Full wwPDB X-ray Structure Validation Report ⓘ

Nov 17, 2026 – 02:54 AM JST

PDB ID	:	27JN / pdb_000027jn
Title	:	Crystal structure of the CYP199A4 mutant V206Y-D251Q-T252E in complex with 4-methoxybenzoic acid
Authors	:	Qin, M.M.; Wang, Z.H.; Jiang, Y.; Cong, Z.
Deposited on	:	2026-06-03
Resolution	:	2.73 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:

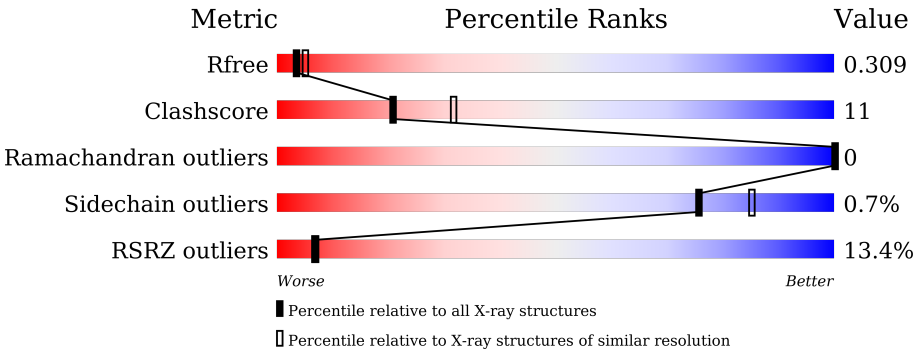
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
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 2.73 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	1819 (2.76-2.72)
Clashscore	190562	1866 (2.76-2.72)
Ramachandran outliers	187476	1830 (2.76-2.72)
Sidechain outliers	187428	1831 (2.76-2.72)
RSRZ outliers	180081	1819 (2.76-2.72)

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	420	9% 70% 23% 6%
1	B	420	16% 71% 22% 7%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 6176 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 Cytochrome P450.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	393	Total	C	N	O	S	0	3	0
			3017	1911	531	563	12			
1	B	390	Total	C	N	O	S	0	4	0
			2978	1887	524	555	12			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	initiating methionine	UNP Q2IU02
A	-1	GLY	-	expression tag	UNP Q2IU02
A	206	TYR	VAL	engineered mutation	UNP Q2IU02
A	251	GLN	ASP	engineered mutation	UNP Q2IU02
A	252	GLU	THR	engineered mutation	UNP Q2IU02
A	410	LEU	-	expression tag	UNP Q2IU02
A	411	GLU	-	expression tag	UNP Q2IU02
A	412	HIS	-	expression tag	UNP Q2IU02
A	413	HIS	-	expression tag	UNP Q2IU02
A	414	HIS	-	expression tag	UNP Q2IU02
A	415	HIS	-	expression tag	UNP Q2IU02
A	416	HIS	-	expression tag	UNP Q2IU02
A	417	HIS	-	expression tag	UNP Q2IU02
B	-2	MET	-	initiating methionine	UNP Q2IU02
B	-1	GLY	-	expression tag	UNP Q2IU02
B	206	TYR	VAL	engineered mutation	UNP Q2IU02
B	251	GLN	ASP	engineered mutation	UNP Q2IU02
B	252	GLU	THR	engineered mutation	UNP Q2IU02
B	410	LEU	-	expression tag	UNP Q2IU02
B	411	GLU	-	expression tag	UNP Q2IU02
B	412	HIS	-	expression tag	UNP Q2IU02
B	413	HIS	-	expression tag	UNP Q2IU02
B	414	HIS	-	expression tag	UNP Q2IU02
B	415	HIS	-	expression tag	UNP Q2IU02
B	416	HIS	-	expression tag	UNP Q2IU02

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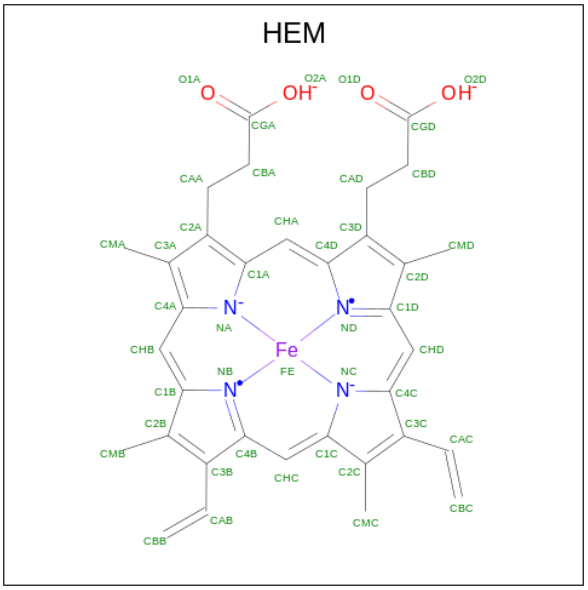
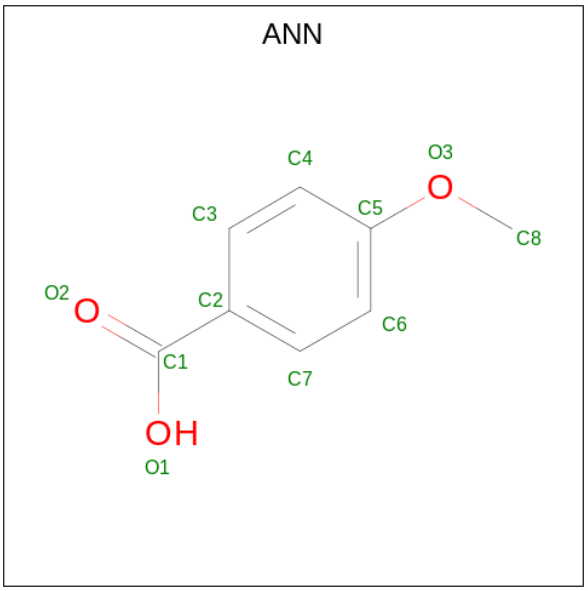
Chain	Residue	Modelled	Actual	Comment	Reference
B	417	HIS	-	expression tag	UNP Q2IU02

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



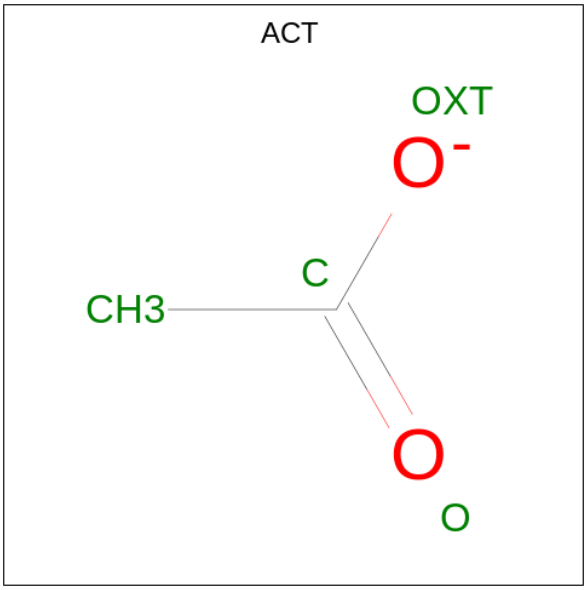
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is 4-METHOXYBENZOIC ACID (CCD ID: ANN) (formula: $C_8H_8O_3$) (labeled as "Ligand of Interest" by depositor).



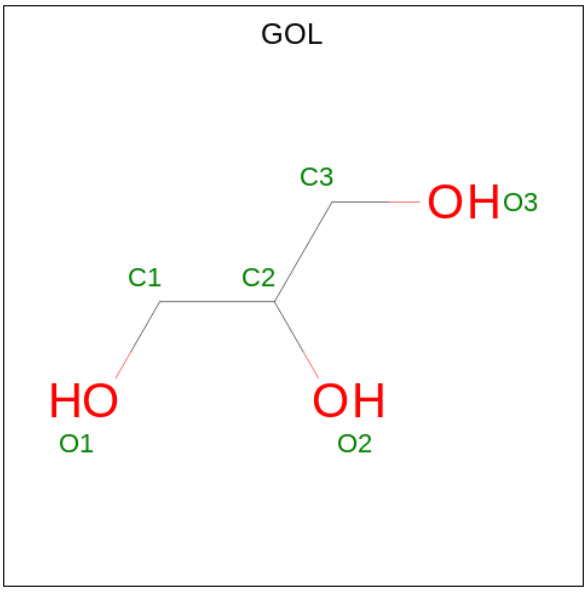
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 11 8 3	0	0
3	B	1	Total C O 11 8 3	0	0

- Molecule 4 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).



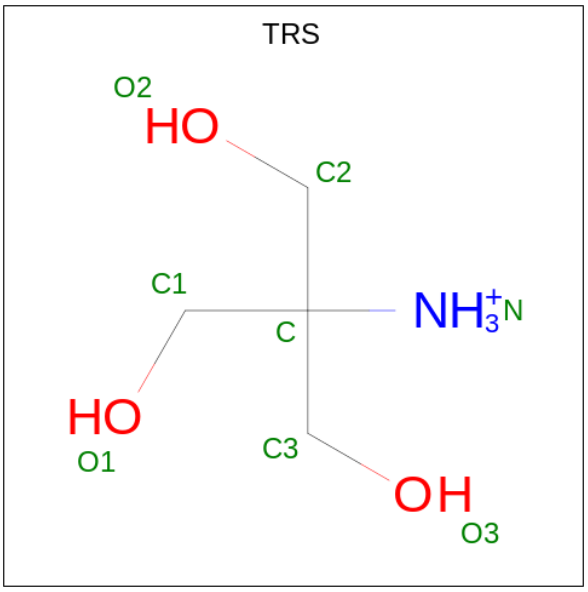
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 4 2 2	0	0

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



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

- Molecule 6 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: $C_4H_{12}NO_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C N O 8 4 1 3	0	0

- Molecule 7 is water.

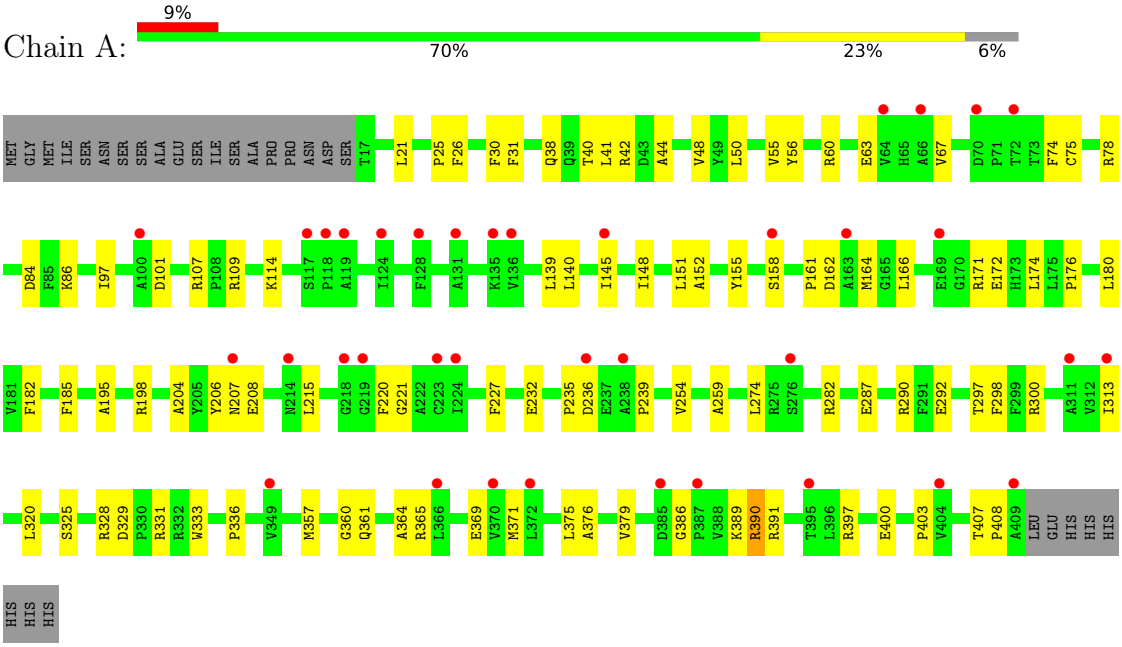
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	30	Total O 30 30	0	0
7	B	25	Total O 25 25	0	0

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.

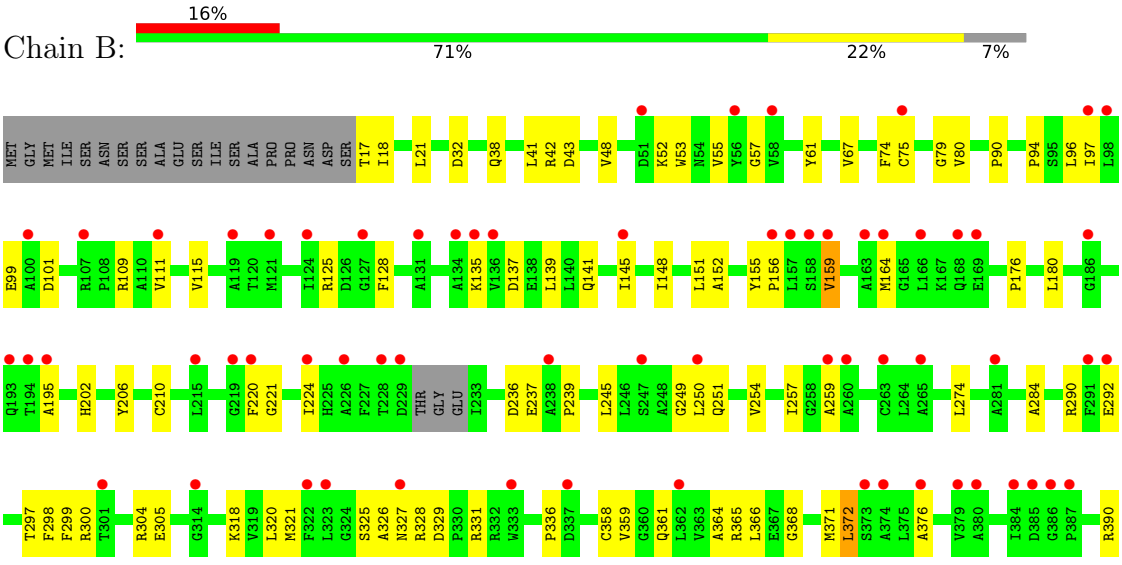
• Molecule 1: Cytochrome P450

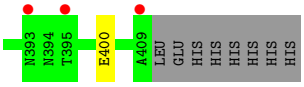
Chain A:



• Molecule 1: Cytochrome P450

Chain B:




N393
N394
T395
E400
A409
LEU
GLU
HIS
HIS
HIS
HIS
HIS
HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	82.74Å 51.64Å 92.64Å 90.00° 116.46° 90.00°	Depositor
Resolution (Å)	74.07 – 2.73 74.07 – 2.73	Depositor EDS
% Data completeness (in resolution range)	98.0 (74.07-2.73) 98.0 (74.07-2.73)	Depositor EDS
R_{merge}	0.28	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.66 (at 2.73Å)	Xtriage
Refinement program	PHENIX (1.18.2_3874: ???)	Depositor
R, R_{free}	0.274 , 0.307 0.276 , 0.309	Depositor DCC
R_{free} test set	1873 reflections (9.89%)	wwPDB-VP
Wilson B-factor (Å^2)	32.2	Xtriage
Anisotropy	0.869	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 57.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.000 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	6176	wwPDB-VP
Average B, all atoms (Å^2)	36.0	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 57.35 % 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 2.3979e-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: GOL, HEM, ANN, ACT, TRS

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	0.25	0/3093	0.55	0/4214
1	B	0.26	0/3052	0.55	0/4160
All	All	0.25	0/6145	0.55	0/8374

There are no bond length outliers.

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	3017	0	2950	63	0
1	B	2978	0	2898	68	0
2	A	43	0	30	5	0
2	B	43	0	30	6	0
3	A	11	0	7	0	0
3	B	11	0	7	0	0
4	A	4	0	3	0	0
5	A	6	0	8	1	0
6	A	8	0	12	0	0
7	A	30	0	0	2	0
7	B	25	0	0	3	0
All	All	6176	0	5945	134	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 11.

All (134) 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:207:ASN:HB2	7:A:621:HOH:O	1.63	0.97
1:B:164:MET:SD	1:B:220:PHE:HB2	2.20	0.82
1:B:164:MET:SD	1:B:220:PHE:HD2	2.04	0.81
1:B:164:MET:HE1	1:B:245:LEU:HD12	1.64	0.79
1:B:148:ILE:HA	1:B:152:ALA:HB3	1.66	0.77
1:B:38:GLN:NE2	7:B:601:HOH:O	2.20	0.74
1:B:221:GLY:HA2	1:B:224:ILE:HD12	1.69	0.73
1:B:251:GLN:HA	1:B:254:VAL:HB	1.73	0.70
1:B:164:MET:SD	1:B:220:PHE:CD2	2.85	0.69
1:A:148:ILE:HA	1:A:152:ALA:HB3	1.76	0.68
1:A:107:ARG:HD2	1:A:232:GLU:HA	1.75	0.67
1:B:155:TYR:CE1	1:B:159:VAL:HG21	2.29	0.67
1:B:259:ALA:HB1	1:B:292:GLU:HG3	1.78	0.66
1:B:257:ILE:HD11	1:B:368:GLY:HA2	1.78	0.65
1:B:180:LEU:HD22	1:B:195:ALA:HA	1.80	0.64
1:A:298:PHE:CE2	2:A:501:HEM:HBA2	2.34	0.63
1:B:274:LEU:HG	1:B:376:ALA:HB2	1.80	0.63
1:B:249:GLY:HA3	2:B:501:HEM:C2C	2.35	0.62
1:A:109:ARG:NH1	2:A:501:HEM:O1D	2.33	0.61
1:B:390:ARG:HA	1:B:400:GLU:H	1.66	0.60
1:A:21:LEU:HD22	1:A:41:LEU:HD23	1.84	0.60
1:A:25:PRO:HA	1:A:30:PHE:CG	2.37	0.59
1:B:21:LEU:HD13	1:B:48:VAL:HB	1.83	0.59
1:B:128:PHE:CE2	1:B:159:VAL:HG12	2.38	0.59
1:B:152:ALA:O	1:B:254:VAL:HG22	2.03	0.58
1:B:55:VAL:HG12	1:B:318:LYS:HB2	1.83	0.58
1:A:328:ARG:HA	1:A:336:PRO:HB2	1.85	0.58
1:B:96:LEU:HD13	1:B:237:GLU:HG2	1.86	0.58
1:A:60:ARG:HB2	1:A:63:GLU:OE1	2.03	0.57
1:B:328:ARG:HA	1:B:336:PRO:HB2	1.85	0.57
1:A:161:PRO:HB3	1:A:166:LEU:HD22	1.86	0.57
1:A:42:ARG:NH1	1:A:325:SER:OG	2.37	0.56
1:A:391:ARG:NH1	7:A:605:HOH:O	2.38	0.56
1:B:297:THR:HB	1:B:320:LEU:HD11	1.88	0.56
1:A:333:TRP:HB2	1:A:336:PRO:HB3	1.88	0.56
1:A:329:ASP:OD1	1:A:331:ARG:NH1	2.36	0.55
1:A:215:LEU:HD13	1:A:221:GLY:C	2.31	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:109:ARG:NH2	1:A:357:MET:O	2.36	0.55
1:B:137:ASP:O	1:B:141:GLN:HG2	2.07	0.55
1:B:74:PHE:HB3	1:B:300:ARG:HB3	1.89	0.54
1:A:151:LEU:HD11	1:A:371:MET:SD	2.48	0.54
1:A:75:CYS:HB2	1:A:101:ASP:OD2	2.07	0.54
1:B:164:MET:SD	1:B:220:PHE:CB	2.94	0.54
1:A:204:ALA:O	1:A:208:GLU:HB2	2.08	0.54
1:B:155:TYR:HB3	1:B:156:PRO:HD3	1.90	0.53
1:A:21:LEU:HD13	1:A:48:VAL:HB	1.90	0.53
1:A:140:LEU:HD22	1:A:408:PRO:HG3	1.89	0.53
1:A:162:ASP:OD1	1:A:171:ARG:NH1	2.33	0.52
1:A:287:GLU:OE1	1:A:290:ARG:NH2	2.38	0.52
1:A:274:LEU:HG	1:A:376:ALA:HB2	1.93	0.51
1:A:172:GLU:H	1:A:172:GLU:CD	2.18	0.51
1:A:180:LEU:HD21	1:A:198:ARG:NH1	2.25	0.51
1:A:297:THR:HB	1:A:320:LEU:HD11	1.92	0.51
1:A:361:GLN:OE1	1:A:365:ARG:NH2	2.44	0.50
1:B:202:HIS:O	1:B:206:TYR:HB2	2.11	0.50
1:A:114:LYS:HD3	1:A:227:PHE:CZ	2.46	0.49
1:A:375:LEU:O	1:A:379:VAL:HG22	2.12	0.49
1:B:290:ARG:HG2	1:B:327:ASN:HB3	1.93	0.49
1:A:56:TYR:CE2	1:A:313:ILE:HG23	2.48	0.49
1:A:364:ALA:HB2	2:A:501:HEM:HMC2	1.95	0.49
1:A:259:ALA:HB1	1:A:292:GLU:HG3	1.94	0.49
2:A:501:HEM:HBC2	2:A:501:HEM:HMC1	1.94	0.49
2:B:501:HEM:HMC1	2:B:501:HEM:HBC2	1.95	0.49
1:A:386:GLY:HA3	1:A:403:PRO:HB2	1.95	0.48
1:B:52:LYS:HG3	1:B:53:TRP:CE2	2.48	0.48
1:B:75:CYS:HB2	1:B:101:ASP:OD2	2.13	0.48
1:A:74:PHE:HB3	1:A:300:ARG:HB3	1.95	0.48
1:A:176:PRO:O	1:A:180:LEU:HG	2.14	0.48
1:B:109:ARG:NH1	1:B:359:VAL:HB	2.29	0.47
1:A:38:GLN:HB3	1:A:325:SER:OG	2.14	0.47
1:A:390:ARG:HH12	1:A:397:ARG:HG3	1.79	0.47
1:B:180:LEU:HD13	1:B:195:ALA:O	2.14	0.47
1:A:97:ILE:HD11	1:A:109:ARG:HD3	1.97	0.47
1:A:236:ASP:OD1	1:A:236:ASP:N	2.47	0.47
1:B:125:ARG:HA	1:B:366:LEU:HD21	1.97	0.47
1:B:210:CYS:HB3	1:B:239:PRO:HB3	1.97	0.47
1:B:361:GLN:OE1	1:B:365:ARG:NH2	2.47	0.47
1:A:282:ARG:HD3	1:A:369:GLU:OE1	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:391:ARG:NE	1:A:400:GLU:OE1	2.41	0.46
1:A:86:LYS:HB3	1:A:86:LYS:HE2	1.65	0.46
1:A:152:ALA:O	1:A:254:VAL:HG22	2.15	0.46
1:B:97:ILE:HG12	2:B:501:HEM:CGD	2.44	0.46
1:B:42:ARG:NH1	1:B:325:SER:OG	2.48	0.46
1:B:151:LEU:HD11	1:B:371:MET:SD	2.56	0.46
1:B:250:LEU:O	1:B:254:VAL:HG23	2.16	0.46
1:B:139:LEU:HB3	1:B:145[B]:ILE:HG21	1.97	0.46
1:A:40:THR:O	1:A:44:ALA:N	2.49	0.45
1:B:21:LEU:HD22	1:B:41:LEU:HD23	1.98	0.45
1:B:304:ARG:NH1	1:B:305:GLU:O	2.48	0.45
1:A:50:LEU:HD12	1:A:55:VAL:HG23	1.99	0.45
1:A:67:VAL:HG13	1:A:74:PHE:CG	2.52	0.45
1:A:139:LEU:HB3	1:A:145:ILE:HG21	2.00	0.44
1:A:331:ARG:HH11	1:A:331:ARG:HG3	1.83	0.44
1:A:164:MET:HA	1:A:220:PHE:HB2	2.00	0.44
1:B:48:VAL:O	1:B:57:GLY:N	2.40	0.44
1:B:139:LEU:HB3	1:B:145[A]:ILE:HG21	1.97	0.44
5:A:504:GOL:O3	5:A:504:GOL:O1	2.16	0.44
1:A:180:LEU:HD13	1:A:195:ALA:O	2.18	0.43
1:A:390:ARG:HH22	1:A:397:ARG:CZ	2.30	0.43
1:B:21:LEU:CD1	1:B:48:VAL:HB	2.48	0.43
1:B:125:ARG:HG3	1:B:366:LEU:HD11	2.00	0.43
1:B:176:PRO:O	1:B:180:LEU:HG	2.19	0.43
1:A:155:TYR:O	1:A:158:SER:OG	2.36	0.43
1:A:174:LEU:HA	1:A:206:TYR:OH	2.19	0.43
1:B:292:GLU:HB3	7:B:624:HOH:O	2.19	0.43
1:A:26:PHE:HA	1:A:31:PHE:CZ	2.54	0.43
1:B:329:ASP:OD1	1:B:331:ARG:NH1	2.48	0.42
1:B:80:VAL:N	7:B:607:HOH:O	2.51	0.42
1:A:389:LYS:HB2	1:A:400:GLU:HB3	2.01	0.42
1:B:67:VAL:HG13	1:B:74:PHE:CG	2.54	0.42
1:B:97:ILE:HD11	1:B:109:ARG:HD3	2.01	0.42
1:B:364:ALA:HB2	2:B:501:HEM:HMC2	2.01	0.42
1:B:135:LYS:O	1:B:139:LEU:HG	2.19	0.42
1:B:321:MET:HE3	1:B:321:MET:HB2	1.87	0.42
1:A:365:ARG:O	1:A:369:GLU:N	2.42	0.41
1:B:43:ASP:OD1	1:B:331:ARG:NH2	2.43	0.41
1:A:78:ARG:HG2	1:A:84:ASP:OD1	2.19	0.41
1:B:80:VAL:C	1:B:299:PHE:HB2	2.44	0.41
1:B:61:TYR:HA	1:B:326:ALA:HB1	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:111:VAL:O	1:B:115:VAL:HG23	2.20	0.41
1:B:128:PHE:CD2	1:B:159:VAL:HG12	2.56	0.41
1:B:236:ASP:OD1	1:B:236:ASP:N	2.51	0.41
1:A:235:PRO:O	1:A:239:PRO:HD3	2.21	0.41
1:A:407:THR:HA	1:A:408:PRO:HD3	1.87	0.41
1:B:284:ALA:HB3	1:B:372:LEU:HD23	2.02	0.41
1:A:182:PHE:HA	1:A:185:PHE:CD2	2.56	0.41
1:A:360:GLY:HA3	2:A:501:HEM:C3C	2.56	0.41
1:B:17:THR:HG23	1:B:18:ILE:H	1.86	0.41
1:A:390:ARG:NH2	1:A:397:ARG:CZ	2.84	0.41
1:B:90:PRO:HG2	1:B:94:PRO:HG3	2.02	0.41
1:B:128:PHE:CD2	1:B:159:VAL:CG1	3.04	0.40
1:B:79:GLY:HA2	1:B:99:GLU:OE1	2.21	0.40
1:B:358:CYS:SG	2:B:501:HEM:C1C	3.11	0.40
1:B:298:PHE:CE2	2:B:501:HEM:HBA2	2.57	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	394/420 (94%)	382 (97%)	12 (3%)	0	100	100
1	B	390/420 (93%)	380 (97%)	10 (3%)	0	100	100
All	All	784/840 (93%)	762 (97%)	22 (3%)	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	313/343 (91%)	312 (100%)	1 (0%)	86 92
1	B	307/343 (90%)	304 (99%)	3 (1%)	68 80
All	All	620/686 (90%)	616 (99%)	4 (1%)	76 87

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	390	ARG
1	B	32	ASP
1	B	159	VAL
1	B	372	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	69	ASN
1	B	168	GLN
1	B	251	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)

7 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	ANN	B	502	-	11,11,11	0.89	0	14,14,14	0.89	0
2	HEM	B	501	1,7	50,50,50	1.32	6 (12%)	66,82,82	1.28	9 (13%)
4	ACT	A	503	-	3,3,3	1.15	0	3,3,3	1.06	0
6	TRS	A	505	-	7,7,7	0.34	0	9,9,9	0.40	0
5	GOL	A	504	-	5,5,5	1.11	0	5,5,5	0.95	0
2	HEM	A	501	1	50,50,50	1.40	6 (12%)	66,82,82	1.18	7 (10%)
3	ANN	A	502	-	11,11,11	0.89	0	14,14,14	0.87	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	ANN	B	502	-	-	4/6/6/6	0/1/1/1
2	HEM	B	501	1,7	-	2/14/54/54	-
6	TRS	A	505	-	-	0/9/9/9	-
5	GOL	A	504	-	-	1/4/4/4	-
2	HEM	A	501	1	-	2/14/54/54	-
3	ANN	A	502	-	-	4/6/6/6	0/1/1/1

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	HEM	FE-NB	3.50	2.05	1.94
2	A	501	HEM	FE-NA	3.32	2.06	1.95
2	B	501	HEM	FE-ND	3.21	2.04	1.94
2	A	501	HEM	FE-NC	3.04	2.05	1.95
2	A	501	HEM	CAC-C3C	3.01	1.55	1.47
2	B	501	HEM	CAC-C3C	2.94	1.55	1.47
2	B	501	HEM	CAB-C3B	2.92	1.55	1.47
2	B	501	HEM	FE-NA	2.92	2.05	1.95
2	A	501	HEM	CAB-C3B	2.90	1.55	1.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	HEM	FE-ND	2.64	2.03	1.94
2	B	501	HEM	FE-NC	2.38	2.03	1.95
2	B	501	HEM	FE-NB	2.32	2.02	1.94

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	501	HEM	C1B-NB-C4B	3.35	108.53	105.07
2	B	501	HEM	C4A-NA-C1A	3.23	108.52	105.35
2	A	501	HEM	C1B-NB-C4B	3.05	108.23	105.07
2	B	501	HEM	C4D-ND-C1D	2.97	108.14	105.07
2	A	501	HEM	C4D-ND-C1D	2.82	107.99	105.07
2	A	501	HEM	C4A-NA-C1A	2.76	108.05	105.35
2	B	501	HEM	C4C-NC-C1C	2.71	108.00	105.35
2	B	501	HEM	CAA-CBA-CGA	-2.51	108.19	113.60
2	A	501	HEM	C4C-NC-C1C	2.47	107.77	105.35
2	B	501	HEM	C3D-C4D-ND	-2.39	107.51	110.17
2	B	501	HEM	CBD-CAD-C3D	-2.35	106.09	112.63
2	B	501	HEM	C2A-C1A-NA	-2.24	107.64	110.15
2	A	501	HEM	CBD-CAD-C3D	-2.19	106.55	112.63
2	A	501	HEM	C3D-C4D-ND	-2.17	107.75	110.17
2	A	501	HEM	C3B-C2B-C1B	2.14	108.07	106.49
2	B	501	HEM	C3B-C2B-C1B	2.11	108.06	106.49

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	502	ANN	O1-C1-C2-C7
3	B	502	ANN	O1-C1-C2-C7
3	A	502	ANN	O2-C1-C2-C7
3	B	502	ANN	O2-C1-C2-C7
3	A	502	ANN	O1-C1-C2-C3
3	B	502	ANN	O1-C1-C2-C3
3	A	502	ANN	O2-C1-C2-C3
2	A	501	HEM	CAA-CBA-CGA-O2A
3	B	502	ANN	O2-C1-C2-C3
2	B	501	HEM	CAA-CBA-CGA-O2A
2	A	501	HEM	CAA-CBA-CGA-O1A
2	B	501	HEM	CAA-CBA-CGA-O1A
5	A	504	GOL	O2-C2-C3-O3

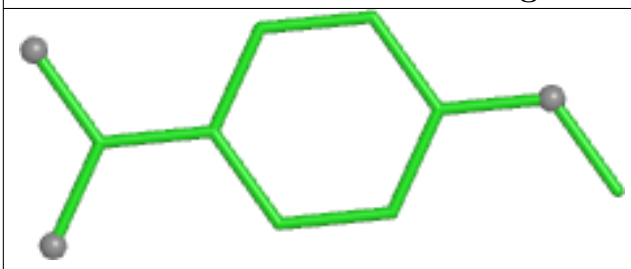
There are no ring outliers.

3 monomers are involved in 12 short contacts:

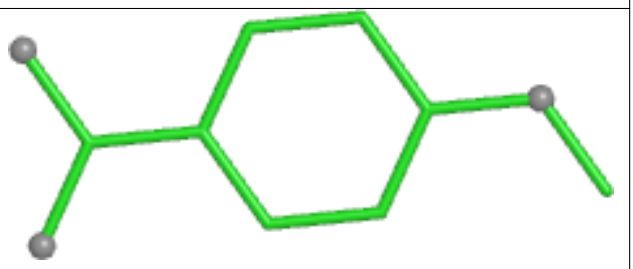
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	501	HEM	6	0
5	A	504	GOL	1	0
2	A	501	HEM	5	0

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.

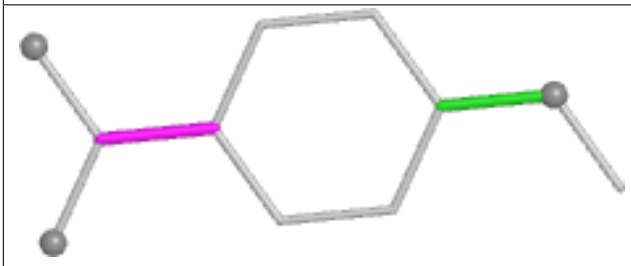
Ligand ANN B 502



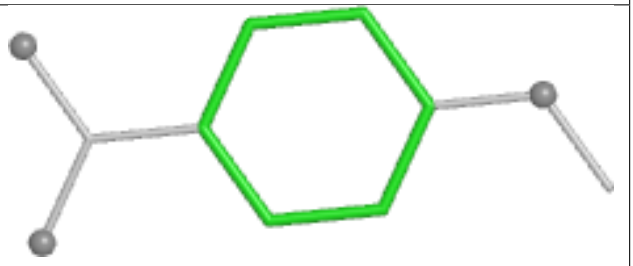
Bond lengths



Bond angles

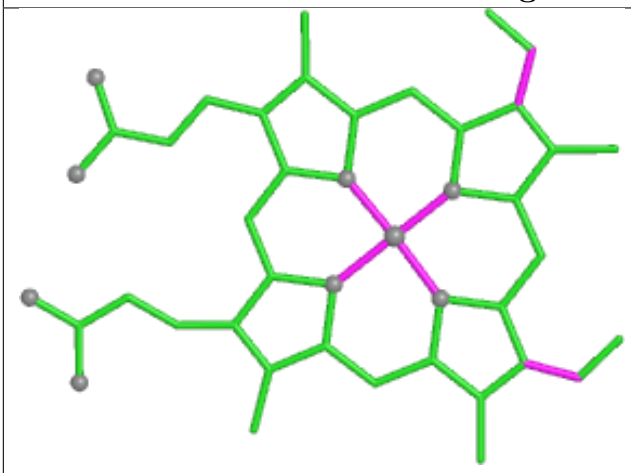


Torsions



Rings

Ligand HEM B 501



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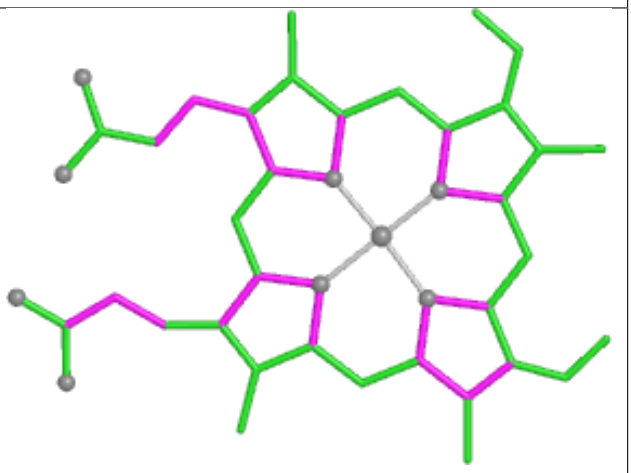

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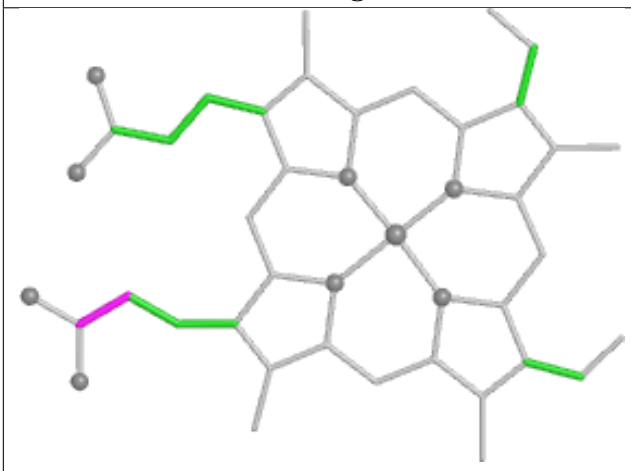

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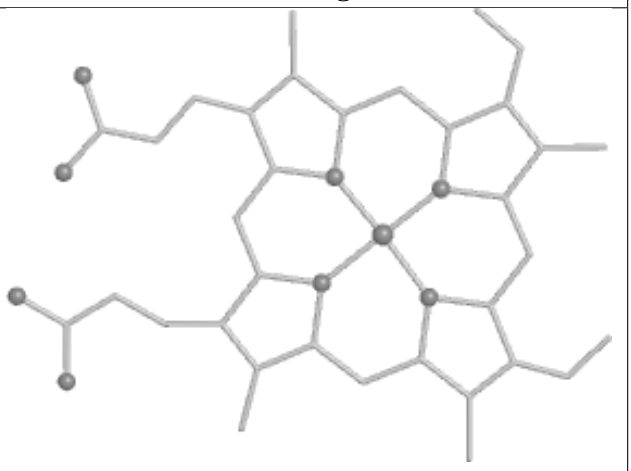
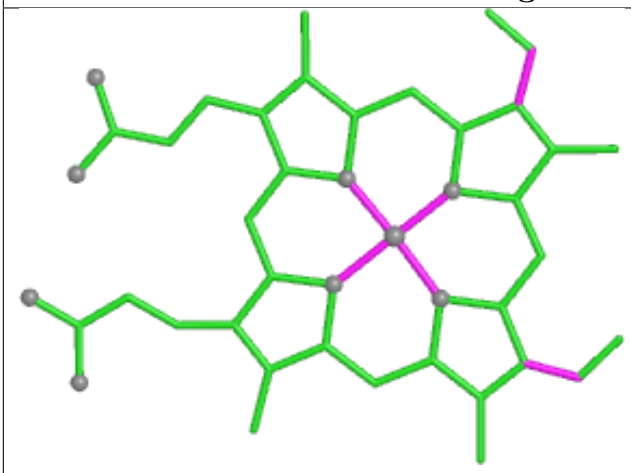


Rings

Ligand HEM A 501



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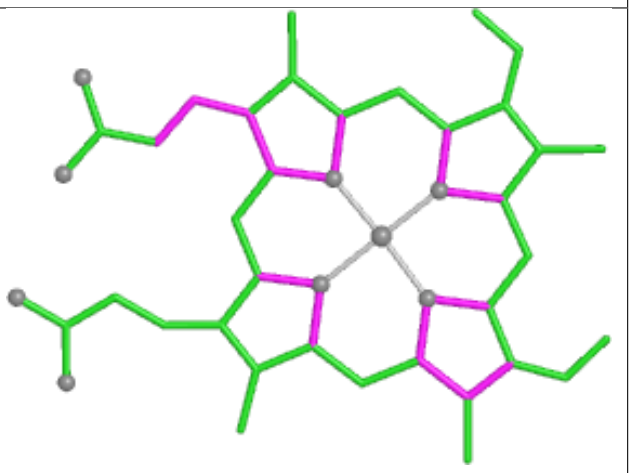
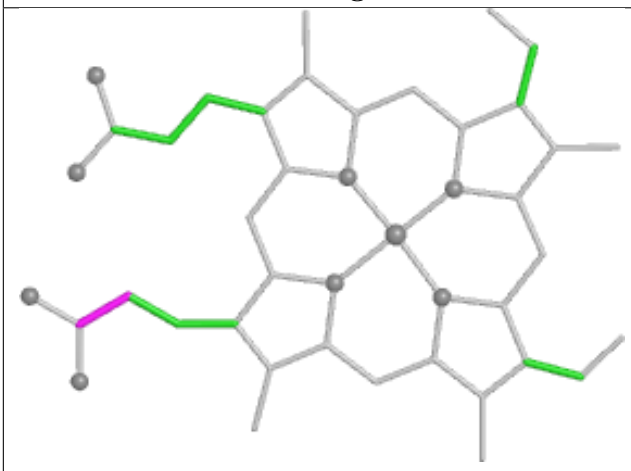
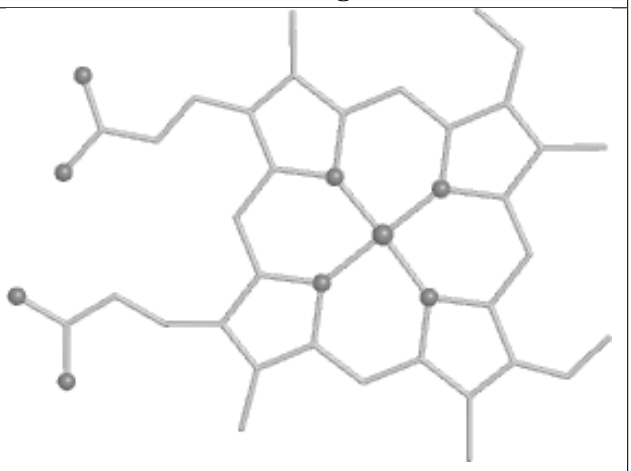


Bond angles

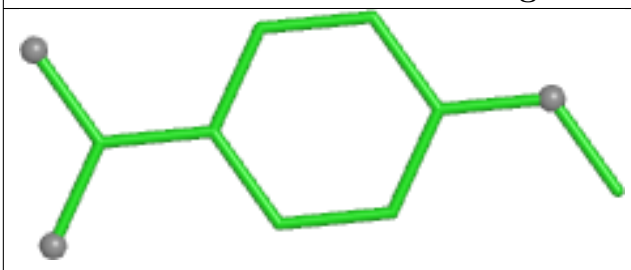


Torsions

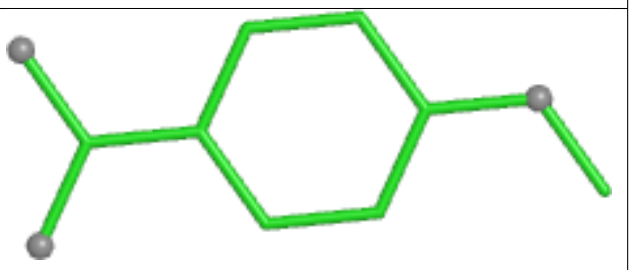


Rings

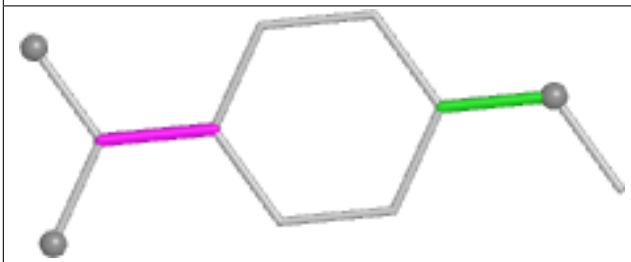
Ligand ANN A 502



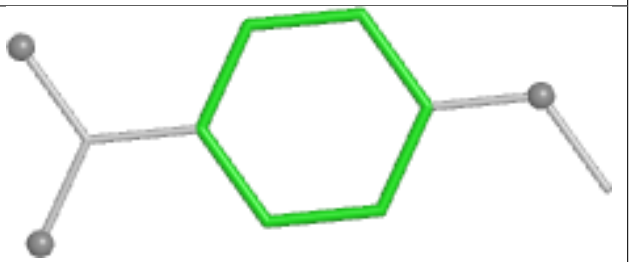
Bond lengths



Bond angles



Torsions



Rings

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	393/420 (93%)	1.07	37 (9%) 14 14	14, 34, 51, 67	3 (0%)
1	B	390/420 (92%)	1.41	68 (17%) 4 4	16, 38, 56, 69	4 (1%)
All	All	783/840 (93%)	1.24	105 (13%) 7 7	14, 36, 55, 69	7 (0%)

All (105) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	385	ASP	4.4
1	A	238	ALA	3.8
1	B	164	MET	3.7
1	B	238	ALA	3.7
1	B	380	ALA	3.7
1	B	166	LEU	3.6
1	B	219	GLY	3.5
1	B	409	ALA	3.4
1	B	51	ASP	3.4
1	A	131	ALA	3.2
1	A	409	ALA	3.2
1	A	214	ASN	3.2
1	B	229	ASP	3.2
1	B	291	PHE	3.2
1	B	292	GLU	3.1
1	B	281	ALA	3.1
1	A	276	SER	3.0
1	B	100	ALA	3.0
1	B	127	GLY	2.9
1	B	158	SER	2.9
1	B	97	ILE	2.9
1	B	156	PRO	2.9
1	B	337[A]	ASP	2.9
1	B	111	VAL	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	134	ALA	2.8
1	A	118	PRO	2.8
1	A	128	PHE	2.8
1	A	124	ILE	2.7
1	B	250	LEU	2.7
1	A	119	ALA	2.7
1	B	224	ILE	2.7
1	A	404	VAL	2.7
1	B	220	PHE	2.7
1	B	260	ALA	2.7
1	A	169	GLU	2.7
1	B	136	VAL	2.7
1	B	215	LEU	2.6
1	B	58	VAL	2.6
1	A	218	GLY	2.6
1	B	157	LEU	2.6
1	B	323	LEU	2.6
1	A	387	PRO	2.6
1	B	98	LEU	2.6
1	B	393	ASN	2.6
1	A	163	ALA	2.5
1	A	145	ILE	2.5
1	A	136	VAL	2.5
1	B	322	PHE	2.5
1	A	72	THR	2.5
1	A	64	VAL	2.5
1	B	75	CYS	2.4
1	B	263	CYS	2.4
1	B	169	GLU	2.4
1	B	121	MET	2.4
1	B	387	PRO	2.4
1	B	301	THR	2.4
1	B	119	ALA	2.4
1	B	395	THR	2.4
1	B	386	GLY	2.4
1	B	259	ALA	2.4
1	B	362	LEU	2.3
1	B	145[A]	ILE	2.3
1	A	236	ASP	2.3
1	B	56	TYR	2.3
1	B	124	ILE	2.3
1	A	135	LYS	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	370	VAL	2.3
1	B	379	VAL	2.3
1	A	100	ALA	2.2
1	B	135	LYS	2.2
1	B	186	GLY	2.2
1	B	314	GLY	2.2
1	B	384	ILE	2.2
1	B	195	ALA	2.2
1	B	226	ALA	2.2
1	A	395	THR	2.2
1	B	107	ARG	2.2
1	A	117	SER	2.2
1	B	247	SER	2.2
1	A	224	ILE	2.2
1	B	333	TRP	2.2
1	A	385	ASP	2.2
1	B	373	SER	2.2
1	A	66	ALA	2.1
1	B	193	GLN	2.1
1	A	366	LEU	2.1
1	A	219	GLY	2.1
1	A	70	ASP	2.1
1	A	372	LEU	2.1
1	B	327	ASN	2.1
1	B	131	ALA	2.1
1	B	376	ALA	2.1
1	A	223[A]	CYS	2.1
1	A	313	ILE	2.1
1	A	349	VAL	2.1
1	B	163	ALA	2.0
1	B	228	THR	2.0
1	A	207	ASN	2.0
1	B	159	VAL	2.0
1	A	311	ALA	2.0
1	B	265	ALA	2.0
1	B	374	ALA	2.0
1	A	158	SER	2.0
1	B	194	THR	2.0
1	B	168	GLN	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)

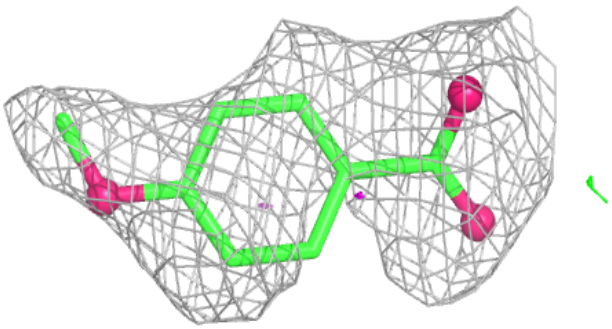
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

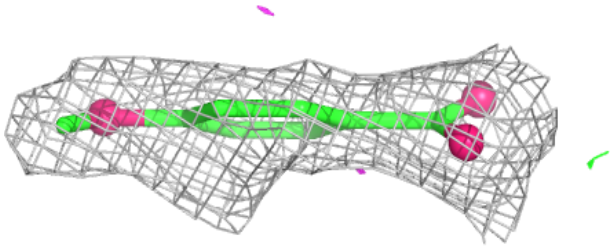
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
6	TRS	A	505	8/8	0.56	0.19	47,60,64,67	0
4	ACT	A	503	4/4	0.67	0.19	33,54,61,69	0
5	GOL	A	504	6/6	0.69	0.15	44,45,49,54	0
3	ANN	B	502	11/11	0.84	0.19	24,32,39,41	0
3	ANN	A	502	11/11	0.85	0.16	22,27,35,35	0
2	HEM	B	501	43/43	0.87	0.14	18,34,43,57	0
2	HEM	A	501	43/43	0.92	0.12	16,31,41,62	0

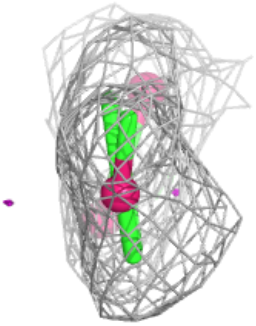
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around ANN B 502:

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

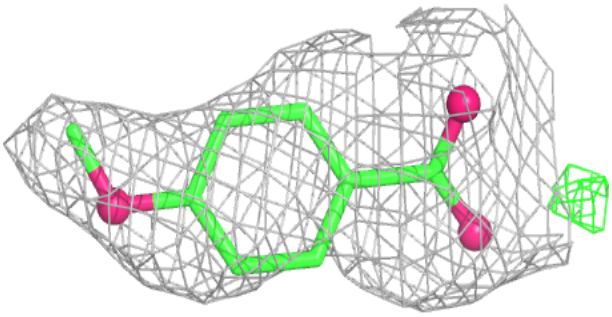


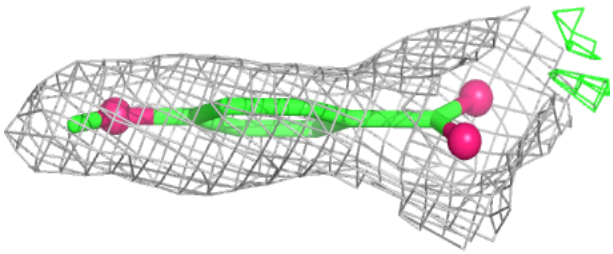


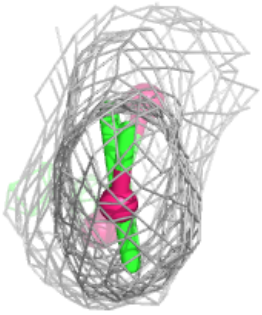


Electron density around ANN A 502:

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

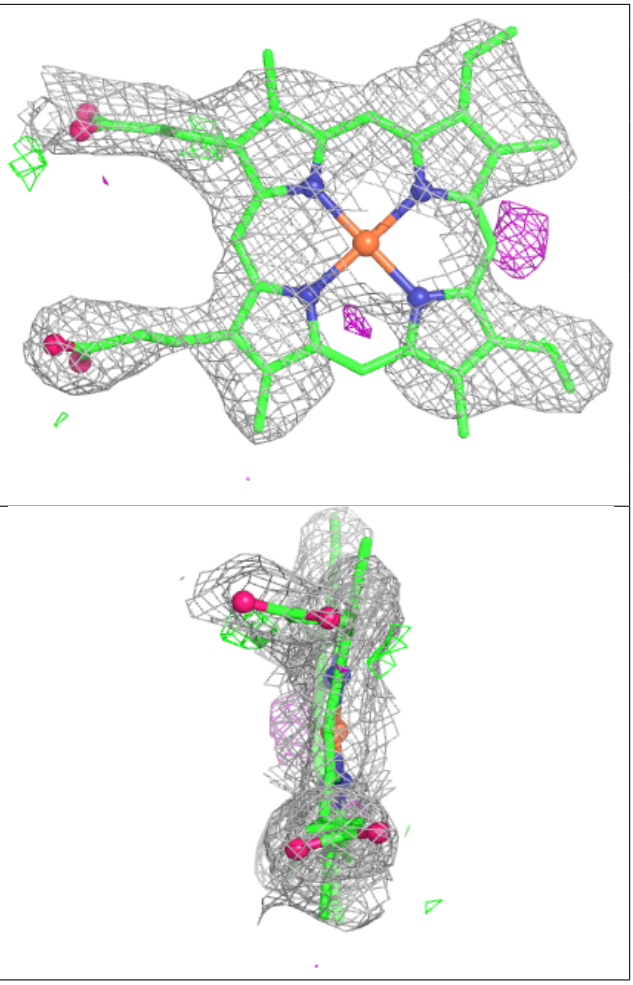






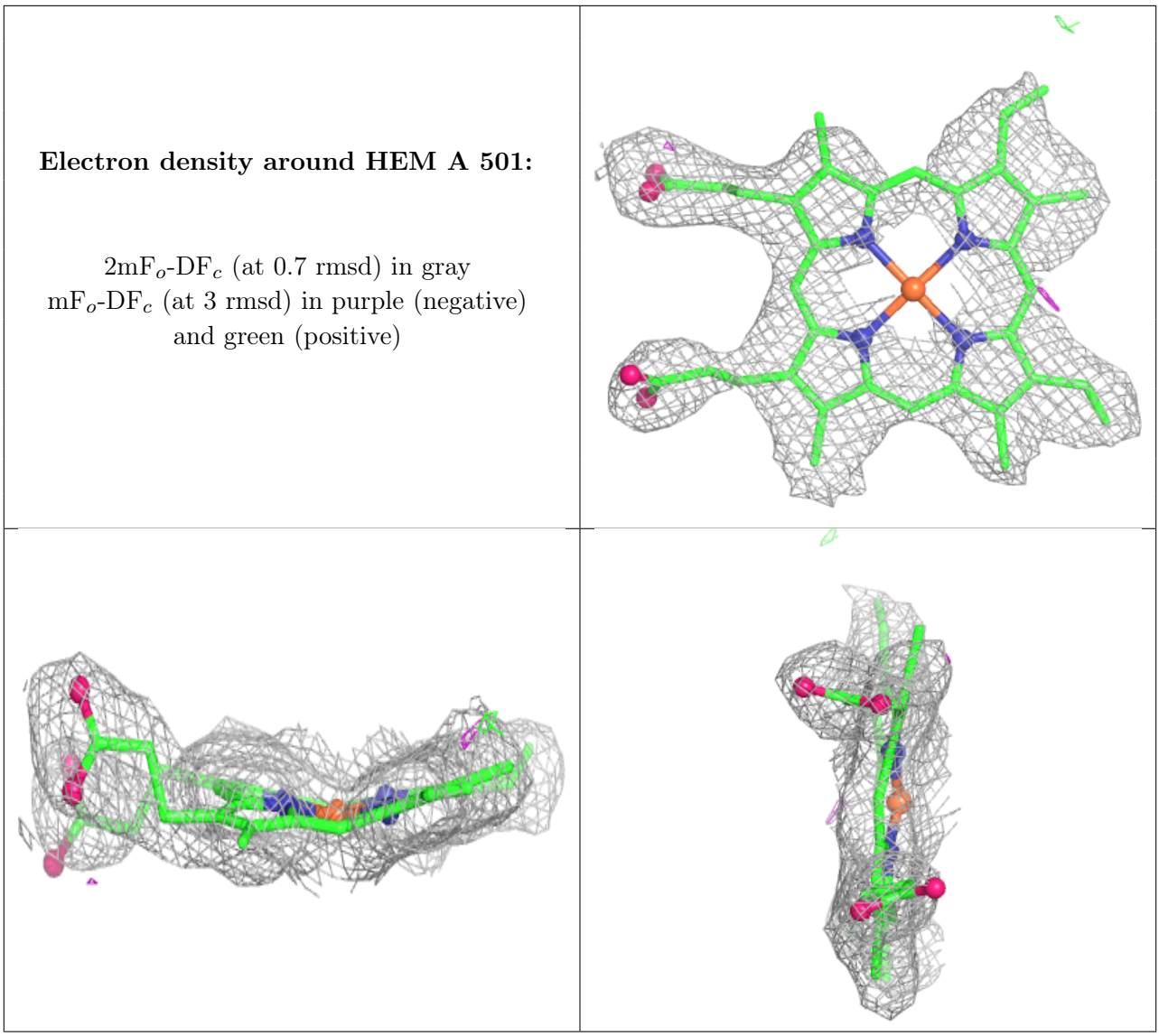
Electron density around HEM B 501:

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



Electron density around HEM A 501:

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



6.5 Other polymers (i)

There are no such residues in this entry.