Full wwPDB X-ray Structure Validation Report ⓘ

Nov 17, 2026 – 02:57 AM JST

PDB ID	:	22LK / pdb_000022lk
Title	:	Crystal structure of the P450 BM3 heme domain triple mutant F87A/L215W/H408W in complex with N-imidazolyl-hexanoyl-L-phenylalanyl-L-phenylalanine
Authors	:	Qin, M.M.; Cong, Z.Q.; Wang, Z.H.
Deposited on	:	2026-01-15
Resolution	:	1.70 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:

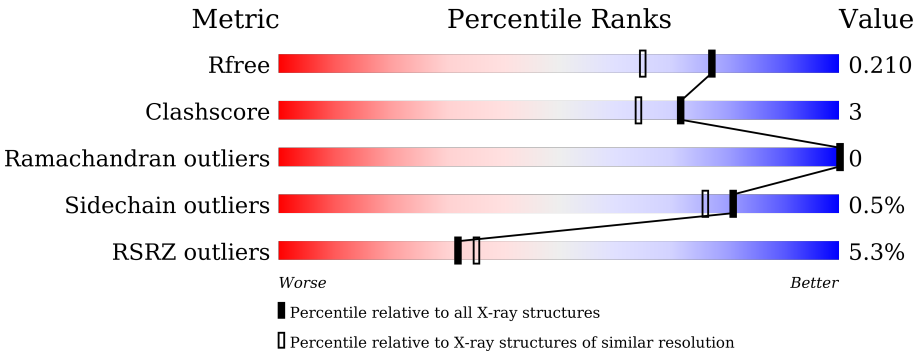
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.70 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}	180053	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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	455	4% 92% 8%
1	B	455	6% 95% 5%
2	D	3	67% 33%
2	E	3	67% 33%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 8692 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 Bifunctional cytochrome P450/NADPH–P450 reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	455	Total	C	N	O	S	0	6	0
			3655	2345	621	671	18			
1	B	455	Total	C	N	O	S	0	5	0
			3637	2333	618	668	18			

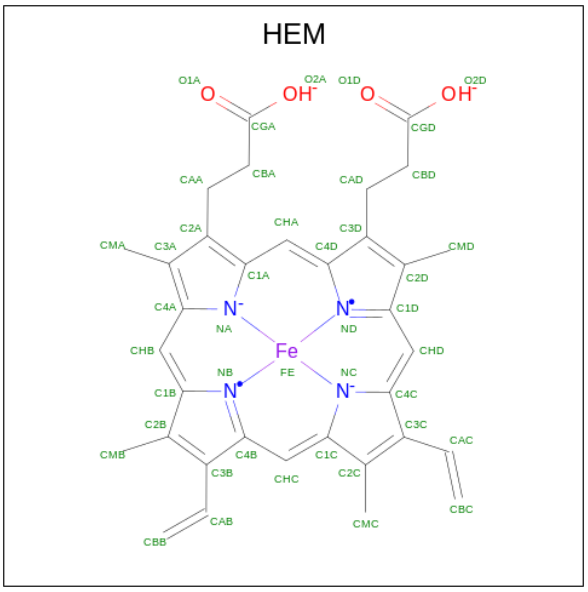
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	87	ALA	PHE	engineered mutation	UNP P14779
A	215	TRP	LEU	engineered mutation	UNP P14779
A	408	TRP	HIS	engineered mutation	UNP P14779
B	87	ALA	PHE	engineered mutation	UNP P14779
B	215	TRP	LEU	engineered mutation	UNP P14779
B	408	TRP	HIS	engineered mutation	UNP P14779

- Molecule 2 is a protein called I7X-PHE-PHE.

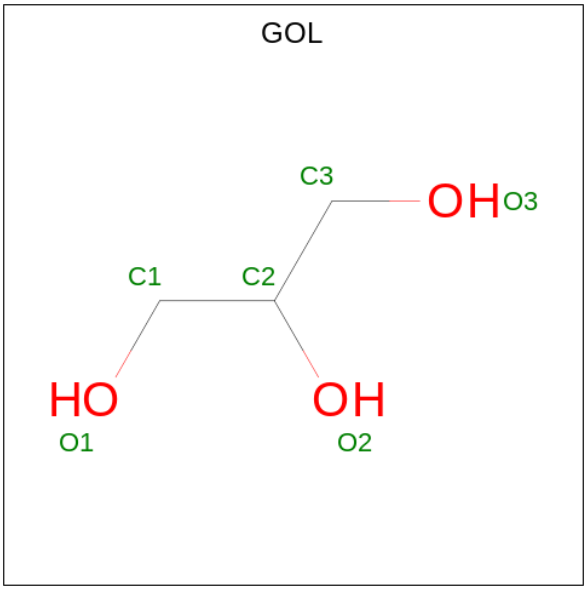
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	D	3	Total	C	N	O	0	0	0
			35	27	4	4			
2	E	3	Total	C	N	O	0	0	0
			35	27	4	4			

- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



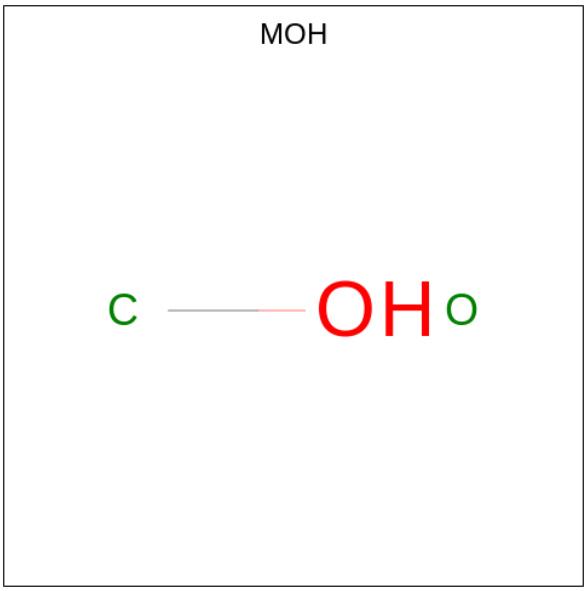
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

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



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

- Molecule 5 is METHANOL (CCD ID: MOH) (formula: CH_4O).



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

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total Mg 1 1	0	0
6	B	1	Total Mg 1 1	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	625	Total O 625 625	0	0
7	B	598	Total O 598 598	0	0

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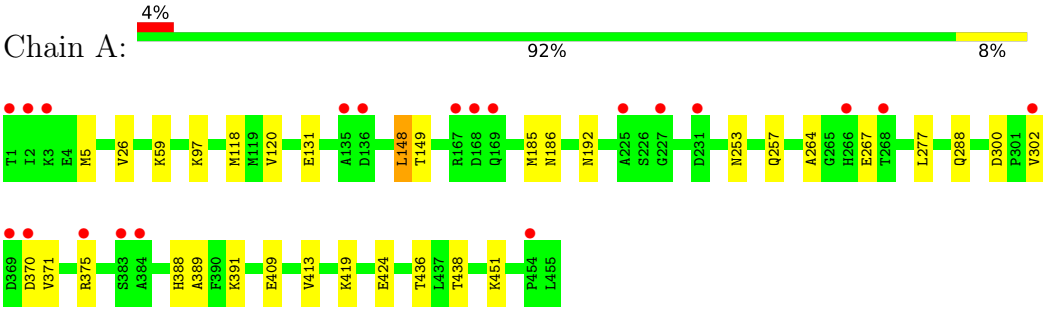
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	D	2	Total O 2 2	0	0
7	E	1	Total O 1 1	0	0

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.

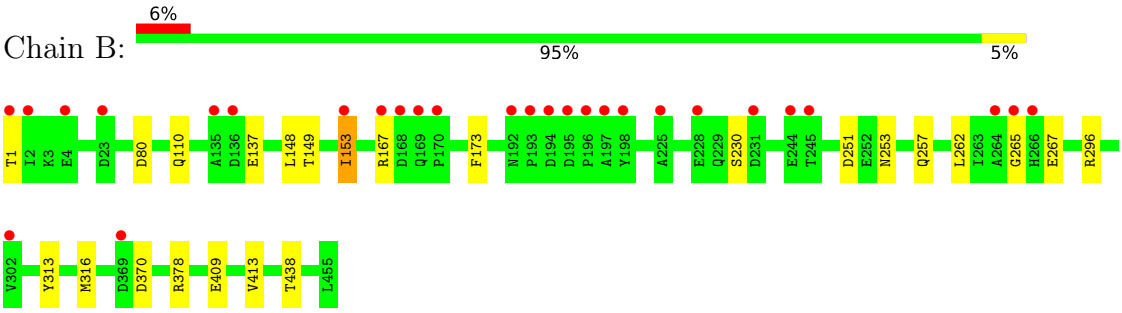
• Molecule 1: Bifunctional cytochrome P450/NADPH–P450 reductase

Chain A:



• Molecule 1: Bifunctional cytochrome P450/NADPH–P450 reductase

Chain B:



• Molecule 2: I7X-PHE-PHE

Chain D:



• Molecule 2: I7X-PHE-PHE

Chain E:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	58.70Å 128.22Å 150.05Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	54.67 – 1.70 54.67 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.2 (54.67-1.70) 99.2 (54.67-1.70)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.57 (at 1.70Å)	Xtriage
Refinement program	PHENIX (1.18.2_3874: ???)	Depositor
R, R_{free}	0.185 , 0.209 0.186 , 0.210	Depositor DCC
R_{free} test set	2000 reflections (1.60%)	wwPDB-VP
Wilson B-factor (Å^2)	19.0	Xtriage
Anisotropy	0.411	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 40.2	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	0.96	EDS
Total number of atoms	8692	wwPDB-VP
Average B, all atoms (Å^2)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 49.20 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 7.7154e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MOH, I7X, HEM, MG, GOL

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	0.18	0/3745	0.42	0/5077
1	B	0.18	0/3727	0.42	0/5051
2	D	1.88	1/24 (4.2%)	1.07	0/29
2	E	1.90	1/24 (4.2%)	0.78	0/29
All	All	0.24	2/7520 (0.0%)	0.42	0/10186

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	2	PHE	C-N	8.62	1.45	1.33
2	D	2	PHE	C-N	8.55	1.45	1.33

There are no bond angle outliers.

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	3655	0	3593	27	0
1	B	3637	0	3570	16	0
2	D	35	0	17	1	0
2	E	35	0	17	0	0
3	A	43	0	30	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	43	0	30	4	0
4	A	6	0	8	1	0
5	A	10	0	0	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
7	A	625	0	0	12	5
7	B	598	0	0	6	3
7	D	2	0	0	0	0
7	E	1	0	0	0	0
All	All	8692	0	7265	48	8

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 3.

All (48) 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:375[A]:ARG:NH1	7:A:602:HOH:O	2.11	0.83
3:A:501:HEM:NB	7:A:603:HOH:O	2.15	0.79
1:A:370:ASP:OD2	1:A:375[A]:ARG:NH2	2.15	0.78
1:B:153[A]:ILE:HG13	1:B:265:GLY:HA3	1.71	0.72
1:B:313:TYR:HA	1:B:316:MET:HE3	1.72	0.71
1:A:192[B]:ASN:OD1	7:A:601:HOH:O	2.10	0.69
1:B:137:GLU:OE2	7:B:601:HOH:O	2.08	0.69
1:A:118[A]:MET:SD	7:A:747:HOH:O	2.48	0.69
1:A:288:GLN:NE2	7:A:606:HOH:O	2.21	0.68
1:B:153[A]:ILE:HD11	3:B:501:HEM:HBB2	1.75	0.67
1:B:1:THR:N	7:B:606:HOH:O	2.29	0.64
1:A:388:HIS:HA	1:A:391:LYS:HD3	1.78	0.64
1:A:264:ALA:HB1	7:A:603:HOH:O	1.98	0.63
1:A:424:GLU:OE2	7:A:604:HOH:O	2.16	0.59
1:B:153[A]:ILE:HD11	3:B:501:HEM:CBB	2.33	0.58
1:B:370:ASP:O	1:B:378:ARG:NH2	2.37	0.56
1:B:148:LEU:HD21	1:B:413:VAL:HG21	1.88	0.55
1:A:148:LEU:HD21	1:A:413:VAL:HG21	1.90	0.54
1:B:296:ARG:NH2	7:B:613:HOH:O	2.40	0.53
1:A:97:LYS:NZ	7:A:622:HOH:O	2.41	0.52
3:A:501:HEM:HMC2	3:A:501:HEM:HBC2	1.93	0.50
1:B:80:ASP:OD2	7:B:602:HOH:O	2.19	0.50
1:B:267:GLU:CB	1:B:438[B]:THR:HG21	2.43	0.49
1:A:59:LYS:NZ	7:A:626:HOH:O	2.42	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:B:501:HEM:HBC2	3:B:501:HEM:HMC2	1.96	0.48
1:B:167:ARG:NH2	7:B:624:HOH:O	2.46	0.47
1:B:173:PHE:CE2	1:B:262:LEU:HD13	2.50	0.47
1:B:251:ASP:OD2	7:B:603:HOH:O	2.20	0.47
1:A:149:THR:HA	1:A:409:GLU:OE2	2.15	0.46
1:A:253:ASN:O	1:A:257:GLN:HG2	2.16	0.46
1:A:300:ASP:OD2	7:A:605:HOH:O	2.21	0.45
3:A:501:HEM:HBB2	3:A:501:HEM:HMB2	1.98	0.45
1:A:264:ALA:CB	7:A:603:HOH:O	2.62	0.44
1:A:367:TRP:HB2	1:A:371:VAL:HG12	1.99	0.44
1:A:186:ASN:OD1	7:A:607:HOH:O	2.21	0.44
1:A:366:ILE:HG21	1:A:389:ALA:HB1	2.01	0.43
1:A:26:VAL:HG22	2:D:2:PHE:HB3	2.01	0.42
3:B:501:HEM:HBB2	3:B:501:HEM:HMB2	2.01	0.42
1:A:277[B]:LEU:HD23	1:A:277[B]:LEU:HA	1.80	0.42
1:B:149:THR:HA	1:B:409:GLU:OE1	2.19	0.42
1:A:5:MET:HE3	1:A:5:MET:HB2	1.88	0.42
1:A:368:GLY:O	1:A:371:VAL:HG13	2.19	0.42
1:A:267:GLU:CB	1:A:438:THR:HG21	2.50	0.41
1:A:131:GLU:HB3	4:A:502:GOL:H2	2.02	0.41
1:B:253:ASN:O	1:B:257:GLN:HG2	2.21	0.41
1:A:419:LYS:O	1:A:451:LYS:HD2	2.21	0.41
1:A:120:VAL:HG11	1:A:302:VAL:HG13	2.03	0.41
1:A:185:MET:SD	1:A:436:THR:HA	2.61	0.40

All (8) 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)
7:A:1103:HOH:O	7:A:1175:HOH:O[4_445]	2.07	0.13
7:A:615:HOH:O	7:A:650:HOH:O[4_445]	2.14	0.06
7:B:671:HOH:O	7:B:977:HOH:O[4_555]	2.14	0.06
7:A:606:HOH:O	7:A:1100:HOH:O[1_655]	2.15	0.05
7:A:1144:HOH:O	7:A:1166:HOH:O[1_455]	2.16	0.04
7:B:1122:HOH:O	7:B:1156:HOH:O[1_455]	2.16	0.04
7:B:1109:HOH:O	7:B:1129:HOH:O[4_555]	2.17	0.03
7:A:898:HOH:O	7:A:1006:HOH:O[4_545]	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	459/455 (101%)	448 (98%)	11 (2%)	0	100	100
1	B	458/455 (101%)	446 (97%)	12 (3%)	0	100	100
All	All	917/910 (101%)	894 (98%)	23 (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	386/398 (97%)	385 (100%)	1 (0%)	86	83
1	B	384/398 (96%)	380 (99%)	4 (1%)	68	58
2	D	2/2 (100%)	2 (100%)	0	100	100
2	E	2/2 (100%)	2 (100%)	0	100	100
All	All	774/800 (97%)	769 (99%)	5 (1%)	81	72

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

Mol	Chain	Res	Type
1	A	148	LEU
1	B	110	GLN
1	B	153[A]	ILE
1	B	153[B]	ILE
1	B	230	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	70	ASN
1	A	204	GLN
1	A	359	GLN
1	B	70	ASN
1	B	110	GLN
1	B	201	ASN
1	B	204	GLN
1	B	403	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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)

Of 10 ligands modelled in this entry, 2 are 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	$\#\|Z\| > 2$
5	MOH	A	503	-	1,1,1	0.08	0	-		
5	MOH	A	507	-	1,1,1	0.07	0	-		
5	MOH	A	504	-	1,1,1	0.09	0	-		
5	MOH	A	506	-	1,1,1	0.16	0	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
4	GOL	A	502	-	5,5,5	0.85	0	5,5,5	1.05	0
5	MOH	A	505	-	1,1,1	0.06	0	-		
3	HEM	A	501	7,1	50,50,50	1.42	8 (16%)	66,82,82	1.29	6 (9%)
3	HEM	B	501	7,1	50,50,50	1.34	8 (16%)	66,82,82	1.18	5 (7%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	HEM	A	501	7,1	-	2/14/54/54	-
4	GOL	A	502	-	-	2/4/4/4	-
3	HEM	B	501	7,1	-	2/14/54/54	-

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	501	HEM	FE-NB	4.46	2.08	1.94
3	A	501	HEM	FE-ND	3.58	2.05	1.94
3	B	501	HEM	FE-NB	3.35	2.05	1.94
3	B	501	HEM	FE-ND	3.20	2.04	1.94
3	A	501	HEM	CAB-C3B	2.80	1.55	1.47
3	A	501	HEM	CAC-C3C	2.78	1.55	1.47
3	B	501	HEM	CAC-C3C	2.78	1.55	1.47
3	B	501	HEM	CAB-C3B	2.78	1.55	1.47
3	A	501	HEM	FE-NA	2.77	2.04	1.95
3	B	501	HEM	FE-NA	2.55	2.03	1.95
3	A	501	HEM	FE-NC	2.46	2.03	1.95
3	B	501	HEM	FE-NC	2.18	2.02	1.95
3	B	501	HEM	CMB-C2B	2.14	1.55	1.50
3	B	501	HEM	CMC-C2C	2.11	1.55	1.50
3	A	501	HEM	CMB-C2B	2.06	1.55	1.50
3	A	501	HEM	CMD-C2D	2.01	1.55	1.50

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	501	HEM	C1B-NB-C4B	3.79	108.99	105.07
3	A	501	HEM	C4C-NC-C1C	3.20	108.48	105.35
3	B	501	HEM	C1B-NB-C4B	2.94	108.11	105.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	501	HEM	C4A-NA-C1A	2.68	107.97	105.35
3	B	501	HEM	C4A-NA-C1A	2.60	107.89	105.35
3	A	501	HEM	C4D-ND-C1D	2.54	107.70	105.07
3	B	501	HEM	C4D-ND-C1D	2.53	107.69	105.07
3	B	501	HEM	C4C-NC-C1C	2.50	107.79	105.35
3	B	501	HEM	C2A-C1A-NA	-2.26	107.62	110.15
3	A	501	HEM	C2A-C1A-NA	-2.13	107.76	110.15
3	A	501	HEM	CHC-C1C-NC	2.05	126.65	124.44

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	502	GOL	C1-C2-C3-O3
4	A	502	GOL	O2-C2-C3-O3
3	A	501	HEM	CAA-CBA-CGA-O1A
3	B	501	HEM	CAA-CBA-CGA-O1A
3	A	501	HEM	CAA-CBA-CGA-O2A
3	B	501	HEM	CAA-CBA-CGA-O2A

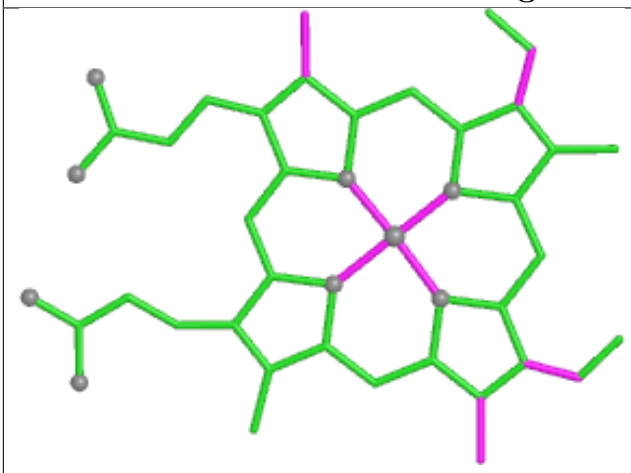
There are no ring outliers.

3 monomers are involved in 8 short contacts:

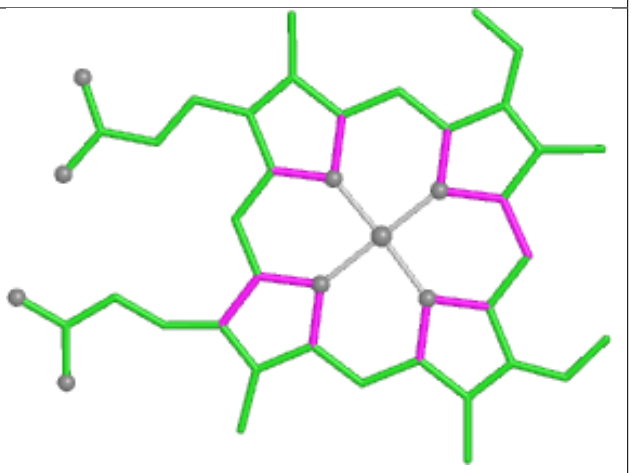
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	502	GOL	1	0
3	A	501	HEM	3	0
3	B	501	HEM	4	0

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.

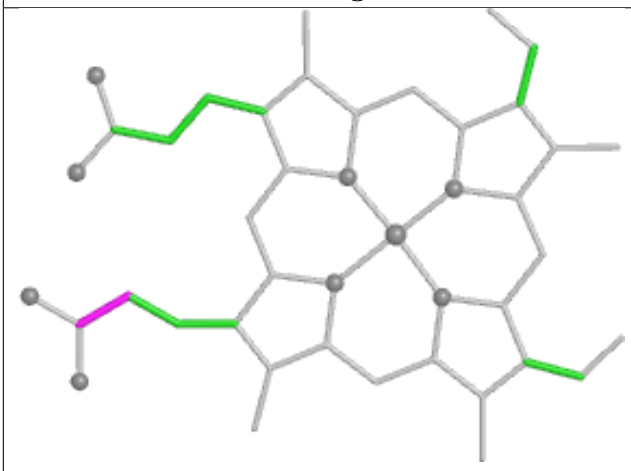
Ligand HEM A 501



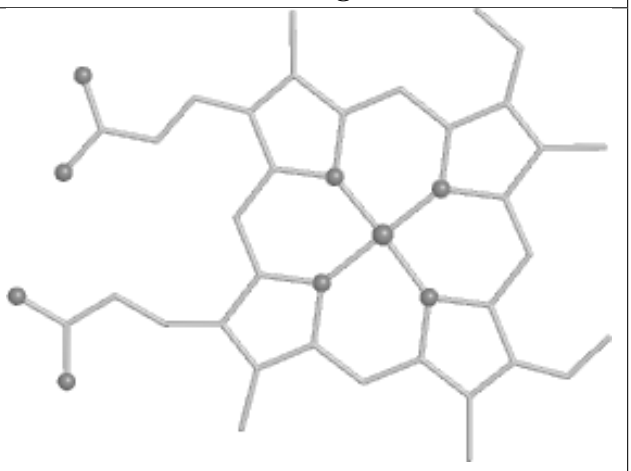
Bond lengths



Bond angles

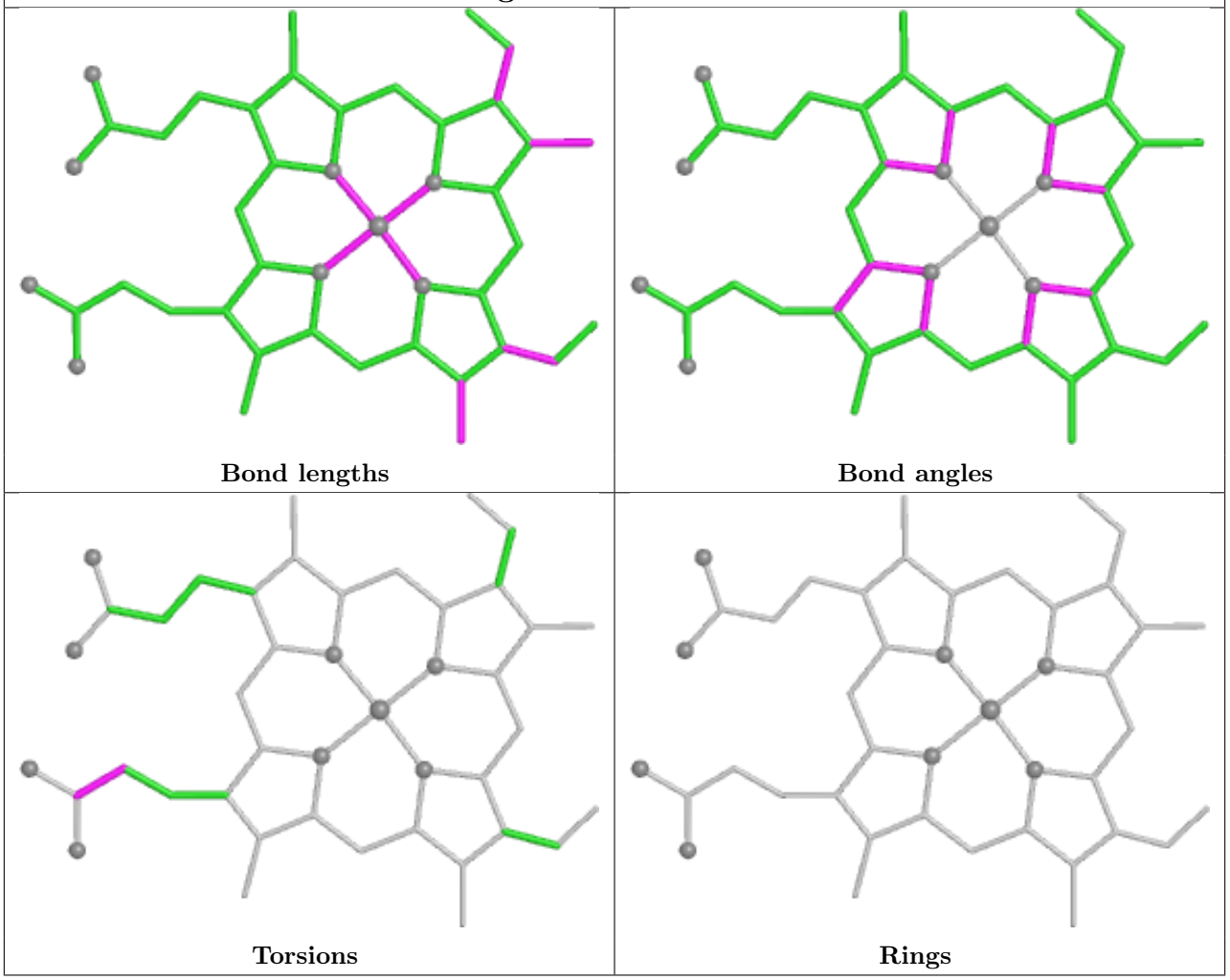


Torsions



Rings

Ligand HEM B 501



5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	A	455/455 (100%)	0.14	20 (4%) 39 42	7, 20, 36, 55	6 (1%)
1	B	455/455 (100%)	0.23	28 (6%) 26 29	8, 21, 40, 51	5 (1%)
2	D	2/3 (66%)	0.94	0 100 100	26, 26, 26, 27	0
2	E	2/3 (66%)	0.69	0 100 100	23, 23, 23, 24	0
All	All	914/916 (99%)	0.19	48 (5%) 32 35	7, 20, 39, 55	11 (1%)

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	136	ASP	6.7
1	B	264	ALA	4.1
1	B	1	THR	3.9
1	B	266	HIS	3.7
1	A	231	ASP	3.7
1	A	1	THR	3.5
1	B	196	PRO	3.5
1	B	136	ASP	3.4
1	A	2	ILE	3.2
1	A	268	THR	3.2
1	B	302	VAL	3.2
1	B	231	ASP	3.1
1	A	266	HIS	3.1
1	A	225	ALA	3.1
1	B	2	ILE	3.1
1	B	193	PRO	3.0
1	B	135	ALA	3.0
1	A	227	GLY	2.9
1	B	198	TYR	2.9
1	B	265	GLY	2.8
1	B	369	ASP	2.8

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Mol	Chain	Res	Type	RSRZ
1	B	23	ASP	2.7
1	A	168	ASP	2.7
1	B	194	ASP	2.7
1	B	192	ASN	2.7
1	B	153[A]	ILE	2.6
1	B	170	PRO	2.6
1	B	225	ALA	2.6
1	B	168	ASP	2.5
1	B	4	GLU	2.5
1	B	228	GLU	2.5
1	A	375[A]	ARG	2.4
1	B	197	ALA	2.4
1	A	369	ASP	2.4
1	A	135	ALA	2.3
1	B	245	THR	2.3
1	A	3	LYS	2.3
1	A	302	VAL	2.3
1	B	244	GLU	2.2
1	A	383	SER	2.2
1	B	167	ARG	2.1
1	A	167	ARG	2.1
1	B	195	ASP	2.1
1	A	454	PRO	2.1
1	A	169	GLN	2.0
1	A	370	ASP	2.0
1	B	169	GLN	2.0
1	A	384	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 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,

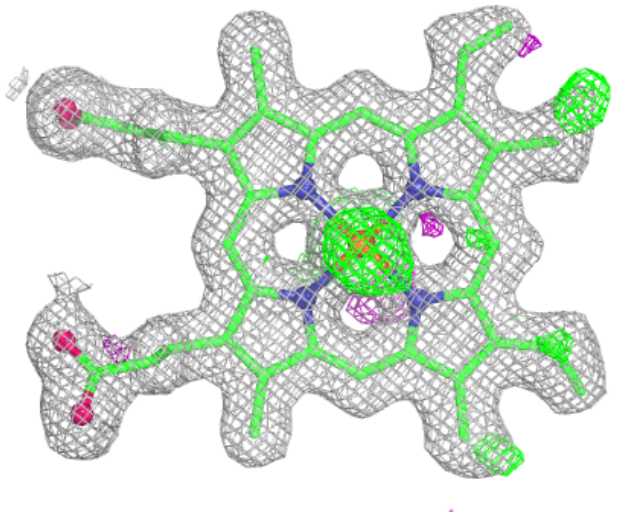
median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

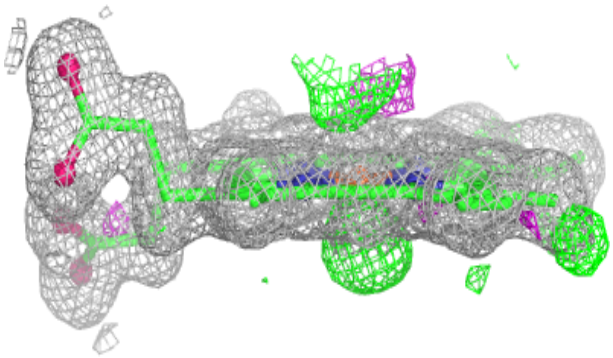
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	MOH	A	506	2/2	0.59	0.20	34,34,34,46	0
4	GOL	A	502	6/6	0.68	0.19	32,41,43,51	0
5	MOH	A	507	2/2	0.79	0.16	32,32,32,43	0
5	MOH	A	505	2/2	0.80	0.20	34,34,34,42	0
5	MOH	A	504	2/2	0.82	0.20	28,28,28,35	0
5	MOH	A	503	2/2	0.82	0.17	30,30,30,37	0
6	MG	A	508	1/1	0.97	0.09	30,30,30,30	0
6	MG	B	502	1/1	0.97	0.13	29,29,29,29	0
3	HEM	A	501	43/43	0.99	0.05	10,13,17,24	0
3	HEM	B	501	43/43	0.99	0.05	10,12,17,25	0

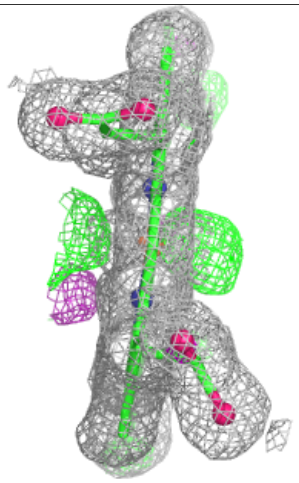
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around HEM A 501:

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

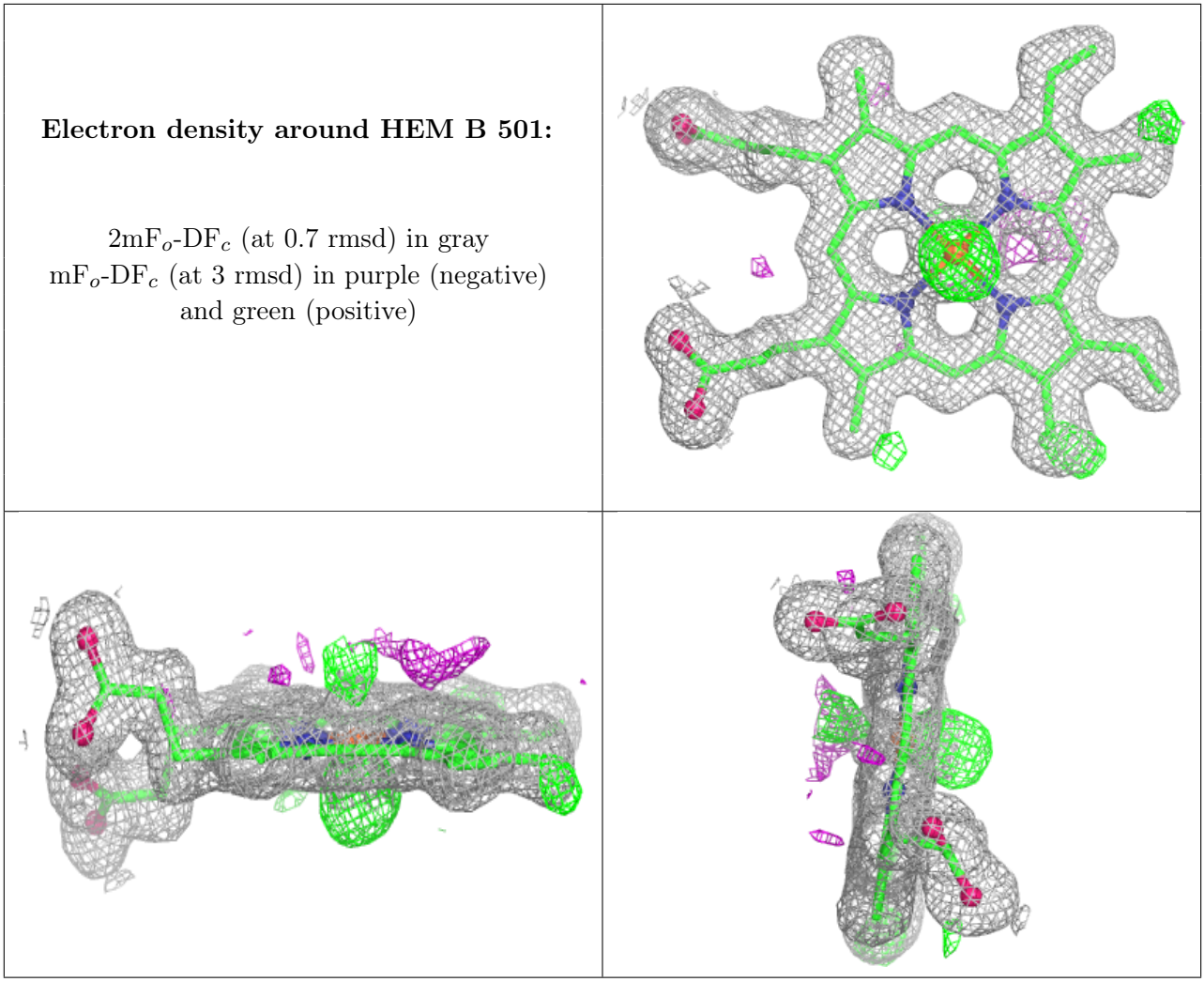






Electron density around HEM B 501:

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



6.5 Other polymers

There are no such residues in this entry.