



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 11:22 PM UTC

PDB ID : 5IUZ / pdb_00005iuz
Title : STRUCTURE OF P450 2B4 F202W MUTANT (CYMAL-5)
Authors : Jang, H.-H.; Halpert, J.R.; Shah, M.B.
Deposited on : 2016-03-18
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 Phenix2.0
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

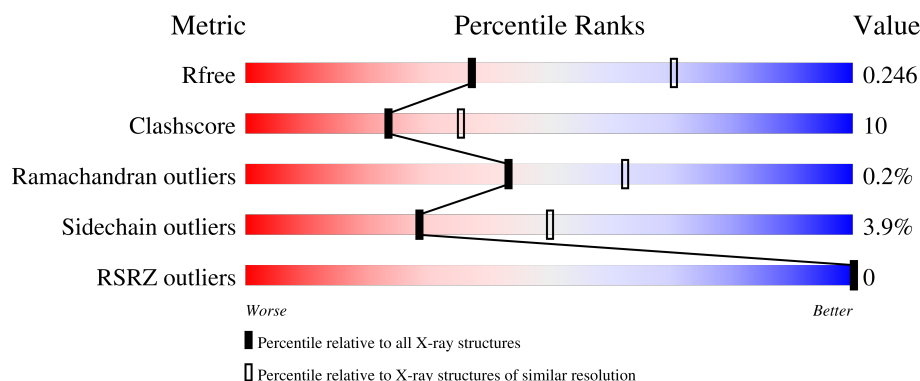
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.73 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 $\leq 5\%$. 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	478	 75% 18% . .
1	B	478	 76% 19% . .

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 7914 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 2B4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	459	Total	C	N	O	S	0	1	0
			3692	2382	637	663	10			
1	B	464	Total	C	N	O	S	0	1	0
			3720	2395	647	667	11			

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	21	ALA	GLU	engineered mutation	UNP P00178
A	?	-	PHE	deletion	UNP P00178
A	?	-	SER	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	ALA	deletion	UNP P00178
A	?	-	PHE	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	ALA	deletion	UNP P00178
A	?	-	GLY	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	LEU	deletion	UNP P00178
A	?	-	PHE	deletion	UNP P00178
A	?	-	ARG	deletion	UNP P00178
A	22	LYS	GLY	engineered mutation	UNP P00178
A	23	LYS	HIS	engineered mutation	UNP P00178
A	24	THR	PRO	engineered mutation	UNP P00178
A	25	SER	LYS	engineered mutation	UNP P00178
A	26	SER	ALA	engineered mutation	UNP P00178

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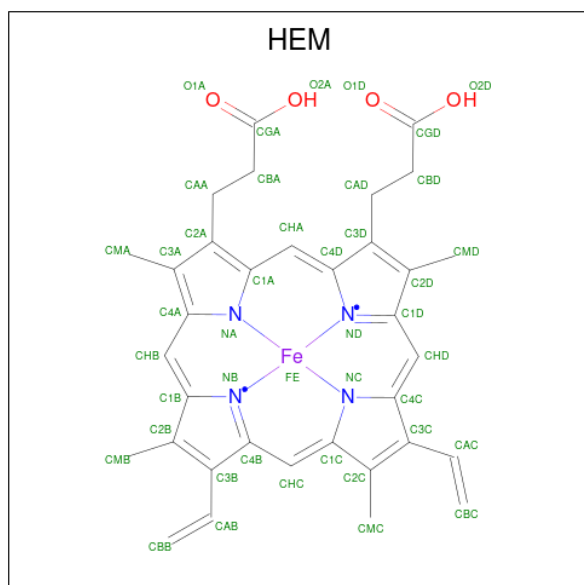
Chain	Residue	Modelled	Actual	Comment	Reference
A	27	LYS	HIS	engineered mutation	UNP P00178
A	29	LYS	ARG	engineered mutation	UNP P00178
A	202	TRP	PHE	engineered mutation	UNP P00178
A	221	SER	PRO	SEE REMARK 999	UNP P00178
A	226	TYR	HIS	engineered mutation	UNP P00178
A	492	HIS	-	expression tag	UNP P00178
A	493	HIS	-	expression tag	UNP P00178
A	494	HIS	-	expression tag	UNP P00178
A	495	HIS	-	expression tag	UNP P00178
A	496	HIS	-	expression tag	UNP P00178
A	497	HIS	-	expression tag	UNP P00178
B	21	ALA	GLU	engineered mutation	UNP P00178
B	?	-	PHE	deletion	UNP P00178
B	?	-	SER	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	ALA	deletion	UNP P00178
B	?	-	PHE	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	ALA	deletion	UNP P00178
B	?	-	GLY	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	LEU	deletion	UNP P00178
B	?	-	PHE	deletion	UNP P00178
B	?	-	ARG	deletion	UNP P00178
B	22	LYS	GLY	engineered mutation	UNP P00178
B	23	LYS	HIS	engineered mutation	UNP P00178
B	24	THR	PRO	engineered mutation	UNP P00178
B	25	SER	LYS	engineered mutation	UNP P00178
B	26	SER	ALA	engineered mutation	UNP P00178
B	27	LYS	HIS	engineered mutation	UNP P00178
B	29	LYS	ARG	engineered mutation	UNP P00178
B	202	TRP	PHE	engineered mutation	UNP P00178
B	221	SER	PRO	variant	UNP P00178
B	226	TYR	HIS	engineered mutation	UNP P00178
B	492	HIS	-	expression tag	UNP P00178

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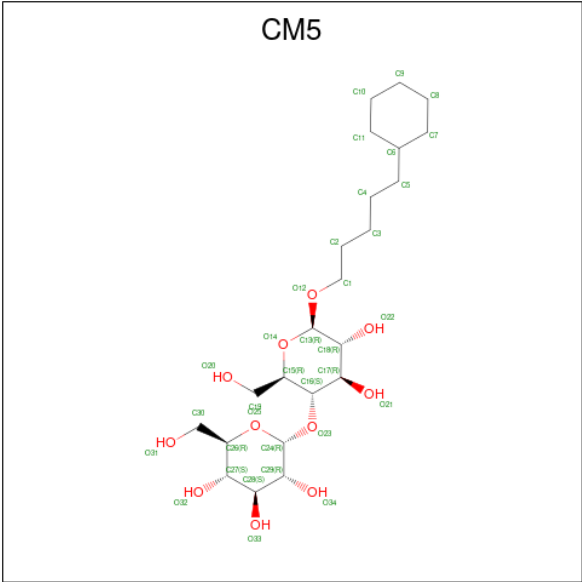
Chain	Residue	Modelled	Actual	Comment	Reference
B	493	HIS	-	expression tag	UNP P00178
B	494	HIS	-	expression tag	UNP P00178
B	495	HIS	-	expression tag	UNP P00178
B	496	HIS	-	expression tag	UNP P00178
B	497	HIS	-	expression tag	UNP P00178

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



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

- Molecule 3 is 5-CYCLOHEXYL-1-PENTYL-BETA-D-MALTOSE (CCD ID: CM5) (formula: $C_{23}H_{42}O_{11}$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			34	23	11		
3	A	1	Total	C	O	0	0
			34	23	11		
3	B	1	Total	C	O	0	0
			34	23	11		
3	B	1	Total	C	O	0	0
			34	23	11		

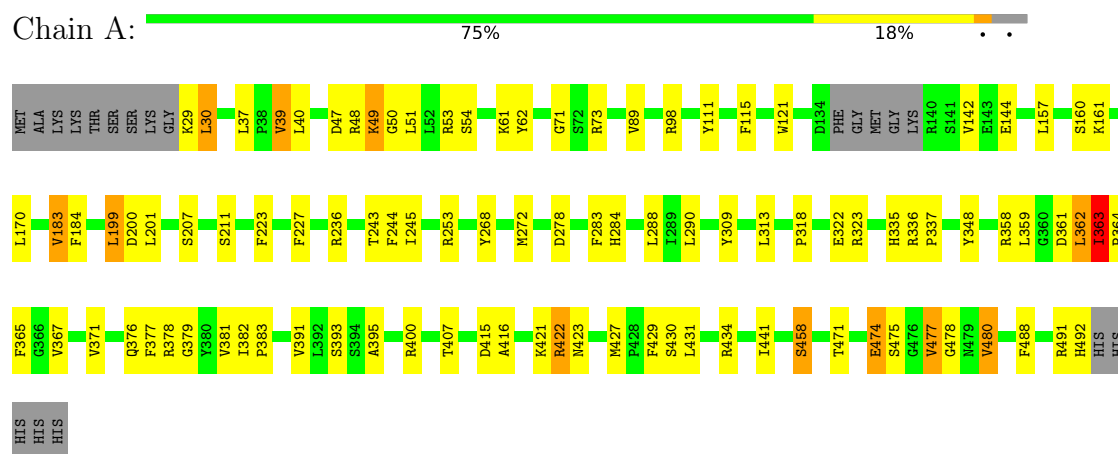
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	136	Total	O	0	0
			136	136		
4	B	144	Total	O	0	0
			144	144		

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 2B4



• Molecule 1: Cytochrome P450 2B4



4 Data and refinement statistics

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, α , β , γ	91.61Å 91.61Å 150.93Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 2.73 20.00 – 2.73	Depositor EDS
% Data completeness (in resolution range)	90.5 (20.00-2.73) 91.0 (20.00-2.73)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.48 (at 2.75Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.180 , 0.248 0.191 , 0.246	Depositor DCC
R_{free} test set	1705 reflections (4.53%)	wwPDB-VP
Wilson B-factor (Å ²)	45.1	Xtriage
Anisotropy	0.113	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 11.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.029 for -h,-k,l 0.459 for h,-h-k,-l 0.028 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	7914	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.26% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: HEM, CM5

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	1.04	8/3789 (0.2%)	1.11	15/5133 (0.3%)
1	B	0.99	3/3815 (0.1%)	1.11	12/5170 (0.2%)
All	All	1.02	11/7604 (0.1%)	1.11	27/10303 (0.3%)

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	367	VAL	CA-C	6.92	1.57	1.52
1	B	163	ALA	CA-CB	-5.98	1.43	1.53
1	A	199	LEU	C-O	-5.86	1.17	1.24
1	B	354	HIS	C-O	-5.83	1.17	1.24
1	A	363	ILE	C-O	-5.71	1.17	1.24
1	A	362	LEU	C-O	-5.46	1.17	1.24
1	B	367	VAL	CA-C	5.30	1.56	1.52
1	A	337	PRO	CA-C	5.25	1.54	1.51
1	A	364	PRO	C-O	-5.24	1.18	1.24
1	A	363	ILE	CA-CB	-5.06	1.47	1.54
1	A	200	ASP	N-CA	-5.04	1.40	1.46

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	89	VAL	CB-CA-C	-8.88	104.16	111.71
1	B	161	LYS	CB-CA-C	-8.28	100.14	111.89
1	B	135	PHE	N-CA-C	-7.90	104.08	112.93
1	B	89	VAL	CB-CA-C	-7.71	105.16	111.71
1	B	407	THR	CB-CA-C	7.30	123.81	109.35
1	A	407	THR	CB-CA-C	7.30	123.80	109.35
1	B	245	ILE	N-CA-C	-6.41	104.51	110.53
1	A	245	ILE	N-CA-C	-6.31	104.60	110.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	441	ILE	N-CA-C	-6.09	104.81	110.53
1	B	423	ASN	N-CA-C	6.06	119.42	109.85
1	A	423	ASN	N-CA-C	6.01	119.45	110.14
1	A	62	TYR	N-CA-C	5.99	120.59	113.16
1	A	89	VAL	N-CA-C	5.93	117.06	111.48
1	A	37	LEU	N-CA-C	-5.78	102.88	110.39
1	B	161	LYS	N-CA-C	-5.77	103.43	111.39
1	B	407	THR	N-CA-C	-5.73	99.67	109.24
1	A	407	THR	N-CA-C	-5.71	99.70	109.24
1	A	73	ARG	CA-C-N	-5.70	114.06	119.76
1	A	73	ARG	C-N-CA	-5.70	114.06	119.76
1	B	421	LYS	CA-C-N	-5.63	114.50	122.94
1	B	421	LYS	C-N-CA	-5.63	114.50	122.94
1	B	37	LEU	N-CA-C	-5.53	103.15	110.40
1	B	62	TYR	N-CA-C	5.40	119.97	113.17
1	A	336	ARG	CA-C-N	-5.35	115.75	119.66
1	A	336	ARG	C-N-CA	-5.35	115.75	119.66
1	A	30	LEU	CB-CA-C	5.30	119.31	109.51
1	A	458	SER	N-CA-C	-5.03	103.02	110.46

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	3692	0	3690	70	0
1	B	3720	0	3706	80	0
2	A	43	0	30	5	0
2	B	43	0	30	2	0
3	A	68	0	84	2	0
3	B	68	0	83	21	0
4	A	136	0	0	10	0
4	B	144	0	0	8	0
All	All	7914	0	7623	155	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 10.

All (155) 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)
3:B:503:CM5:H192	3:B:503:CM5:C29	1.44	1.45
1:B:423:ASN:HB2	4:B:712:HOH:O	1.50	1.10
3:B:503:CM5:H29	3:B:503:CM5:C19	1.85	1.07
1:A:422:ARG:HB2	1:A:422:ARG:HH21	1.12	1.05
3:B:503:CM5:H192	3:B:503:CM5:H29	0.99	0.99
1:A:422:ARG:HH21	1:A:422:ARG:CB	1.75	0.97
3:B:503:CM5:H192	3:B:503:CM5:C24	1.96	0.96
3:B:503:CM5:C29	3:B:503:CM5:C19	2.41	0.94
1:B:422:ARG:HD2	4:B:645:HOH:O	1.67	0.93
1:B:50:GLY:HA2	3:B:503:CM5:H82	1.58	0.85
1:A:422:ARG:HB2	1:A:422:ARG:NH2	1.92	0.84
1:B:474:GLU:O	1:B:480:VAL:HG23	1.82	0.80
1:B:377:PHE:O	1:B:378:ARG:C	2.25	0.79
1:B:244:PHE:CZ	3:B:502:CM5:H31A	2.18	0.79
1:B:244:PHE:CE1	3:B:502:CM5:O12	2.37	0.78
1:A:474:GLU:O	1:A:480:VAL:HG23	1.85	0.76
1:A:427:MET:O	1:A:427:MET:HG3	1.87	0.75
1:A:115:PHE:HB3	4:A:667:HOH:O	1.89	0.71
1:A:491:ARG:O	1:A:492:HIS:C	2.35	0.69
1:A:474:GLU:HG2	4:A:606:HOH:O	1.93	0.68
3:B:503:CM5:C19	3:B:503:CM5:C24	2.70	0.68
1:B:345:LYS:HD2	4:B:637:HOH:O	1.92	0.68
1:A:49:LYS:HD3	1:A:53:ARG:HG2	1.76	0.67
1:A:71:GLY:HA3	4:A:613:HOH:O	1.95	0.66
1:A:268:TYR:CE1	1:A:288:LEU:HB2	2.30	0.66
1:B:430:SER:O	1:B:431:LEU:HD23	1.96	0.65
1:B:377:PHE:O	1:B:379:GLY:N	2.30	0.65
1:A:29:LYS:HA	4:A:681:HOH:O	1.97	0.64
2:A:501:HEM:HBC2	2:A:501:HEM:HMC1	1.78	0.64
1:A:416:ALA:H	1:B:233:GLN:HE22	1.45	0.62
3:B:503:CM5:H192	3:B:503:CM5:O34	1.99	0.62
1:A:395:ALA:HB1	1:A:427:MET:HE3	1.82	0.61
1:A:379:GLY:HA2	1:B:161:LYS:HD3	1.82	0.61
1:B:268:TYR:CE1	1:B:288:LEU:HB2	2.35	0.61
1:B:420:LEU:HD21	1:B:422:ARG:HE	1.66	0.61
1:A:160:SER:O	1:A:161:LYS:HB2	2.02	0.60
1:B:198:LEU:HD22	3:B:502:CM5:H22A	1.83	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:415:ASP:HB2	1:B:233:GLN:NE2	2.17	0.59
1:A:236:ARG:HD3	4:A:695:HOH:O	2.02	0.59
1:B:189:ASP:HB2	4:B:686:HOH:O	2.02	0.59
1:B:381:VAL:O	1:B:383:PRO:HD3	2.03	0.58
1:A:377:PHE:O	1:A:378:ARG:C	2.47	0.58
1:A:415:ASP:OD1	1:A:415:ASP:C	2.45	0.58
1:A:272:MET:HG2	1:A:283:PHE:O	2.04	0.58
2:A:501:HEM:HBB2	2:A:501:HEM:HMB2	1.85	0.57
1:B:183:VAL:HG12	1:B:184:PHE:CD1	2.39	0.57
1:B:415:ASP:OD1	1:B:415:ASP:C	2.47	0.57
1:A:379:GLY:HA2	1:B:161:LYS:CD	2.35	0.57
1:A:416:ALA:H	1:B:233:GLN:NE2	2.02	0.56
1:B:420:LEU:CD2	1:B:422:ARG:HE	2.18	0.56
1:A:371:VAL:HG21	1:A:382:ILE:HG22	1.88	0.56
1:A:400:ARG:O	1:B:197:ARG:HG3	2.06	0.55
1:A:323:ARG:HB3	1:A:348:TYR:CE2	2.40	0.55
1:B:323:ARG:HB3	1:B:348:TYR:CE2	2.40	0.55
1:A:458:SER:HB2	4:A:716:HOH:O	2.06	0.55
1:B:98:ARG:HG2	1:B:115:PHE:HA	1.89	0.55
1:A:30:LEU:HD21	1:A:383:PRO:HD2	1.89	0.55
1:A:30:LEU:HD21	1:A:382:ILE:HA	1.89	0.54
1:B:134:ASP:C	1:B:136:GLY:H	2.14	0.54
1:B:421:LYS:O	1:B:421:LYS:HG3	2.06	0.54
1:B:458:SER:HB2	4:B:727:HOH:O	2.06	0.54
1:A:98:ARG:HG2	1:A:115:PHE:HA	1.89	0.54
1:A:379:GLY:CA	1:B:161:LYS:HD3	2.37	0.54
2:A:501:HEM:HBC2	2:A:501:HEM:CMC	2.38	0.54
1:A:47:ASP:OD1	1:A:49:LYS:CD	2.56	0.53
1:B:362:LEU:O	1:B:478:GLY:HA2	2.07	0.53
1:A:422:ARG:HH21	1:A:422:ARG:CG	2.21	0.53
1:B:371:VAL:HG21	1:B:382:ILE:HG22	1.92	0.52
1:B:268:TYR:CD1	1:B:288:LEU:HD13	2.44	0.52
1:B:272:MET:HG2	1:B:283:PHE:O	2.08	0.52
1:B:244:PHE:CZ	3:B:502:CM5:C3	2.93	0.51
1:A:421:LYS:O	1:A:421:LYS:HG3	2.11	0.51
1:A:362:LEU:O	1:A:478:GLY:HA2	2.11	0.51
1:A:415:ASP:HB2	1:B:233:GLN:HE22	1.74	0.51
1:B:111:TYR:HB2	1:B:290:LEU:HD12	1.92	0.51
1:B:236:ARG:HD3	4:B:667:HOH:O	2.10	0.51
1:B:188:PHE:CE2	3:B:502:CM5:H11	2.46	0.50
1:A:268:TYR:CG	1:A:288:LEU:HD13	2.47	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:244:PHE:CE2	3:B:502:CM5:H31A	2.47	0.50
1:A:381:VAL:O	1:A:383:PRO:HD3	2.11	0.50
1:B:302:THR:HG21	1:B:363:ILE:HD11	1.93	0.50
1:A:268:TYR:CD1	1:A:288:LEU:HD13	2.46	0.50
1:A:379:GLY:HA2	1:B:161:LYS:HB2	1.94	0.50
1:A:430:SER:OG	1:A:431:LEU:N	2.45	0.49
1:A:475:SER:N	4:A:606:HOH:O	2.45	0.49
1:A:111:TYR:HB2	1:A:290:LEU:HD12	1.95	0.49
3:A:503:CM5:O20	3:A:503:CM5:H24	2.13	0.49
1:B:195:PHE:HA	3:B:502:CM5:H21A	1.94	0.49
1:B:361:ASP:OD2	1:B:393:SER:OG	2.27	0.48
1:A:39:VAL:HG12	1:A:40:LEU:HD12	1.96	0.48
1:B:377:PHE:C	1:B:379:GLY:N	2.72	0.48
1:A:47:ASP:OD1	1:A:49:LYS:HD3	2.13	0.48
1:B:137:MET:HG2	1:B:267:VAL:HG21	1.95	0.48
1:A:183:VAL:HG12	1:A:184:PHE:CD1	2.49	0.48
1:B:309:TYR:HE2	1:B:313:LEU:HD11	1.79	0.47
1:A:429:PHE:O	1:A:430:SER:HB3	2.15	0.47
1:B:244:PHE:HE1	3:B:502:CM5:O12	1.92	0.47
1:A:358:ARG:NH2	1:A:359:LEU:HD13	2.30	0.47
1:B:268:TYR:CG	1:B:288:LEU:HD13	2.49	0.47
1:B:278:ASP:HA	1:B:279:PRO:HD3	1.79	0.46
1:B:98:ARG:NH2	2:B:501:HEM:O2D	2.40	0.46
1:B:429:PHE:HB3	1:B:436:CYS:CB	2.45	0.46
1:A:284:HIS:HB2	4:A:701:HOH:O	2.15	0.46
1:B:50:GLY:CA	3:B:503:CM5:H82	2.38	0.46
1:B:278:ASP:OD1	1:B:278:ASP:C	2.57	0.46
1:B:438:GLY:HA3	2:B:501:HEM:C3C	2.51	0.46
3:B:503:CM5:O34	3:B:503:CM5:C16	2.64	0.46
2:A:501:HEM:HBB2	2:A:501:HEM:CMB	2.46	0.45
1:B:430:SER:OG	1:B:431:LEU:N	2.50	0.45
1:A:365:PHE:HA	1:A:391:VAL:HA	1.98	0.45
1:A:309:TYR:CE2	1:A:313:LEU:HD11	2.52	0.45
1:B:146:ILE:HG12	1:B:178:ILE:HD12	1.98	0.45
1:A:142:VAL:HG23	4:A:614:HOH:O	2.16	0.45
1:A:278:ASP:OD1	1:A:278:ASP:C	2.57	0.45
1:B:29:LYS:O	1:B:380:TYR:HB3	2.17	0.44
1:B:121:TRP:CZ2	1:B:434:ARG:HD3	2.52	0.44
1:A:121:TRP:CZ2	1:A:434:ARG:HD3	2.52	0.44
1:B:309:TYR:CE2	1:B:313:LEU:HD11	2.52	0.44
1:A:309:TYR:HE2	1:A:313:LEU:HD11	1.82	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:395:ALA:CB	1:A:427:MET:HE3	2.46	0.44
1:A:318:PRO:O	1:A:322:GLU:HG3	2.18	0.44
1:A:157:LEU:HD22	1:A:488:PHE:CD2	2.54	0.43
1:B:427:MET:HA	4:B:648:HOH:O	2.17	0.43
1:A:243:THR:O	1:A:244:PHE:C	2.61	0.43
1:A:50:GLY:HA2	3:A:503:CM5:C10	2.49	0.43
1:B:42:ASN:O	1:B:43:LEU:C	2.62	0.43
1:B:348:TYR:HD1	1:B:414:LEU:HD11	1.84	0.43
1:B:429:PHE:HB3	1:B:436:CYS:HB3	2.00	0.43
1:B:183:VAL:O	1:B:265:ILE:HG13	2.19	0.43
1:B:188:PHE:CZ	3:B:502:CM5:H32A	2.54	0.43
1:B:421:LYS:HA	4:B:734:HOH:O	2.19	0.42
1:A:361:ASP:OD2	1:A:393:SER:OG	2.31	0.42
1:B:365:PHE:HA	1:B:391:VAL:HA	2.01	0.42
1:B:149:GLU:OE2	1:B:190:TYR:OH	2.30	0.42
3:B:503:CM5:O34	3:B:503:CM5:O14	2.35	0.42
1:B:192:ASP:HA	1:B:193:PRO:HD3	1.92	0.42
1:A:98:ARG:NH2	2:A:501:HEM:O2D	2.49	0.41
1:B:159:LYS:O	1:B:160:SER:C	2.62	0.41
1:B:111:TYR:HB2	1:B:290:LEU:CD1	2.49	0.41
1:A:335:HIS:CE1	4:A:638:HOH:O	2.73	0.41
1:B:374:ASP:OD2	1:B:383:PRO:HA	2.20	0.41
1:B:429:PHE:O	1:B:430:SER:HB3	2.20	0.41
1:B:133:ARG:O	1:B:133:ARG:HG2	2.21	0.41
1:A:30:LEU:CD2	1:A:382:ILE:HA	2.50	0.41
1:A:227:PHE:CD1	1:A:227:PHE:N	2.88	0.41
1:A:422:ARG:NH2	1:A:422:ARG:CG	2.84	0.41
1:B:46:MET:C	3:B:503:CM5:H22A	2.46	0.41
1:B:227:PHE:CD1	1:B:227:PHE:N	2.88	0.41
1:A:51:LEU:O	1:A:54:SER:HB2	2.22	0.40
1:B:382:ILE:O	1:B:383:PRO:C	2.65	0.40
1:A:47:ASP:OD1	1:A:49:LYS:HD2	2.21	0.40
1:A:363:ILE:HA	1:A:477:VAL:O	2.20	0.40
1:B:35:SER:HA	1:B:36:PRO:HD2	1.89	0.40
1:B:179:ILE:O	1:B:183:VAL:HB	2.21	0.40
1:A:170:LEU:HD23	1:A:170:LEU:HA	1.93	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	456/478 (95%)	435 (95%)	21 (5%)	0	100	100
1	B	463/478 (97%)	437 (94%)	24 (5%)	2 (0%)	30	47
All	All	919/956 (96%)	872 (95%)	45 (5%)	2 (0%)	43	62

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	378	ARG
1	B	430	SER

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	406/423 (96%)	387 (95%)	19 (5%)	23	43
1	B	407/423 (96%)	394 (97%)	13 (3%)	34	56
All	All	813/846 (96%)	781 (96%)	32 (4%)	28	50

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	39	VAL
1	A	48	ARG
1	A	49	LYS
1	A	61	LYS

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Mol	Chain	Res	Type
1	A	144	GLU
1	A	183	VAL
1	A	199	LEU
1	A	201	LEU
1	A	207	SER
1	A	211	SER
1	A	223	PHE
1	A	253	ARG
1	A	363	ILE
1	A	376	GLN
1	A	422	ARG
1	A	471	THR
1	A	474	GLU
1	A	477	VAL
1	A	480	VAL
1	B	48	ARG
1	B	49	LYS
1	B	137	MET
1	B	144	GLU
1	B	161	LYS
1	B	199	LEU
1	B	207	SER
1	B	236	ARG
1	B	303	THR
1	B	376	GLN
1	B	471	THR
1	B	477	VAL
1	B	480	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	357	GLN
1	A	417	ASN
1	B	284	HIS
1	B	285	HIS
1	B	330	GLN
1	B	357	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

6 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	CM5	B	502	-	36,36,36	2.09	3 (8%)	49,49,49	2.88	6 (12%)
3	CM5	B	503	-	36,36,36	2.84	8 (22%)	49,49,49	3.85	16 (32%)
3	CM5	A	503	-	36,36,36	0.92	2 (5%)	49,49,49	2.78	5 (10%)
2	HEM	B	501	1	50,50,50	1.76	7 (14%)	67,82,82	1.67	15 (22%)
3	CM5	A	502	-	36,36,36	1.49	2 (5%)	49,49,49	2.07	7 (14%)
2	HEM	A	501	1	50,50,50	1.71	8 (16%)	67,82,82	1.16	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	CM5	B	502	-	-	8/17/65/65	0/3/3/3
3	CM5	B	503	-	-	7/17/65/65	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	CM5	A	503	-	-	16/17/65/65	0/3/3/3
2	HEM	B	501	1	-	3/14/54/54	-
3	CM5	A	502	-	-	5/17/65/65	0/3/3/3
2	HEM	A	501	1	-	2/14/54/54	-

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	502	CM5	O12-C13	8.88	1.55	1.40
3	B	503	CM5	O12-C13	-7.90	1.27	1.40
3	B	503	CM5	O23-C24	7.58	1.63	1.41
3	B	502	CM5	O14-C13	7.56	1.61	1.41
3	A	502	CM5	O14-C13	7.56	1.61	1.41
2	A	501	HEM	C3D-C2D	7.49	1.52	1.36
2	B	501	HEM	C3D-C2D	7.46	1.52	1.36
3	B	503	CM5	O12-C1	7.24	1.62	1.43
3	B	503	CM5	O23-C16	6.49	1.60	1.43
3	B	503	CM5	C17-C18	4.30	1.63	1.52
3	B	503	CM5	C17-C16	4.28	1.63	1.52
3	B	503	CM5	C16-C15	4.17	1.64	1.52
3	A	503	CM5	O12-C13	3.86	1.46	1.40
3	B	503	CM5	C13-C18	3.81	1.63	1.52
3	B	502	CM5	C13-C18	3.37	1.62	1.52
3	A	502	CM5	C13-C18	3.37	1.62	1.52
2	B	501	HEM	CAB-C3B	2.98	1.55	1.47
2	A	501	HEM	CAC-C3C	2.96	1.55	1.47
3	A	503	CM5	O23-C16	-2.93	1.36	1.43
2	B	501	HEM	CAC-C3C	2.89	1.55	1.47
2	B	501	HEM	C3C-C2C	-2.88	1.31	1.37
2	A	501	HEM	CAB-C3B	2.54	1.54	1.47
2	A	501	HEM	CMB-C2B	2.48	1.55	1.50
2	A	501	HEM	CMC-C2C	2.41	1.55	1.50
2	B	501	HEM	CHA-C1A	-2.24	1.34	1.39
2	A	501	HEM	C3C-C2C	-2.07	1.32	1.37
2	A	501	HEM	CMA-C3A	2.07	1.55	1.50
2	B	501	HEM	CMA-C3A	2.06	1.55	1.50
2	B	501	HEM	C2A-C3A	-2.06	1.33	1.38
2	A	501	HEM	FE-NB	2.05	2.01	1.94

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	503	CM5	O23-C16-C17	-14.32	70.85	107.23
3	B	502	CM5	O12-C13-C18	13.98	129.50	108.27
3	B	503	CM5	O23-C16-C17	13.54	141.64	107.23
3	B	503	CM5	C1-O12-C13	-11.79	93.55	113.68
3	B	502	CM5	C1-O12-C13	-11.00	94.89	113.68
3	A	503	CM5	O12-C13-C18	-10.85	91.80	108.27
3	B	503	CM5	O14-C13-O12	10.53	134.94	110.04
3	B	503	CM5	C18-C17-C16	-9.44	88.25	109.68
3	A	502	CM5	O12-C13-C18	9.42	122.58	108.27
3	B	502	CM5	O14-C13-C18	-7.19	95.59	110.37
3	A	502	CM5	O14-C13-C18	-7.19	95.60	110.37
3	B	503	CM5	C13-O14-C15	-5.36	103.26	113.72
3	B	503	CM5	O14-C15-C16	-5.26	98.84	109.72
3	B	503	CM5	C13-C18-C17	-5.14	99.20	110.01
3	A	502	CM5	O14-C13-O12	4.84	121.48	110.04
3	B	503	CM5	O23-C16-C15	-4.75	97.03	109.48
3	B	503	CM5	C17-C16-C15	-4.60	100.73	110.93
3	B	503	CM5	O12-C13-C18	4.30	114.80	108.27
2	B	501	HEM	CAC-C3C-C4C	4.29	135.07	124.82
3	A	503	CM5	O23-C16-C15	4.25	120.62	109.48
3	B	503	CM5	O14-C13-C18	-3.86	102.44	110.37
2	B	501	HEM	CHA-C4D-ND	3.72	128.97	124.37
3	B	503	CM5	C19-C15-C16	-3.50	103.53	113.38
2	B	501	HEM	CHA-C4D-C3D	-3.43	118.90	125.23
3	A	503	CM5	C24-O23-C16	-3.31	110.13	117.98
2	A	501	HEM	CAA-CBA-CGA	-3.29	104.94	113.67
2	A	501	HEM	C4D-ND-C1D	3.24	109.05	105.21
2	B	501	HEM	CAA-CBA-CGA	-2.84	106.14	113.67
2	B	501	HEM	CAC-C3C-C2C	-2.82	119.26	128.43
2	B	501	HEM	C4D-ND-C1D	2.73	108.44	105.21
2	A	501	HEM	O2A-CGA-CBA	2.70	122.54	114.00
2	B	501	HEM	O2A-CGA-CBA	2.69	122.51	114.00
2	B	501	HEM	CHC-C1C-NC	2.66	127.35	124.45
2	B	501	HEM	C4C-CHD-C1D	-2.62	120.44	126.02
2	B	501	HEM	CHD-C4C-NC	-2.61	121.61	124.45
3	B	503	CM5	O21-C17-C16	-2.58	103.31	109.94
2	A	501	HEM	CBD-CAD-C3D	-2.51	105.60	112.53
2	B	501	HEM	CMC-C2C-C3C	-2.44	122.52	128.43
2	B	501	HEM	C3C-C2C-C1C	2.42	109.33	107.05
3	B	502	CM5	O22-C18-C13	-2.40	104.35	110.08
3	A	502	CM5	O22-C18-C13	-2.40	104.35	110.08
2	B	501	HEM	CHD-C1D-ND	2.38	126.99	124.42
2	A	501	HEM	C1D-C2D-C3D	-2.34	104.52	106.98

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	502	CM5	C9-C8-C7	2.27	116.08	111.42
3	A	502	CM5	O14-C15-C16	2.18	114.22	109.72
3	B	502	CM5	O14-C15-C16	2.17	114.20	109.72
3	A	503	CM5	O14-C15-C16	2.16	114.19	109.72
2	B	501	HEM	CBD-CAD-C3D	-2.14	106.62	112.53
3	B	503	CM5	O21-C17-C18	-2.12	105.39	110.38
2	B	501	HEM	C4A-CHB-C1B	-2.11	121.29	126.25
3	B	503	CM5	O12-C1-C2	2.09	116.45	109.37
3	B	502	CM5	C13-C18-C17	-2.09	105.62	110.01
3	A	502	CM5	C13-C18-C17	-2.07	105.65	110.01
3	B	503	CM5	O23-C24-C29	2.05	113.13	108.09

There are no chirality outliers.

All (41) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	503	CM5	C18-C13-O12-C1
3	B	503	CM5	C29-C24-O23-C16
3	A	503	CM5	O14-C13-O12-C1
3	B	502	CM5	C4-C5-C6-C11
3	A	503	CM5	C3-C4-C5-C6
3	A	503	CM5	C17-C16-O23-C24
3	A	502	CM5	O25-C26-C30-O31
3	A	503	CM5	O25-C26-C30-O31
3	B	502	CM5	O25-C26-C30-O31
3	B	503	CM5	O25-C26-C30-O31
3	B	502	CM5	O14-C13-O12-C1
3	B	503	CM5	C3-C4-C5-C6
3	B	502	CM5	C18-C13-O12-C1
3	A	502	CM5	C4-C5-C6-C7
3	A	503	CM5	C2-C3-C4-C5
3	A	502	CM5	O14-C15-C19-O20
3	A	503	CM5	O14-C15-C19-O20
3	B	502	CM5	O14-C15-C19-O20
3	B	503	CM5	O14-C15-C19-O20
3	A	502	CM5	C4-C5-C6-C11
3	A	503	CM5	C4-C5-C6-C7
3	A	503	CM5	C4-C5-C6-C11
3	B	502	CM5	C2-C3-C4-C5
3	A	503	CM5	O12-C1-C2-C3
3	A	503	CM5	C2-C1-O12-C13
3	A	503	CM5	O25-C24-O23-C16

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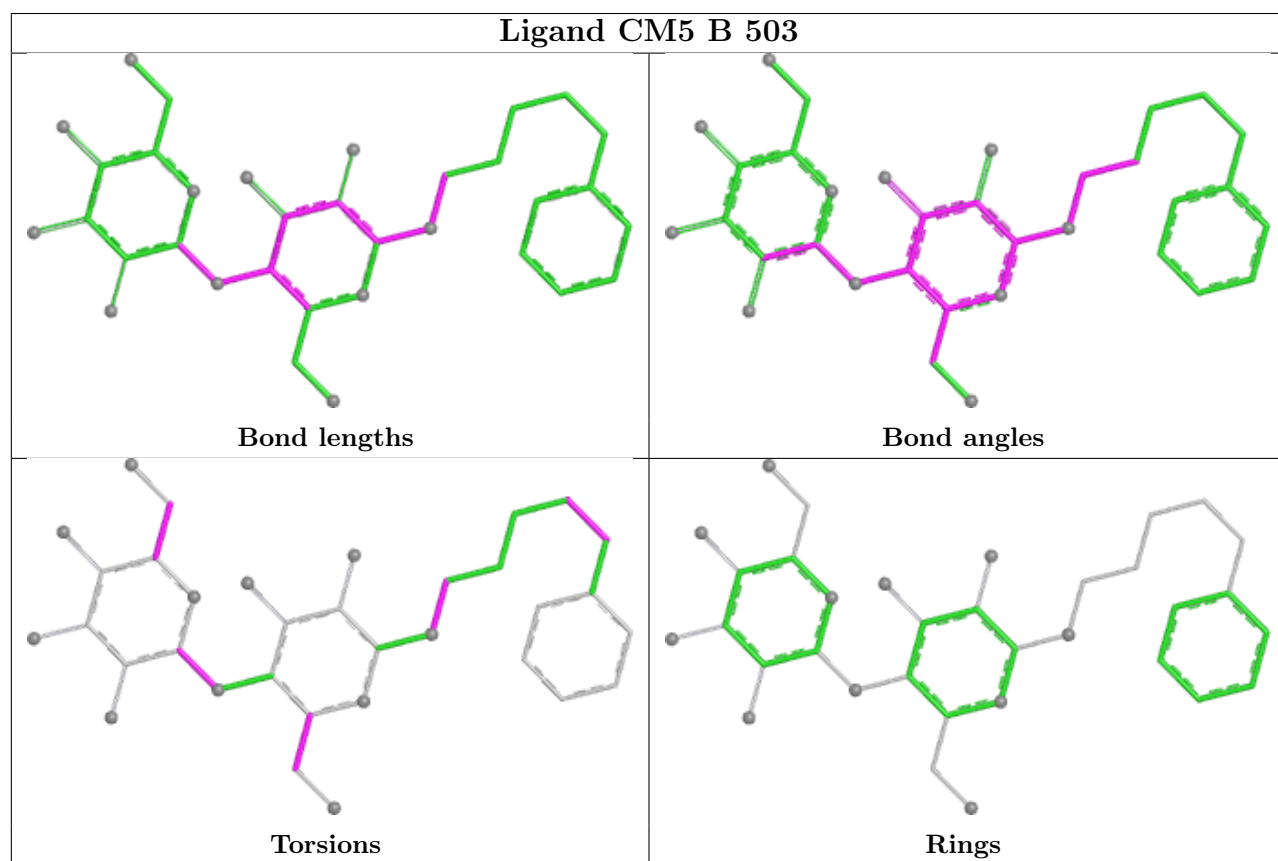
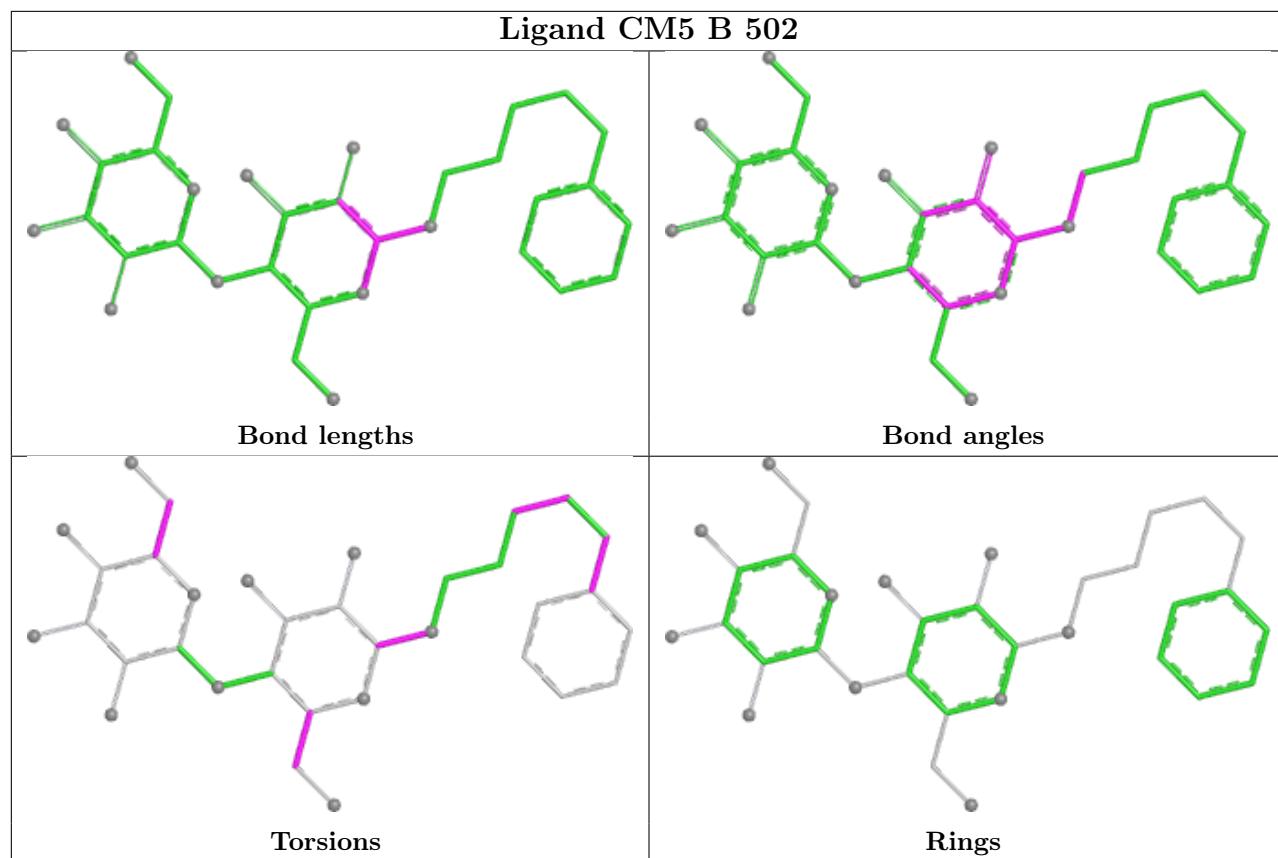
Mol	Chain	Res	Type	Atoms
3	A	503	CM5	C15-C16-O23-C24
3	A	503	CM5	C1-C2-C3-C4
3	B	503	CM5	C2-C1-O12-C13
3	A	503	CM5	C29-C24-O23-C16
2	A	501	HEM	CAA-CBA-CGA-O1A
3	A	503	CM5	C27-C26-C30-O31
3	B	503	CM5	C27-C26-C30-O31
3	A	502	CM5	C27-C26-C30-O31
3	B	502	CM5	C27-C26-C30-O31
3	B	503	CM5	C16-C15-C19-O20
2	A	501	HEM	CAA-CBA-CGA-O2A
3	B	502	CM5	C4-C5-C6-C7
2	B	501	HEM	CAA-CBA-CGA-O2A
2	B	501	HEM	CAA-CBA-CGA-O1A
2	B	501	HEM	CAD-CBD-CGD-O2D

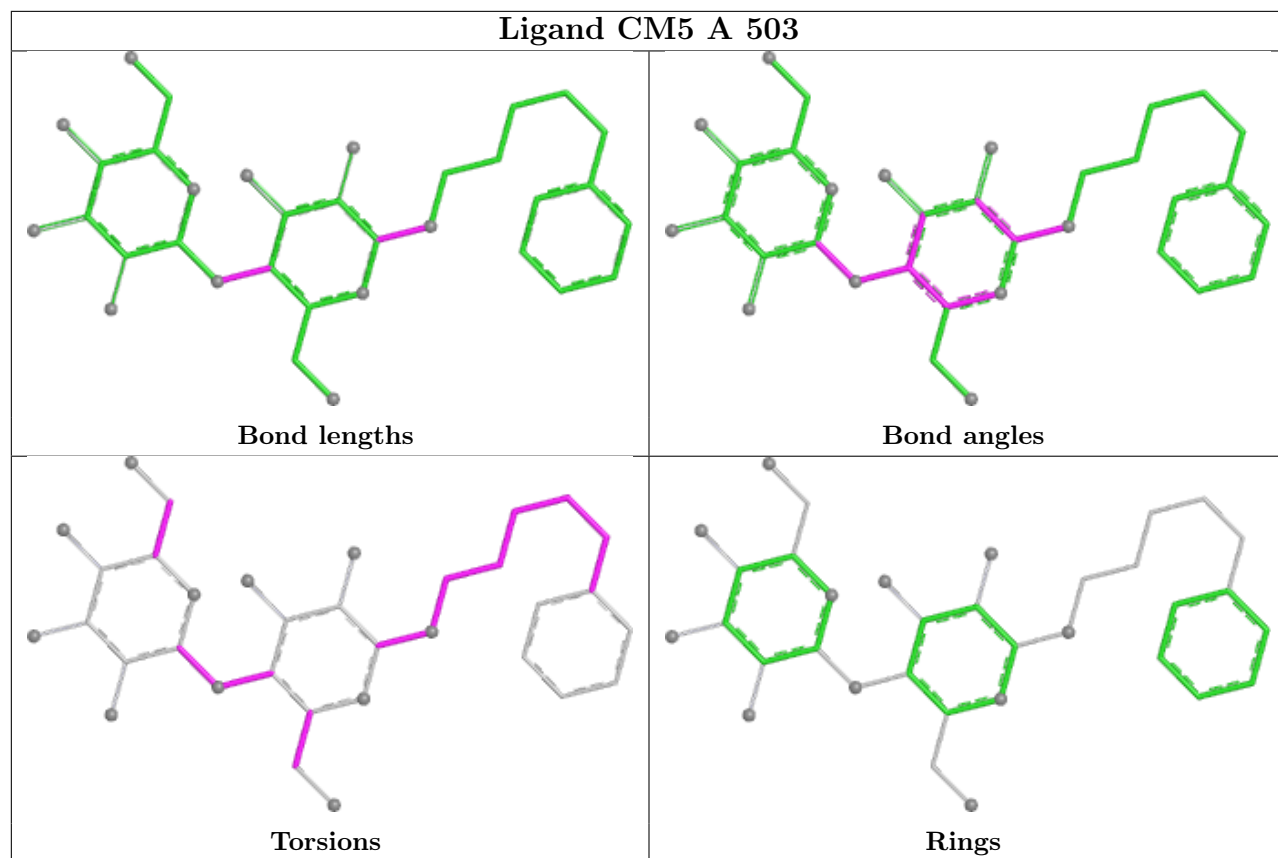
There are no ring outliers.

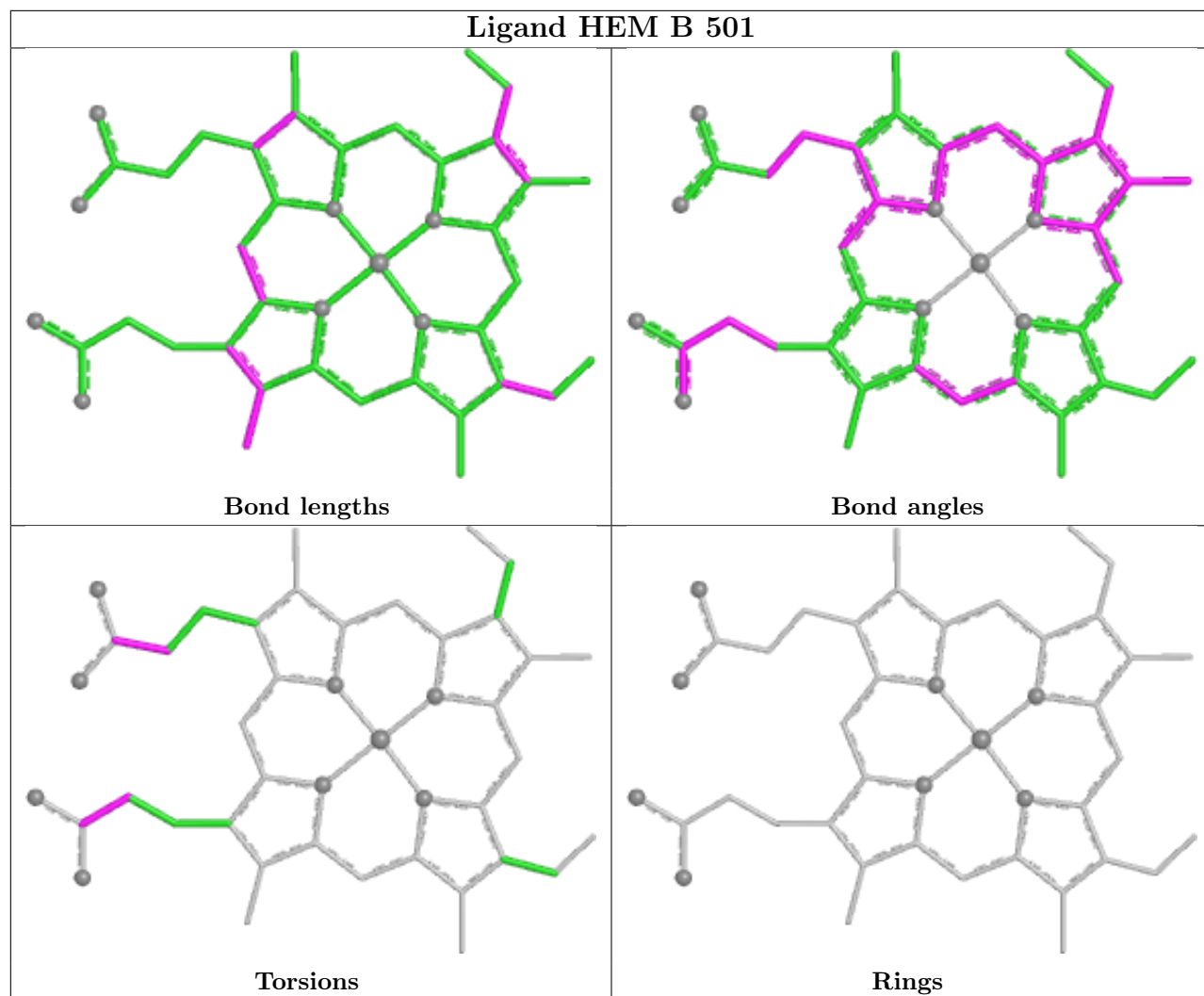
5 monomers are involved in 30 short contacts:

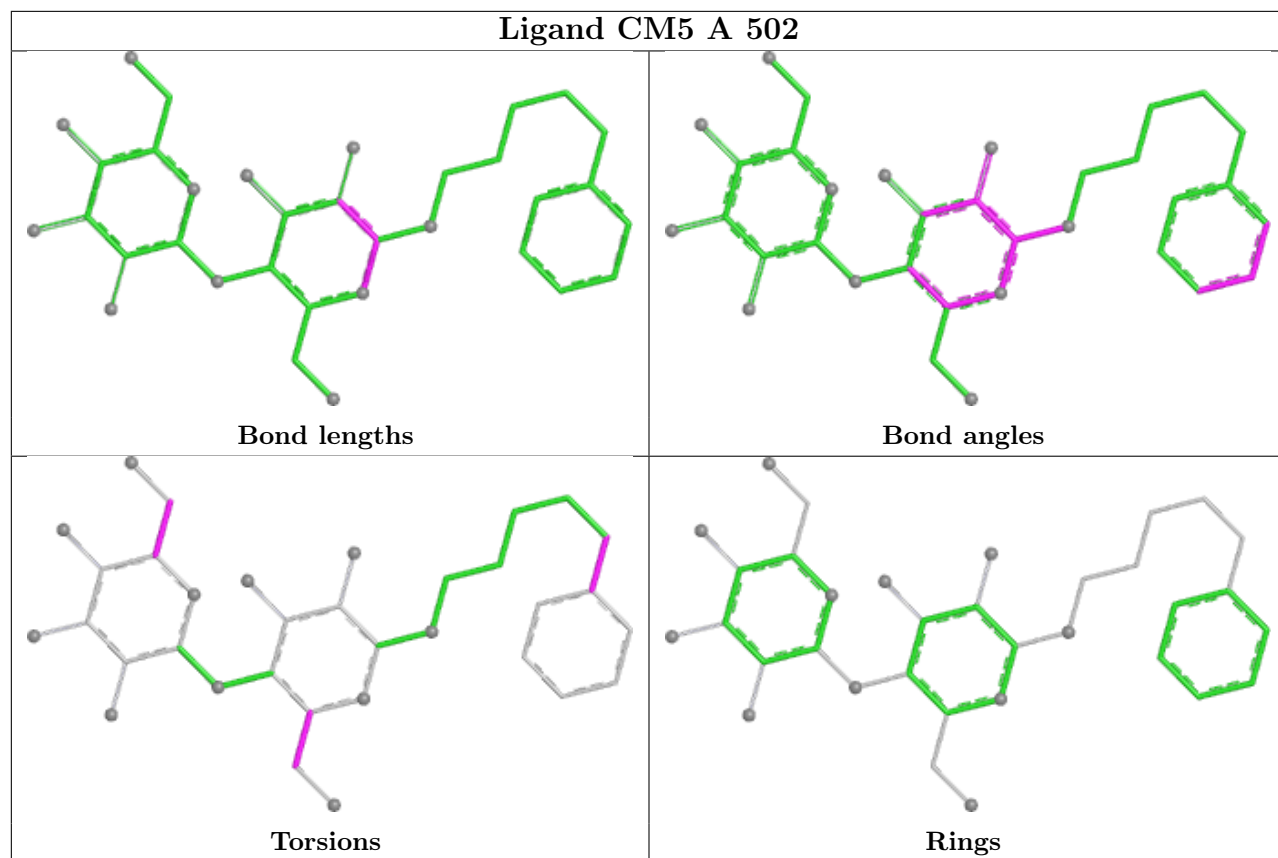
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	502	CM5	9	0
3	B	503	CM5	12	0
3	A	503	CM5	2	0
2	B	501	HEM	2	0
2	A	501	HEM	5	0

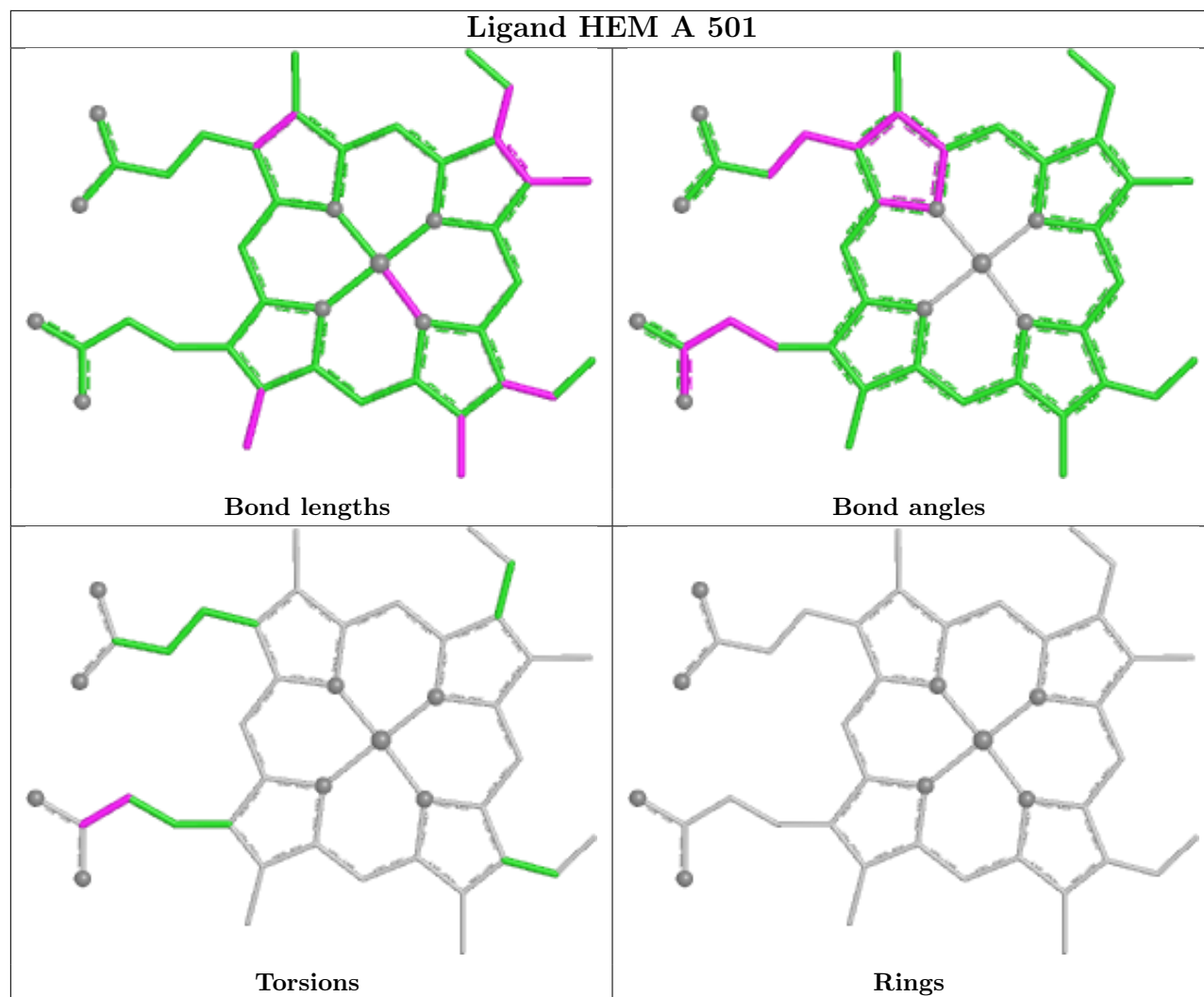
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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.











5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	459/478 (96%)	-1.81	0 100 100	17, 36, 58, 73	1 (0%)
1	B	464/478 (97%)	-1.80	0 100 100	17, 36, 59, 73	1 (0%)
All	All	923/956 (96%)	-1.81	0 100 100	17, 36, 58, 73	2 (0%)

There are no RSRZ outliers to report.

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](#)

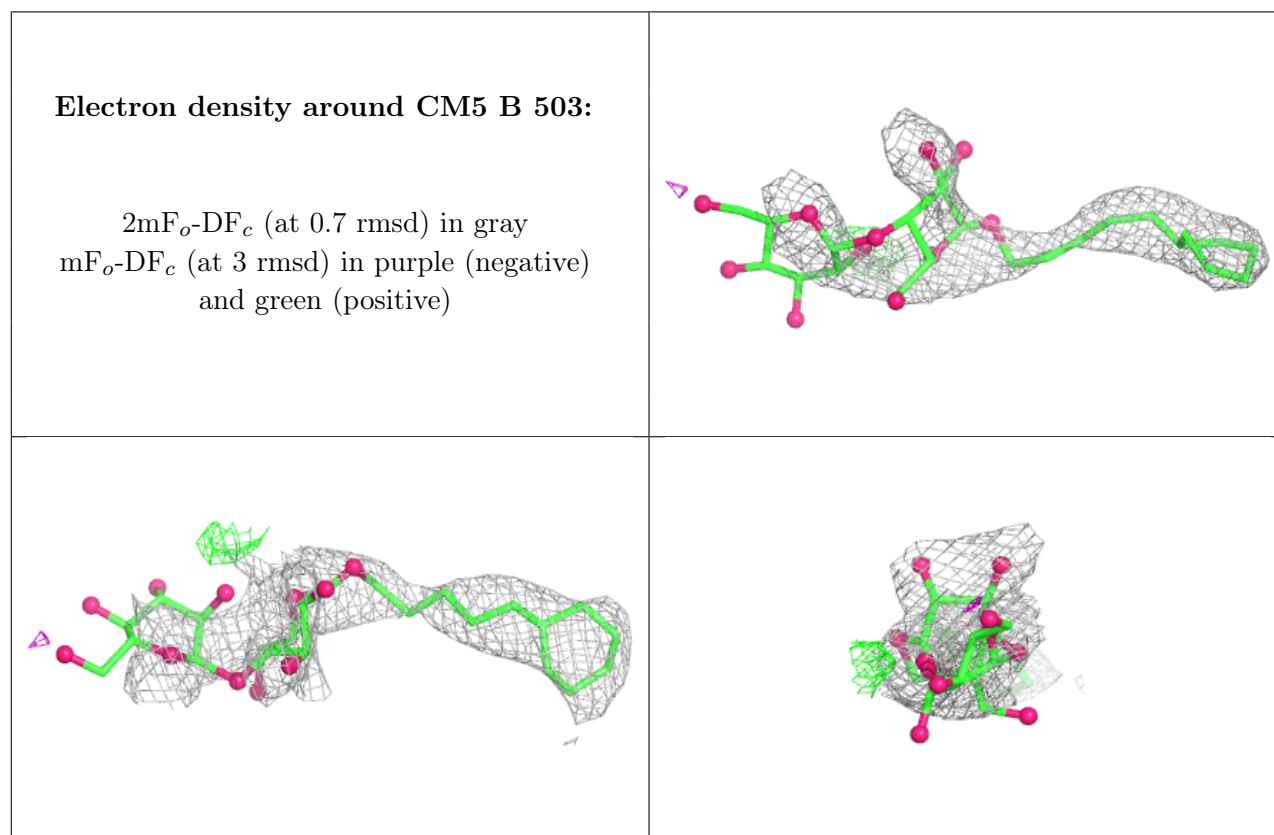
There are no oligosaccharides in this entry.

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.

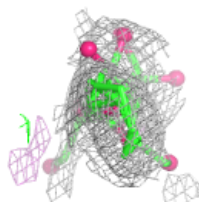
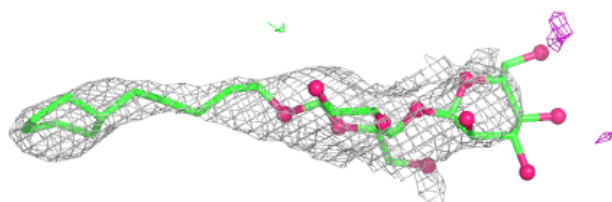
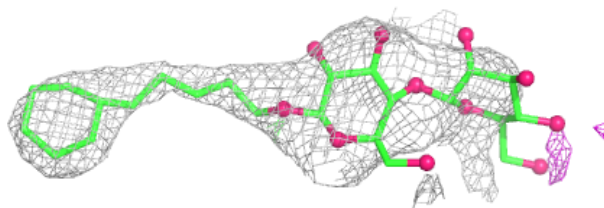
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	CM5	B	503	34/34	0.96	0.07	66,142,167,172	0
3	CM5	A	503	34/34	0.97	0.07	63,106,117,117	0
3	CM5	B	502	34/34	0.99	0.04	48,88,101,102	0
3	CM5	A	502	34/34	0.99	0.05	52,97,107,108	0
2	HEM	A	501	43/43	1.00	0.02	14,21,28,31	0
2	HEM	B	501	43/43	1.00	0.02	16,20,32,39	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.

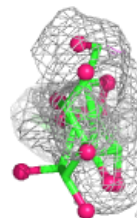
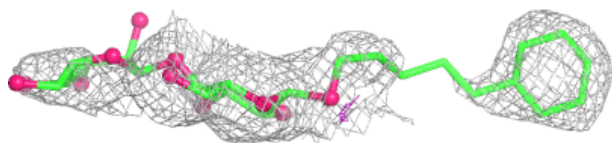
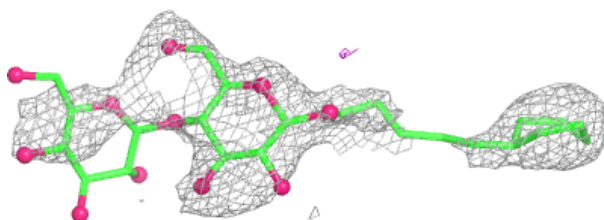


Electron density around CM5 A 503:

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

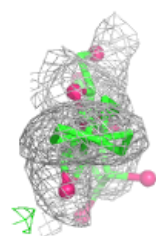
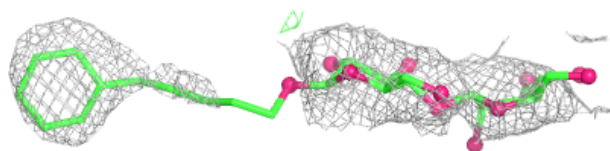
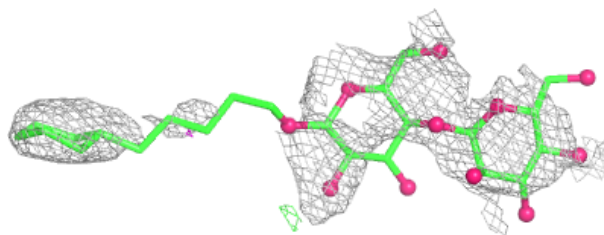
**Electron density around CM5 B 502:**

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



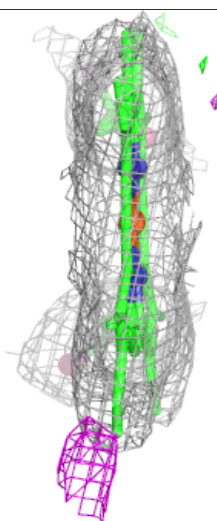
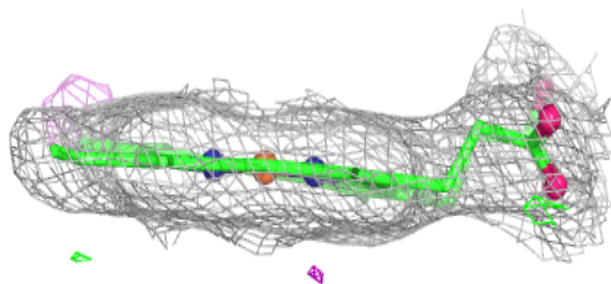
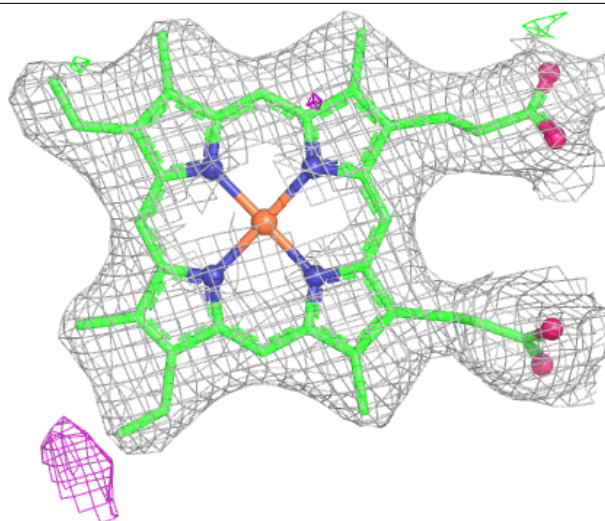
Electron density around CM5 A 502:

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



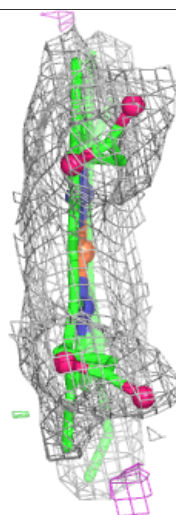
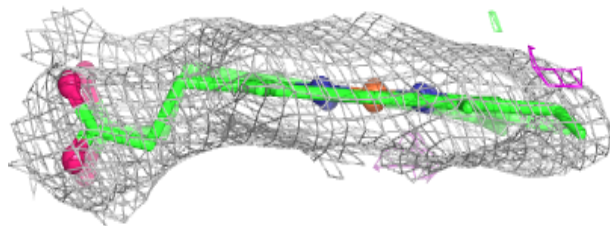
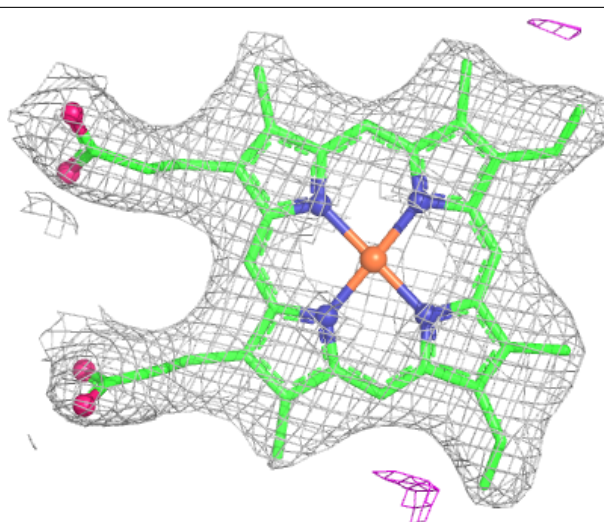
Electron density around HEM A 501:

$2mF_o-DF_c$ (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 [i](#)

There are no such residues in this entry.