Full wwPDB X-ray Structure Validation Report (i)

Feb 14, 2024 – 11:21 PM EST

PDB ID	:	3N69
Title	:	Structure of endothelial nitric oxide synthase N368D/V106M double mutant heme domain complexed with 6,6'-(2,2'-(pyridine-3,5-diyl)bis(ethane-2,1-diyl))bis(4-methylpyridin-2-amine)
Authors	:	Delker, S.L.; Li, H.; Poulos, T.L.
Deposited on	:	2010-05-25
Resolution	:	2.65 Å(reported)

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

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

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

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

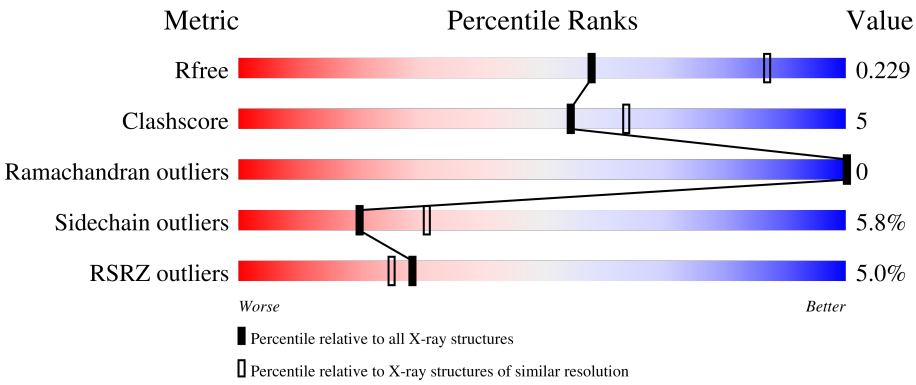
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.65 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1332 (2.68-2.64)
Clashscore	141614	1374 (2.68-2.64)
Ramachandran outliers	138981	1349 (2.68-2.64)
Sidechain outliers	138945	1349 (2.68-2.64)
RSRZ outliers	127900	1318 (2.68-2.64)

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	444	5% 80% 9% • 9%
1	B	444	4% 78% 10% • 9%

2 Entry composition (i)

There are 8 unique types of molecules in this entry. The entry contains 7116 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.

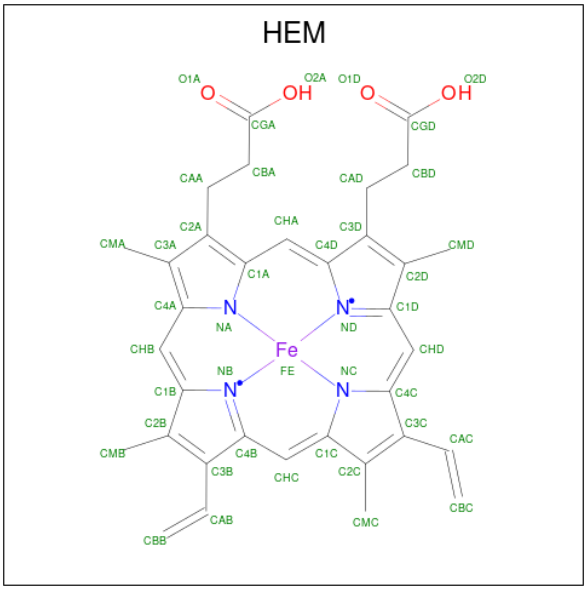
- Molecule 1 is a protein called Nitric oxide synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	404	3240	2057	572	594	17	0	3	0
1	B	403	3249	2061	576	595	17	0	4	0

There are 6 discrepancies between the modelled and reference sequences:

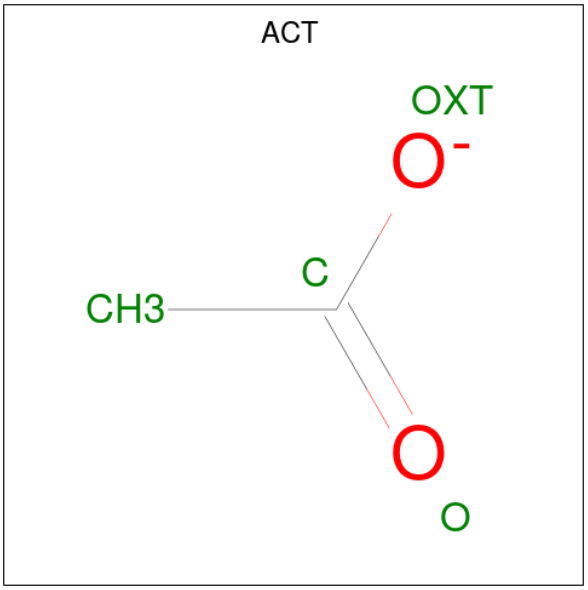
Chain	Residue	Modelled	Actual	Comment	Reference
A	100	ARG	CYS	SEE REMARK 999	UNP P29476
A	106	MET	VAL	engineered mutation	UNP P29476
A	368	ASP	ASN	engineered mutation	UNP P29476
B	100	ARG	CYS	SEE REMARK 999	UNP P29476
B	106	MET	VAL	engineered mutation	UNP P29476
B	368	ASP	ASN	engineered mutation	UNP P29476

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



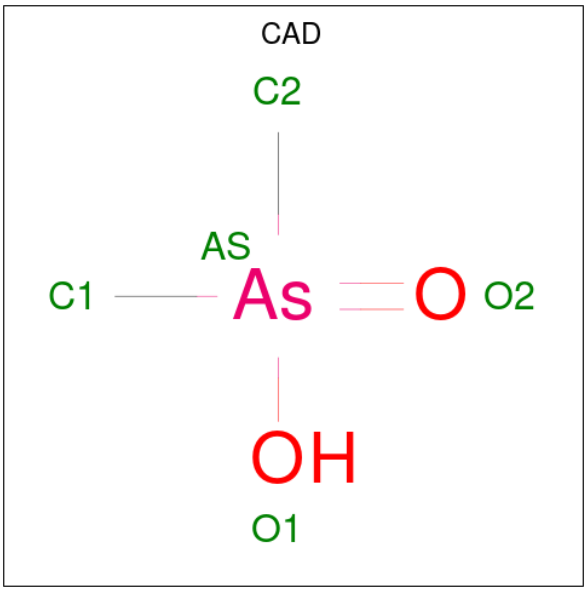
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	N	O		
2	A	1	43	34	1	4	4	0	0
2	B	1	43	34	1	4	4	0	0

- Molecule 3 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).



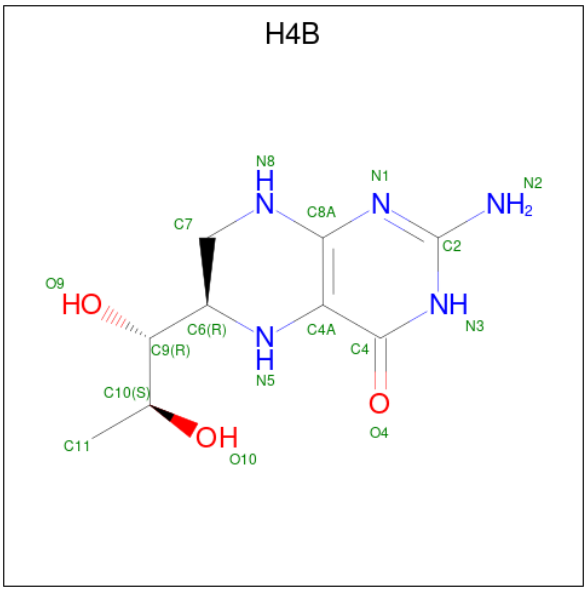
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	4	2	2	0	0
3	B	1	4	2	2	0	0

- Molecule 4 is CACODYLIC ACID (three-letter code: CAD) (formula: $C_2H_7AsO_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	As	C		
4	A	1	3	1	2	0	0
			Total	As	C		
4	B	1	3	1	2	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

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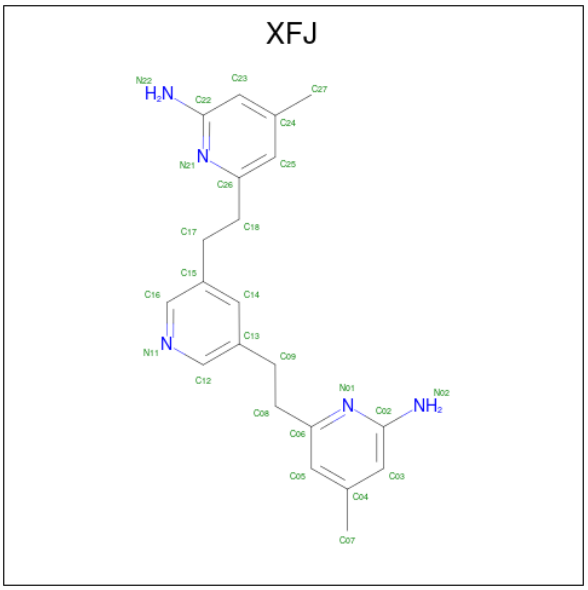
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
5	B	1	17	9	5	3	0	0

- Molecule 6 is 6,6'-(pyridine-3,5-diyldiethane-2,1-diyl)bis(4-methylpyridin-2-amine) (three-letter code: XFJ) (formula: $C_{21}H_{25}N_5$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N			
6	A	1	26	21	5		0	0
6	B	1	26	21	5		0	0

- Molecule 7 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 8 is water.

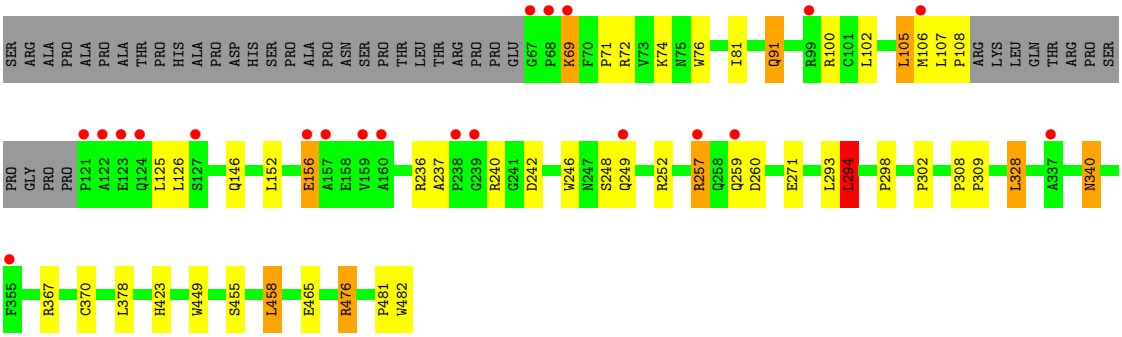
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
8	A	224	224	224	0	0
8	B	216	216	216	0	0

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.

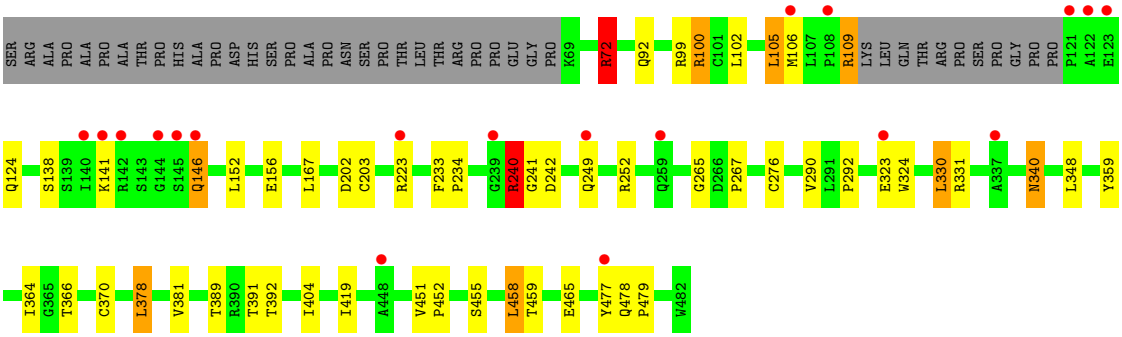
• Molecule 1: Nitric oxide synthase

Chain A:



• Molecule 1: Nitric oxide synthase

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	58.15Å 106.63Å 156.96Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.30 – 2.65 39.24 – 2.65	Depositor EDS
% Data completeness (in resolution range)	99.4 (39.30-2.65) 97.9 (39.24-2.65)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	2.20 (at 2.65Å)	Xtriage
Refinement program	REFMAC 5.5.0109, CNS	Depositor
R, R_{free}	0.167 , 0.215 0.198 , 0.229	Depositor DCC
R_{free} test set	1396 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å^2)	50.0	Xtriage
Anisotropy	0.405	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 37.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	7116	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.66% 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: CAD, HEM, ZN, ACT, H4B, XFJ

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	0.75	0/3330	0.75	3/4533 (0.1%)
1	B	0.77	1/3337 (0.0%)	0.76	5/4539 (0.1%)
All	All	0.76	1/6667 (0.0%)	0.76	8/9072 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	203	CYS	CB-SG	-6.47	1.71	1.82

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	240	ARG	NE-CZ-NH1	8.56	124.58	120.30
1	B	72	ARG	NE-CZ-NH1	7.80	124.20	120.30
1	B	240	ARG	NE-CZ-NH2	-7.42	116.59	120.30
1	A	367	ARG	NE-CZ-NH1	-7.03	116.78	120.30
1	B	72	ARG	NE-CZ-NH2	-6.08	117.26	120.30
1	A	328	LEU	CA-CB-CG	6.06	129.24	115.30
1	B	242	ASP	CB-CG-OD1	5.17	122.95	118.30
1	A	294	LEU	CA-CB-CG	5.10	127.02	115.30

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	3240	0	3139	34	0
1	B	3249	0	3150	35	0
2	A	43	0	30	1	0
2	B	43	0	30	5	0
3	A	4	0	3	0	0
3	B	4	0	3	0	0
4	A	3	0	0	0	0
4	B	3	0	0	1	0
5	A	17	0	15	1	0
5	B	17	0	15	0	0
6	A	26	0	25	2	0
6	B	26	0	25	2	0
7	A	1	0	0	0	0
8	A	224	0	0	4	0
8	B	216	0	0	3	0
All	All	7116	0	6435	68	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (68) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:107:LEU:HB3	1:A:108:PRO:HD2	1.61	0.83
1:B:249[A]:GLN:HB2	1:B:252:ARG:HG3	1.64	0.79
1:A:240:ARG:HD3	1:A:298:PRO:HB3	1.69	0.75
1:B:381:VAL:HG21	1:B:404:ILE:HD11	1.72	0.70
1:B:324:TRP:HB2	4:B:950:CAD:C1	2.22	0.69
1:A:249:GLN:HB2	1:A:252:ARG:HG3	1.78	0.66
1:B:366:THR:O	1:B:370:CYS:HB2	1.96	0.65
1:A:259:GLN:CD	1:A:259:GLN:H	1.99	0.65
1:A:340:ASN:H	1:A:340:ASN:HD22	1.44	0.63
2:A:500:HEM:O2D	6:A:800:XFJ:H17	1.98	0.63
1:B:72:ARG:HH11	1:B:72:ARG:HG2	1.64	0.62
1:B:109[B]:ARG:HB2	1:B:109[B]:ARG:NH1	2.14	0.62
1:A:237:ALA:O	8:A:1206:HOH:O	2.16	0.62
1:A:76:TRP:CE2	1:B:106:MET:HE3	2.36	0.60
1:A:71:PRO:HA	1:B:109[B]:ARG:HH21	1.65	0.60
1:A:69:LYS:HA	1:A:69:LYS:HE2	1.83	0.59
1:B:370:CYS:SG	1:B:378:LEU:HD13	2.43	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:152:LEU:O	1:A:156:GLU:HG2	2.04	0.58
1:A:370:CYS:SG	1:A:378:LEU:HD13	2.44	0.58
1:B:249[A]:GLN:HB2	1:B:252:ARG:CG	2.33	0.57
1:B:109[B]:ARG:HB2	1:B:109[B]:ARG:CZ	2.35	0.56
1:B:478:GLN:HB2	1:B:479:PRO:HD2	1.88	0.56
1:A:246:TRP:HB2	1:A:294:LEU:HB3	1.88	0.54
1:A:71:PRO:HA	1:B:109[B]:ARG:NH2	2.24	0.53
1:A:476:ARG:HD2	8:A:1148:HOH:O	2.09	0.53
1:B:378:LEU:HB2	8:B:1232:HOH:O	2.09	0.52
1:B:330:LEU:HB2	8:B:1233:HOH:O	2.08	0.51
2:B:500:HEM:HBC2	2:B:500:HEM:CMC	2.41	0.51
1:B:72:ARG:HG2	1:B:72:ARG:NH1	2.27	0.49
1:B:359:TYR:CD2	1:B:364:ILE:HD11	2.47	0.49
1:A:106:MET:HE1	6:A:800:XFJ:C24	2.43	0.48
2:B:500:HEM:HBB2	2:B:500:HEM:HHC	1.95	0.48
1:A:465:GLU:HB3	1:B:105:LEU:HD22	1.96	0.48
1:B:340:ASN:HD22	1:B:340:ASN:H	1.61	0.48
1:A:126:LEU:HD11	1:A:156:GLU:HA	1.96	0.47
1:B:152:LEU:O	1:B:156:GLU:HG2	2.15	0.47
1:B:290:VAL:HG23	8:B:1388:HOH:O	2.14	0.47
2:B:500:HEM:HBC2	2:B:500:HEM:HMC1	1.97	0.47
1:A:248:SER:HA	1:A:340:ASN:HB3	1.97	0.46
1:A:476:ARG:NE	8:A:1148:HOH:O	2.49	0.46
1:A:105:LEU:HD22	1:B:465:GLU:HB3	1.98	0.46
1:B:455:SER:O	1:B:458:LEU:HB2	2.16	0.45
1:A:72[B]:ARG:H	1:B:109[B]:ARG:CZ	2.30	0.45
1:A:455:SER:HB3	1:A:458:LEU:HD22	1.99	0.45
1:B:451:VAL:HA	1:B:452:PRO:HD3	1.85	0.45
1:B:233:PHE:HB3	1:B:234:PRO:CD	2.47	0.44
1:A:246:TRP:CZ2	1:A:302:PRO:HG3	2.52	0.43
1:A:74:LYS:HD2	1:A:81:ILE:HD11	2.00	0.43
1:A:91:GLN:HE21	1:A:91:GLN:HA	1.84	0.43
1:A:308:PRO:HA	1:A:309:PRO:HD3	1.93	0.43
1:B:167:LEU:HG	1:B:348:LEU:HD12	2.01	0.43
2:B:500:HEM:O2D	6:B:800:XFJ:H17	2.18	0.43
1:A:423:HIS:HB2	1:B:392:THR:HB	2.00	0.42
1:A:378:LEU:HB2	8:A:1005:HOH:O	2.18	0.42
1:B:452:PRO:HG2	1:B:459:THR:HG21	2.01	0.42
1:B:240:ARG:HD2	1:B:241:GLY:O	2.20	0.42
1:B:265:GLY:O	1:B:267:PRO:HD3	2.20	0.42
1:A:449:TRP:HA	5:A:600:H4B:N1	2.35	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:236:ARG:HD3	1:A:242:ASP:OD1	2.19	0.42
1:A:240:ARG:HD3	1:A:298:PRO:CB	2.45	0.41
1:B:72:ARG:HH11	1:B:72:ARG:CG	2.31	0.41
1:A:126:LEU:HD21	1:A:156:GLU:HB3	2.02	0.41
1:A:481:PRO:HD2	1:A:482:TRP:CE3	2.56	0.41
1:B:99:ARG:HG2	1:B:100:ARG:HD2	2.02	0.40
1:B:276:CYS:SG	1:B:292:PRO:HG2	2.61	0.40
1:A:257:ARG:HG3	1:A:257:ARG:HH11	1.86	0.40
1:B:146:GLN:HA	1:B:146:GLN:HE21	1.87	0.40
2:B:500:HEM:C1C	6:B:800:XFJ:H07B	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	403/444 (91%)	394 (98%)	9 (2%)	0	100	100
1	B	402/444 (90%)	391 (97%)	11 (3%)	0	100	100
All	All	805/888 (91%)	785 (98%)	20 (2%)	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	346/377 (92%)	329 (95%)	17 (5%)	25	38
1	B	347/377 (92%)	323 (93%)	24 (7%)	15	24
All	All	693/754 (92%)	652 (94%)	41 (6%)	20	30

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	69	LYS
1	A	91	GLN
1	A	100	ARG
1	A	102	LEU
1	A	105	LEU
1	A	125	LEU
1	A	146	GLN
1	A	156	GLU
1	A	257	ARG
1	A	260	ASP
1	A	271	GLU
1	A	293	LEU
1	A	294	LEU
1	A	328	LEU
1	A	340	ASN
1	A	458	LEU
1	A	476	ARG
1	B	72	ARG
1	B	92	GLN
1	B	100	ARG
1	B	102	LEU
1	B	105	LEU
1	B	109[A]	ARG
1	B	109[B]	ARG
1	B	124	GLN
1	B	138	SER
1	B	141	LYS
1	B	146	GLN
1	B	202	ASP
1	B	223	ARG
1	B	240	ARG
1	B	323	GLU
1	B	330	LEU
1	B	331	ARG
1	B	340	ASN

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Mol	Chain	Res	Type
1	B	378	LEU
1	B	389	THR
1	B	391	THR
1	B	419	ILE
1	B	458	LEU
1	B	477	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	GLN
1	A	146	GLN
1	A	191	GLN
1	A	278	GLN
1	A	340	ASN
1	A	376	ASN
1	A	413	GLN
1	A	468	ASN
1	B	146	GLN
1	B	191	GLN
1	B	222	ASN
1	B	225	ASN
1	B	340	ASN
1	B	376	ASN
1	B	405	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 11 ligands modelled in this entry, 1 is monoatomic - leaving 10 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	$\#\|Z\| > 2$
5	H4B	B	600	-	16,18,18	1.06	1 (6%)	11,26,26	2.60	7 (63%)
3	ACT	A	860	-	3,3,3	0.78	0	3,3,3	0.72	0
4	CAD	A	950	-	0,2,4	-	-	0,1,6	-	-
4	CAD	B	950	-	0,2,4	-	-	0,1,6	-	-
2	HEM	A	500	1	41,50,50	1.85	7 (17%)	45,82,82	1.60	9 (20%)
3	ACT	B	860	-	3,3,3	0.73	0	3,3,3	0.86	0
2	HEM	B	500	1	41,50,50	1.92	6 (14%)	45,82,82	1.68	7 (15%)
5	H4B	A	600	-	16,18,18	1.18	2 (12%)	11,26,26	2.98	6 (54%)
6	XFJ	A	800	-	28,28,28	0.94	1 (3%)	38,38,38	2.14	13 (34%)
6	XFJ	B	800	-	28,28,28	0.86	0	38,38,38	2.19	11 (28%)

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
5	H4B	B	600	-	-	0/8/17/17	0/2/2/2
2	HEM	A	500	1	-	0/12/54/54	-
2	HEM	B	500	1	-	0/12/54/54	-
5	H4B	A	600	-	-	0/8/17/17	0/2/2/2
6	XFJ	A	800	-	-	3/10/10/10	0/3/3/3
6	XFJ	B	800	-	-	3/10/10/10	0/3/3/3

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	500	HEM	C3D-C2D	7.36	1.52	1.36
2	A	500	HEM	C3D-C2D	6.42	1.50	1.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	500	HEM	C3C-CAC	4.06	1.56	1.47
2	B	500	HEM	C3C-C2C	-3.66	1.35	1.40
2	B	500	HEM	C3C-CAC	3.63	1.55	1.47
2	B	500	HEM	CAB-C3B	3.10	1.55	1.47
2	A	500	HEM	C3C-C2C	-2.93	1.36	1.40
2	A	500	HEM	FE-NB	2.67	2.10	1.96
2	A	500	HEM	CAB-C3B	2.66	1.54	1.47
2	A	500	HEM	CMB-C2B	2.58	1.56	1.50
5	A	600	H4B	C7-N8	2.34	1.48	1.44
6	A	800	XFJ	C03-C02	2.33	1.43	1.39
2	B	500	HEM	CMB-C2B	2.30	1.55	1.50
2	B	500	HEM	CMD-C2D	2.28	1.55	1.50
5	B	600	H4B	C4A-C4	-2.26	1.38	1.41
5	A	600	H4B	C7-C6	2.04	1.54	1.52
2	A	500	HEM	C2C-C1C	2.01	1.47	1.42

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	B	800	XFJ	C22-N21-C26	6.27	122.85	118.10
2	B	500	HEM	CBA-CAA-C2A	-5.77	102.77	112.62
6	A	800	XFJ	C22-N21-C26	5.17	122.02	118.10
2	A	500	HEM	C4D-ND-C1D	5.02	110.25	105.07
6	B	800	XFJ	C18-C26-N21	4.76	123.04	115.95
5	A	600	H4B	C4-C4A-N5	4.62	123.00	119.12
6	A	800	XFJ	C18-C26-N21	4.58	122.78	115.95
6	A	800	XFJ	C14-C15-C16	4.37	120.93	116.71
5	A	600	H4B	C8A-C4A-C4	4.28	118.37	114.57
2	B	500	HEM	C4D-ND-C1D	4.28	109.49	105.07
5	A	600	H4B	N1-C2-N3	-4.19	118.85	125.42
6	B	800	XFJ	C14-C15-C16	4.12	120.68	116.71
5	B	600	H4B	C8A-C4A-C4	3.98	118.11	114.57
5	B	600	H4B	C2-N3-C4	3.97	122.25	115.93
2	A	500	HEM	CBA-CAA-C2A	-3.87	106.01	112.62
5	B	600	H4B	N1-C2-N3	-3.73	119.56	125.42
5	A	600	H4B	C2-N1-C8A	3.64	122.71	114.54
6	B	800	XFJ	N22-C22-N21	3.53	122.06	116.49
6	A	800	XFJ	C18-C26-C25	-3.50	116.59	121.22
6	A	800	XFJ	N22-C22-N21	3.40	121.87	116.49
5	A	600	H4B	C2-N3-C4	3.35	121.26	115.93
6	B	800	XFJ	C18-C26-C25	-3.28	116.88	121.22
6	A	800	XFJ	C14-C13-C12	3.23	119.83	116.71

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	B	800	XFJ	C02-N01-C06	3.07	120.43	118.10
2	B	500	HEM	C4B-CHC-C1C	3.06	126.60	122.56
6	A	800	XFJ	C15-C14-C13	-3.03	117.50	121.23
6	B	800	XFJ	C16-N11-C12	2.98	121.55	117.48
6	A	800	XFJ	C02-N01-C06	2.90	120.30	118.10
6	A	800	XFJ	C24-C25-C26	-2.87	118.44	120.32
6	B	800	XFJ	C05-C06-N01	-2.84	119.89	122.90
2	B	500	HEM	C3B-C2B-C1B	2.81	108.57	106.49
5	B	600	H4B	C2-N1-C8A	2.74	120.69	114.54
5	A	600	H4B	N2-C2-N3	2.73	121.50	117.25
6	A	800	XFJ	C16-N11-C12	2.73	121.20	117.48
2	B	500	HEM	C1B-NB-C4B	2.70	107.86	105.07
2	B	500	HEM	CHA-C4D-ND	2.69	127.70	124.38
2	A	500	HEM	CHC-C4B-C3B	2.68	128.68	124.57
6	B	800	XFJ	C25-C26-N21	-2.67	120.07	122.90
5	B	600	H4B	C4-C4A-N5	2.58	121.29	119.12
2	A	500	HEM	CBD-CAD-C3D	-2.53	105.59	112.63
2	A	500	HEM	C1B-NB-C4B	2.49	107.64	105.07
2	A	500	HEM	CMD-C2D-C1D	2.46	128.78	125.04
2	A	500	HEM	C1D-C2D-C3D	-2.45	104.38	106.96
2	A	500	HEM	C4C-CHD-C1D	2.44	125.78	122.56
2	A	500	HEM	C4B-CHC-C1C	2.39	125.72	122.56
6	A	800	XFJ	C15-C16-N11	-2.37	119.09	123.72
6	B	800	XFJ	C15-C16-N11	-2.28	119.26	123.72
6	B	800	XFJ	C15-C14-C13	-2.28	118.43	121.23
6	A	800	XFJ	C25-C24-C23	2.20	120.71	118.09
5	B	600	H4B	N2-C2-N1	2.19	120.67	117.25
6	A	800	XFJ	C25-C26-N21	-2.15	120.62	122.90
2	B	500	HEM	C1D-C2D-C3D	-2.14	104.71	106.96
5	B	600	H4B	C4A-N5-C6	-2.03	115.63	121.16

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	800	XFJ	C17-C18-C26-N21
6	A	800	XFJ	C17-C18-C26-C25
6	B	800	XFJ	C17-C18-C26-N21
6	B	800	XFJ	C17-C18-C26-C25
6	A	800	XFJ	C14-C15-C17-C18
6	B	800	XFJ	C14-C15-C17-C18

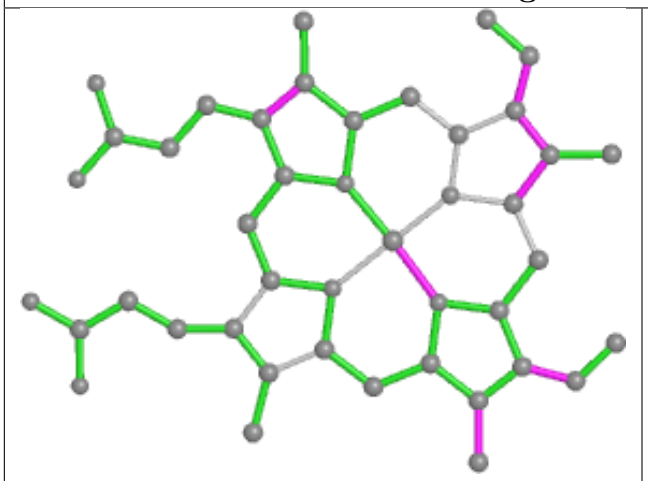
There are no ring outliers.

6 monomers are involved in 9 short contacts:

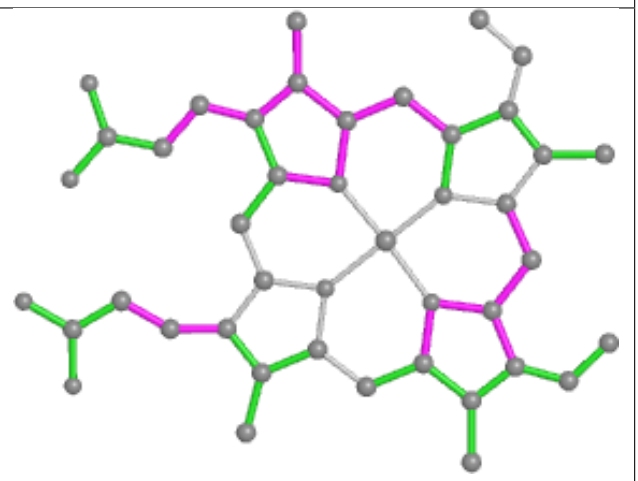
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	950	CAD	1	0
2	A	500	HEM	1	0
2	B	500	HEM	5	0
5	A	600	H4B	1	0
6	A	800	XFJ	2	0
6	B	800	XFJ	2	0

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.

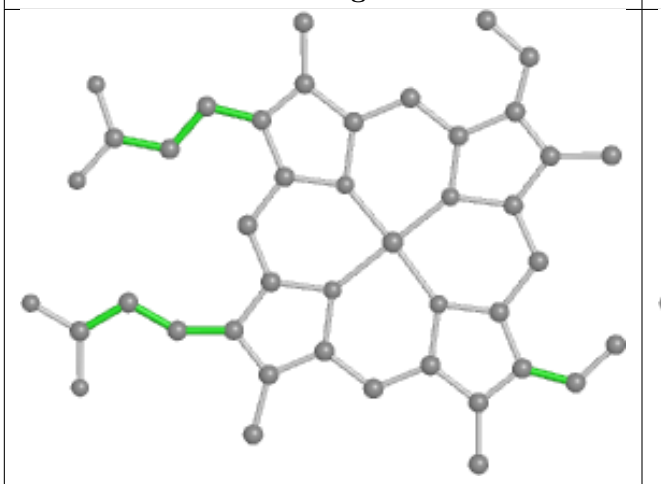
Ligand HEM A 500



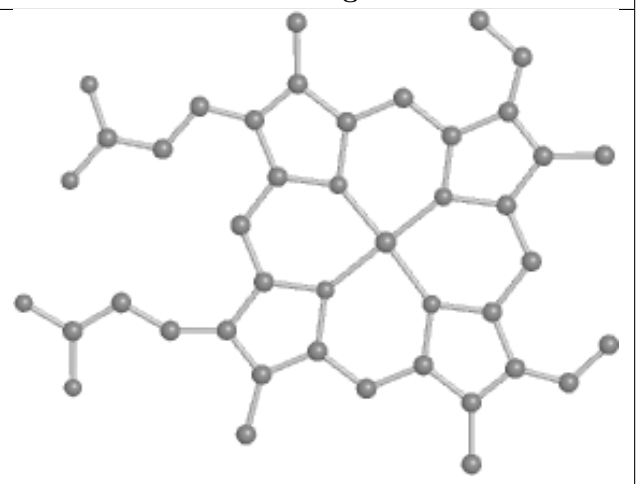
Bond lengths



Bond angles

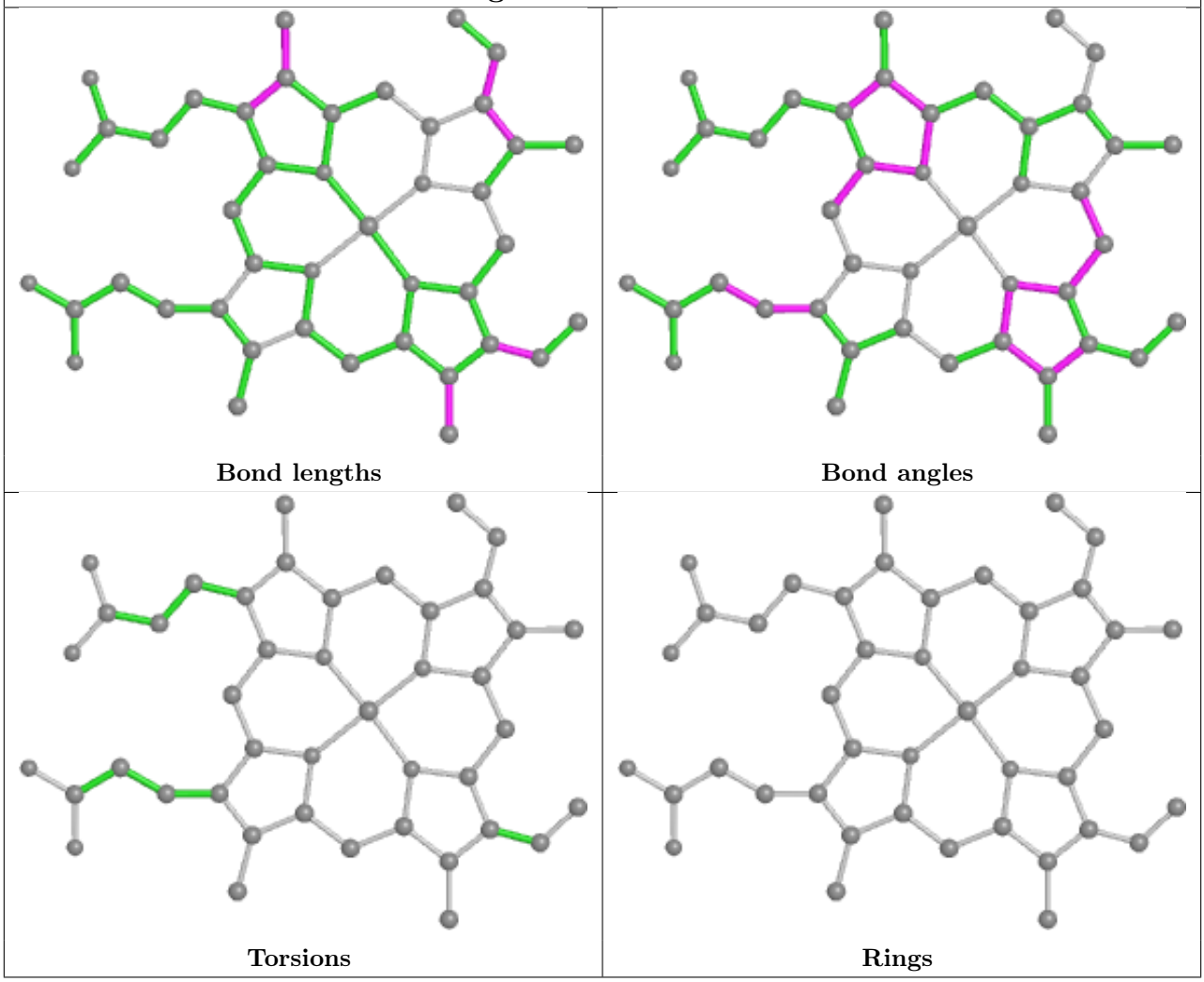


Torsions

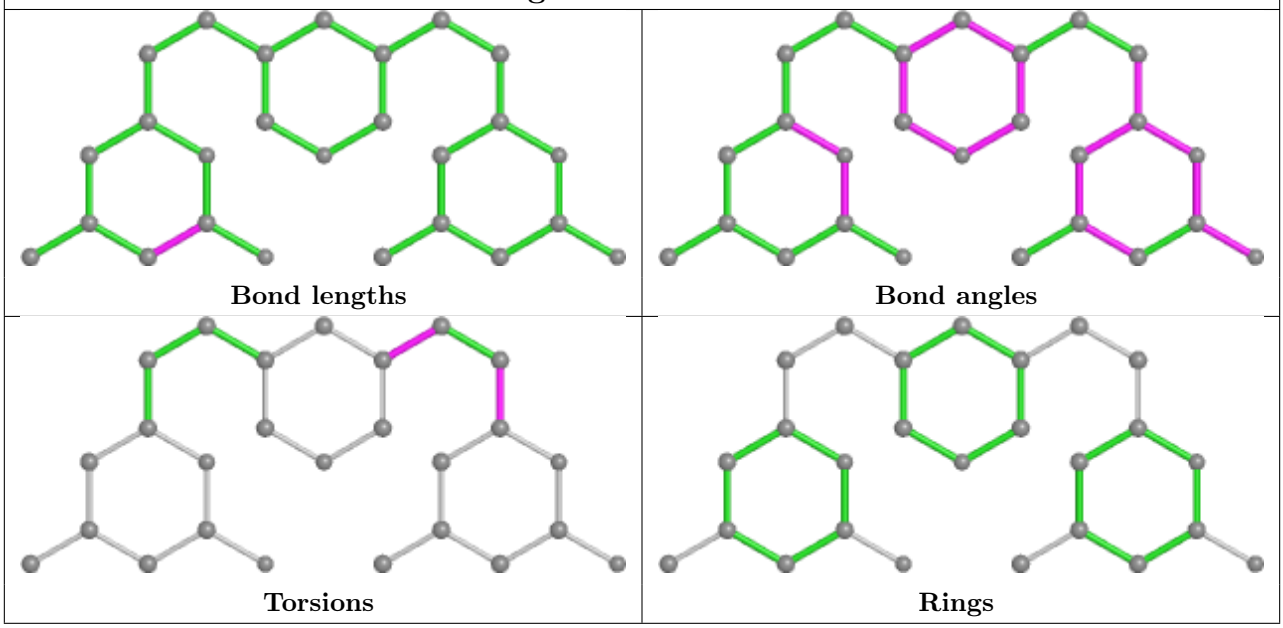


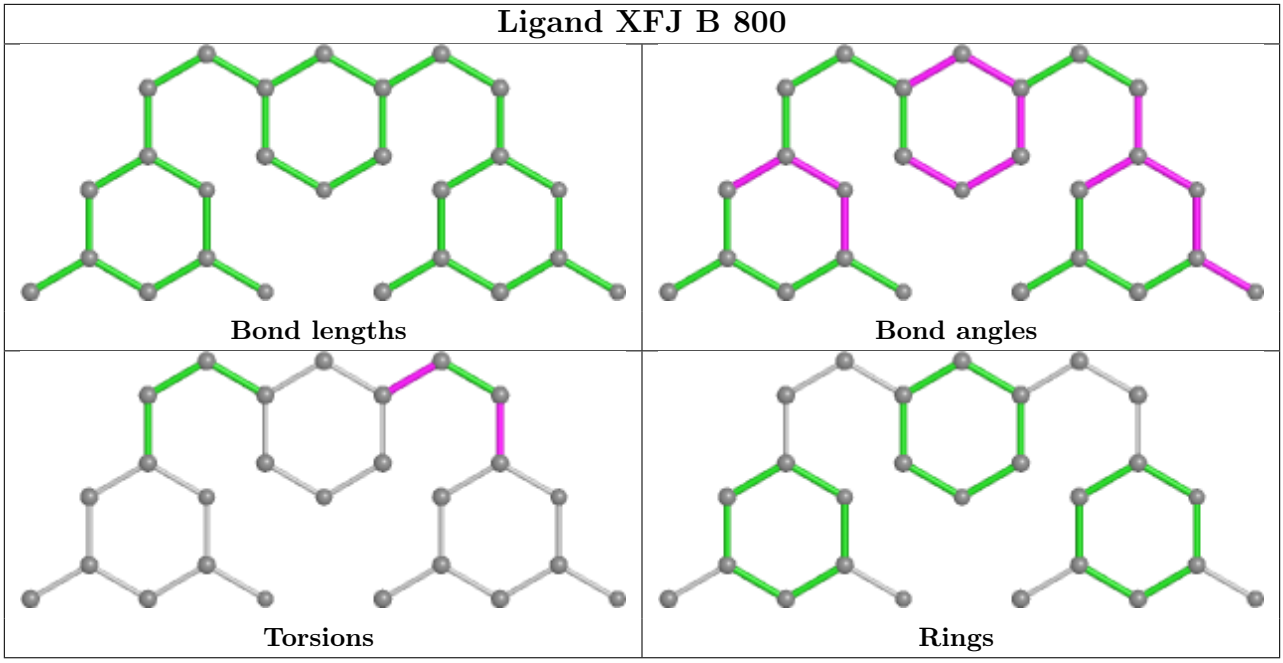
Rings

Ligand HEM B 500



Ligand XFJ A 800





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	404/444 (90%)	0.22	21 (5%)	27	24	24, 39, 63, 82	0
1	B	403/444 (90%)	0.11	19 (4%)	31	28	25, 41, 65, 90	0
All	All	807/888 (90%)	0.17	40 (4%)	28	25	24, 40, 64, 90	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	121	PRO	5.3
1	A	239	GLY	5.2
1	A	160	ALA	4.8
1	A	159	VAL	4.7
1	B	259	GLN	4.7
1	B	122	ALA	4.3
1	A	156	GLU	4.1
1	A	123	GLU	4.0
1	A	122	ALA	3.7
1	A	238	PRO	3.7
1	A	259	GLN	3.5
1	A	69	LYS	3.4
1	A	124	GLN	3.3
1	A	68	PRO	3.2
1	B	477	TYR	3.1
1	B	123	GLU	3.0
1	A	99	ARG	2.9
1	B	142	ARG	2.9
1	B	223	ARG	2.8
1	B	106	MET	2.8
1	B	249[A]	GLN	2.7
1	B	121	PRO	2.6
1	A	106	MET	2.6
1	B	239	GLY	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	337	ALA	2.5
1	A	67	GLY	2.4
1	A	127	SER	2.4
1	B	144	GLY	2.4
1	A	257	ARG	2.3
1	B	448	ALA	2.2
1	B	145	SER	2.2
1	B	108	PRO	2.2
1	B	146	GLN	2.2
1	B	323	GLU	2.2
1	B	140	ILE	2.2
1	B	141	LYS	2.2
1	A	249	GLN	2.1
1	A	157	ALA	2.1
1	A	355	PHE	2.0
1	B	337	ALA	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
6	XFJ	B	800	26/26	0.81	0.40	33,49,55,55	0
6	XFJ	A	800	26/26	0.87	0.31	24,40,54,55	0
4	CAD	A	950	3/5	0.94	0.19	56,56,59,60	0
3	ACT	B	860	4/4	0.95	0.25	48,50,50,50	0
3	ACT	A	860	4/4	0.95	0.20	43,45,45,48	0
2	HEM	A	500	43/43	0.96	0.27	27,29,37,41	0
5	H4B	B	600	17/17	0.97	0.21	25,30,31,32	0

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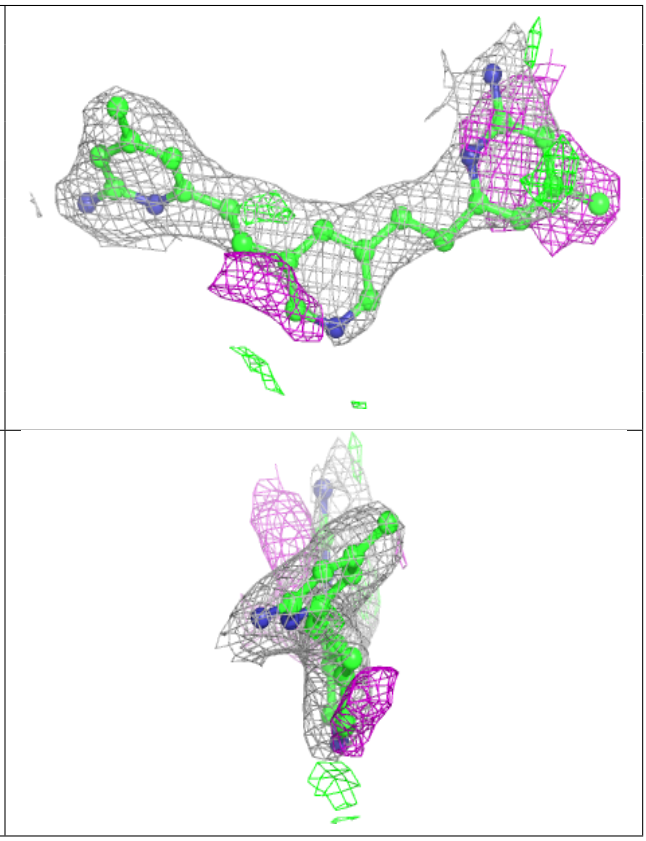
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	H4B	A	600	17/17	0.98	0.22	27,31,32,34	0
2	HEM	B	500	43/43	0.98	0.20	25,30,34,37	0
4	CAD	B	950	3/5	0.99	0.10	60,60,61,62	0
7	ZN	A	900	1/1	0.99	0.07	32,32,32,32	0

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.

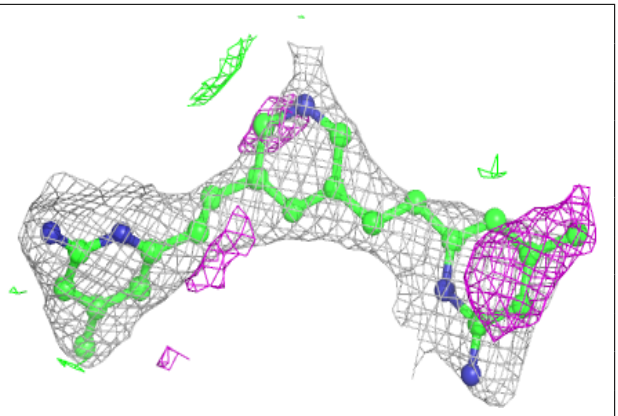
Electron density around XFJ B 800:

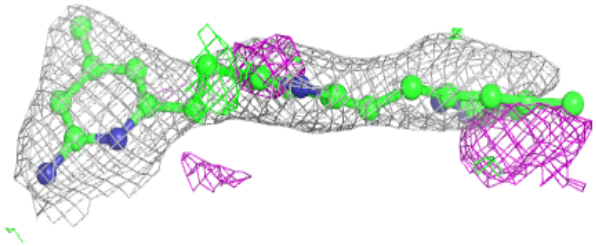
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

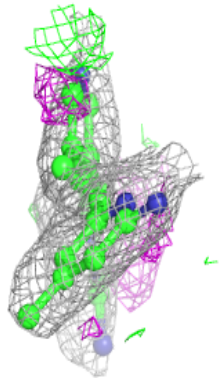


Electron density around XFJ A 800:

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

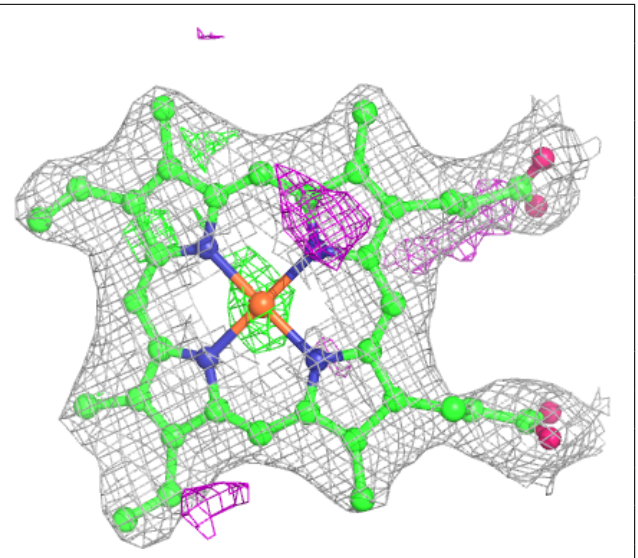


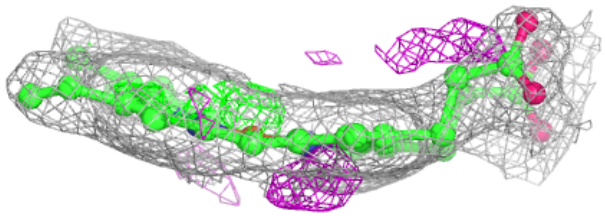


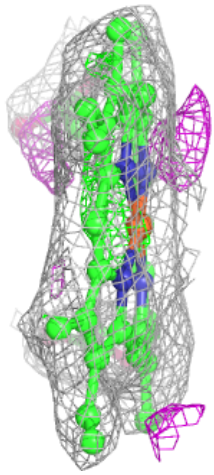


Electron density around HEM A 500:

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

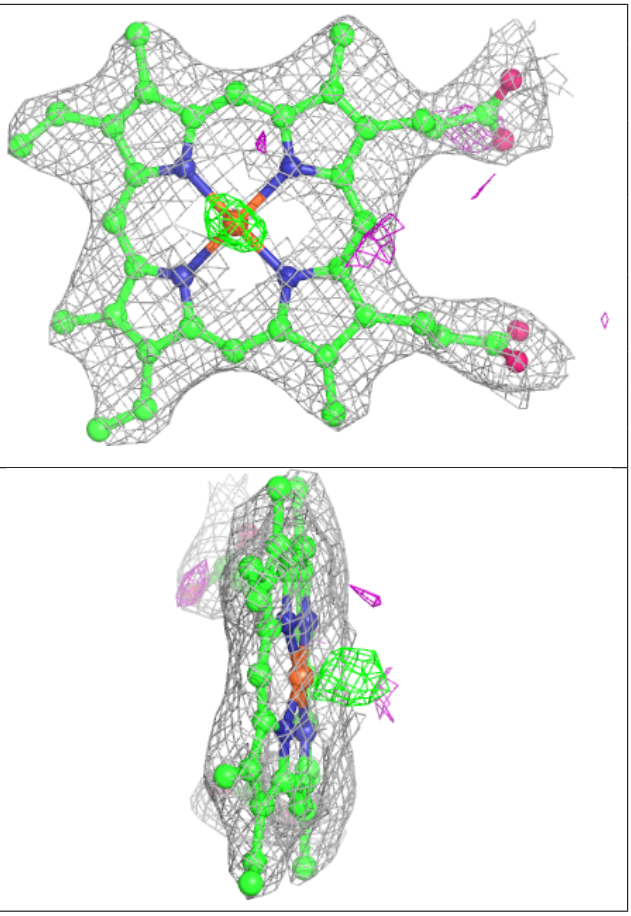






Electron density around HEM B 500:

$2mF_o$-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.