU:CD1	1:B:323:GLU:N	2.79	0.40
1:A:551:PHE:HB3	1:A:553:TRP:CE2	2.56	0.40
1:A:681:PRO:HA	1:A:682:PRO:HD3	1.76	0.40
1:B:449:ALA:O	1:B:455:LEU:HA	2.22	0.40
1:A:326:CYS:O	1:B:328:GLU:HA	2.21	0.40
1:B:571:LEU:HD13	1:B:580:SER:HA	2.04	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	403/419 (96%)	382 (95%)	21 (5%)	0	100	100
1	B	406/419 (97%)	392 (97%)	14 (3%)	0	100	100
All	All	809/838 (96%)	774 (96%)	35 (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	363/375 (97%)	350 (96%)	13 (4%)	35	34
1	B	366/375 (98%)	359 (98%)	7 (2%)	57	61

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	729/750 (97%)	709 (97%)	20 (3%)	44 46

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	316	LEU
1	A	322	LEU
1	A	337	LEU
1	A	454	ASN
1	A	485	TYR
1	A	493	LEU
1	A	516	ARG
1	A	523	LEU
1	A	547	ARG
1	A	552	ASP
1	A	616	LEU
1	A	662	MET
1	A	697	ASN
1	B	316	LEU
1	B	337	LEU
1	B	423	LYS
1	B	454	ASN
1	B	523	LEU
1	B	547	ARG
1	B	697	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	364	GLN
1	A	407	HIS
1	A	425	GLN
1	A	436	HIS
1	A	451	ASN
1	A	454	ASN
1	A	527	ASN
1	A	634	ASN
1	A	697	ASN
1	B	364	GLN
1	B	377	HIS
1	B	425	GLN

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Mol	Chain	Res	Type
1	B	451	ASN
1	B	454	ASN
1	B	507	GLN
1	B	527	ASN
1	B	529	ASN
1	B	535	GLN
1	B	634	ASN
1	B	697	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 for Mogul analysis.

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	HEM	A	1750	1	41,50,50	1.30	4 (9%)	45,82,82	1.26	4 (8%)
5	H4B	A	1760	-	16,18,18	2.16	4 (25%)	11,26,26	4.27	9 (81%)
4	HEM	B	2750	1	41,50,50	1.30	5 (12%)	45,82,82	1.25	4 (8%)
2	ACT	B	2860	-	3,3,3	0.91	0	3,3,3	0.76	0
5	H4B	B	2760	-	16,18,18	2.18	4 (25%)	11,26,26	4.32	9 (81%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
6	VIO	A	1780	-	11,13,13	1.97	3 (27%)	11,15,15	1.69	3 (27%)
2	ACT	A	1860	-	3,3,3	0.88	0	3,3,3	0.83	0
6	VIO	B	2780	-	11,13,13	1.85	3 (27%)	11,15,15	1.52	3 (27%)

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	HEM	A	1750	1	-	1/12/54/54	-
5	H4B	A	1760	-	-	0/8/17/17	0/2/2/2
4	HEM	B	2750	1	-	1/12/54/54	-
5	H4B	B	2760	-	-	0/8/17/17	0/2/2/2
6	VIO	A	1780	-	-	4/13/14/14	-
6	VIO	B	2780	-	-	3/13/14/14	-

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	2760	H4B	C4-N3	5.23	1.42	1.33
5	A	1760	H4B	C4-N3	5.19	1.42	1.33
6	A	1780	VIO	CH1-CZ	5.17	1.56	1.50
5	A	1760	H4B	C4A-N5	4.64	1.47	1.38
6	B	2780	VIO	CH1-CZ	4.37	1.55	1.50
5	B	2760	H4B	C4A-N5	4.13	1.46	1.38
5	B	2760	H4B	C6-N5	3.99	1.53	1.45
5	A	1760	H4B	C6-N5	3.93	1.53	1.45
4	B	2750	HEM	C3C-C2C	-3.74	1.35	1.40
4	A	1750	HEM	C3C-CAC	-3.16	1.41	1.47
4	A	1750	HEM	C1A-NA	2.93	1.42	1.36
4	A	1750	HEM	CAB-C3B	-2.83	1.39	1.47
4	B	2750	HEM	CAB-C3B	-2.79	1.39	1.47
6	B	2780	VIO	CZ-NH2	2.46	1.34	1.27
4	B	2750	HEM	CHB-C1B	2.44	1.41	1.35
6	A	1780	VIO	CZ-NH2	2.28	1.33	1.27
5	B	2760	H4B	C7-N8	2.25	1.48	1.44
5	A	1760	H4B	C8A-N1	2.23	1.38	1.34
4	B	2750	HEM	C3C-CAC	-2.22	1.43	1.47
4	A	1750	HEM	CHB-C1B	2.21	1.40	1.35
6	A	1780	VIO	C2-C1	-2.07	1.32	1.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	B	2780	VIO	C2-C1	-2.05	1.33	1.49
4	B	2750	HEM	C4A-NA	2.01	1.40	1.36

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	2760	H4B	C8A-C4A-C4	9.38	122.90	114.57
5	A	1760	H4B	C8A-C4A-C4	8.88	122.45	114.57
5	A	1760	H4B	C2-N3-C4	5.71	125.01	115.93
5	B	2760	H4B	C2-N3-C4	5.43	124.56	115.93
5	A	1760	H4B	N1-C2-N3	-4.95	117.65	125.42
5	B	2760	H4B	N1-C2-N3	-4.62	118.18	125.42
5	A	1760	H4B	N2-C2-N1	3.66	122.94	117.25
5	B	2760	H4B	C4A-C4-N3	-3.62	113.71	124.01
5	A	1760	H4B	C2-N1-C8A	3.62	122.65	114.54
5	B	2760	H4B	C2-N1-C8A	3.57	122.53	114.54
5	B	2760	H4B	C4-C4A-N5	-3.55	116.14	119.12
5	A	1760	H4B	C4A-C4-N3	-3.55	113.93	124.01
4	B	2750	HEM	CBA-CAA-C2A	-3.44	106.74	112.62
5	B	2760	H4B	N2-C2-N1	3.34	122.45	117.25
5	A	1760	H4B	C4A-N5-C6	-3.25	112.31	121.16
5	B	2760	H4B	C4A-N5-C6	-3.06	112.84	121.16
4	A	1750	HEM	C4B-CHC-C1C	2.92	126.41	122.56
6	A	1780	VIO	NE-CZ-NH2	-2.79	114.42	121.24
4	B	2750	HEM	C4B-CHC-C1C	2.73	126.16	122.56
6	A	1780	VIO	C2-C1-CH1	2.64	123.94	112.67
5	A	1760	H4B	C4-C4A-N5	-2.64	116.91	119.12
6	B	2780	VIO	C2-C1-CH1	2.62	123.88	112.67
4	A	1750	HEM	CAB-C3B-C2B	-2.51	120.34	128.60
5	A	1760	H4B	O9-C9-C6	2.50	114.96	108.98
6	B	2780	VIO	NE-CZ-NH2	-2.48	115.19	121.24
4	B	2750	HEM	C2C-C3C-C4C	-2.44	105.20	106.90
4	A	1750	HEM	CBD-CAD-C3D	-2.43	105.88	112.63
5	B	2760	H4B	O9-C9-C6	2.34	114.58	108.98
4	A	1750	HEM	CBA-CAA-C2A	-2.33	108.65	112.62
6	A	1780	VIO	OXT-C-CA	2.29	121.20	113.38
6	B	2780	VIO	OXT-C-CA	2.20	120.89	113.38
4	B	2750	HEM	CBD-CAD-C3D	-2.01	107.03	112.63

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	2780	VIO	C2-C1-CH1-CZ
6	A	1780	VIO	C2-C1-CH1-CZ
4	A	1750	HEM	C4B-C3B-CAB-CBB
4	B	2750	HEM	C4B-C3B-CAB-CBB
6	A	1780	VIO	CH1-CZ-NE-CD
6	B	2780	VIO	CH1-CZ-NE-CD
6	A	1780	VIO	C1-CH1-CZ-NE
6	A	1780	VIO	O-C-CA-N
6	B	2780	VIO	O-C-CA-N

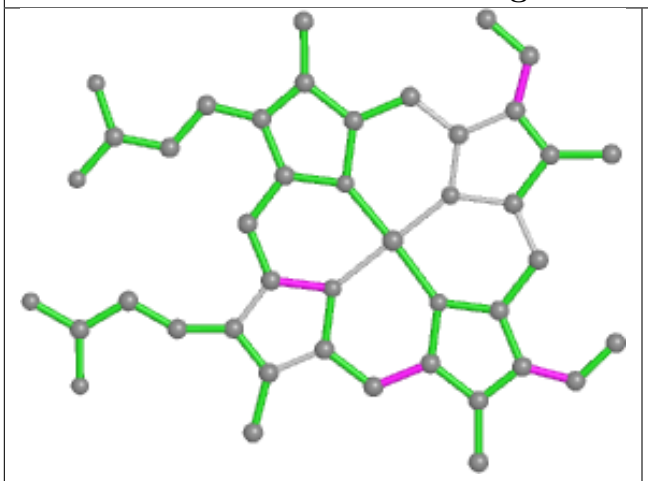
There are no ring outliers.

3 monomers are involved in 5 short contacts:

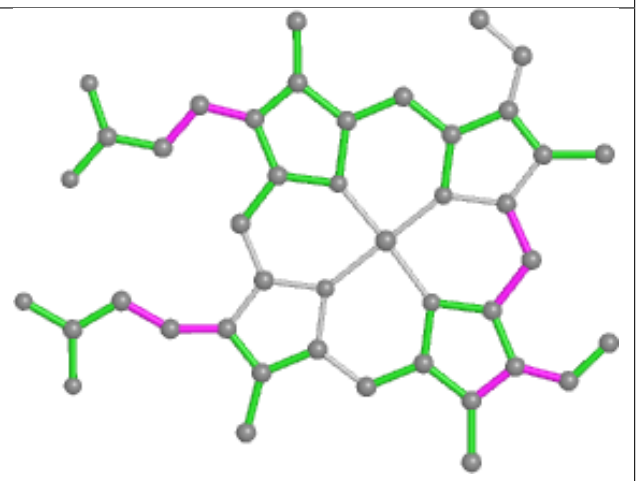
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1750	HEM	2	0
5	A	1760	H4B	1	0
4	B	2750	HEM	2	0

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.

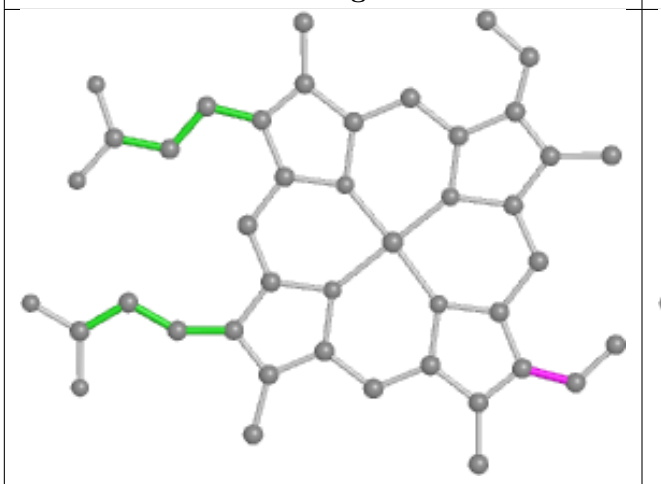
Ligand HEM A 1750



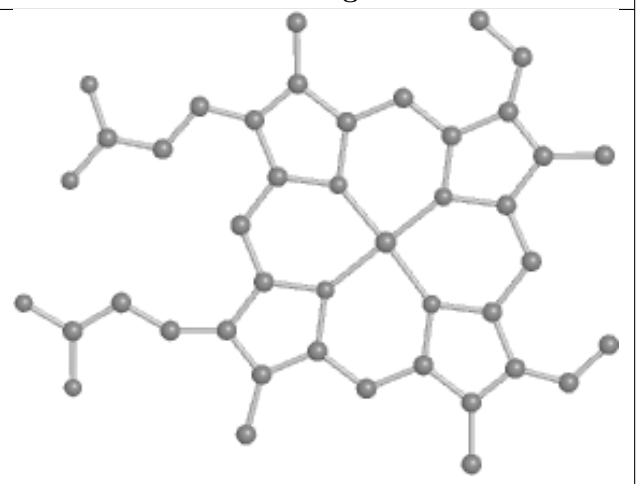
Bond lengths



Bond angles

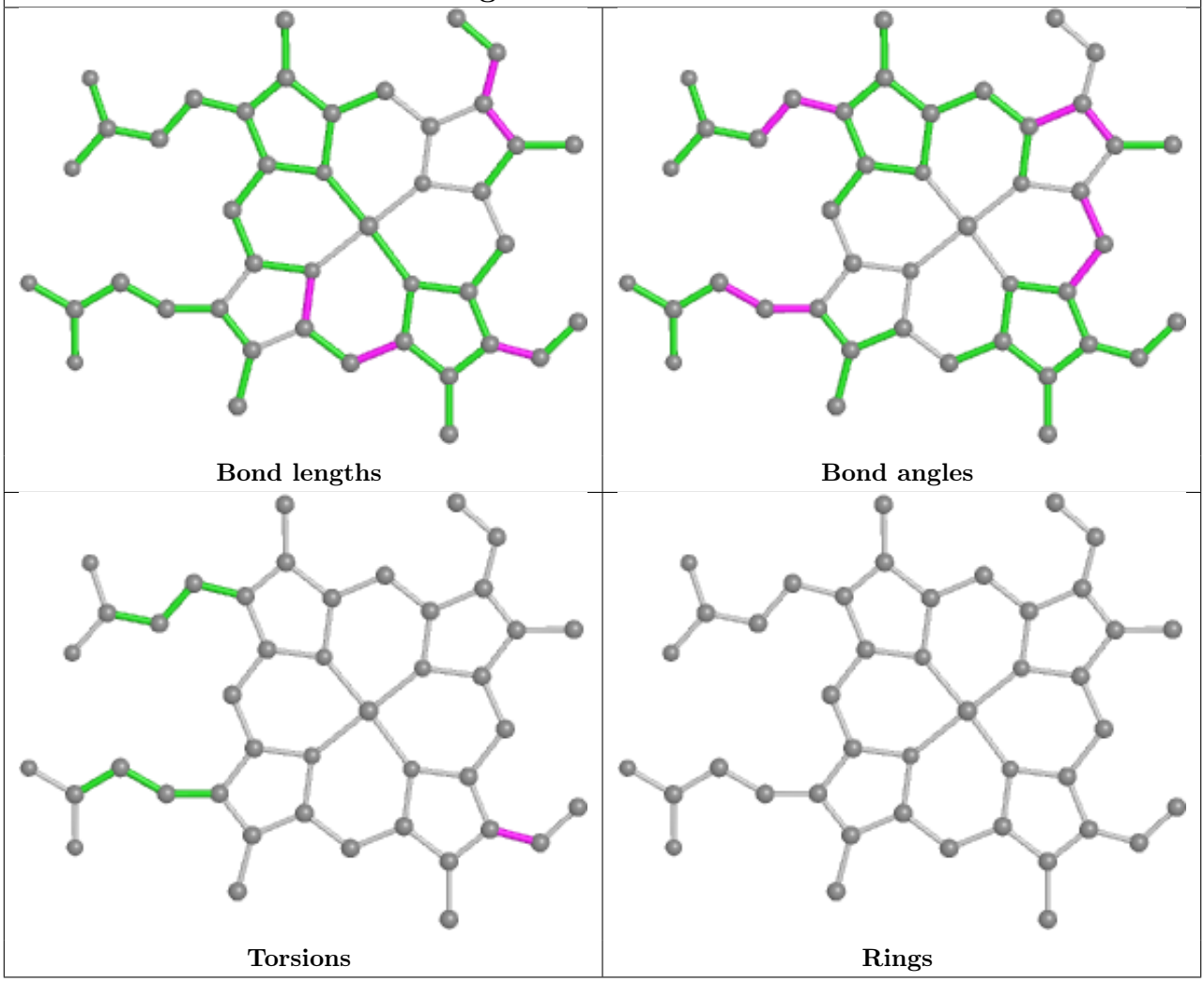


Torsions



Rings

Ligand HEM B 2750



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	407/419 (97%)	0.93	63 (15%) 2 1	25, 42, 66, 79	0
1	B	410/419 (97%)	0.41	28 (6%) 17 16	23, 34, 60, 70	0
All	All	817/838 (97%)	0.67	91 (11%) 5 4	23, 37, 64, 79	0

All (91) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	322	LEU	8.2
1	A	324	THR	8.0
1	A	322	LEU	7.7
1	A	330	ILE	7.1
1	A	715	VAL	6.3
1	B	348	VAL	5.9
1	A	488	PRO	5.8
1	B	300	PHE	5.7
1	A	491	SER	5.5
1	A	327	THR	5.2
1	A	300	PHE	5.2
1	A	716	TRP	5.1
1	B	321	THR	4.7
1	A	299	ARG	4.7
1	A	351	LYS	4.7
1	A	489	ASP	4.3
1	A	352	ASP	4.1
1	B	328	GLU	4.0
1	A	321	THR	4.0
1	B	323	GLU	4.0
1	A	355	PHE	4.0
1	B	338	PRO	3.8
1	A	490	GLY	3.8
1	A	328	GLU	3.8

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Mol	Chain	Res	Type	RSRZ
1	A	713	THR	3.7
1	A	329	HIS	3.6
1	B	350	THR	3.6
1	A	503	GLU	3.6
1	A	388	ILE	3.5
1	B	324	THR	3.4
1	A	567	VAL	3.4
1	A	325	GLY	3.3
1	A	386	LYS	3.3
1	A	487	GLN	3.3
1	B	329	HIS	3.3
1	A	711	TRP	3.2
1	B	337	LEU	3.2
1	A	311	VAL	3.0
1	B	351	LYS	3.0
1	B	619	ARG	2.9
1	B	311	VAL	2.8
1	B	715	VAL	2.8
1	A	714	HIS	2.8
1	A	392	SER	2.8
1	A	572	LEU	2.8
1	B	392	SER	2.8
1	A	350	THR	2.8
1	B	301	LEU	2.8
1	A	619	ARG	2.7
1	A	337	LEU	2.7
1	A	390	SER	2.7
1	B	327	THR	2.6
1	A	310	VAL	2.6
1	A	318	LEU	2.6
1	B	310	VAL	2.6
1	A	469	LYS	2.6
1	B	620	LYS	2.5
1	A	704	PHE	2.5
1	A	486	LYS	2.5
1	A	512	ALA	2.5
1	A	391	THR	2.5
1	A	389	GLU	2.5
1	A	302	LYS	2.5
1	A	710	PRO	2.5
1	A	323	GLU	2.4
1	B	615	ASP	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	330	ILE	2.4
1	B	352	ASP	2.4
1	A	499	VAL	2.4
1	A	617	ASP	2.4
1	A	370	LYS	2.3
1	A	371	ARG	2.3
1	A	679	ILE	2.3
1	A	682	PRO	2.2
1	A	616	LEU	2.2
1	A	584	PHE	2.2
1	A	326	CYS	2.2
1	A	667	ARG	2.2
1	A	645	LYS	2.2
1	A	712	ASN	2.2
1	B	567	VAL	2.2
1	B	309	ASP	2.2
1	B	571	LEU	2.1
1	A	309	ASP	2.1
1	A	480	ILE	2.1
1	B	376	ALA	2.1
1	B	389	GLU	2.0
1	A	504	ILE	2.0
1	A	412	ALA	2.0
1	A	552	ASP	2.0
1	A	680	VAL	2.0

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

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

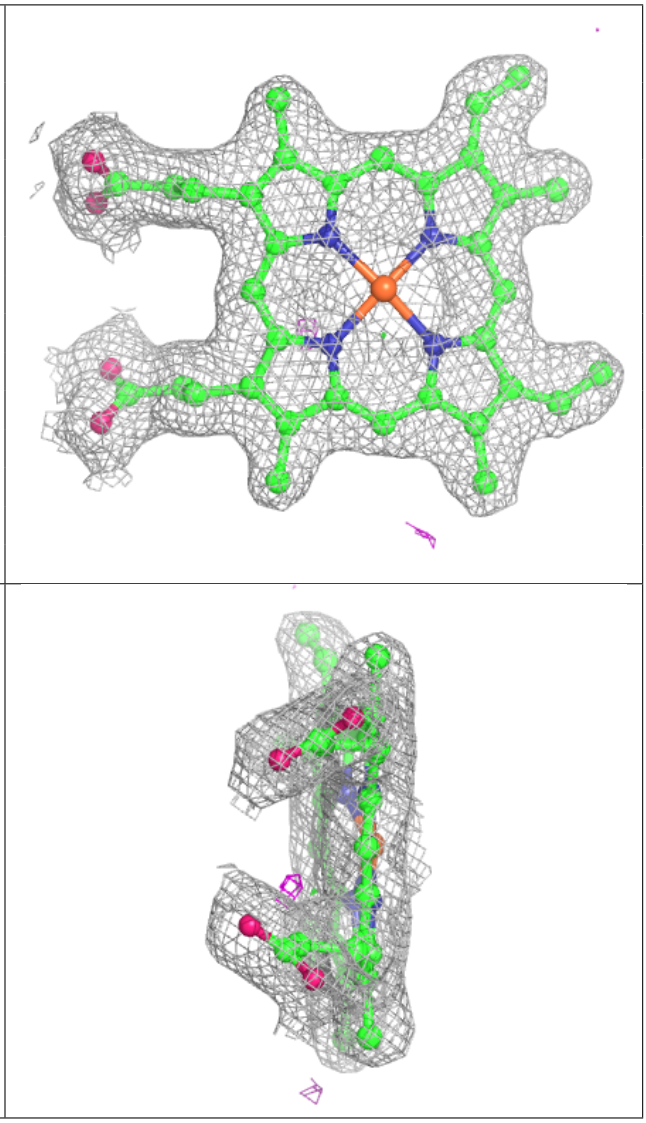
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	ACT	A	1860	4/4	0.93	0.17	51,51,51,51	0
5	H4B	A	1760	17/17	0.93	0.18	28,29,31,31	0
2	ACT	B	2860	4/4	0.96	0.11	35,35,35,36	0
5	H4B	B	2760	17/17	0.96	0.14	27,28,32,33	0
4	HEM	A	1750	43/43	0.97	0.19	25,27,27,27	0
4	HEM	B	2750	43/43	0.97	0.17	23,25,27,28	0
6	VIO	A	1780	14/14	0.97	0.24	26,27,30,31	0
6	VIO	B	2780	14/14	0.97	0.19	22,24,29,29	0
3	ZN	A	900	1/1	0.98	0.05	55,55,55,55	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.

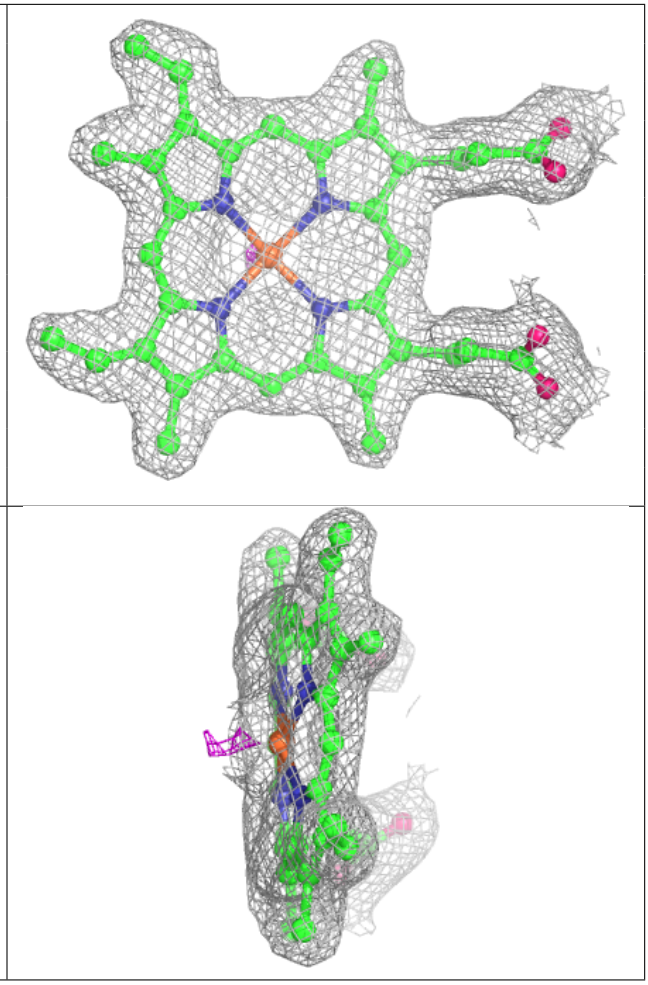
Electron density around HEM A 1750:

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 2750:

$2mF_o$-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.