



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:57 PM UTC

PDB ID : 4C50 / pdb_00004c50
Title : Crystal Structure of the Catalase-Peroxidase (KatG) D137S mutant from Mycobacterium Tuberculosis
Authors : Hersleth, H.-P.; Zhao, X.; Magliozzo, R.S.; Andersson, K.K.
Deposited on : 2013-09-10
Resolution : 2.50 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 Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
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	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

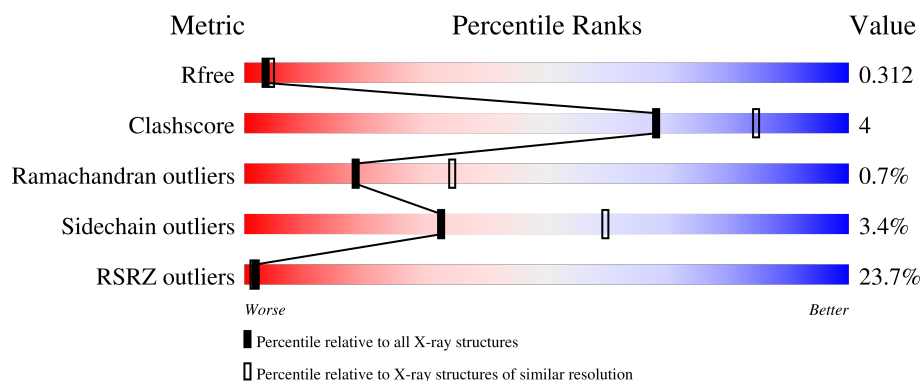
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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 $\leq 5\%$. 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	740	<div> <div>8%</div> <div>86%</div> <div>10%</div> <div>••</div> </div>
1	B	740	<div> <div>38%</div> <div>88%</div> <div>9%</div> <div>•</div> </div>

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 11241 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.

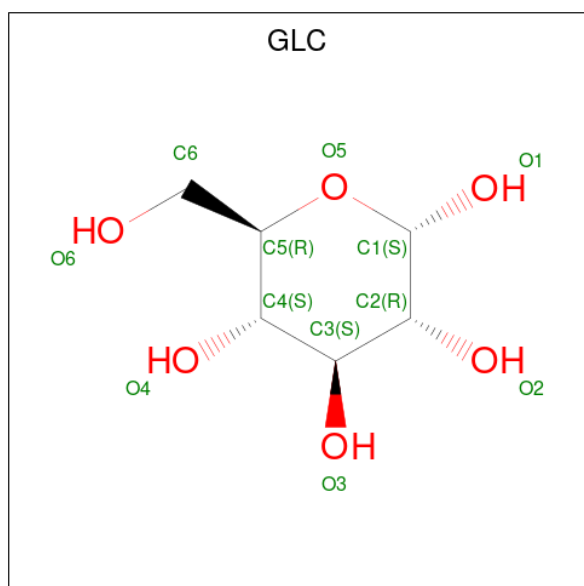
- Molecule 1 is a protein called CATALASE-PEROXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	716	Total	C	N	O	S	0	0	0
			5524	3512	952	1041	19			
1	B	716	Total	C	N	O	S	0	1	0
			5533	3517	953	1044	19			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	137	SER	ASP	engineered mutation	UNP Q08129
B	137	SER	ASP	engineered mutation	UNP Q08129

- Molecule 2 is alpha-D-glucopyranose (CCD ID: GLC) (formula: C₆H₁₂O₆).



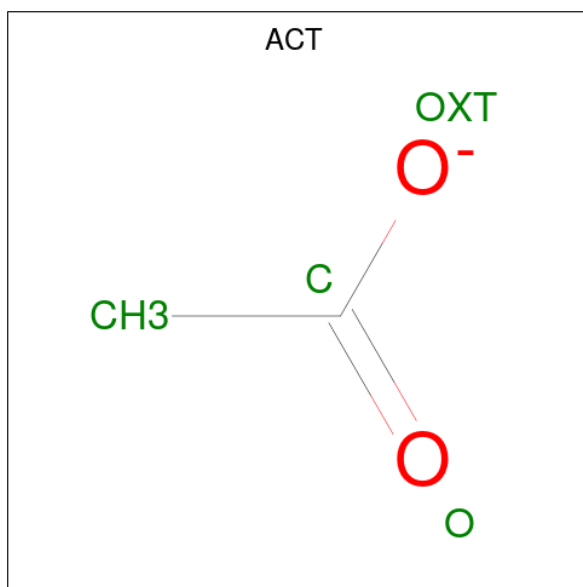
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			12	6	6		

- 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 43	C 34	Fe 1	N 4	O 4	0	0
3	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

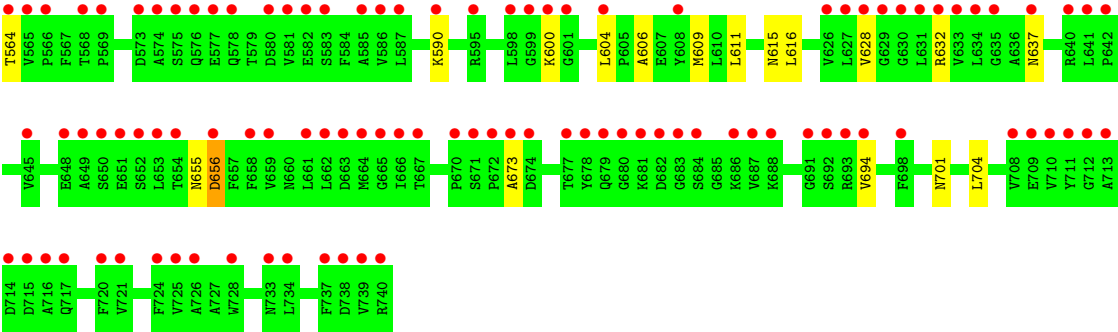
- Molecule 4 is ACETATE ION (CCD ID: ACT) (formula: $\text{C}_2\text{H}_3\text{O}_2$).



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

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	56	Total	O	0	0
			56	56		
5	B	26	Total	O	0	0
			26	26		



4 Data and refinement statistics

Property	Value	Source
Space group	P 42 21 2	Depositor
Cell constants a, b, c, α , β , γ	150.59Å 150.59Å 157.35Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	75.41 – 2.50 75.41 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.8 (75.41-2.50) 99.7 (75.41-2.50)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.71 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.264 , 0.311 0.267 , 0.312	Depositor DCC
R_{free} test set	3188 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	27.4	Xtriage
Anisotropy	0.047	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 27.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.019 for -h,l,k 0.013 for -l,-k,-h	Xtriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	11241	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.29% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: ACT, GLC, HEM

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	0.83	0/5675	0.92	3/7724 (0.0%)
1	B	0.75	0/5684	0.91	1/7736 (0.0%)
All	All	0.79	0/11359	0.92	4/15460 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	431	VAL	CB-CA-C	-6.10	104.19	110.71
1	A	93	ALA	N-CA-C	6.07	118.18	108.41
1	A	734	LEU	N-CA-C	5.63	118.14	111.33
1	B	440	ASP	CB-CA-C	-5.27	106.42	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	5524	0	5353	43	0
1	B	5533	0	5358	35	0
2	A	12	0	12	0	0
3	A	43	0	30	2	0
3	B	43	0	30	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	4	0	3	0	0
5	A	56	0	0	1	0
5	B	26	0	0	2	0
All	All	11241	0	10786	78	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 4.

All (78) 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:TRP:HH2	1:A:229:TYR:CE2	1.15	1.62
1:B:107:TRP:HH2	1:B:229:TYR:CE2	1.15	1.57
1:B:107:TRP:CH2	1:B:229:TYR:HE2	1.23	1.53
1:A:107:TRP:CH2	1:A:229:TYR:CE2	1.99	1.48
1:A:107:TRP:CH2	1:A:229:TYR:HE2	1.28	1.47
1:B:107:TRP:CH2	1:B:229:TYR:CE2	1.96	1.42
1:B:107:TRP:HH2	1:B:229:TYR:CD2	1.83	0.96
1:A:107:TRP:HH2	1:A:229:TYR:CD2	1.86	0.92
1:B:107:TRP:CZ3	1:B:229:TYR:HE2	1.88	0.91
1:A:107:TRP:CZ3	1:A:229:TYR:HE2	1.95	0.85
1:A:258:ASN:C	1:A:258:ASN:HD22	1.86	0.84
1:A:49:HIS:O	1:A:49:HIS:CD2	2.41	0.73
1:B:69:ALA:HB2	5:B:2003:HOH:O	1.88	0.72
1:B:107:TRP:CZ3	1:B:229:TYR:CE2	2.70	0.72
1:A:107:TRP:CZ3	1:A:229:TYR:CE2	2.74	0.70
1:A:49:HIS:O	1:A:49:HIS:HD2	1.75	0.69
1:B:258:ASN:C	1:B:258:ASN:HD22	2.04	0.66
1:B:107:TRP:CH2	1:B:229:TYR:CD2	2.68	0.63
1:A:107:TRP:CH2	1:A:229:TYR:CD2	2.71	0.62
1:A:701:ASN:HD22	1:A:704:LEU:H	1.49	0.61
1:B:45:LEU:HD23	1:B:611:LEU:HD21	1.84	0.59
1:A:318:GLU:H	1:A:352:GLN:HE22	1.51	0.58
1:A:45:LEU:HD23	1:A:611:LEU:HD21	1.87	0.57
1:B:275:THR:HG22	3:B:1741:HEM:HAA1	1.86	0.56
1:B:606:ALA:HB1	1:B:694:VAL:HG23	1.90	0.54
1:B:119:ARG:HH21	1:B:615:ASN:HD22	1.57	0.52
1:A:91:TRP:CE3	1:A:143:LYS:HD2	2.45	0.52
1:B:318:GLU:H	1:B:352:GLN:HE22	1.57	0.51
1:A:139:ALA:HA	1:A:300:TRP:CH2	2.45	0.51
1:A:139:ALA:HA	1:A:300:TRP:CZ3	2.46	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:116:HIS:CD2	1:A:219:PRO:HB3	2.46	0.50
1:B:345:LYS:HE2	1:B:351:TRP:CH2	2.46	0.49
1:B:91:TRP:CE3	1:B:143:LYS:HD2	2.48	0.49
1:A:119:ARG:HH21	1:A:615:ASN:HD22	1.61	0.49
1:A:650:SER:O	1:A:651:GLU:C	2.56	0.48
1:B:45:LEU:CD2	1:B:611:LEU:HD21	2.43	0.48
1:B:49:HIS:O	1:B:49:HIS:CD2	2.67	0.48
1:B:105:MET:HE1	1:B:148:LEU:HD11	1.95	0.48
1:A:45:LEU:CD2	1:A:611:LEU:HD21	2.44	0.47
1:A:259:ASP:HA	5:A:2023:HOH:O	2.14	0.47
1:A:107:TRP:CD1	1:A:108:HIS:HD2	2.33	0.47
1:B:604:LEU:HB2	1:B:609:MET:HE3	1.96	0.47
1:B:258:ASN:C	1:B:258:ASN:ND2	2.73	0.46
1:A:606:ALA:HB1	1:A:694:VAL:HG23	1.96	0.46
1:B:655:ASN:O	1:B:656:ASP:C	2.59	0.46
1:A:105:MET:HE1	1:A:148:LEU:HD11	1.97	0.45
1:B:95:TYR:CE1	1:B:367:PRO:HA	2.51	0.45
1:A:239:PRO:O	1:A:241:PRO:HD3	2.16	0.45
1:B:107:TRP:CD1	1:B:108:HIS:HD2	2.35	0.45
1:B:701:ASN:HD22	1:B:704:LEU:H	1.64	0.45
1:A:378:LEU:HB2	1:A:381:ASP:OD2	2.17	0.45
1:A:505:TRP:O	1:A:506:GLU:C	2.59	0.45
1:B:116:HIS:CD2	1:B:219:PRO:HB3	2.52	0.45
1:B:511:ASP:C	1:B:512:GLY:O	2.60	0.44
1:B:275:THR:HG1	1:B:319:VAL:H	1.63	0.44
1:A:604:LEU:HB2	1:A:609:MET:HE3	2.00	0.43
1:A:666:ILE:HA	1:A:681:LYS:O	2.18	0.43
1:A:39:TRP:HB2	1:A:42:ARG:HD2	2.01	0.43
1:A:95:TYR:CE1	1:A:367:PRO:HA	2.53	0.43
1:A:345:LYS:HE2	1:A:351:TRP:CH2	2.53	0.43
1:B:616:LEU:HD23	1:B:616:LEU:HA	1.86	0.42
1:A:100:PRO:HB2	3:A:1741:HEM:O2D	2.18	0.42
1:B:317:ILE:HG23	1:B:352:GLN:HE21	1.84	0.42
1:A:646:PHE:O	1:A:656:ASP:HB3	2.21	0.41
1:A:56:ASP:OD1	1:A:56:ASP:C	2.63	0.41
1:A:672:PRO:O	1:A:674:ASP:N	2.53	0.41
1:B:637:ASN:CG	5:B:2026:HOH:O	2.63	0.41
1:A:275:THR:OG1	1:A:317:ILE:O	2.35	0.41
1:A:314:THR:HB	3:A:1741:HEM:O1A	2.21	0.41
1:A:658:PHE:HD1	1:A:708:VAL:HG13	1.86	0.41
1:B:67:GLU:HB3	1:B:158:LYS:HA	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:317:ILE:HG23	1:A:352:GLN:HE21	1.85	0.41
1:A:616:LEU:HD23	1:A:616:LEU:HA	1.83	0.41
1:B:95:TYR:CD1	1:B:367:PRO:HA	2.56	0.41
1:B:167:PHE:CE2	1:B:171:CYS:SG	3.14	0.40
1:B:628:VAL:O	1:B:632:ARG:HG2	2.21	0.40
1:A:511:ASP:C	1:A:512:GLY:O	2.65	0.40
1:A:93:ALA:O	1:A:94:ASP:C	2.65	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	714/740 (96%)	677 (95%)	32 (4%)	5 (1%)	18	34
1	B	715/740 (97%)	673 (94%)	37 (5%)	5 (1%)	18	34
All	All	1429/1480 (97%)	1350 (94%)	69 (5%)	10 (1%)	18	34

All (10) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	512	GLY
1	A	673	ALA
1	B	512	GLY
1	B	513	ASP
1	B	673	ALA
1	A	513	ASP
1	A	514	LEU
1	B	656	ASP
1	A	370	GLY
1	B	514	LEU

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	565/584 (97%)	547 (97%)	18 (3%)	34	62
1	B	566/584 (97%)	545 (96%)	21 (4%)	30	57
All	All	1131/1168 (97%)	1092 (97%)	39 (3%)	32	60

All (39) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	GLU
1	A	175	SER
1	A	179	LYS
1	A	195	GLU
1	A	218	ASN
1	A	258	ASN
1	A	310	LYS
1	A	327	LYS
1	A	330	ASN
1	A	373	ARG
1	A	376	THR
1	A	378	LEU
1	A	433	LYS
1	A	526	GLU
1	A	554	LYS
1	A	562	ASN
1	A	564	THR
1	A	600	LYS
1	B	81[A]	GLU
1	B	81[B]	GLU
1	B	82	GLU
1	B	175	SER
1	B	179	LYS
1	B	195	GLU
1	B	218	ASN
1	B	258	ASN
1	B	310	LYS

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Mol	Chain	Res	Type
1	B	327	LYS
1	B	330	ASN
1	B	373	ARG
1	B	376	THR
1	B	378	LEU
1	B	433	LYS
1	B	526	GLU
1	B	554	LYS
1	B	562	ASN
1	B	564	THR
1	B	590	LYS
1	B	600	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (32) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	25	HIS
1	A	41	ASN
1	A	49	HIS
1	A	51	ASN
1	A	116	HIS
1	A	190	GLN
1	A	218	ASN
1	A	236	ASN
1	A	258	ASN
1	A	295	GLN
1	A	330	ASN
1	A	352	GLN
1	A	447	HIS
1	A	535	ASN
1	A	615	ASN
1	A	701	ASN
1	B	36	GLN
1	B	41	ASN
1	B	49	HIS
1	B	51	ASN
1	B	116	HIS
1	B	190	GLN
1	B	218	ASN
1	B	236	ASN
1	B	258	ASN
1	B	295	GLN

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Mol	Chain	Res	Type
1	B	330	ASN
1	B	352	GLN
1	B	461	GLN
1	B	615	ASN
1	B	701	ASN
1	B	717	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](#)

4 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	$\# Z > 2$
3	HEM	A	1741	1,5	50,50,50	2.17	14 (28%)	67,82,82	1.72	13 (19%)
3	HEM	B	1741	1	50,50,50	2.11	10 (20%)	67,82,82	1.66	15 (22%)
4	ACT	A	1743	-	3,3,3	0.96	0	3,3,3	0.45	0
2	GLC	A	1742	-	12,12,12	0.92	0	17,17,17	2.24	7 (41%)

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	1741	1,5	-	2/14/54/54	-
3	HEM	B	1741	1	-	4/14/54/54	-
2	GLC	A	1742	-	-	0/2/22/22	0/1/1/1

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1741	HEM	FE-ND	8.01	2.19	1.94
3	A	1741	HEM	FE-ND	7.49	2.18	1.94
3	B	1741	HEM	C3D-C2D	7.04	1.51	1.36
3	A	1741	HEM	C3D-C2D	6.50	1.50	1.36
3	B	1741	HEM	FE-NA	4.60	2.10	1.95
3	A	1741	HEM	FE-NA	-4.54	1.80	1.95
3	B	1741	HEM	FE-NC	-3.77	1.82	1.95
3	A	1741	HEM	FE-NC	-3.58	1.83	1.95
3	B	1741	HEM	FE-NB	3.25	2.04	1.94
3	A	1741	HEM	CHC-C4B	-2.94	1.32	1.39
3	A	1741	HEM	CAB-C3B	2.82	1.54	1.47
3	B	1741	HEM	CAB-C3B	2.78	1.54	1.47
3	A	1741	HEM	C2A-C3A	-2.77	1.31	1.38
3	A	1741	HEM	C1B-NB	-2.76	1.35	1.40
3	A	1741	HEM	C3B-C2B	-2.63	1.31	1.37
3	A	1741	HEM	CMC-C2C	2.58	1.56	1.50
3	B	1741	HEM	CMB-C2B	2.55	1.56	1.50
3	A	1741	HEM	CHA-C4D	-2.55	1.33	1.38
3	B	1741	HEM	CAC-C3C	2.50	1.54	1.47
3	B	1741	HEM	C2A-C3A	-2.31	1.32	1.38
3	A	1741	HEM	CHB-C1B	-2.28	1.33	1.38
3	A	1741	HEM	FE-NB	2.23	2.01	1.94
3	A	1741	HEM	CAC-C3C	2.15	1.53	1.47
3	B	1741	HEM	CMC-C2C	2.04	1.54	1.50

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1741	HEM	C4D-ND-C1D	5.22	111.39	105.21
3	A	1741	HEM	CAA-CBA-CGA	-4.46	101.84	113.67
3	B	1741	HEM	CHD-C4C-NC	4.32	129.16	124.45
3	A	1741	HEM	CAD-C3D-C4D	4.25	132.11	124.70
3	A	1741	HEM	CHC-C1C-NC	4.13	128.95	124.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1742	GLC	O2-C2-C1	4.03	118.54	109.25
3	A	1741	HEM	C3B-C4B-NB	3.79	112.19	109.47
2	A	1742	GLC	O3-C3-C2	-3.71	101.62	110.38
2	A	1742	GLC	O6-C6-C5	3.67	123.82	111.33
3	A	1741	HEM	CHA-C1A-NA	3.65	130.47	123.86
2	A	1742	GLC	O5-C5-C6	3.62	115.41	106.44
3	B	1741	HEM	CHC-C1C-NC	3.46	128.22	124.45
3	A	1741	HEM	C4D-ND-C1D	3.43	109.26	105.21
2	A	1742	GLC	O5-C1-C2	3.23	115.97	110.30
3	B	1741	HEM	C1C-CHC-C4B	-3.10	119.44	126.02
3	B	1741	HEM	CAD-C3D-C4D	3.07	130.04	124.70
3	B	1741	HEM	C4C-C3C-C2C	3.00	109.42	106.81
3	B	1741	HEM	CAA-CBA-CGA	-2.93	105.90	113.67
3	A	1741	HEM	CHC-C1C-C2C	-2.91	119.44	125.49
2	A	1742	GLC	C3-C4-C5	2.82	115.35	110.23
3	A	1741	HEM	CHB-C4A-NA	2.70	128.75	123.86
3	B	1741	HEM	CHB-C4A-NA	2.66	128.68	123.86
3	A	1741	HEM	CMD-C2D-C1D	2.64	129.17	125.03
3	B	1741	HEM	C3B-C4B-NB	2.64	111.37	109.47
3	A	1741	HEM	CHA-C1A-C2A	-2.35	120.16	125.30
3	A	1741	HEM	C4D-C3D-C2D	-2.29	103.56	106.89
2	A	1742	GLC	O3-C3-C4	2.28	115.74	110.38
3	B	1741	HEM	CHD-C1D-ND	2.26	126.86	124.42
3	A	1741	HEM	CHB-C1B-NB	-2.22	121.62	124.37
3	B	1741	HEM	CAA-C2A-C1A	2.22	129.27	124.94
3	B	1741	HEM	O1D-CGD-CBD	-2.20	116.12	123.09
3	B	1741	HEM	CHC-C4B-NB	-2.17	122.09	124.42
3	A	1741	HEM	C4A-CHB-C1B	-2.17	121.15	126.25
3	B	1741	HEM	C4D-C3D-C2D	-2.11	103.81	106.89
3	B	1741	HEM	O2D-CGD-CBD	2.10	120.63	114.00

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	1741	HEM	C2C-C3C-CAC-CBC
3	B	1741	HEM	C4C-C3C-CAC-CBC
3	A	1741	HEM	CAA-CBA-CGA-O2A
3	A	1741	HEM	CAA-CBA-CGA-O1A
3	B	1741	HEM	C4B-C3B-CAB-CBB
3	B	1741	HEM	C2B-C3B-CAB-CBB

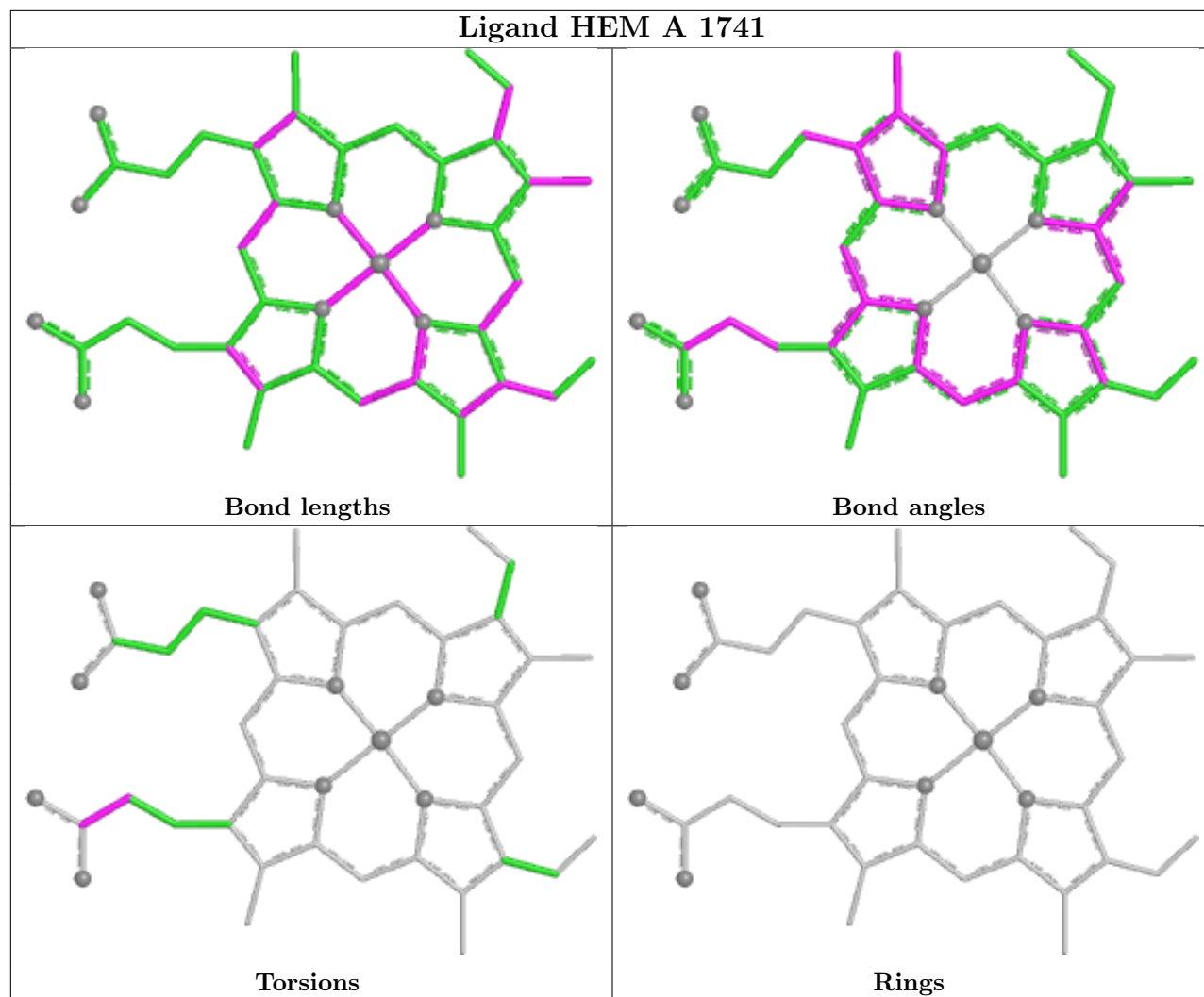
There are no ring outliers.

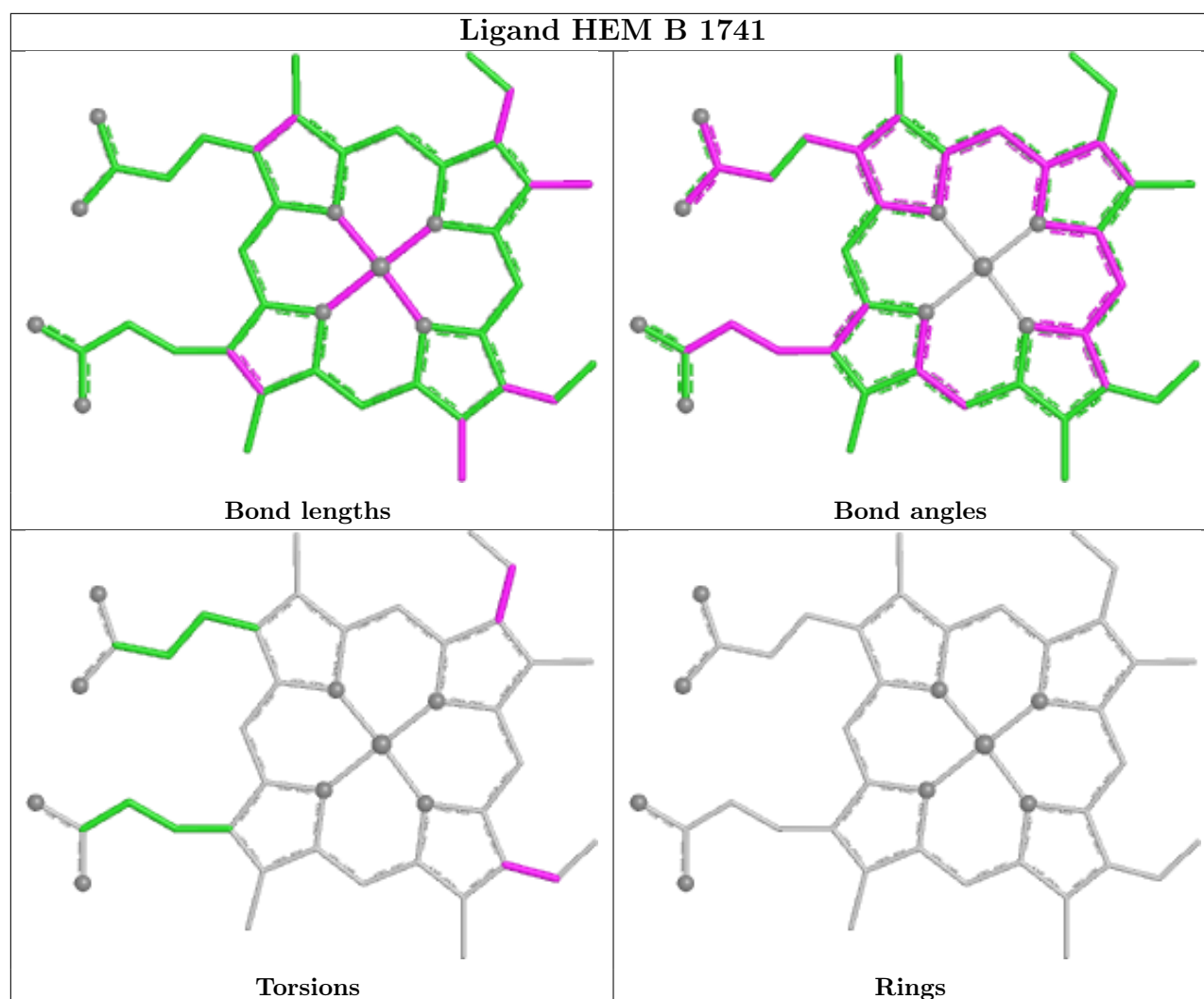
2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1741	HEM	2	0
3	B	1741	HEM	1	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 than 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.

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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, 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	716/740 (96%)	0.58	59 (8%) 17 15	9, 25, 48, 82	0
1	B	716/740 (96%)	1.84	280 (39%) 1 0	10, 39, 75, 129	1 (0%)
All	All	1432/1480 (96%)	1.21	339 (23%) 2 1	9, 31, 67, 129	1 (0%)

All (339) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	455	ILE	7.8
1	A	510	PRO	7.5
1	B	533	PRO	7.2
1	B	514	LEU	7.1
1	B	535	ASN	6.7
1	B	541	ALA	6.6
1	B	466	GLY	6.5
1	B	534	GLY	6.5
1	B	581	VAL	6.3
1	B	467	LEU	6.2
1	B	524	ILE	6.1
1	B	563	ILE	6.1
1	B	550	ALA	6.1
1	B	503	VAL	5.9
1	B	654	THR	5.9
1	B	462	ILE	5.8
1	B	458	LEU	5.8
1	B	528	PHE	5.7
1	B	510	PRO	5.7
1	A	399	GLU	5.7
1	B	517	VAL	5.6
1	B	538	VAL	5.6
1	B	472	LEU	5.6
1	B	459	LYS	5.6

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Mol	Chain	Res	Type	RSRZ
1	B	508	ASN	5.6
1	A	511	ASP	5.4
1	B	494	GLY	5.4
1	B	473	VAL	5.3
1	B	536	ILE	5.3
1	B	561	HIS	5.3
1	B	683	GLY	5.2
1	B	497	ILE	5.1
1	B	505	TRP	5.0
1	B	507	VAL	5.0
1	B	532	ALA	4.9
1	B	738	ASP	4.9
1	B	213	LYS	4.9
1	B	498	ARG	4.9
1	B	540	PHE	4.9
1	B	469	VAL	4.8
1	B	520	THR	4.8
1	B	474	SER	4.8
1	B	629	GLY	4.8
1	B	558	ALA	4.8
1	B	633	VAL	4.7
1	B	452	GLU	4.7
1	B	499	LEU	4.7
1	B	521	LEU	4.7
1	B	518	ILE	4.6
1	B	537	LYS	4.6
1	B	527	SER	4.6
1	B	511	ASP	4.6
1	B	464	ALA	4.5
1	B	555	ALA	4.5
1	B	557	LYS	4.5
1	B	539	SER	4.5
1	B	529	ASN	4.4
1	B	551	ALA	4.4
1	B	554	LYS	4.4
1	B	574	ALA	4.4
1	B	212	GLY	4.4
1	B	447	HIS	4.4
1	A	310	LYS	4.3
1	B	564	THR	4.3
1	B	475	THR	4.2
1	B	445	VAL	4.2

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Mol	Chain	Res	Type	RSRZ
1	B	449	LEU	4.2
1	B	653	LEU	4.2
1	B	453	ALA	4.2
1	B	595	ARG	4.2
1	B	526	GLU	4.2
1	B	519	ARG	4.2
1	B	358	GLY	4.2
1	B	350	ALA	4.2
1	B	359	ALA	4.2
1	B	673	ALA	4.1
1	B	210	TYR	4.1
1	B	468	THR	4.1
1	B	530	SER	4.1
1	B	504	GLY	4.0
1	A	297	GLY	4.0
1	B	544	VAL	4.0
1	A	69	ALA	4.0
1	B	652	SER	4.0
1	B	543	LEU	4.0
1	B	598	LEU	4.0
1	B	450	VAL	3.9
1	A	179	LYS	3.9
1	B	506	GLU	3.9
1	B	716	ALA	3.9
1	A	25	HIS	3.9
1	B	516	LYS	3.9
1	B	388	PRO	3.9
1	B	454	GLU	3.9
1	B	456	ALA	3.9
1	B	463	ARG	3.9
1	B	721	VAL	3.9
1	B	515	ARG	3.8
1	B	423	VAL	3.8
1	B	470	SER	3.8
1	B	549	CYS	3.8
1	A	90	TRP	3.8
1	B	500	GLN	3.8
1	B	476	ALA	3.7
1	B	546	LEU	3.7
1	A	673	ALA	3.7
1	B	649	ALA	3.7
1	A	434	GLN	3.7

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Mol	Chain	Res	Type	RSRZ
1	B	740	ARG	3.7
1	A	213	LYS	3.6
1	B	392	ARG	3.6
1	B	637	ASN	3.6
1	B	523	GLU	3.6
1	B	216	LEU	3.6
1	B	525	GLN	3.6
1	A	563	ILE	3.6
1	B	465	SER	3.6
1	B	642	PRO	3.6
1	B	737	PHE	3.6
1	A	147	LEU	3.5
1	B	585	ALA	3.5
1	B	576	GLN	3.5
1	B	491	GLY	3.5
1	B	495	GLY	3.5
1	B	711	TYR	3.5
1	B	211	SER	3.5
1	B	562	ASN	3.4
1	B	687	VAL	3.4
1	B	634	LEU	3.4
1	B	559	ALA	3.4
1	B	513	ASP	3.4
1	B	457	SER	3.4
1	B	451	GLY	3.4
1	B	547	GLY	3.3
1	B	446	SER	3.3
1	B	575	SER	3.3
1	A	97	HIS	3.3
1	B	206	GLY	3.3
1	A	28	TYR	3.3
1	B	632	ARG	3.3
1	B	650	SER	3.3
1	B	235	PRO	3.3
1	B	471	GLN	3.2
1	B	715	ASP	3.2
1	A	149	TRP	3.2
1	B	556	ALA	3.2
1	A	512	GLY	3.2
1	B	553	GLU	3.2
1	B	565	VAL	3.2
1	B	260	VAL	3.1

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Mol	Chain	Res	Type	RSRZ
1	B	545	VAL	3.1
1	A	70	THR	3.1
1	B	254	ARG	3.1
1	A	327	LYS	3.1
1	B	215	ASP	3.1
1	B	343	LEU	3.1
1	B	684	SER	3.1
1	B	386	VAL	3.1
1	B	502	GLN	3.1
1	B	341	TRP	3.1
1	B	493	ASN	3.1
1	B	560	GLY	3.1
1	B	628	VAL	3.1
1	B	710	VAL	3.1
1	A	36	GLN	3.0
1	B	734	LEU	3.0
1	B	357	ASP	3.0
1	B	448	ASP	3.0
1	B	531	ALA	3.0
1	B	651	GLU	3.0
1	B	209	ARG	3.0
1	B	218	ASN	3.0
1	B	717	GLN	3.0
1	A	533	PRO	3.0
1	B	492	ALA	3.0
1	B	587	LEU	3.0
1	B	327	LYS	3.0
1	A	368	PHE	3.0
1	B	641	LEU	2.9
1	A	369	GLY	2.9
1	A	66	ALA	2.9
1	B	437	LEU	2.9
1	B	608	TYR	2.9
1	B	645	VAL	2.9
1	B	461	GLN	2.9
1	B	648	GLU	2.9
1	B	671	SER	2.8
1	B	627	LEU	2.8
1	B	663	ASP	2.8
1	B	582	GLU	2.8
1	A	157	LYS	2.8
1	B	635	GLY	2.8

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Mol	Chain	Res	Type	RSRZ
1	B	219	PRO	2.8
1	B	501	PRO	2.8
1	B	678	TYR	2.8
1	B	667	THR	2.8
1	B	395	ARG	2.8
1	B	693	ARG	2.8
1	B	714	ASP	2.8
1	B	460	SER	2.8
1	B	246	VAL	2.8
1	B	604	LEU	2.8
1	B	631	LEU	2.7
1	B	577	GLU	2.7
1	B	542	ASP	2.7
1	A	73	VAL	2.7
1	B	242	MET	2.7
1	B	116	HIS	2.7
1	A	509	ASP	2.7
1	A	83	VAL	2.7
1	B	522	GLU	2.7
1	B	580	ASP	2.7
1	B	658	PHE	2.7
1	B	442	VAL	2.7
1	B	243	ALA	2.7
1	A	153	LYS	2.6
1	B	686	LYS	2.6
1	B	698	PHE	2.6
1	B	496	ARG	2.6
1	B	220	LEU	2.6
1	B	221	ALA	2.6
1	B	512	GLY	2.6
1	B	566	PRO	2.6
1	B	236	ASN	2.6
1	B	739	VAL	2.6
1	B	478	ALA	2.6
1	B	353	TYR	2.6
1	B	548	GLY	2.6
1	B	682	ASP	2.6
1	B	712	GLY	2.6
1	B	640	ARG	2.6
1	B	659	VAL	2.6
1	B	692	SER	2.6
1	A	306	THR	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	232	PRO	2.6
1	B	379	ALA	2.6
1	B	479	ALA	2.6
1	B	370	GLY	2.5
1	B	586	VAL	2.5
1	B	362	GLY	2.5
1	B	728	TRP	2.5
1	B	583	SER	2.5
1	B	664	MET	2.5
1	B	630	GLY	2.5
1	B	509	ASP	2.5
1	A	68	VAL	2.5
1	B	626	VAL	2.5
1	B	670	PRO	2.5
1	A	72	ASP	2.5
1	B	713	ALA	2.5
1	B	443	PRO	2.4
1	A	31	GLU	2.4
1	A	683	GLY	2.4
1	B	601	GLY	2.4
1	B	310	LYS	2.4
1	B	433	LYS	2.4
1	B	590	LYS	2.4
1	A	62	PHE	2.4
1	A	125	GLY	2.4
1	A	370	GLY	2.4
1	B	282	ASP	2.4
1	B	578	GLN	2.4
1	B	231	ASN	2.4
1	B	694	VAL	2.4
1	A	109	ALA	2.4
1	B	348	ALA	2.4
1	B	438	TRP	2.4
1	B	688	LYS	2.4
1	B	666	ILE	2.4
1	B	661	LEU	2.4
1	B	197	TYR	2.4
1	B	477	TRP	2.4
1	B	214	ARG	2.3
1	B	674	ASP	2.3
1	B	234	GLY	2.3
1	A	26	MET	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	600	LYS	2.3
1	A	93	ALA	2.3
1	A	150	PRO	2.3
1	B	672	PRO	2.3
1	B	665	GLY	2.3
1	B	679	GLN	2.3
1	B	259	ASP	2.3
1	B	681	LYS	2.3
1	B	480	ALA	2.3
1	B	726	ALA	2.3
1	B	599	GLY	2.3
1	B	364	ILE	2.3
1	B	662	LEU	2.3
1	B	36	GLN	2.2
1	B	552	ILE	2.2
1	B	573	ASP	2.2
1	B	656	ASP	2.2
1	B	725	VAL	2.2
1	B	361	ALA	2.2
1	B	444	ALA	2.2
1	B	394	THR	2.2
1	B	389	ILE	2.2
1	A	155	TYR	2.2
1	B	203	THR	2.2
1	A	293	LEU	2.2
1	B	247	ASP	2.2
1	B	733	ASN	2.2
1	A	371	PRO	2.2
1	B	198	TRP	2.2
1	B	708	VAL	2.1
1	B	677	THR	2.1
1	A	64	TYR	2.1
1	A	284	VAL	2.1
1	B	281	ALA	2.1
1	B	680	GLY	2.1
1	A	82	GLU	2.1
1	A	433	LYS	2.1
1	B	46	LYS	2.1
1	B	200	LYS	2.1
1	B	244	ALA	2.1
1	B	691	GLY	2.1
1	B	115	ILE	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	393	ILE	2.1
1	A	154	LYS	2.1
1	A	557	LYS	2.1
1	B	371	PRO	2.1
1	B	245	ALA	2.1
1	A	96	GLY	2.1
1	A	309	GLY	2.1
1	B	568	THR	2.1
1	A	71	ILE	2.1
1	B	179	LYS	2.1
1	B	315	SER	2.1
1	B	569	PRO	2.1
1	B	720	PHE	2.0
1	B	724	PHE	2.0
1	B	223	VAL	2.0
1	A	75	ALA	2.0
1	A	283	LEU	2.0
1	A	402	GLU	2.0
1	B	709	GLU	2.0
1	A	95	TYR	2.0
1	A	561	HIS	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, 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(\AA^2)	Q<0.9
2	GLC	A	1742	12/12	0.73	0.20	29,44,48,57	0
4	ACT	A	1743	4/4	0.78	0.17	23,23,24,25	0

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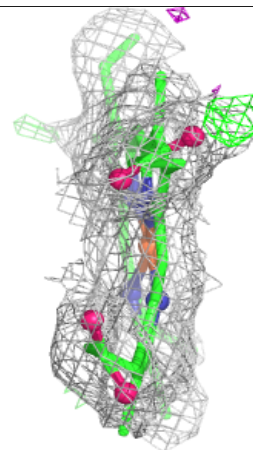
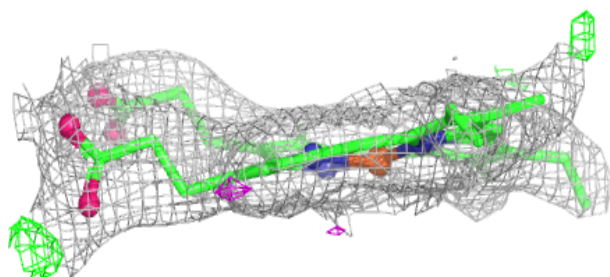
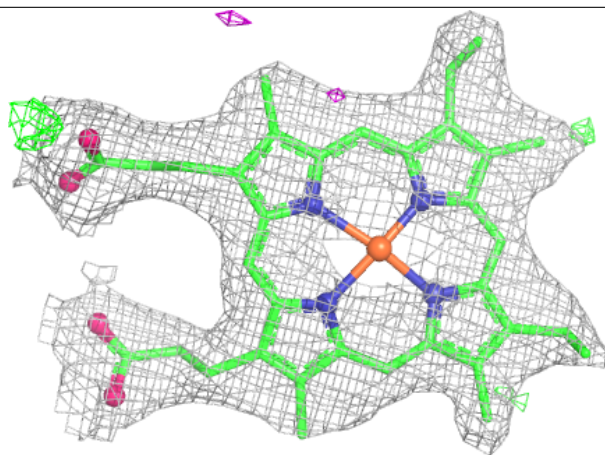
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	HEM	B	1741	43/43	0.95	0.10	19,28,34,35	0
3	HEM	A	1741	43/43	0.95	0.09	19,21,29,36	0

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.

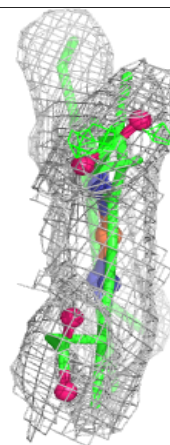
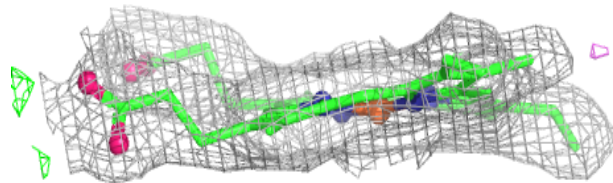
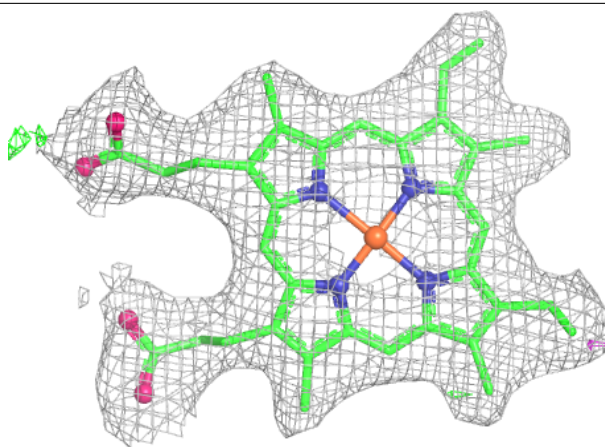
Electron density around HEM B 1741:

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 1741:

$2mF_o - DF_c$ (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.