



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 9, 2020 – 05:56 PM BST

PDB ID : 1V8X
Title : Crystal Structure of the Dioxygen-bound Heme Oxygenase from *Corynebacterium diphtheriae*
Authors : Unno, M.; Matsui, T.; Chu, G.C.; Couture, M.; Yoshida, T.; Rousseau, D.L.; Olson, J.S.; Ikeda-Saito, M.
Deposited on : 2004-01-15
Resolution : 1.85 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 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 : 2.13.1
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) : 2.13.1

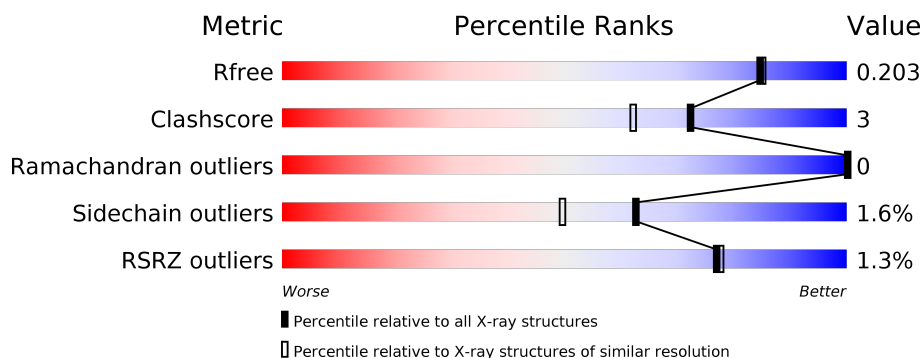
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 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	2469 (1.86-1.86)
Clashscore	141614	2625 (1.86-1.86)
Ramachandran outliers	138981	2592 (1.86-1.86)
Sidechain outliers	138945	2592 (1.86-1.86)
RSRZ outliers	127900	2436 (1.86-1.86)

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 on 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	215	<div> <div>2%</div> <div> <div></div> <div>88%</div> <div>9%</div> <div>••</div> </div> </div>
1	B	215	<div> <div></div> <div> <div>88%</div> <div>8%</div> <div>••</div> </div> </div>
1	C	215	<div> <div>2%</div> <div> <div></div> <div>89%</div> <div>7%</div> <div>•</div> </div> </div>
2	D	2	<div> <div></div> <div>100%</div> </div>

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5679 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.

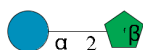
- Molecule 1 is a protein called Heme oxygenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	210	Total	C	N	O	S	0	1	0
			1674	1054	299	318	3			
1	B	209	Total	C	N	O	S	0	3	0
			1676	1054	298	321	3			
1	C	208	Total	C	N	O	S	0	1	0
			1662	1048	294	317	3			

There are 15 discrepancies between the modelled and reference sequences:

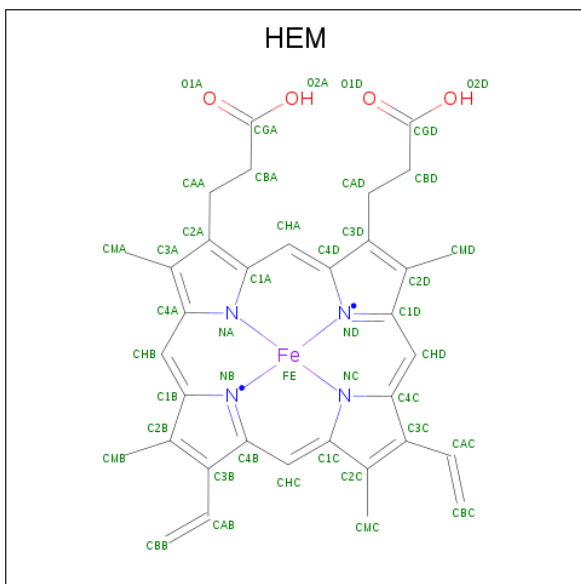
Chain	Residue	Modelled	Actual	Comment	Reference
A	34	LYS	GLU	SEE REMARK 999	UNP P71119
A	60	VAL	ALA	SEE REMARK 999	UNP P71119
A	92	GLY	ASP	SEE REMARK 999	UNP P71119
A	93	SER	GLY	SEE REMARK 999	UNP P71119
A	192	HIS	ASN	SEE REMARK 999	UNP P71119
B	334	LYS	GLU	SEE REMARK 999	UNP P71119
B	360	VAL	ALA	SEE REMARK 999	UNP P71119
B	392	GLY	ASP	SEE REMARK 999	UNP P71119
B	393	SER	GLY	SEE REMARK 999	UNP P71119
B	492	HIS	ASN	SEE REMARK 999	UNP P71119
C	634	LYS	GLU	SEE REMARK 999	UNP P71119
C	660	VAL	ALA	SEE REMARK 999	UNP P71119
C	692	GLY	ASP	SEE REMARK 999	UNP P71119
C	693	SER	GLY	SEE REMARK 999	UNP P71119
C	792	HIS	ASN	SEE REMARK 999	UNP P71119

- Molecule 2 is an oligosaccharide called beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	D	2	Total	C	O	0	0	0
			23	12	11			

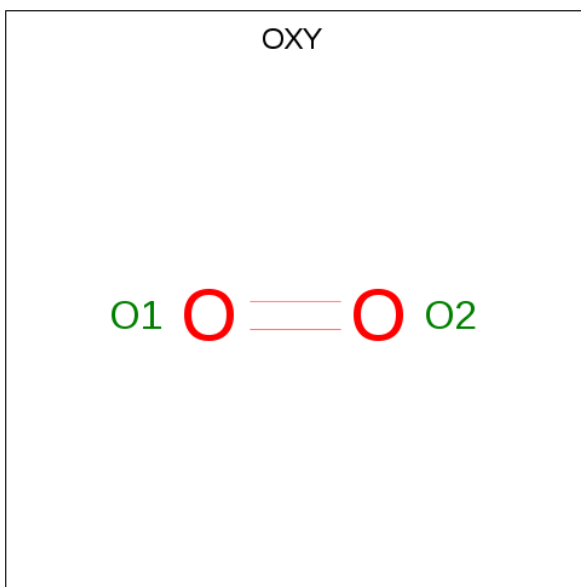
- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).





Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is OXYGEN MOLECULE (three-letter code: OXY) (formula: O₂).




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

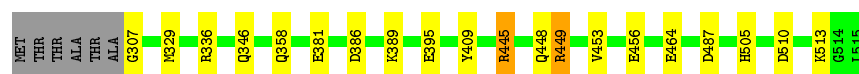
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	152	Total O 152 152	0	0
6	B	164	Total O 164 164	0	0
6	C	133	Total O 133 133	0	0

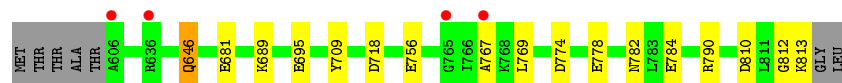
- Molecule 1: Heme oxygenase



- Chain B:  88% 8% ..



- Chain C: 2% 89% 7%



- Chain D:  100%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	54.00 Å 62.97 Å 107.49 Å 90.00° 100.96° 90.00°	Depositor
Resolution (Å)	40.00 – 1.85 40.56 – 1.85	Depositor EDS
% Data completeness (in resolution range)	100.0 (40.00-1.85) 100.0 (40.56-1.85)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.63 (at 1.86 Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.153 , 0.193 0.166 , 0.203	Depositor DCC
R_{free} test set	6150 reflections (10.15%)	wwPDB-VP
Wilson B-factor (Å ²)	16.5	Xtriage
Anisotropy	0.089	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5679	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.16% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: HEM, GLC, OXY, FRU, SO4

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	0.94	0/1711	0.96	7/2310 (0.3%)
1	B	0.97	1/1725 (0.1%)	1.01	9/2328 (0.4%)
1	C	0.94	1/1698 (0.1%)	0.96	5/2293 (0.2%)
All	All	0.95	2/5134 (0.0%)	0.98	21/6931 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	681	GLU	CD-OE1	7.22	1.33	1.25
1	B	381	GLU	CD-OE1	5.93	1.32	1.25

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	445[A]	ARG	NE-CZ-NH1	7.66	124.13	120.30
1	B	445[B]	ARG	NE-CZ-NH1	7.66	124.13	120.30
1	C	718	ASP	CB-CG-OD2	7.61	125.15	118.30
1	C	790	ARG	NE-CZ-NH1	7.35	123.97	120.30
1	B	445[A]	ARG	NE-CZ-NH2	-7.33	116.63	120.30
1	B	445[B]	ARG	NE-CZ-NH2	-7.33	116.63	120.30
1	B	487	ASP	CB-CG-OD2	6.44	124.09	118.30
1	B	386	ASP	CB-CG-OD2	6.21	123.89	118.30
1	A	86	ASP	CB-CG-OD2	6.05	123.75	118.30
1	B	449	ARG	NE-CZ-NH1	5.96	123.28	120.30
1	A	108	ASP	CB-CG-OD2	5.94	123.64	118.30
1	C	810	ASP	CB-CG-OD2	5.88	123.59	118.30
1	B	329	MET	CG-SD-CE	-5.84	90.85	100.20
1	A	210	ASP	CB-CG-OD2	5.83	123.55	118.30
1	A	85	ARG	NE-CZ-NH1	5.80	123.20	120.30
1	B	336	ARG	NE-CZ-NH2	-5.67	117.46	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	187	ASP	CB-CG-OD2	5.55	123.30	118.30
1	C	709	TYR	CB-CG-CD1	5.39	124.24	121.00
1	A	118	ASP	CB-CG-OD1	5.37	123.13	118.30
1	A	44	ARG	NE-CZ-NH1	5.09	122.84	120.30
1	C	774	ASP	CB-CG-OD2	5.07	122.86	118.30

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	1674	0	1635	10	1
1	B	1676	0	1628	11	1
1	C	1662	0	1618	11	0
2	D	23	0	21	0	0
3	A	43	0	30	4	0
3	B	43	0	30	0	0
3	C	43	0	30	0	0
4	A	15	0	0	1	0
4	B	20	0	0	0	0
4	C	25	0	0	0	0
5	A	2	0	0	0	0
5	B	2	0	0	0	0
5	C	2	0	0	0	0
6	A	152	0	0	2	0
6	B	164	0	0	5	0
6	C	133	0	0	4	0
All	All	5679	0	4992	35	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (35) 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)
4:A:2003:SO4:O3	6:A:5149:HOH:O	1.97	0.81
3:A:901:HEM:HHD	3:A:901:HEM:HBC2	1.67	0.77
1:A:168:LYS:HD2	1:A:168:LYS:H	1.61	0.63
1:B:307:GLY:N	6:B:5163:HOH:O	2.31	0.63
1:A:118:ASP:OD2	1:B:445[A]:ARG:NH2	2.32	0.61
1:B:358:GLN:NE2	6:B:5141:HOH:O	2.35	0.58
1:C:767:ALA:HA	6:C:272:HOH:O	2.02	0.58
1:C:695:GLU:HG3	6:C:438:HOH:O	2.04	0.57
1:C:646:GLN:HA	1:C:646:GLN:HE21	1.70	0.57
1:C:646:GLN:NE2	1:C:646:GLN:HA	2.20	0.55
1:B:448:GLN:HG2	1:B:453:VAL:O	2.07	0.55
1:B:389:LYS:CE	6:B:5080:HOH:O	2.56	0.54
1:B:510:ASP:HA	1:B:513:LYS:HE2	1.90	0.54
1:C:812:GLY:O	1:C:813:LYS:HB2	2.10	0.52
1:A:34:LYS:HG3	1:A:36:ARG:HG3	1.92	0.50
1:B:389:LYS:HE2	6:B:5080:HOH:O	2.11	0.50
1:C:689:LYS:HD2	1:C:756:GLU:O	2.14	0.48
1:B:389:LYS:HE3	6:B:5080:HOH:O	2.14	0.47
1:A:155:PRO:O	1:A:162:HIS:HE1	1.99	0.46
1:A:11:GLU:O	1:A:15:SER:HB2	2.16	0.45
1:A:168:LYS:CD	1:A:168:LYS:H	2.21	0.44
1:B:346:GLN:HA	1:B:346:GLN:NE2	2.33	0.44
1:A:178:GLU:HG3	6:A:5142:HOH:O	2.17	0.44
1:B:505:HIS:O	1:B:505:HIS:HD2	2.01	0.43
1:C:689:LYS:HE3	6:C:362:HOH:O	2.18	0.43
1:A:46:GLN:HA	1:A:46:GLN:NE2	2.32	0.43
1:A:33:LEU:HD11	3:A:901:HEM:HMC1	2.01	0.42
1:C:778[B]:GLU:HG3	1:C:782:ASN:ND2	2.34	0.42
1:C:689:LYS:CE	6:C:362:HOH:O	2.67	0.42
3:A:901:HEM:CHD	3:A:901:HEM:HBC2	2.37	0.42
1:A:112[B]:ARG:NH1	1:A:199:ASP:OD2	2.50	0.42
1:B:389:LYS:HD2	1:B:456:GLU:O	2.20	0.42
1:C:812:GLY:O	1:C:813:LYS:CB	2.68	0.42
1:C:646:GLN:CA	1:C:646:GLN:HE21	2.33	0.41
3:A:901:HEM:HBB2	3:A:901:HEM:CMB	2.51	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:167:ALA:O	1:B:449:ARG:NH2[2_645]	2.18	0.02

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	209/215 (97%)	203 (97%)	6 (3%)	0	100	100
1	B	210/215 (98%)	206 (98%)	4 (2%)	0	100	100
1	C	207/215 (96%)	203 (98%)	4 (2%)	0	100	100
All	All	626/645 (97%)	612 (98%)	14 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	172/175 (98%)	170 (99%)	2 (1%)	71	62
1	B	174/175 (99%)	171 (98%)	3 (2%)	60	47
1	C	171/175 (98%)	168 (98%)	3 (2%)	59	45
All	All	517/525 (98%)	509 (98%)	8 (2%)	62	53

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	GLU
1	A	168	LYS
1	B	395	GLU
1	B	409	TYR
1	B	464	GLU

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Mol	Chain	Res	Type
1	C	646	GLN
1	C	769	LEU
1	C	784	GLU

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

Mol	Chain	Res	Type
1	A	46	GLN
1	B	346	GLN
1	B	358	GLN
1	B	506	GLN
1	C	625	HIS
1	C	646	GLN
1	C	762	HIS
1	C	782	ASN

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 ⓘ

2 monosaccharides 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	$\# Z > 2$
2	GLC	D	1	2	11,11,12	1.07	0	15,15,17	1.46	3 (20%)
2	FRU	D	2	2	11,12,12	1.20	1 (9%)	10,18,18	1.51	1 (10%)

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	GLC	D	1	2	-	0/2/19/22	0/1/1/1
2	FRU	D	2	2	-	1/5/24/24	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	2	FRU	O2-C2	3.60	1.46	1.40

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	2	FRU	O1-C1-C2	-4.21	102.92	111.86
2	D	1	GLC	O3-C3-C2	3.71	117.10	109.99
2	D	1	GLC	C2-C3-C4	-2.60	106.40	110.89
2	D	1	GLC	O4-C4-C3	-2.18	105.31	110.35

There are no chirality outliers.

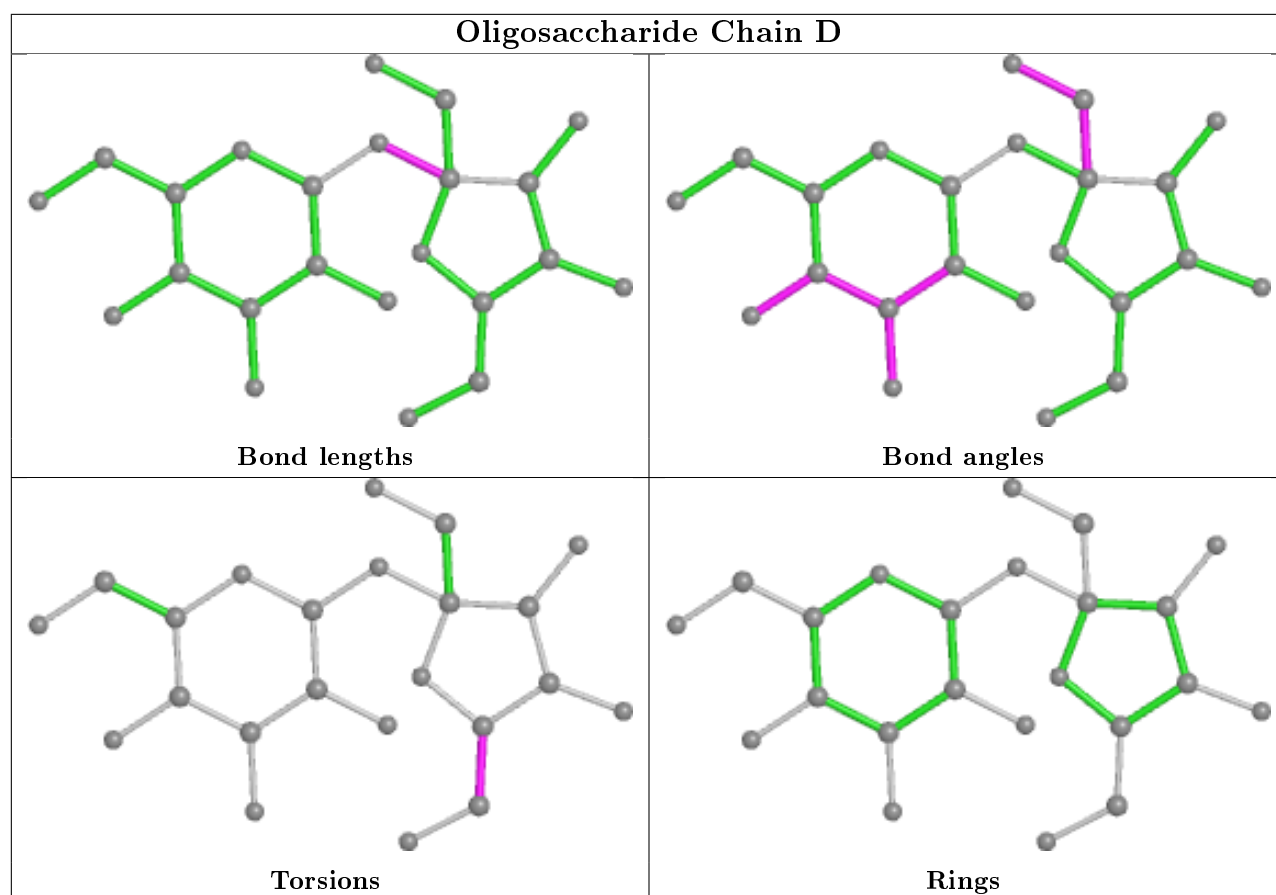
All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	2	FRU	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



5.6 Ligand geometry [i](#)

18 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	$\# Z > 2$
4	SO4	A	2003	-	4,4,4	0.38	0	6,6,6	0.64	0
4	SO4	A	2007	-	4,4,4	0.10	0	6,6,6	0.36	0
4	SO4	B	2009	-	4,4,4	0.20	0	6,6,6	0.37	0
3	HEM	B	902	1,5	27,50,50	2.05	5 (18%)	17,82,82	2.08	5 (29%)
5	OXY	A	5001	3	1,1,1	0.03	0	-	-	-
4	SO4	C	2004	-	4,4,4	0.14	0	6,6,6	0.28	0
4	SO4	C	2010	-	4,4,4	0.19	0	6,6,6	0.31	0
4	SO4	C	2012	-	4,4,4	0.18	0	6,6,6	0.28	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	HEM	A	901	1,5	27,50,50	1.93	4 (14%)	17,82,82	2.35	7 (41%)
5	OXY	B	5002	3	1,1,1	0.14	0	-		
4	SO4	B	2008	-	4,4,4	0.26	0	6,6,6	0.50	0
4	SO4	A	2011	-	4,4,4	0.13	0	6,6,6	0.87	0
4	SO4	C	2005	-	4,4,4	0.28	0	6,6,6	0.65	0
4	SO4	B	2006	-	4,4,4	0.65	0	6,6,6	0.52	0
5	OXY	C	5003	3	1,1,1	0.25	0	-		
4	SO4	C	2002	-	4,4,4	0.27	0	6,6,6	0.32	0
4	SO4	B	2001	-	4,4,4	0.30	0	6,6,6	0.58	0
3	HEM	C	903	1,5	27,50,50	2.09	5 (18%)	17,82,82	1.95	5 (29%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	HEM	B	902	1,5	-	0/6/54/54	-
3	HEM	C	903	1,5	-	0/6/54/54	-
3	HEM	A	901	1,5	-	0/6/54/54	-

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	903	HEM	C3B-C2B	-5.91	1.32	1.40
3	B	902	HEM	C3C-C2C	-5.63	1.32	1.40
3	A	901	HEM	C3C-C2C	-5.39	1.32	1.40
3	A	901	HEM	C3B-C2B	-4.91	1.33	1.40
3	B	902	HEM	C3B-C2B	-4.83	1.33	1.40
3	C	903	HEM	C3D-C2D	4.76	1.51	1.37
3	A	901	HEM	C3D-C2D	4.63	1.51	1.37
3	B	902	HEM	C3D-C2D	4.42	1.50	1.37
3	C	903	HEM	C3C-C2C	-4.05	1.34	1.40
3	C	903	HEM	C3B-CAB	3.50	1.55	1.47
3	B	902	HEM	C3C-CAC	2.81	1.53	1.47
3	B	902	HEM	C3B-CAB	2.52	1.53	1.47
3	A	901	HEM	C3B-CAB	2.26	1.52	1.47
3	C	903	HEM	C3C-CAC	2.08	1.52	1.47

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	901	HEM	C4C-C3C-C2C	4.77	110.23	106.90
3	C	903	HEM	CBD-CAD-C3D	-4.74	103.74	112.48
3	A	901	HEM	C4A-C3A-C2A	4.71	110.27	107.00
3	B	902	HEM	CMA-C3A-C4A	-4.26	121.92	128.46
3	A	901	HEM	CMA-C3A-C4A	-4.02	122.29	128.46
3	B	902	HEM	CAA-CBA-CGA	-3.83	106.24	112.67
3	B	902	HEM	CBD-CAD-C3D	-3.37	106.27	112.48
3	C	903	HEM	C4C-C3C-C2C	3.19	109.12	106.90
3	A	901	HEM	CMB-C2B-C3B	3.01	130.31	124.68
3	C	903	HEM	CAA-CBA-CGA	-2.76	108.03	112.67
3	C	903	HEM	C4A-C3A-C2A	2.66	108.84	107.00
3	A	901	HEM	CAD-CBD-CGD	2.60	117.03	112.67
3	A	901	HEM	C3C-C4C-NC	-2.45	106.31	110.94
3	B	902	HEM	CMA-C3A-C2A	2.39	129.45	124.94
3	B	902	HEM	C4A-C3A-C2A	2.31	108.60	107.00
3	A	901	HEM	CAA-CBA-CGA	-2.23	108.93	112.67
3	C	903	HEM	CMA-C3A-C4A	-2.11	125.22	128.46

There are no chirality outliers.

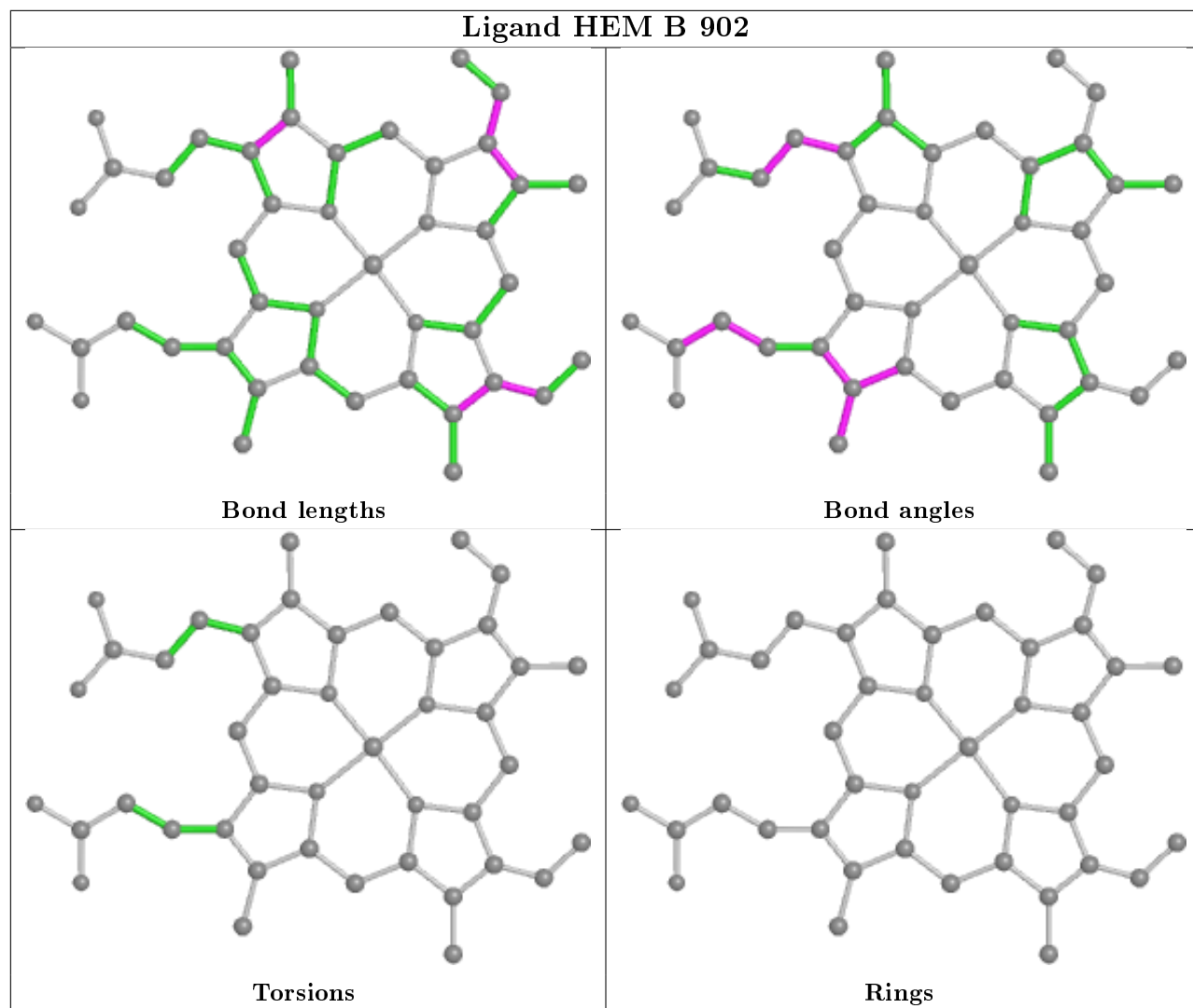
There are no torsion outliers.

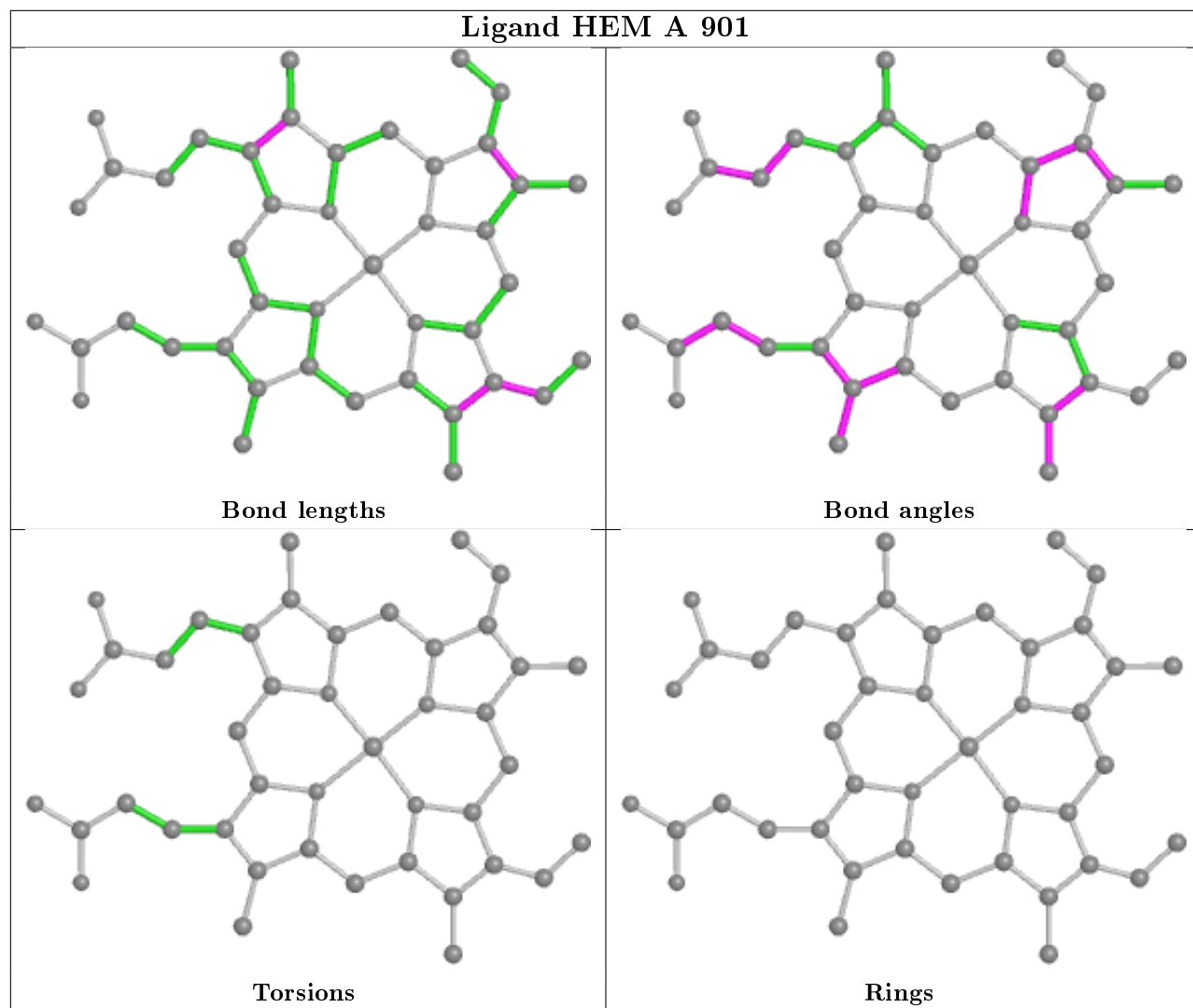
There are no ring outliers.

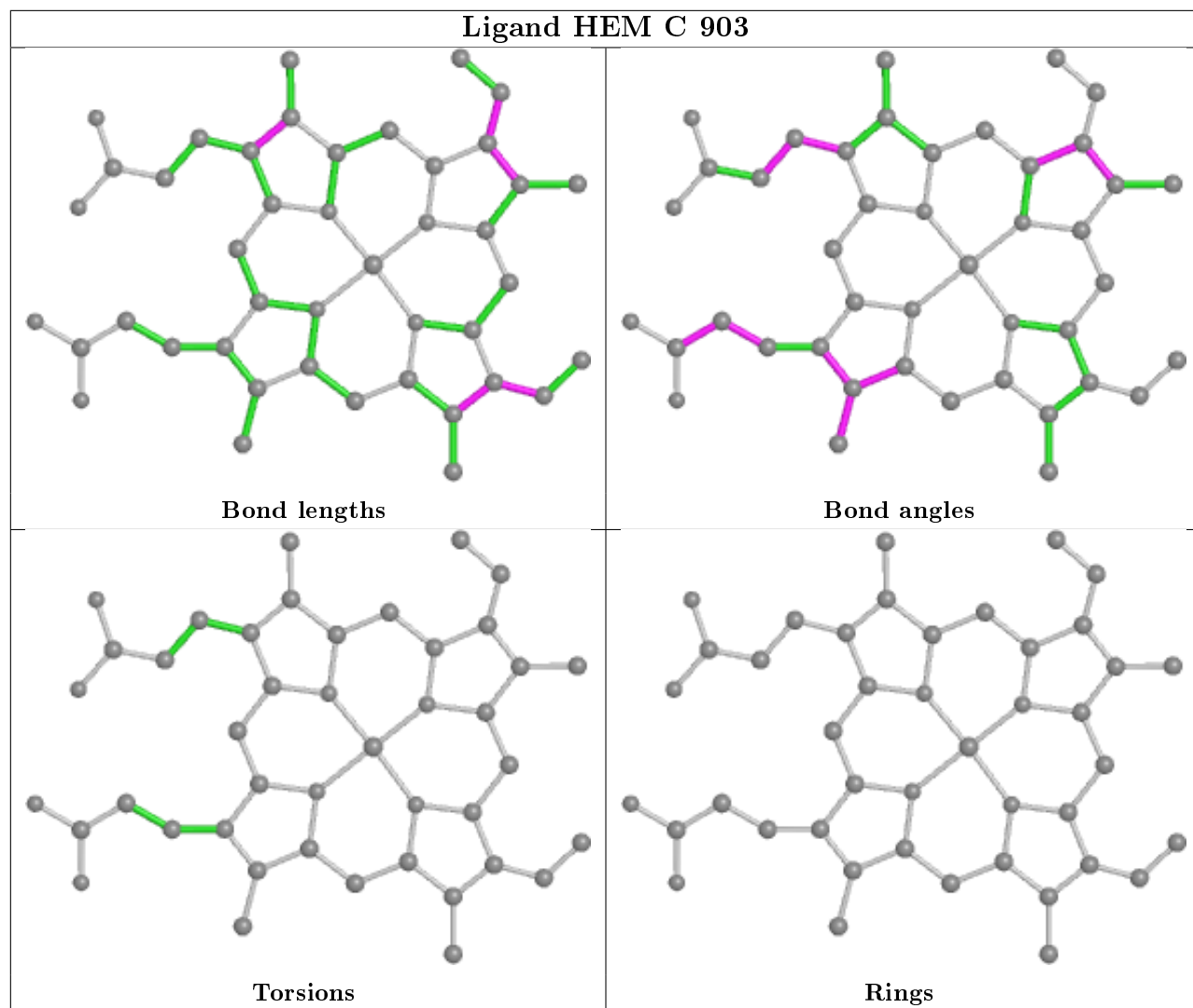
2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	2003	SO4	1	0
3	A	901	HEM	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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	210/215 (97%)	-0.19	4 (1%) 66 66	11, 20, 35, 48	0
1	B	209/215 (97%)	-0.38	0 100 100	10, 19, 35, 40	1 (0%)
1	C	208/215 (96%)	-0.34	4 (1%) 66 66	12, 22, 40, 49	0
All	All	627/645 (97%)	-0.30	8 (1%) 77 78	10, 20, 36, 49	1 (0%)

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	214	GLY	4.5
1	C	606	ALA	4.3
1	C	767	ALA	3.4
1	A	213	LYS	3.1
1	C	765	GLY	2.8
1	A	5	THR	2.7
1	C	636	ARG	2.5
1	A	6	ALA	2.2

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

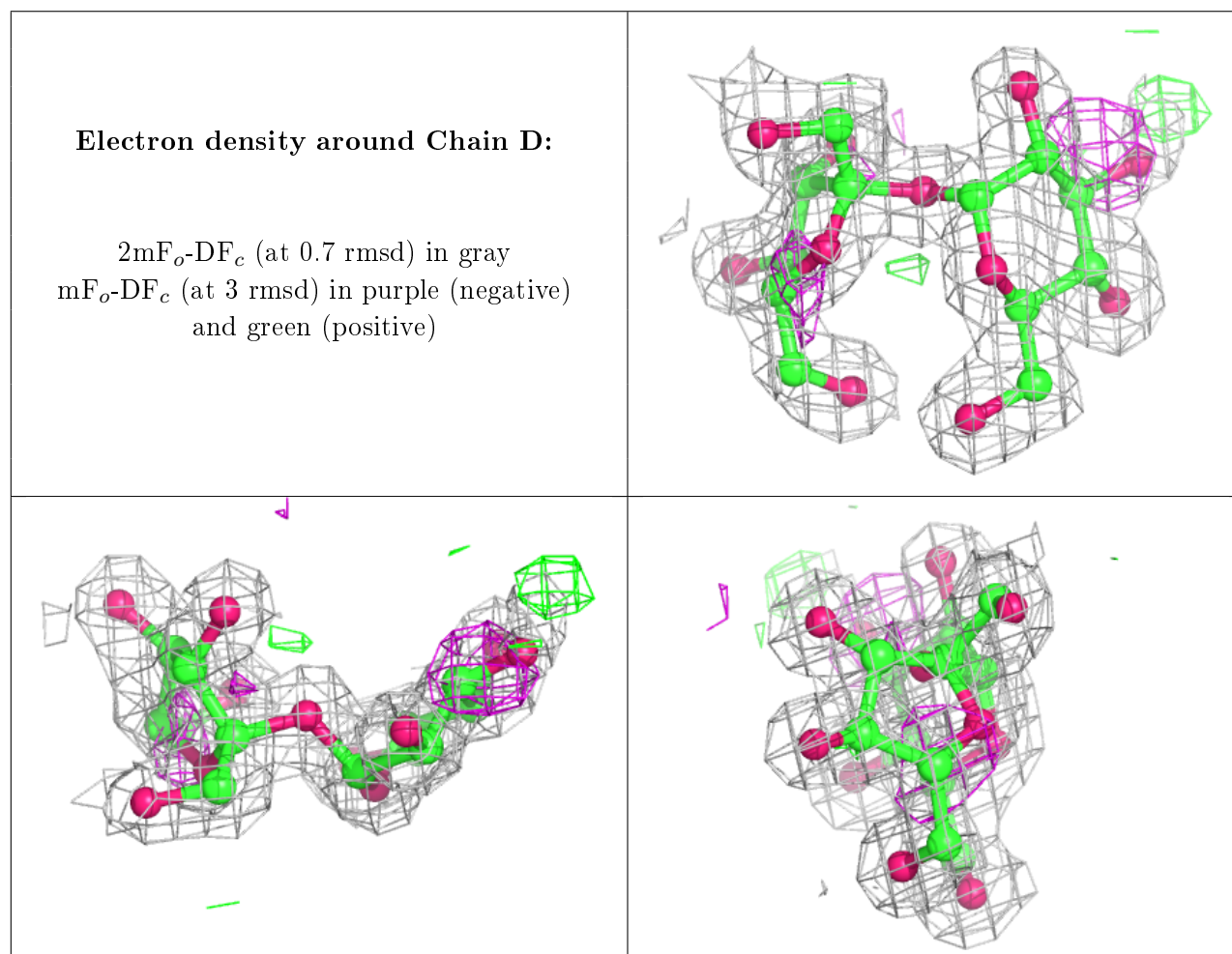
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GLC	D	1	11/12	0.86	0.14	21,26,31,35	0
2	FRU	D	2	12/12	0.91	0.14	24,27,30,30	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



6.4 Ligands ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	C	2012	5/5	0.71	0.25	80,81,82,83	0
4	SO4	C	2010	5/5	0.78	0.25	92,93,94,94	0
4	SO4	C	2004	5/5	0.82	0.32	74,75,76,76	0

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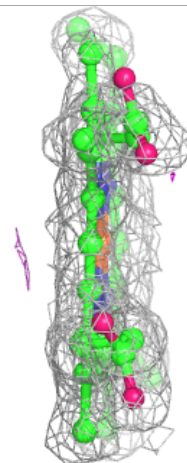
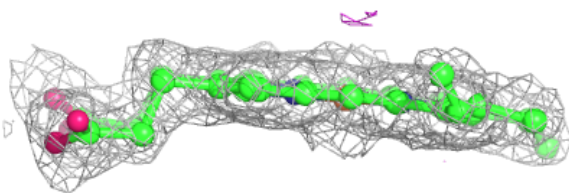
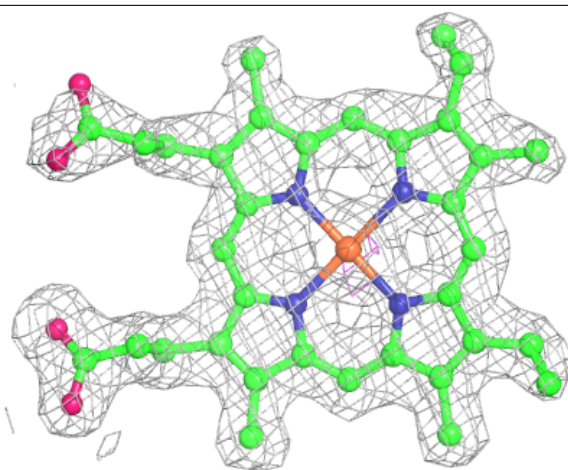
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	A	2011	5/5	0.83	0.17	68,71,72,73	0
4	SO4	A	2003	5/5	0.86	0.15	55,56,59,60	0
4	SO4	B	2006	5/5	0.87	0.25	28,34,44,45	0
4	SO4	C	2005	5/5	0.89	0.36	45,51,52,53	0
4	SO4	C	2002	5/5	0.89	0.22	45,45,50,50	0
4	SO4	A	2007	5/5	0.92	0.25	52,53,57,58	0
4	SO4	B	2008	5/5	0.93	0.25	56,58,60,61	0
4	SO4	B	2009	5/5	0.94	0.30	52,52,53,56	0
3	HEM	B	902	43/43	0.97	0.09	15,22,43,57	0
4	SO4	B	2001	5/5	0.97	0.11	39,39,42,43	0
5	OXY	C	5003	2/2	0.98	0.13	33,33,33,33	0
3	HEM	C	903	43/43	0.98	0.07	17,22,36,48	0
3	HEM	A	901	43/43	0.99	0.10	10,16,23,31	0
5	OXY	B	5002	2/2	0.99	0.20	26,26,26,32	0
5	OXY	A	5001	2/2	0.99	0.11	31,31,31,31	0

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

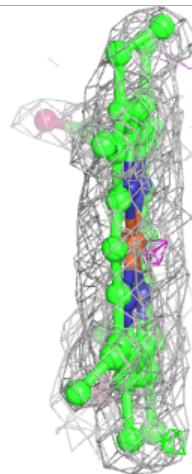
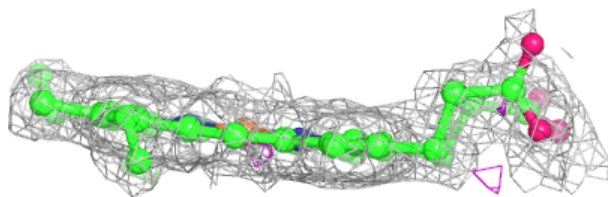
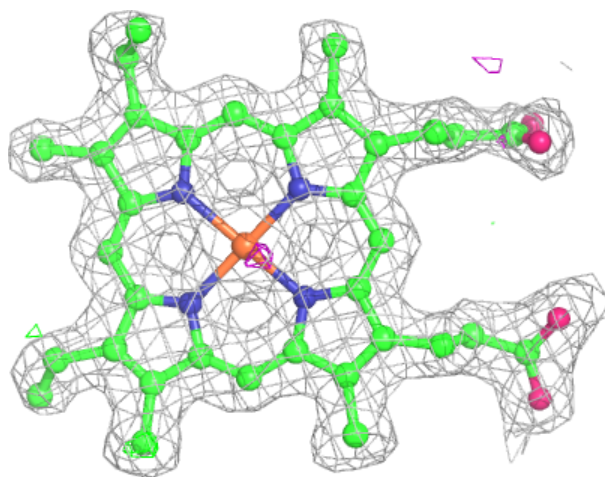
Electron density around HEM B 902:

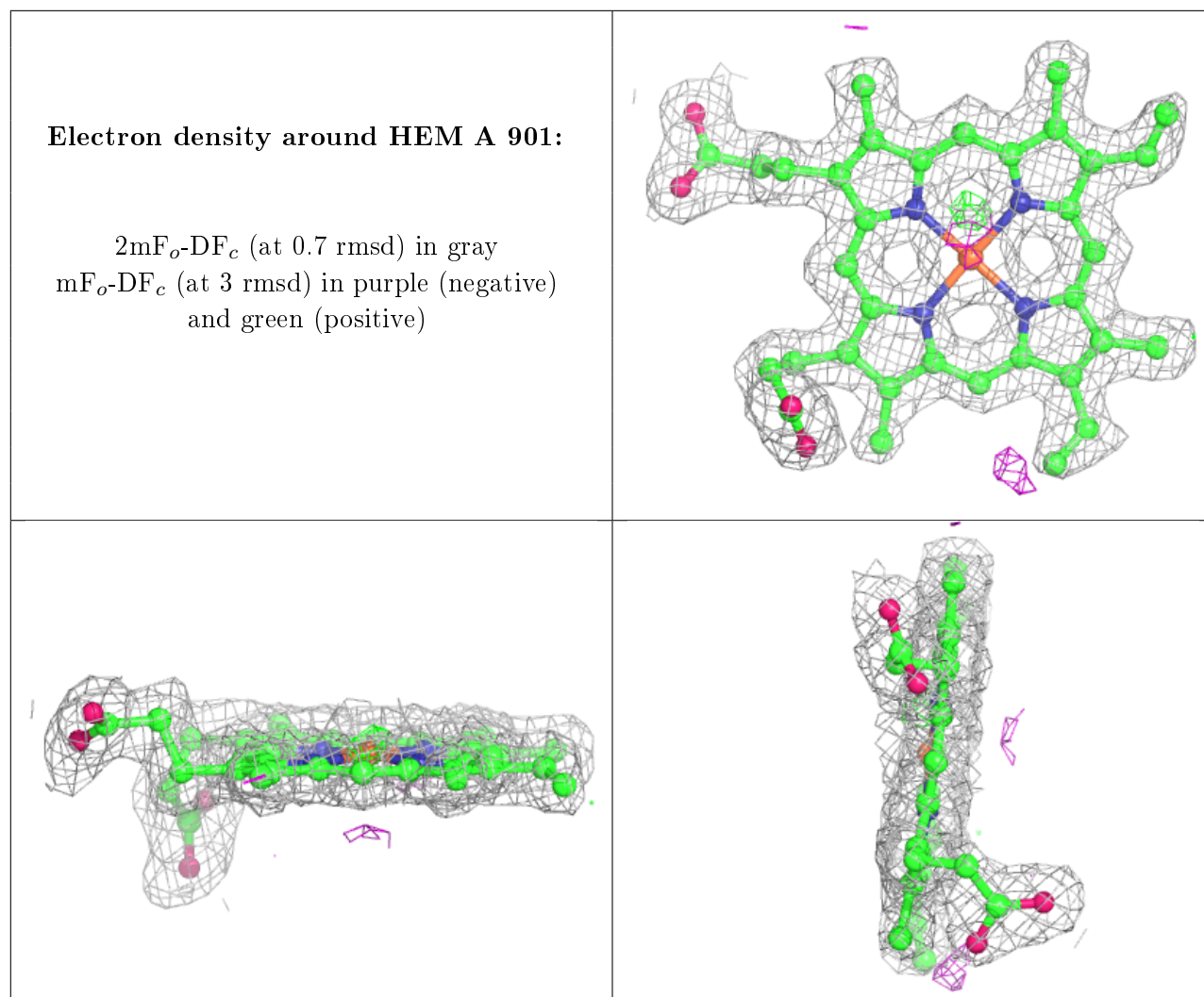
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM C 903:

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





6.5 Other polymers ⓘ

There are no such residues in this entry.