



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2024 – 03:40 AM EST

PDB ID : 3HX9  
Title : Structure of heme-degrader, MhuD (Rv3592), from Mycobacterium tuberculosis with two hemes bound in its active site  
Authors : Chim, N.; Nguyen, T.Q.; Iniguez, A.; Goulding, C.W.  
Deposited on : 2009-06-19  
Resolution : 1.75 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](mailto: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>.

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

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

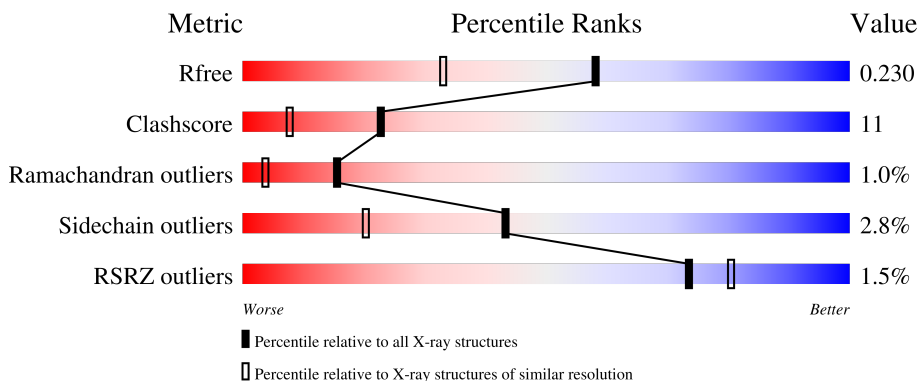
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.75 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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  $\geq 3$ , 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	124	 66% 13% • 19%
1	B	124	 65% 14% • 21%

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 1793 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 Protein Rv3592.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	101	754	484	133	137	0	0	0
1	B	98	742	477	131	134	0	0	0

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	106	GLY	-	expression tag	UNP O06156
A	107	GLY	-	expression tag	UNP O06156
A	108	VAL	-	expression tag	UNP O06156
A	109	PRO	-	expression tag	UNP O06156
A	110	ARG	-	expression tag	UNP O06156
A	111	GLY	-	expression tag	UNP O06156
A	112	LYS	-	expression tag	UNP O06156
A	113	LEU	-	expression tag	UNP O06156
A	114	ALA	-	expression tag	UNP O06156
A	115	ALA	-	expression tag	UNP O06156
A	116	ALA	-	expression tag	UNP O06156
A	117	LEU	-	expression tag	UNP O06156
A	118	GLU	-	expression tag	UNP O06156
A	119	HIS	-	expression tag	UNP O06156
A	120	HIS	-	expression tag	UNP O06156
A	121	HIS	-	expression tag	UNP O06156
A	122	HIS	-	expression tag	UNP O06156
A	123	HIS	-	expression tag	UNP O06156
A	124	HIS	-	expression tag	UNP O06156
B	106	GLY	-	expression tag	UNP O06156
B	107	GLY	-	expression tag	UNP O06156
B	108	VAL	-	expression tag	UNP O06156
B	109	PRO	-	expression tag	UNP O06156
B	110	ARG	-	expression tag	UNP O06156
B	111	GLY	-	expression tag	UNP O06156

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- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0
3	B	1	Total Cl 1 1	0	0

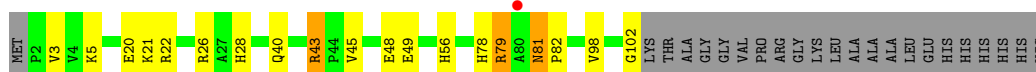
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	62	Total O 62 62	0	0
4	B	61	Total O 61 61	0	0

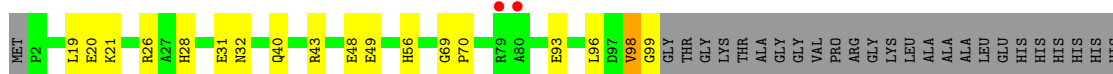
### 3 Residue-property plots [i](#)

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: Protein Rv3592



- Molecule 1: Protein Rv3592



## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	43.97Å 64.62Å 71.08Å 90.00° 90.01° 90.00°	Depositor
Resolution (Å)	19.35 – 1.75 19.34 – 1.75	Depositor EDS
% Data completeness (in resolution range)	98.9 (19.35-1.75) 98.8 (19.34-1.75)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.19 (at 1.74Å)	Xtrriage
Refinement program	REFMAC 5.5.0089	Depositor
R, $R_{free}$	0.186 , 0.231 0.185 , 0.230	Depositor DCC
$R_{free}$ test set	1018 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.6	Xtrriage
Anisotropy	0.095	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 19.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.488 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	1793	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	22.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.60% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: HEM, CL

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	1.25	2/776 (0.3%)	1.17	3/1058 (0.3%)
1	B	1.31	1/764 (0.1%)	0.99	1/1042 (0.1%)
All	All	1.28	3/1540 (0.2%)	1.08	4/2100 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	98	VAL	C-N	19.36	1.67	1.33
1	A	98	VAL	C-N	14.62	1.59	1.33
1	A	48	GLU	CD-OE2	-5.98	1.19	1.25

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	43	ARG	NE-CZ-NH1	15.86	128.23	120.30
1	A	43	ARG	NE-CZ-NH2	-13.07	113.76	120.30
1	A	43	ARG	CD-NE-CZ	5.95	131.94	123.60
1	B	98	VAL	O-C-N	-5.08	114.56	123.20

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	754	0	722	15	0
1	B	742	0	713	15	0
2	A	86	0	60	6	0
2	B	86	0	60	5	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	62	0	0	3	0
4	B	61	0	0	2	0
All	All	1793	0	1555	37	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 (37) 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:B:98:VAL:C	1:B:99:GLY:N	1.67	1.45
1:A:20:GLU:OE2	1:A:43:ARG:HD3	1.59	1.02
1:A:81:ASN:CB	1:A:82:PRO:HA	1.94	0.96
1:A:22:ARG:HH12	1:A:81:ASN:CB	1.87	0.87
1:B:20:GLU:OE2	1:B:43:ARG:NH1	2.07	0.86
1:A:28:HIS:HD2	4:A:129:HOH:O	1.61	0.84
1:A:81:ASN:CB	1:A:82:PRO:CA	2.58	0.82
2:B:300:HEM:HBC2	2:B:300:HEM:HMC2	1.69	0.73
1:B:26:ARG:HD3	2:B:300:HEM:HBD2	1.76	0.68
1:A:22:ARG:NH1	1:A:81:ASN:CB	2.56	0.67
1:B:28:HIS:HE1	4:B:195:HOH:O	1.77	0.66
2:A:300:HEM:HBC2	2:A:300:HEM:HMC1	1.77	0.66
1:A:40:GLN:OE1	1:A:56:HIS:HE1	1.83	0.61
1:B:98:VAL:C	1:B:99:GLY:CA	2.67	0.61
1:B:40:GLN:OE1	1:B:56:HIS:HE1	1.84	0.60
1:B:49:GLU:H	1:B:49:GLU:CD	2.08	0.56
1:A:102:GLY:H	1:B:32:ASN:HD21	1.57	0.53
1:A:20:GLU:OE2	1:A:43:ARG:CD	2.47	0.53
2:A:300:HEM:HBA1	2:A:200:HEM:HAA1	1.91	0.52
2:B:300:HEM:HBA2	2:B:200:HEM:HMA3	1.90	0.51
2:A:300:HEM:HBA2	2:A:200:HEM:HMA3	1.92	0.51
1:B:56:HIS:HD2	4:B:167:HOH:O	1.94	0.50
1:B:20:GLU:CD	1:B:43:ARG:NH1	2.65	0.49
2:A:200:HEM:HHC	2:A:200:HEM:HBB2	1.97	0.46
2:A:300:HEM:HBC2	2:A:300:HEM:CMC	2.44	0.46
1:A:26:ARG:NE	2:A:300:HEM:O2A	2.50	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:49:GLU:CD	1:B:49:GLU:N	2.70	0.45
1:A:56:HIS:HD2	4:A:173:HOH:O	1.99	0.45
2:B:300:HEM:HBC2	2:B:300:HEM:CMC	2.44	0.45
1:A:49:GLU:H	1:A:49:GLU:CD	2.20	0.44
1:A:78:HIS:O	1:A:79:ARG:CB	2.65	0.44
1:A:45:VAL:HG21	1:B:93:GLU:HG3	1.99	0.43
1:B:96:LEU:C	1:B:96:LEU:HD12	2.39	0.42
4:A:159:HOH:O	1:B:31:GLU:HG3	2.20	0.42
1:B:69:GLY:HA3	1:B:70:PRO:HD3	1.91	0.41
2:B:200:HEM:HHD	2:B:200:HEM:CBC	2.50	0.41
1:A:3:VAL:HG21	1:A:5:LYS:NZ	2.37	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	99/124 (80%)	96 (97%)	1 (1%)	2 (2%)	<a href="#">7</a> <a href="#">1</a>
1	B	96/124 (77%)	95 (99%)	1 (1%)	0	<a href="#">100</a> <a href="#">100</a>
All	All	195/248 (79%)	191 (98%)	2 (1%)	2 (1%)	<a href="#">15</a> <a href="#">4</a>

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	79	ARG
1	A	81	ASN

### 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	72/90 (80%)	71 (99%)	1 (1%)	67	52
1	B	72/90 (80%)	69 (96%)	3 (4%)	30	9
All	All	144/180 (80%)	140 (97%)	4 (3%)	43	20

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

Mol	Chain	Res	Type
1	A	21	LYS
1	B	19	LEU
1	B	21	LYS
1	B	48	GLU

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

Mol	Chain	Res	Type
1	A	7	ASN
1	A	28	HIS
1	A	56	HIS
1	B	7	ASN
1	B	28	HIS
1	B	32	ASN
1	B	56	HIS
1	B	68	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	HEM	B	300	1	41,50,50	1.91	10 (24%)	45,82,82	1.98	10 (22%)
2	HEM	A	300	1	41,50,50	1.87	8 (19%)	45,82,82	1.95	16 (35%)
2	HEM	B	200	-	41,50,50	1.86	8 (19%)	45,82,82	2.23	16 (35%)
2	HEM	A	200	-	41,50,50	1.89	11 (26%)	45,82,82	2.19	14 (31%)

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
2	HEM	B	300	1	-	5/12/54/54	-
2	HEM	A	300	1	-	4/12/54/54	-
2	HEM	B	200	-	-	2/12/54/54	-
2	HEM	A	200	-	-	2/12/54/54	-

All (37) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	200	HEM	C3D-C2D	7.31	1.52	1.36
2	B	200	HEM	C3D-C2D	7.18	1.52	1.36
2	B	300	HEM	C3C-C2C	-6.14	1.31	1.40
2	A	300	HEM	C3C-C2C	-6.06	1.32	1.40
2	B	300	HEM	C3D-C2D	5.17	1.47	1.36
2	A	300	HEM	C3D-C2D	5.04	1.47	1.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	200	HEM	C3C-C2C	-4.01	1.34	1.40
2	B	200	HEM	C3C-C2C	-3.75	1.35	1.40
2	B	300	HEM	C3C-CAC	3.38	1.54	1.47
2	A	300	HEM	C3C-CAC	3.22	1.54	1.47
2	A	300	HEM	CAB-C3B	2.89	1.55	1.47
2	B	300	HEM	CAA-C2A	2.79	1.56	1.52
2	A	200	HEM	CAA-C2A	2.71	1.56	1.52
2	B	300	HEM	CMC-C2C	2.65	1.57	1.51
2	B	200	HEM	C3C-CAC	2.64	1.53	1.47
2	B	200	HEM	CMD-C2D	2.63	1.56	1.50
2	A	200	HEM	CMD-C2D	2.53	1.56	1.50
2	A	300	HEM	C3B-C2B	-2.51	1.32	1.37
2	A	200	HEM	FE-NB	2.47	2.09	1.96
2	B	300	HEM	CAD-C3D	2.43	1.57	1.51
2	B	300	HEM	CAB-C3B	2.40	1.54	1.47
2	A	300	HEM	CAD-C3D	2.37	1.57	1.51
2	B	300	HEM	FE-ND	2.36	2.08	1.96
2	B	300	HEM	C1A-NA	2.27	1.40	1.36
2	A	200	HEM	C3C-CAC	2.26	1.52	1.47
2	B	200	HEM	FE-NB	2.25	2.08	1.96
2	A	200	HEM	C1A-NA	2.23	1.40	1.36
2	B	200	HEM	FE-ND	2.17	2.07	1.96
2	B	200	HEM	CMB-C2B	2.16	1.55	1.50
2	A	300	HEM	CMD-C2D	2.14	1.55	1.50
2	A	300	HEM	FE-ND	2.11	2.07	1.96
2	B	200	HEM	C1A-NA	2.11	1.40	1.36
2	A	200	HEM	CAB-C3B	2.08	1.53	1.47
2	A	200	HEM	FE-ND	2.08	2.07	1.96
2	B	300	HEM	C3B-C2B	-2.07	1.33	1.37
2	A	200	HEM	O2A-CGA	-2.01	1.24	1.30
2	A	200	HEM	C1B-NB	-2.01	1.36	1.40

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	200	HEM	C4D-ND-C1D	6.20	111.48	105.07
2	B	200	HEM	C2C-C3C-C4C	6.16	111.20	106.90
2	A	200	HEM	C4D-ND-C1D	6.10	111.38	105.07
2	A	200	HEM	C2C-C3C-C4C	5.80	110.95	106.90
2	B	300	HEM	C4D-ND-C1D	5.43	110.69	105.07
2	A	300	HEM	C4D-ND-C1D	5.13	110.37	105.07
2	B	300	HEM	CHC-C4B-NB	5.01	129.88	124.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	300	HEM	CHC-C4B-NB	4.90	129.76	124.43
2	B	200	HEM	CHB-C1B-NB	4.29	129.69	124.38
2	B	300	HEM	C1B-NB-C4B	4.16	109.38	105.07
2	A	200	HEM	C1B-NB-C4B	4.14	109.35	105.07
2	B	300	HEM	C3B-C2B-C1B	3.72	109.25	106.49
2	A	200	HEM	CMA-C3A-C4A	-3.72	122.75	128.46
2	B	300	HEM	CAD-C3D-C4D	3.55	130.86	124.66
2	A	300	HEM	C1B-NB-C4B	3.54	108.72	105.07
2	A	300	HEM	C3B-C2B-C1B	3.52	109.10	106.49
2	B	200	HEM	CMA-C3A-C4A	-3.44	123.17	128.46
2	B	200	HEM	CHC-C4B-NB	3.40	128.13	124.43
2	B	300	HEM	CAD-CBD-CGD	3.40	120.92	113.60
2	A	200	HEM	CHC-C4B-NB	3.31	128.03	124.43
2	B	200	HEM	C1B-NB-C4B	3.19	108.37	105.07
2	A	200	HEM	CHB-C1B-NB	3.03	128.13	124.38
2	A	200	HEM	CBD-CAD-C3D	-2.97	104.36	112.63
2	B	300	HEM	C2B-C1B-NB	-2.90	106.40	109.84
2	A	300	HEM	CAD-C3D-C4D	2.84	129.63	124.66
2	B	200	HEM	C4C-CHD-C1D	2.77	126.21	122.56
2	A	200	HEM	O2D-CGD-CBD	2.73	122.80	114.03
2	B	200	HEM	CAD-CBD-CGD	-2.72	107.76	113.60
2	B	200	HEM	CBD-CAD-C3D	-2.72	105.08	112.63
2	B	300	HEM	CAD-C3D-C2D	-2.66	122.92	127.88
2	A	300	HEM	CHA-C4D-ND	2.62	127.62	124.38
2	A	200	HEM	C1D-C2D-C3D	-2.60	104.23	106.96
2	B	200	HEM	C1D-C2D-C3D	-2.58	104.25	106.96
2	A	300	HEM	CAA-CBA-CGA	-2.53	106.67	113.76
2	B	200	HEM	CBA-CAA-C2A	-2.48	108.39	112.62
2	A	200	HEM	C4A-C3A-C2A	2.46	108.71	107.00
2	B	200	HEM	O2D-CGD-CBD	2.40	121.74	114.03
2	A	300	HEM	CAD-C3D-C2D	-2.33	123.53	127.88
2	A	300	HEM	CBA-CAA-C2A	-2.33	108.64	112.62
2	A	200	HEM	CAD-CBD-CGD	-2.32	108.60	113.60
2	B	200	HEM	CMA-C3A-C2A	2.32	129.32	124.94
2	A	300	HEM	CMA-C3A-C4A	-2.32	124.90	128.46
2	A	300	HEM	O2D-CGD-CBD	2.28	121.37	114.03
2	A	200	HEM	CBA-CAA-C2A	-2.27	108.75	112.62
2	B	200	HEM	O2A-CGA-CBA	2.26	121.29	114.03
2	A	200	HEM	O2A-CGA-CBA	2.24	121.22	114.03
2	A	300	HEM	CBD-CAD-C3D	-2.23	106.42	112.63
2	B	200	HEM	CAD-C3D-C4D	2.21	128.52	124.66
2	B	300	HEM	C4A-C3A-C2A	2.18	108.51	107.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	200	HEM	O2D-CGD-O1D	-2.16	117.92	123.30
2	A	300	HEM	C2B-C1B-NB	-2.14	107.31	109.84
2	A	300	HEM	O1D-CGD-CBD	-2.12	116.26	123.08
2	A	300	HEM	C1D-C2D-C3D	-2.09	104.76	106.96
2	B	300	HEM	O1A-CGA-CBA	-2.03	116.55	123.08
2	B	200	HEM	C3B-C2B-C1B	2.02	107.99	106.49
2	A	300	HEM	CMB-C2B-C1B	-2.01	121.98	125.04

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	300	HEM	C3D-CAD-CBD-CGD
2	A	300	HEM	C2A-CAA-CBA-CGA
2	A	200	HEM	CAA-CBA-CGA-O1A
2	B	200	HEM	CAA-CBA-CGA-O1A
2	B	300	HEM	CAD-CBD-CGD-O1D
2	B	300	HEM	CAD-CBD-CGD-O2D
2	B	200	HEM	CAA-CBA-CGA-O2A
2	A	200	HEM	CAA-CBA-CGA-O2A
2	A	300	HEM	CAA-CBA-CGA-O1A
2	A	300	HEM	CAA-CBA-CGA-O2A
2	B	300	HEM	CAA-CBA-CGA-O1A
2	B	300	HEM	CAA-CBA-CGA-O2A
2	A	300	HEM	CAD-CBD-CGD-O1D

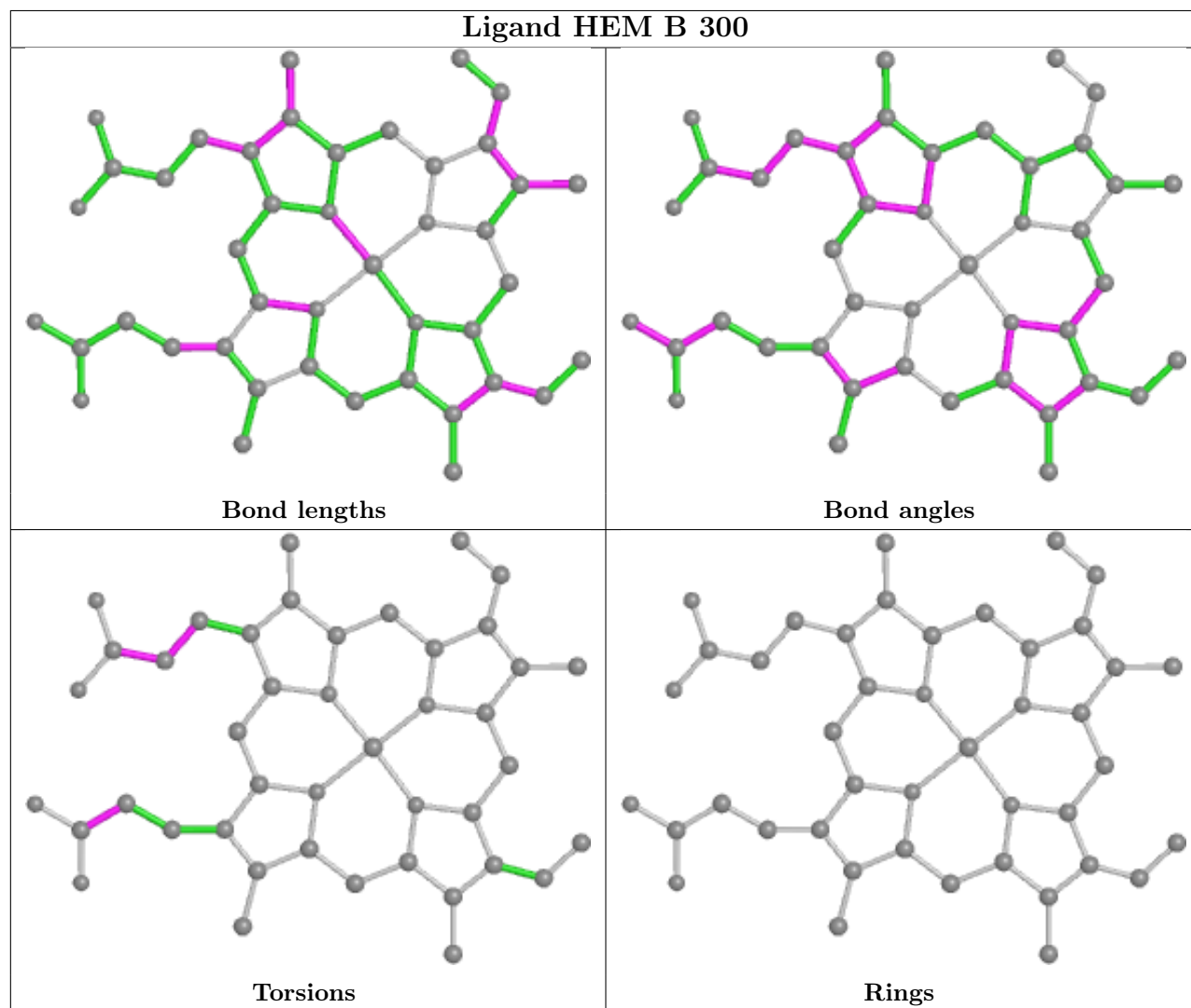
There are no ring outliers.

4 monomers are involved in 11 short contacts:

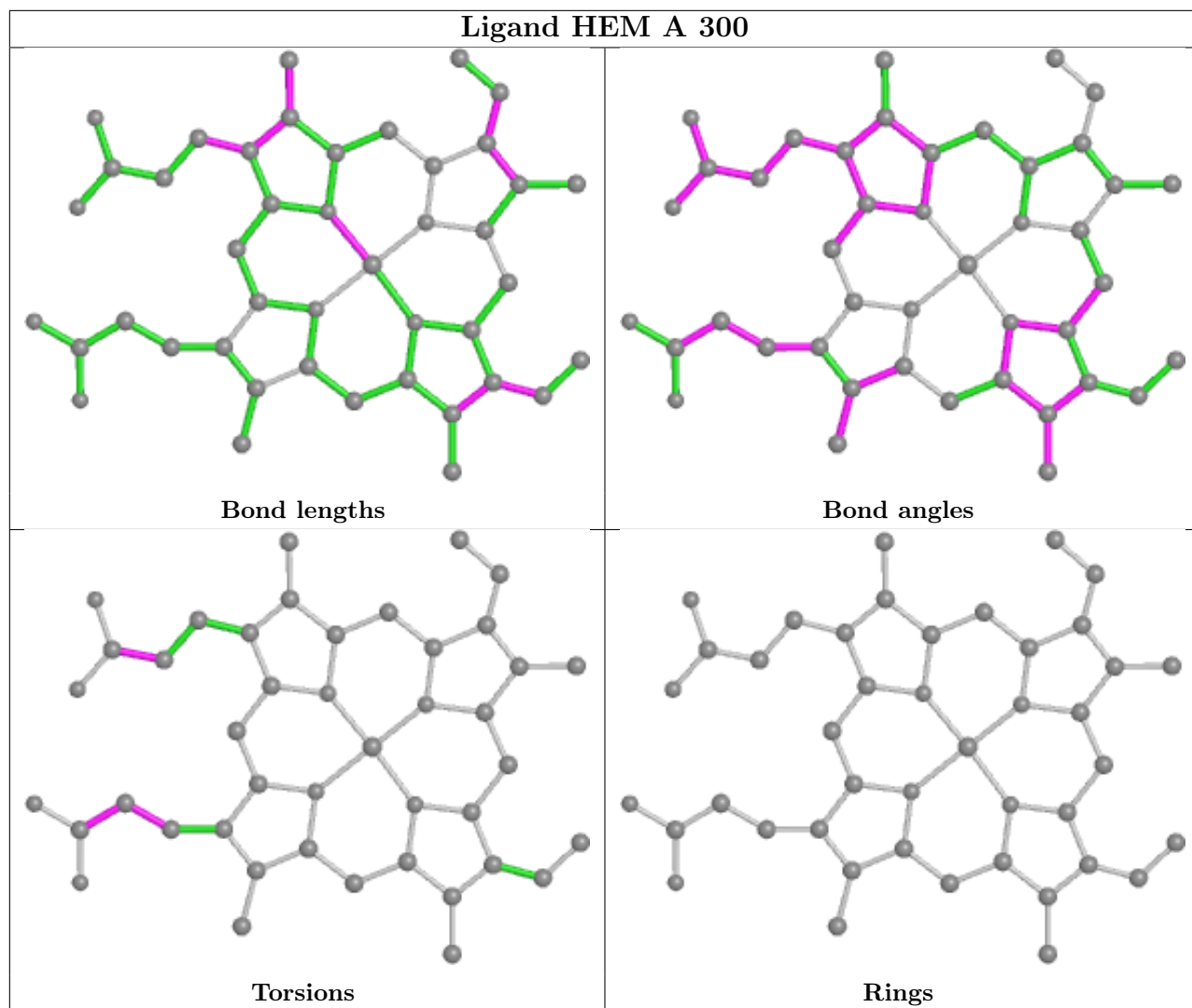
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	300	HEM	4	0
2	A	300	HEM	5	0
2	B	200	HEM	2	0
2	A	200	HEM	3	0

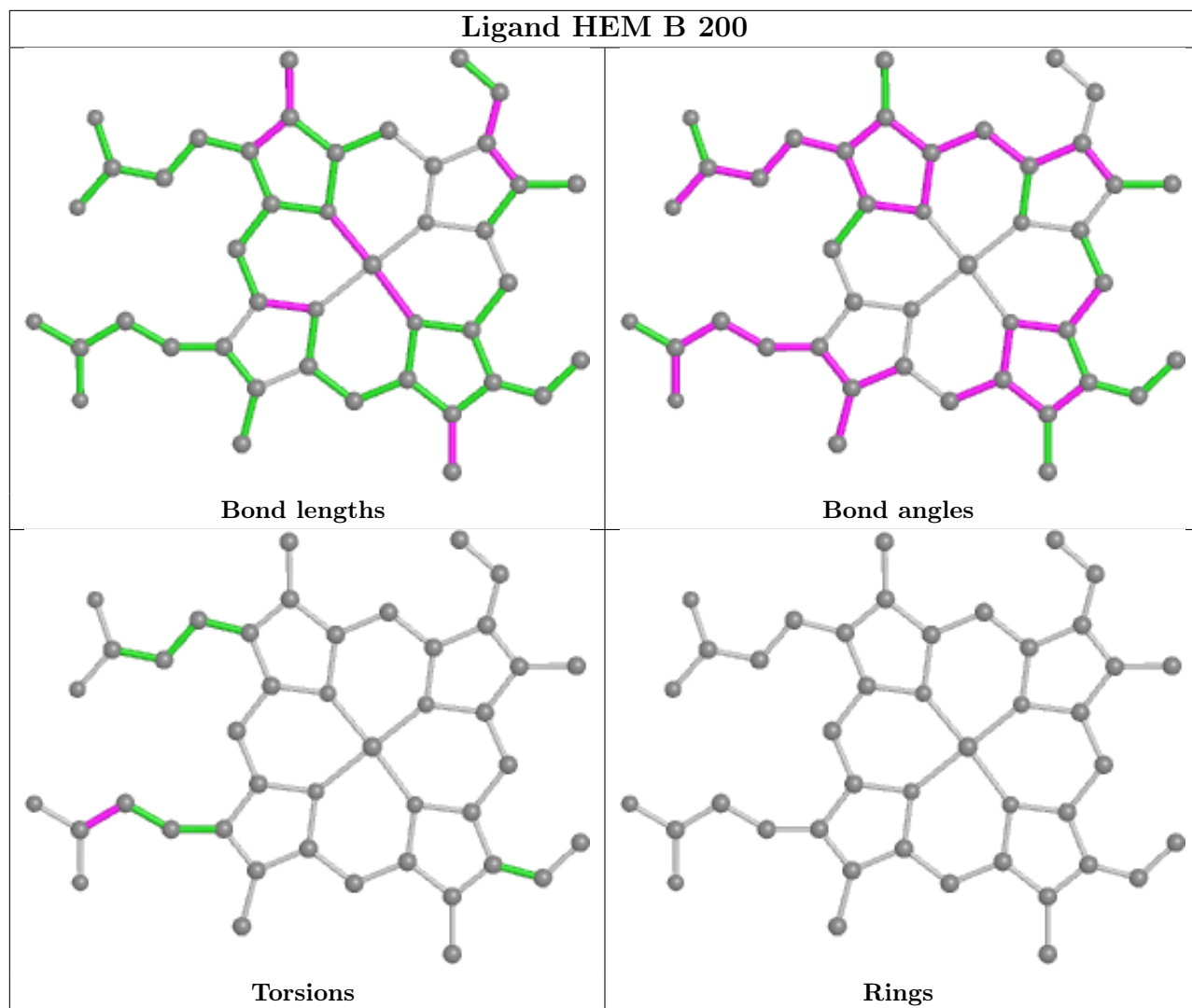
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

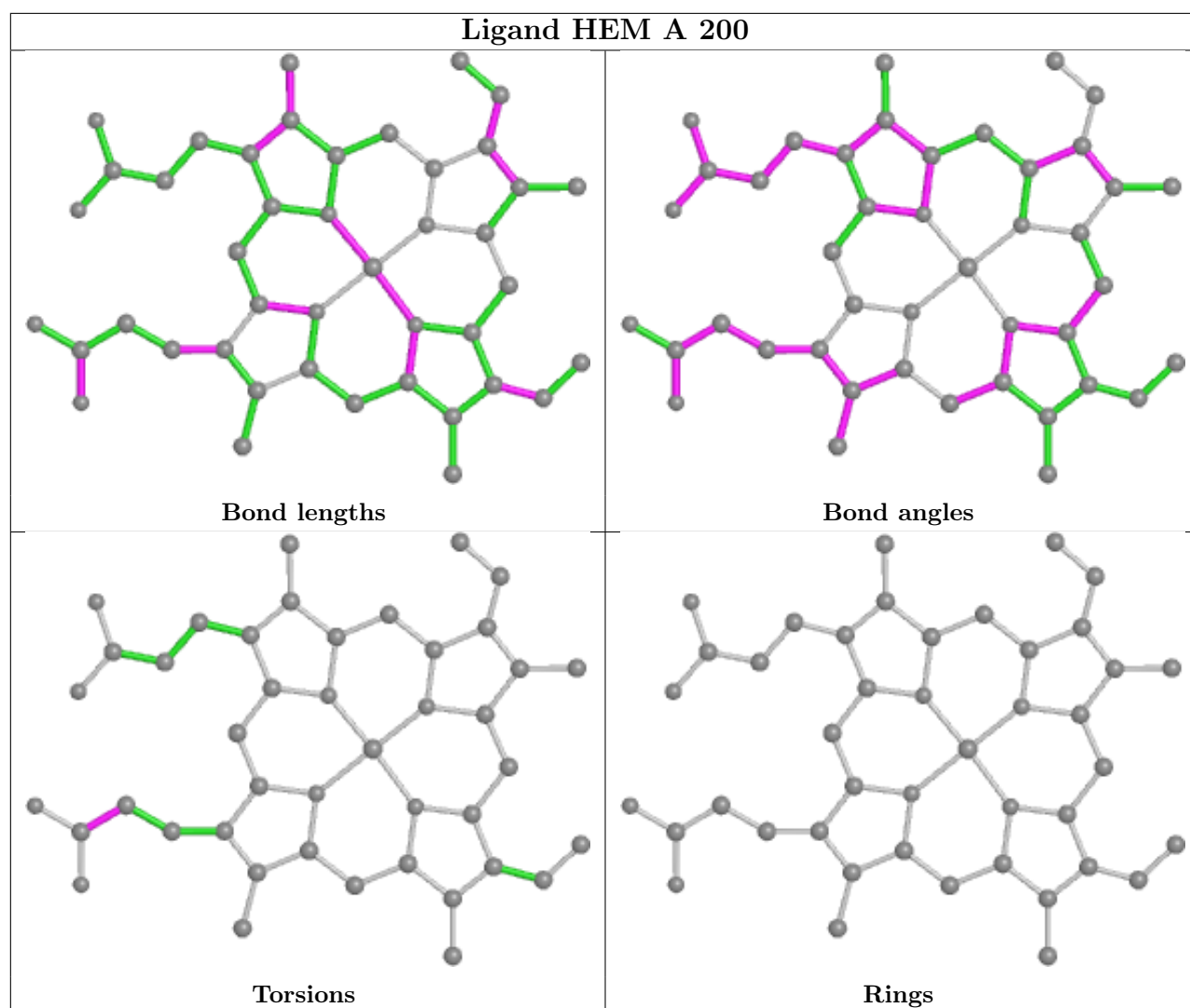
in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers 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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	98:VAL	C	99:GLY	N	1.67

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	101/124 (81%)	-0.26	1 (0%) 82 87	12, 20, 40, 52	0
1	B	98/124 (79%)	-0.30	2 (2%) 65 72	12, 20, 40, 52	0
All	All	199/248 (80%)	-0.28	3 (1%) 73 80	12, 20, 42, 52	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	80	ALA	4.1
1	B	79	ARG	3.4
1	B	80	ALA	3.1

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> 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.

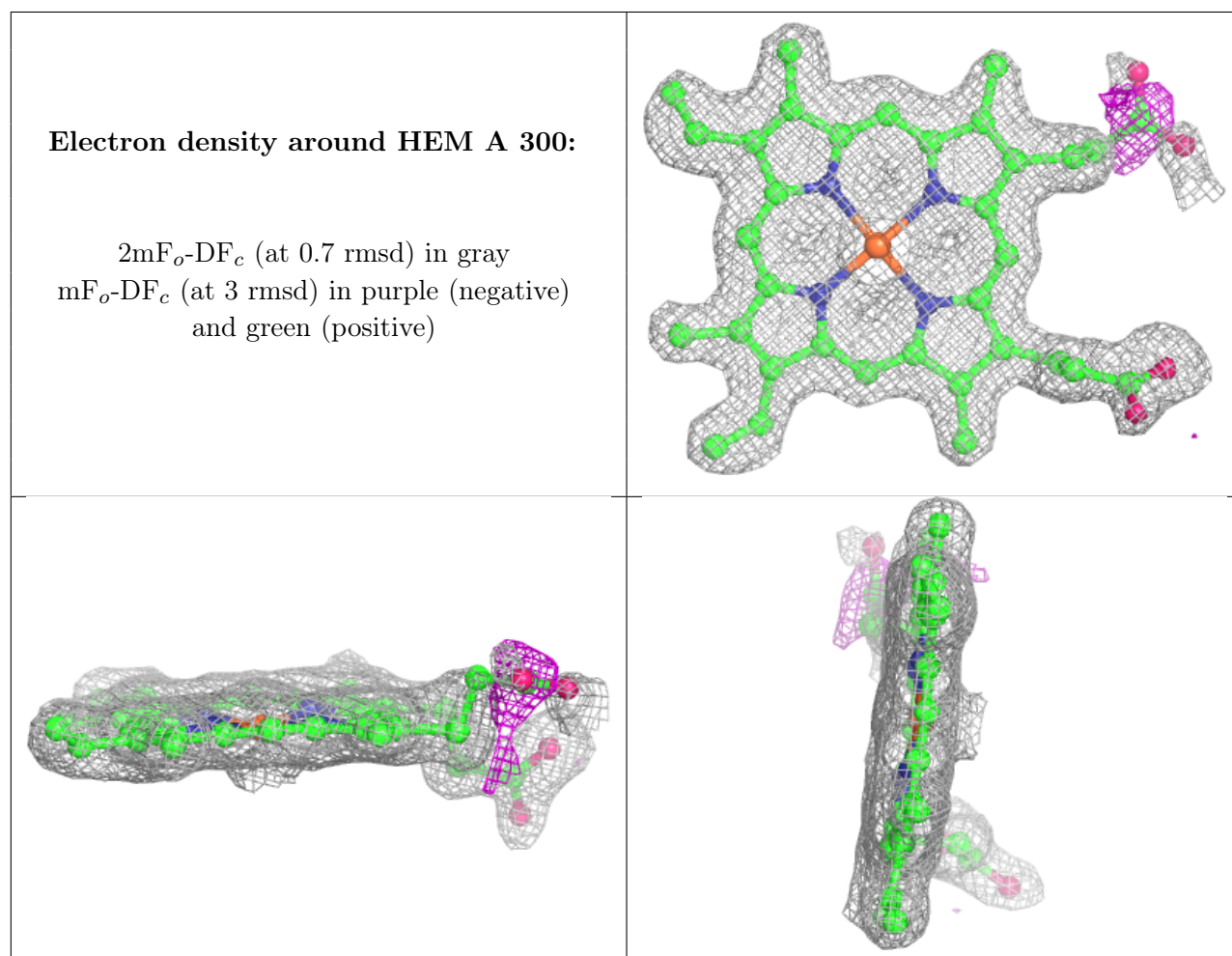
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	HEM	A	300	43/43	0.97	0.11	18,20,41,51	0
2	HEM	A	200	43/43	0.97	0.10	16,19,30,37	0

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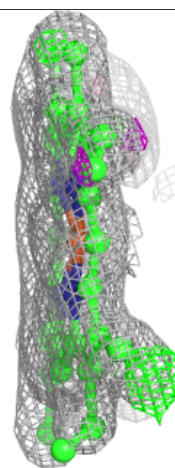
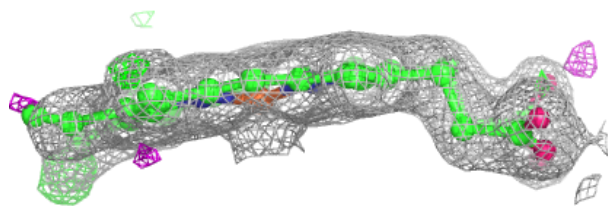
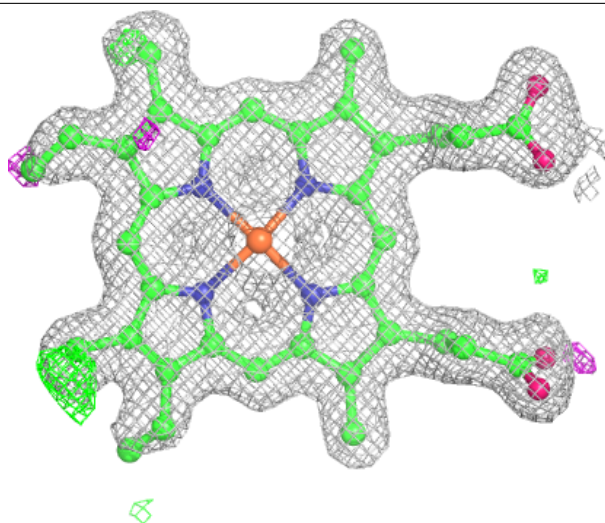
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
2	HEM	B	300	43/43	0.97	0.11	18,21,48,51	0
2	HEM	B	200	43/43	0.97	0.10	15,20,29,36	0
3	CL	A	301	1/1	1.00	0.05	18,18,18,18	0
3	CL	B	301	1/1	1.00	0.06	18,18,18,18	0

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



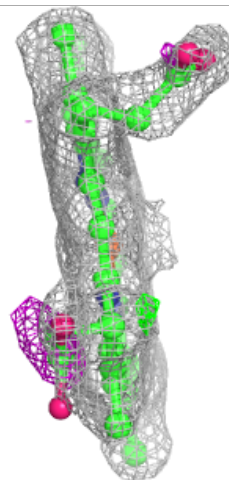
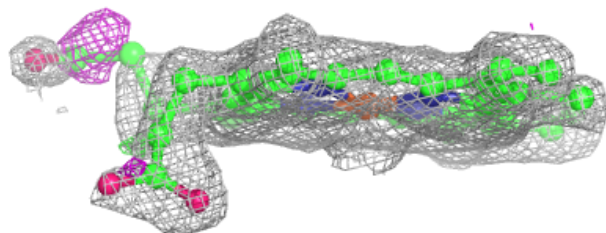
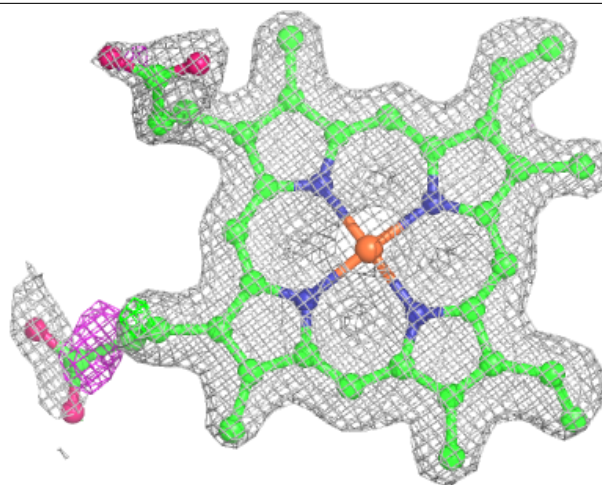
**Electron density around HEM A 200:**

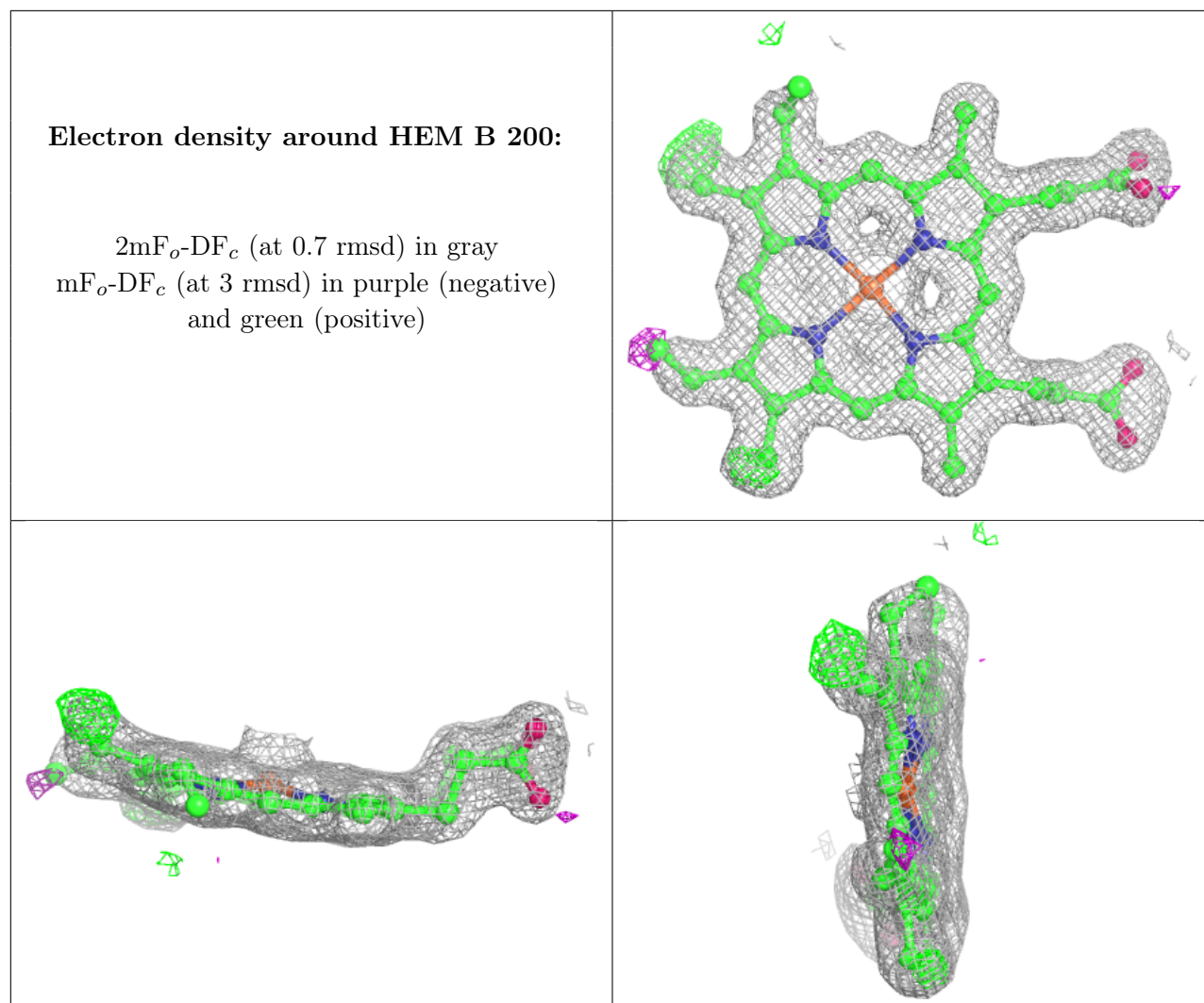
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around HEM B 300:**

$2mF_o-DF_c$  (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.