



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 03:48 PM UTC

PDB ID : 4X0L / pdb_00004x0l
Title : Human haptoglobin-haemoglobin complex
Authors : Lane-Serff, H.; MacGregor, P.; Lowe, E.D.; Carrington, M.; Higgins, M.K.
Deposited on : 2014-11-21
Resolution : 2.05 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

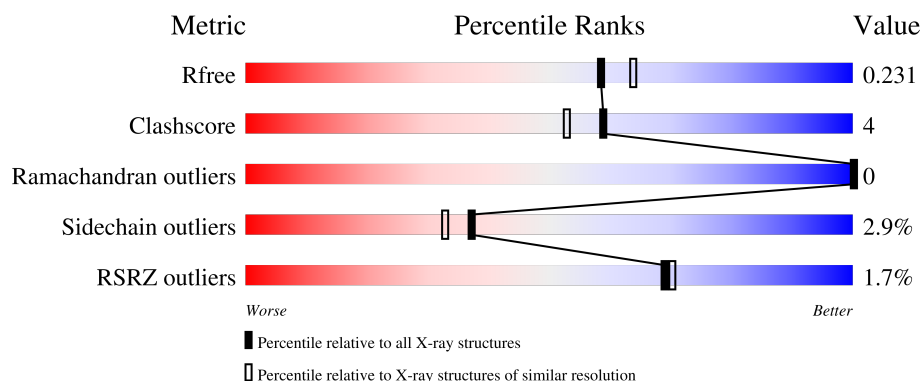
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

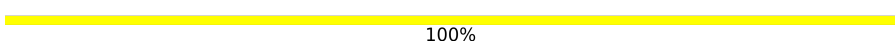
The reported resolution of this entry is 2.05 Å.

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	2260 (2.04-2.04)
Clashscore	190562	2333 (2.04-2.04)
Ramachandran outliers	187476	2318 (2.04-2.04)
Sidechain outliers	187428	2318 (2.04-2.04)
RSRZ outliers	180081	2260 (2.04-2.04)

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	141	
2	B	146	
3	C	259	
4	D	2	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
9	CAC	C	505	-	X	X	X

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 4551 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 Hemoglobin subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	141	Total	C	N	O	S	0	0	0
			1069	685	187	194	3			

- Molecule 2 is a protein called Hemoglobin subunit beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	144	Total	C	N	O	S	0	0	0
			1105	713	191	198	3			

- Molecule 3 is a protein called Haptoglobin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	259	Total	C	N	O	S	0	0	0
			2024	1290	344	380	10			

- Molecule 4 is an oligosaccharide called alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.



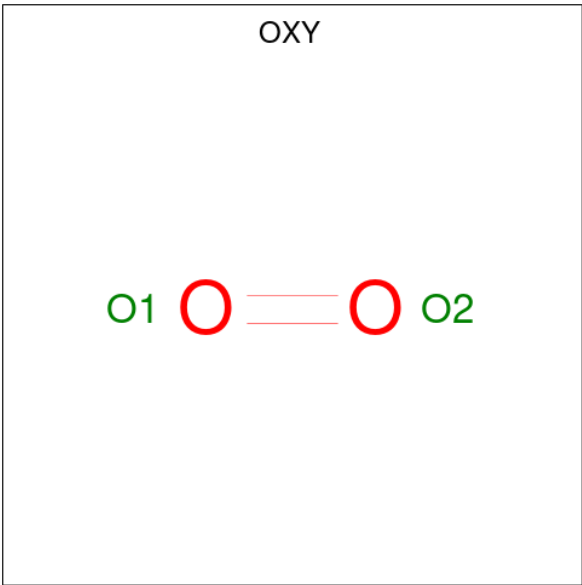
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	D	2	Total	C	N	O	0	0	0
			24	14	1	9			

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C₃₄H₃₂FeN₄O₄).



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

- Molecule 6 is OXYGEN MOLECULE (CCD ID: OXY) (formula: O₂).



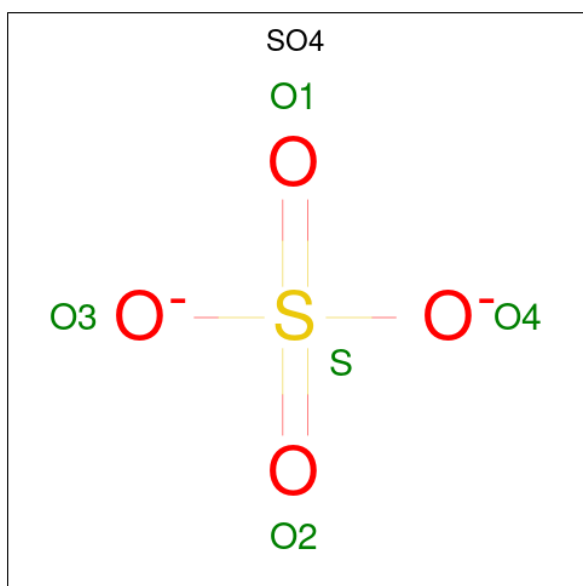
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	O	0	0
			2	2		
6	B	1	Total	O	0	0
			2	2		

- Molecule 7 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



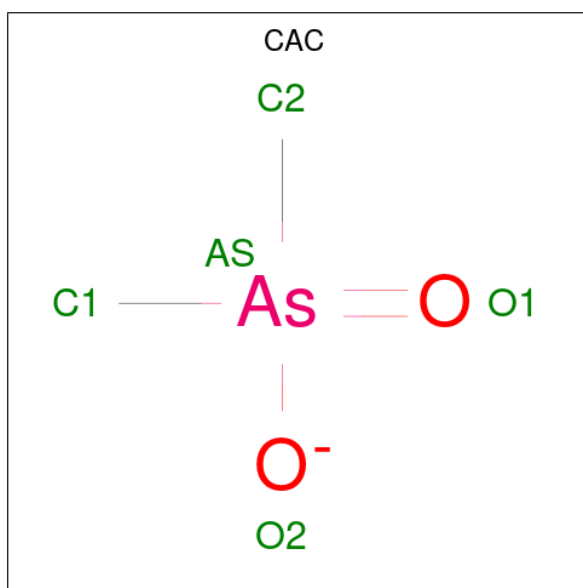
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	B	1	Total	C	O	0	0
			6	3	3		
7	C	1	Total	C	O	0	0
			6	3	3		

- Molecule 8 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



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

- Molecule 9 is CACODYLATE ION (CCD ID: CAC) (formula: $C_2H_6AsO_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
9	C	1	Total	As	C	O	0	0
			5	1	2	2		

- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	55	Total	O	0	0
			55	55		
10	B	28	Total	O	0	0
			28	28		
10	C	134	Total	O	0	0
			134	134		

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.

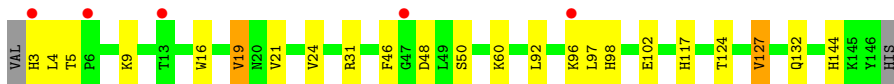
- Molecule 1: Hemoglobin subunit alpha

Chain A:  89% 10% .



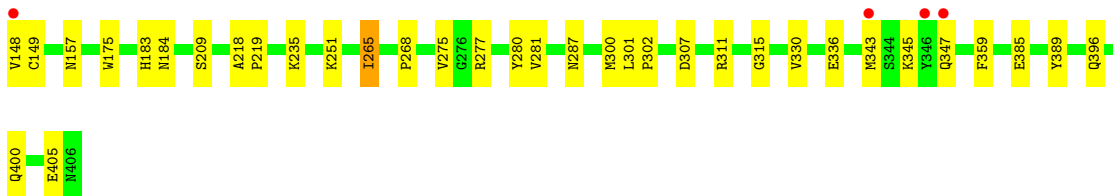
- Molecule 2: Hemoglobin subunit beta

Chain B:  3% 83% 14% ..

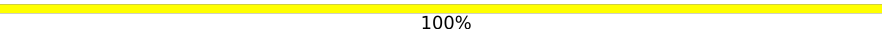


- Molecule 3: Haptoglobin

Chain C:  2% 86% 13%



- Molecule 4: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:  100%



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	96.60Å 96.60Å 132.77Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	39.93 – 2.05 39.93 – 2.05	Depositor EDS
% Data completeness (in resolution range)	99.8 (39.93-2.05) 99.8 (39.93-2.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.94 (at 2.05Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.180 , 0.224 0.188 , 0.231	Depositor DCC
R_{free} test set	2295 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	21.7	Xtriage
Anisotropy	0.061	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 41.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.032 for -h,-k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4551	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% 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: OXY, CAC, HEM, NAG, GOL, SO4, FUC

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	1.34	3/1097 (0.3%)	1.17	1/1491 (0.1%)
2	B	1.23	0/1134	1.19	1/1541 (0.1%)
3	C	1.32	6/2073 (0.3%)	1.18	2/2818 (0.1%)
All	All	1.30	9/4304 (0.2%)	1.18	4/5850 (0.1%)

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	104	HIS	CA-C	6.43	1.60	1.52
1	A	88	HIS	C-O	6.08	1.31	1.24
3	C	251	LYS	N-CA	5.93	1.53	1.46
1	A	51	HIS	C-O	-5.69	1.17	1.23
3	C	265	ILE	N-CA	-5.65	1.40	1.46
3	C	149	CYS	N-CA	5.54	1.52	1.46
3	C	315	GLY	C-O	-5.42	1.16	1.23
3	C	301	LEU	N-CA	5.36	1.52	1.46
3	C	157	ASN	C-O	-5.20	1.18	1.24

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	97	VAL	CB-CA-C	-7.53	102.18	112.04
3	C	235	LYS	N-CA-C	5.98	116.45	108.38
3	C	405	GLU	N-CA-C	5.27	119.56	113.18
2	B	31	ARG	N-CA-C	5.25	117.00	111.28

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	1069	0	1070	6	0
2	B	1105	0	1099	14	0
3	C	2024	0	2000	20	0
4	D	24	0	22	0	0
5	A	43	0	30	0	0
5	B	43	0	30	2	0
6	A	2	0	0	0	0
6	B	2	0	0	0	0
7	B	6	0	8	0	0
7	C	6	0	7	0	0
8	C	5	0	0	1	0
9	C	5	0	0	3	2
10	A	55	0	0	0	0
10	B	28	0	0	1	0
10	C	134	0	0	6	0
All	All	4551	0	4266	38	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (38) 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:C:275:VAL:HB	10:C:632:HOH:O	1.31	1.23
3:C:336:GLU:OE2	10:C:601:HOH:O	1.60	1.18
1:A:8:LYS:NZ	1:A:75:ASP:OD1	2.10	0.84
3:C:385:GLU:OE2	9:C:505:CAC:O2	1.97	0.81
3:C:343:MET:HB2	9:C:505:CAC:C1	2.23	0.69
2:B:98:HIS:HD2	8:C:503:SO4:O3	1.85	0.58
2:B:102:GLU:OE1	3:C:287:ASN:HB2	2.04	0.58
2:B:4:LEU:C	2:B:5:THR:O	2.48	0.55
3:C:307:ASP:HB3	3:C:311:ARG:NH1	2.21	0.55
5:B:201:HEM:HBC2	5:B:201:HEM:HMC2	1.89	0.54
2:B:16:TRP:O	2:B:19:VAL:HG13	2.08	0.53
2:B:92:LEU:HD12	2:B:96:LYS:HE2	1.90	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:275:VAL:CB	10:C:632:HOH:O	2.12	0.52
2:B:124:THR:OG1	2:B:127:VAL:HG13	2.10	0.52
3:C:343:MET:HA	9:C:505:CAC:O2	2.10	0.51
3:C:175:TRP:CE2	3:C:265:ILE:HD12	2.47	0.50
3:C:275:VAL:CG2	10:C:632:HOH:O	2.50	0.50
3:C:281:VAL:HG22	3:C:359:PHE:HA	1.95	0.49
2:B:4:LEU:HD23	2:B:9:LYS:HA	1.96	0.48
1:A:115:PRO:O	2:B:117:HIS:HE1	1.98	0.47
3:C:280:TYR:CE2	3:C:300:MET:HE3	2.50	0.45
3:C:336:GLU:H	3:C:336:GLU:CD	2.25	0.45
2:B:46:PHE:HA	2:B:60:LYS:HD2	1.99	0.45
1:A:3:LEU:HD12	1:A:74:VAL:HG11	1.99	0.44
3:C:268:PRO:O	3:C:396:GLN:NE2	2.50	0.44
1:A:97:VAL:HG23	1:A:98:ASN:N	2.33	0.44
2:B:144:HIS:HB3	10:B:315:HOH:O	2.17	0.43
3:C:345:LYS:O	3:C:347:GLN:HG2	2.19	0.43
2:B:4:LEU:O	2:B:5:THR:C	2.61	0.43
3:C:281:VAL:HG21	3:C:389:TYR:OH	2.18	0.43
3:C:184:ASN:ND2	10:C:712:HOH:O	2.37	0.43
1:A:71:VAL:O	1:A:74:VAL:HG23	2.20	0.41
2:B:97:LEU:HD13	5:B:201:HEM:C2D	2.55	0.41
3:C:218:ALA:N	3:C:219:PRO:HD2	2.36	0.41
2:B:48:ASP:OD1	2:B:50:SER:OG	2.38	0.41
3:C:311:ARG:HD3	10:C:631:HOH:O	2.19	0.41
1:A:36:SER:HB3	2:B:132:GLN:HG3	2.02	0.41
3:C:277:ARG:O	3:C:302:PRO:HA	2.22	0.40

All (2) 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)
9:C:505:CAC:C1	9:C:505:CAC:C1[5_554]	1.32	0.88
9:C:505:CAC:AS	9:C:505:CAC:C1[5_554]	1.84	0.36

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	139/141 (99%)	139 (100%)	0	0	100	100
2	B	142/146 (97%)	133 (94%)	9 (6%)	0	100	100
3	C	257/259 (99%)	246 (96%)	11 (4%)	0	100	100
All	All	538/546 (98%)	518 (96%)	20 (4%)	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	113/113 (100%)	110 (97%)	3 (3%)	39	36
2	B	116/118 (98%)	111 (96%)	5 (4%)	26	20
3	C	222/222 (100%)	217 (98%)	5 (2%)	44	42
All	All	451/453 (100%)	438 (97%)	13 (3%)	37	33

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	VAL
1	A	79	ASN
1	A	96	PRO
2	B	3	HIS
2	B	19	VAL
2	B	21	VAL
2	B	24	VAL
2	B	127	VAL
3	C	148	VAL
3	C	183	HIS
3	C	209	SER

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Mol	Chain	Res	Type
3	C	330	VAL
3	C	400	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	21	HIS
1	A	73	HIS
2	B	3	HIS
2	B	98	HIS
2	B	117	HIS
2	B	140	ASN
3	C	154	ASN
3	C	157	ASN
3	C	195	GLN
3	C	295	HIS
3	C	396	GLN
3	C	406	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](#)

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
4	NAG	D	1	4,3	14,14,15	0.72	0	17,19,21	1.65	4 (23%)
4	FUC	D	2	4	10,10,11	0.98	0	14,14,16	1.26	1 (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
4	NAG	D	1	4,3	-	0/6/23/26	0/1/1/1
4	FUC	D	2	4	-	-	0/1/1/1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
4	D	1	NAG	C2-N2-C7	3.21	127.20	122.90
4	D	2	FUC	O5-C5-C6	3.01	113.93	107.40
4	D	1	NAG	C3-C4-C5	-2.53	105.65	110.23
4	D	1	NAG	O5-C1-C2	-2.34	107.67	111.29
4	D	1	NAG	O7-C7-N2	2.18	125.83	121.98

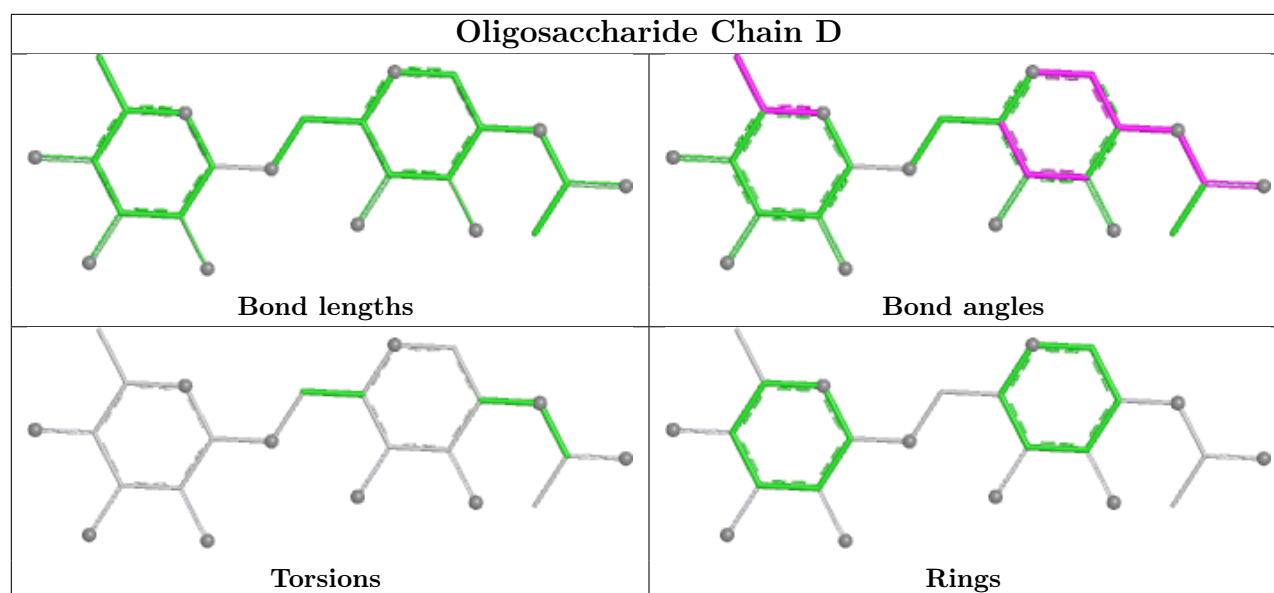
There are no chirality outliers.

There are no torsion outliers.

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](#)

8 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	$\# Z > 2$
5	HEM	B	201	2,6	50,50,50	1.78	10 (20%)	67,82,82	1.70	17 (25%)
5	HEM	A	201	1,6	50,50,50	1.90	15 (30%)	67,82,82	1.68	14 (20%)
6	OXY	B	202	5	1,1,1	0.15	0	-		
7	GOL	C	504	-	5,5,5	0.87	0	5,5,5	1.92	2 (40%)
7	GOL	B	203	-	5,5,5	0.36	0	5,5,5	0.93	0
9	CAC	C	505	-	2,4,4	4.85	2 (100%)	4,6,6	2.26	2 (50%)
6	OXY	A	202	5	1,1,1	0.10	0	-		
8	SO4	C	503	-	4,4,4	0.38	0	6,6,6	1.07	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	GOL	C	504	-	-	0/4/4/4	-
7	GOL	B	203	-	-	2/4/4/4	-
5	HEM	B	201	2,6	-	0/14/54/54	-
5	HEM	A	201	1,6	-	2/14/54/54	-

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	C	505	CAC	AS-C1	5.68	2.03	1.90
5	A	201	HEM	C1B-NB	-4.57	1.32	1.40
5	B	201	HEM	C1B-NB	-4.54	1.32	1.40
5	B	201	HEM	FE-NB	4.45	2.08	1.94
5	B	201	HEM	FE-NC	4.31	2.09	1.95
5	A	201	HEM	C4D-ND	-4.17	1.33	1.40
5	A	201	HEM	FE-NB	4.17	2.07	1.94
9	C	505	CAC	AS-C2	3.85	1.99	1.90
5	A	201	HEM	C1D-ND	-3.64	1.31	1.38
5	B	201	HEM	C1C-NC	-3.49	1.33	1.39
5	B	201	HEM	C4C-NC	-3.37	1.33	1.39
5	A	201	HEM	C4B-NB	-3.14	1.32	1.38
5	B	201	HEM	C4B-NB	-2.94	1.33	1.38
5	A	201	HEM	O2D-CGD	-2.84	1.21	1.30
5	A	201	HEM	C4C-NC	-2.67	1.34	1.39
5	A	201	HEM	C1C-C2C	-2.61	1.40	1.45
5	A	201	HEM	C1C-NC	-2.53	1.34	1.39
5	A	201	HEM	C4D-C3D	2.46	1.49	1.45
5	A	201	HEM	FE-NC	2.33	2.02	1.95
5	B	201	HEM	FE-NA	2.26	2.02	1.95
5	A	201	HEM	C3D-C2D	-2.24	1.31	1.36
5	A	201	HEM	C4A-NA	-2.22	1.35	1.39
5	A	201	HEM	C1A-C2A	-2.21	1.40	1.44
5	A	201	HEM	C1D-C2D	2.21	1.49	1.44
5	B	201	HEM	CHC-C1C	2.19	1.42	1.38
5	B	201	HEM	C4D-C3D	2.06	1.48	1.45
5	B	201	HEM	C3B-C4B	2.03	1.48	1.44

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	201	HEM	C1B-NB-C4B	5.34	111.53	105.21
5	B	201	HEM	C1B-NB-C4B	4.75	110.83	105.21
5	A	201	HEM	CHC-C4B-NB	4.22	128.96	124.42
5	A	201	HEM	C4B-C3B-C2B	-4.12	103.49	107.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	201	HEM	CHC-C4B-NB	3.86	128.58	124.42
5	B	201	HEM	C3B-C4B-NB	-3.64	106.85	109.47
7	C	504	GOL	C3-C2-C1	-3.63	98.48	111.80
5	A	201	HEM	O2D-CGD-O1D	-3.59	114.09	123.33
9	C	505	CAC	O2-AS-C2	-3.54	97.26	105.84
5	B	201	HEM	CBA-CAA-C2A	-3.11	103.94	112.53
5	B	201	HEM	CHB-C1B-NB	3.08	128.17	124.37
5	B	201	HEM	CHA-C4D-ND	3.01	128.09	124.37
5	A	201	HEM	CHB-C1B-NB	2.81	127.85	124.37
5	B	201	HEM	CMD-C2D-C1D	2.76	129.34	125.03
5	B	201	HEM	CHA-C4D-C3D	-2.74	120.17	125.23
5	A	201	HEM	C3D-C4D-ND	2.71	113.15	110.17
5	A	201	HEM	CHA-C4D-C3D	-2.57	120.49	125.23
5	A	201	HEM	CHD-C1D-C2D	-2.53	121.04	125.03
5	A	201	HEM	C2B-C1B-NB	-2.51	106.95	109.84
5	B	201	HEM	CBD-CAD-C3D	-2.50	105.62	112.53
5	B	201	HEM	CHD-C4C-NC	2.49	127.16	124.45
5	B	201	HEM	O2D-CGD-O1D	-2.48	116.95	123.33
5	B	201	HEM	C1A-CHA-C4D	-2.47	120.43	126.25
5	B	201	HEM	O2A-CGA-O1A	-2.35	117.28	123.33
5	B	201	HEM	C4C-NC-C1C	2.35	109.65	105.82
5	A	201	HEM	O2D-CGD-CBD	2.34	121.39	114.00
5	B	201	HEM	CAD-C3D-C4D	2.33	128.76	124.70
9	C	505	CAC	O1-AS-C2	-2.30	108.63	111.50
5	A	201	HEM	C3B-C2B-C1B	2.23	108.08	106.41
5	B	201	HEM	O2D-CGD-CBD	2.15	120.80	114.00
5	B	201	HEM	CHD-C1D-C2D	-2.15	121.64	125.03
7	C	504	GOL	O1-C1-C2	-2.08	101.01	110.38
5	A	201	HEM	CAA-C2A-C1A	2.07	128.99	124.94
5	A	201	HEM	C4D-C3D-C2D	-2.07	103.88	106.89
5	A	201	HEM	C2D-C1D-ND	2.06	112.28	109.90

There are no chirality outliers.

All (4) torsion outliers are listed below:

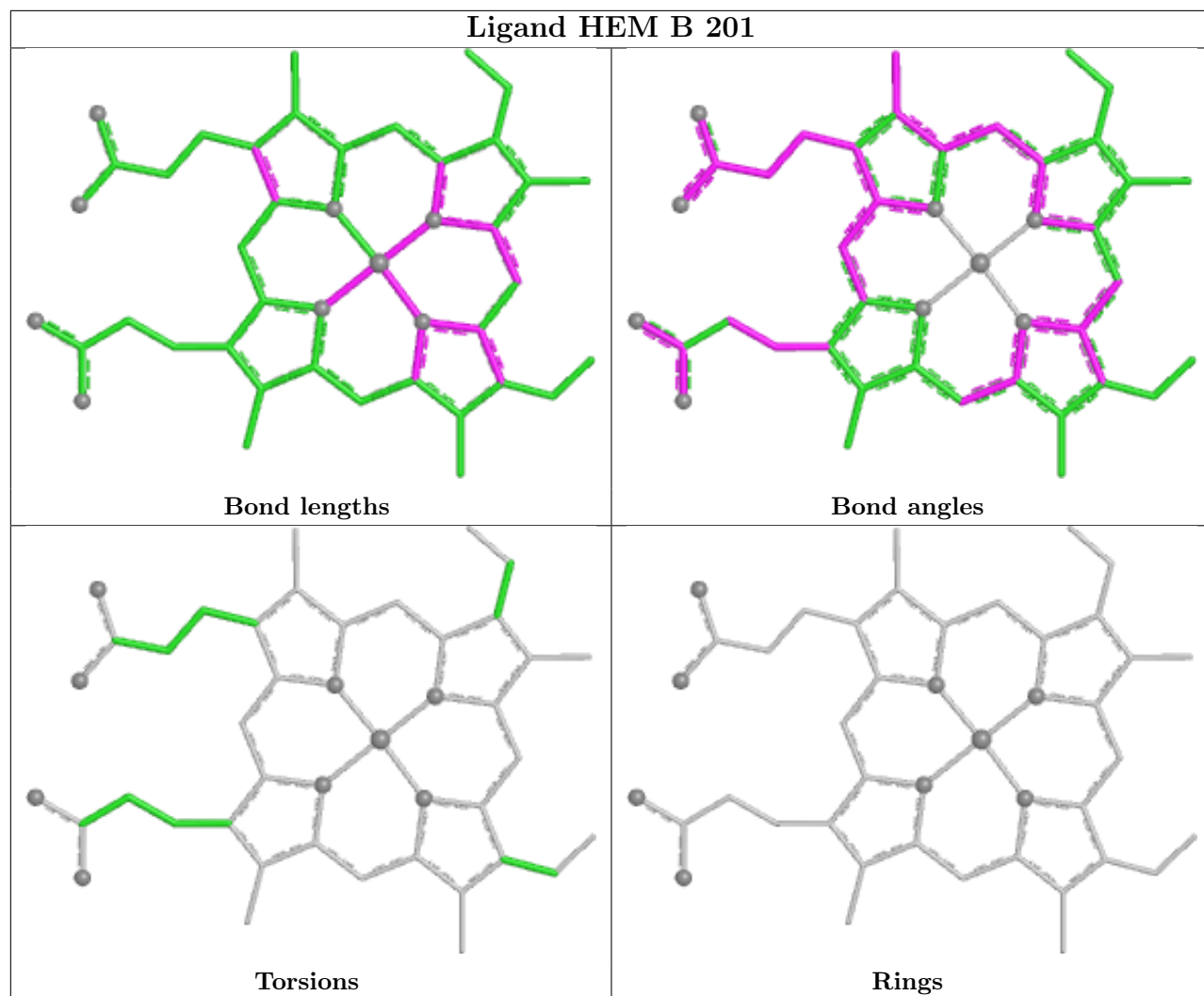
Mol	Chain	Res	Type	Atoms
7	B	203	GOL	O1-C1-C2-C3
7	B	203	GOL	O1-C1-C2-O2
5	A	201	HEM	CAD-CBD-CGD-O2D
5	A	201	HEM	CAD-CBD-CGD-O1D

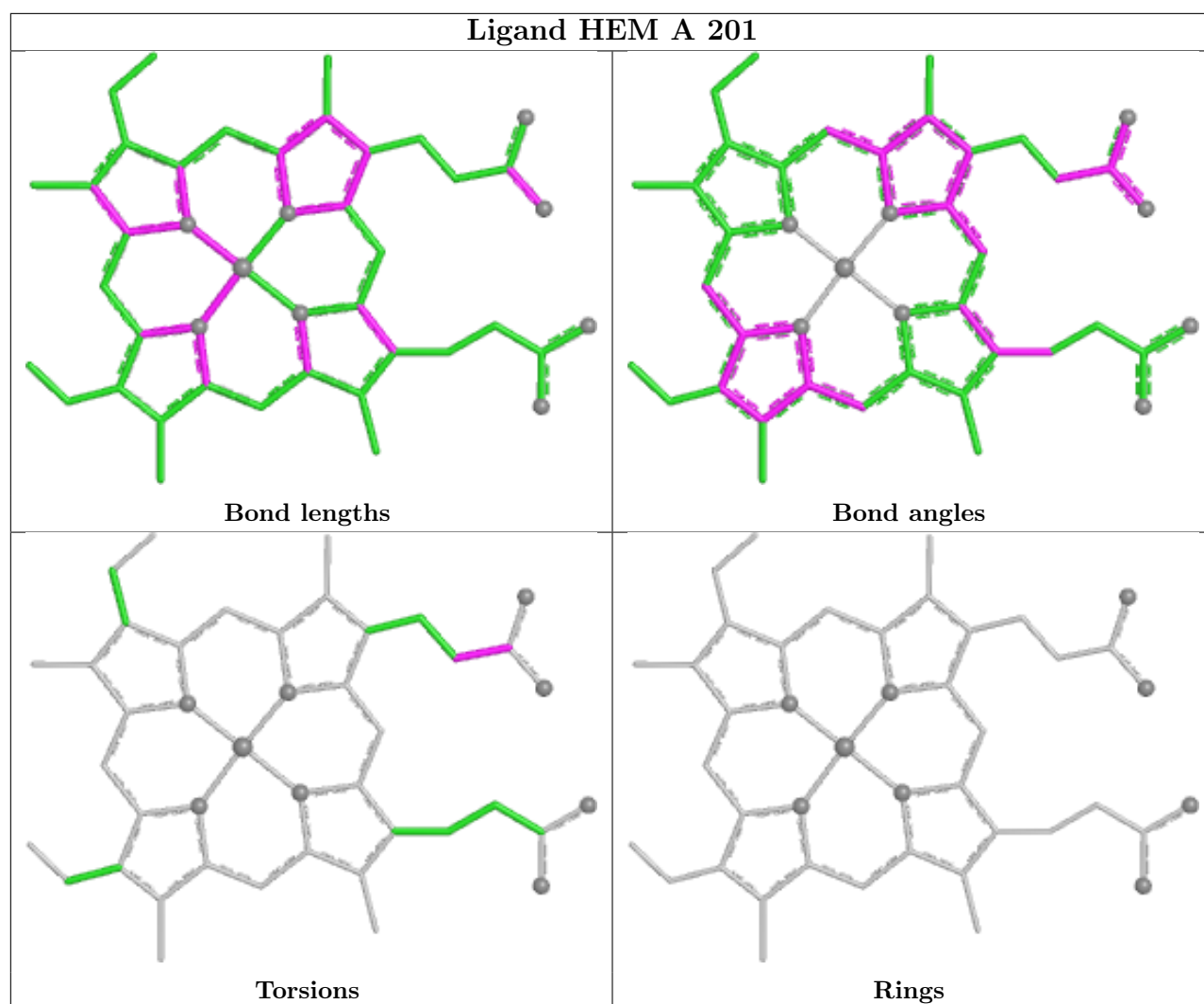
There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	201	HEM	2	0
9	C	505	CAC	3	2
8	C	503	SO4	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





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	141/141 (100%)	-0.31	0 100 100	13, 20, 33, 39	0
2	B	144/146 (98%)	0.23	5 (3%) 47 48	16, 29, 44, 58	0
3	C	259/259 (100%)	-0.30	4 (1%) 72 73	11, 19, 39, 57	0
All	All	544/546 (99%)	-0.16	9 (1%) 69 70	11, 21, 40, 58	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	148	VAL	4.2
2	B	3	HIS	3.3
3	C	346	TYR	3.3
2	B	6	PRO	2.6
3	C	347	GLN	2.4
2	B	13	THR	2.4
2	B	47	GLY	2.3
3	C	343	MET	2.2
2	B	96	LYS	2.0

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

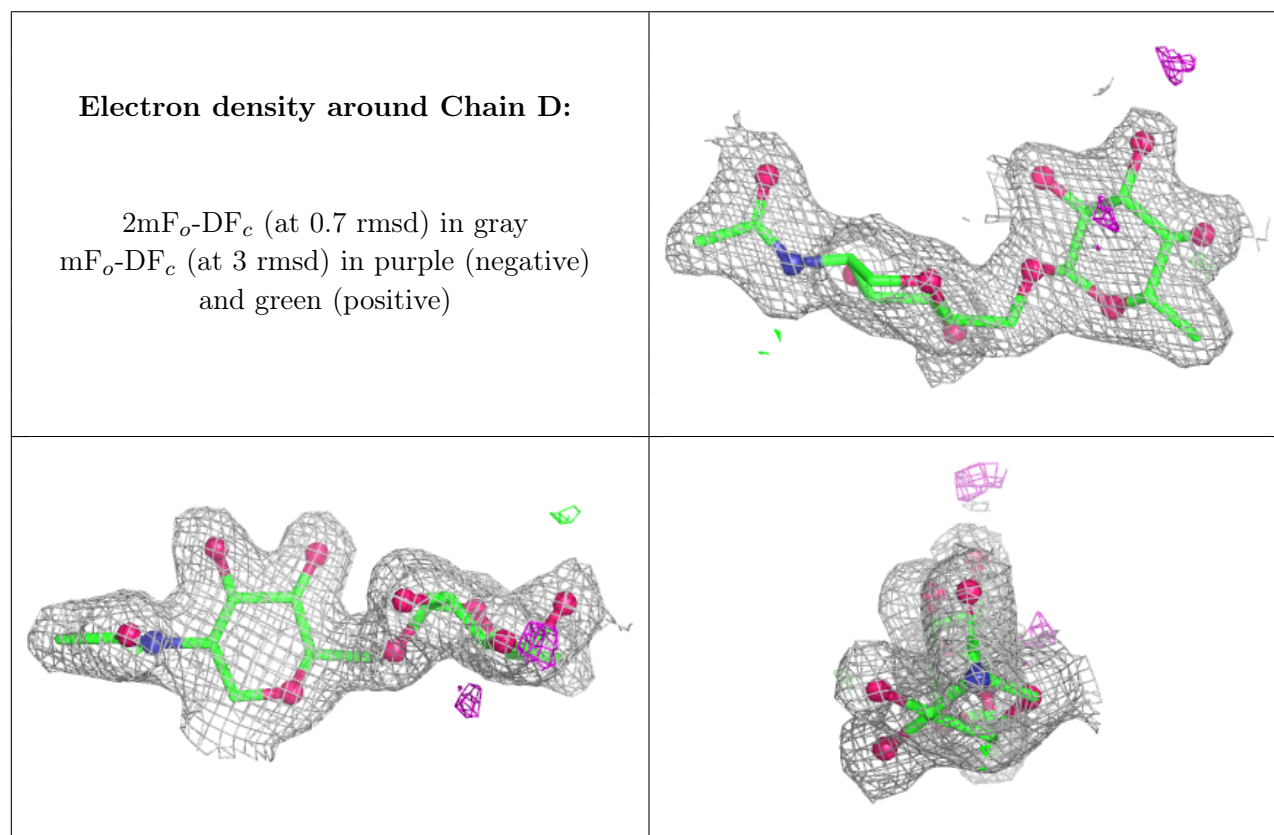
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

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($\text{\AA}^2$)	Q<0.9
4	FUC	D	2	10/11	0.92	0.08	26,30,32,32	0
4	NAG	D	1	14/15	0.94	0.07	23,26,30,33	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.

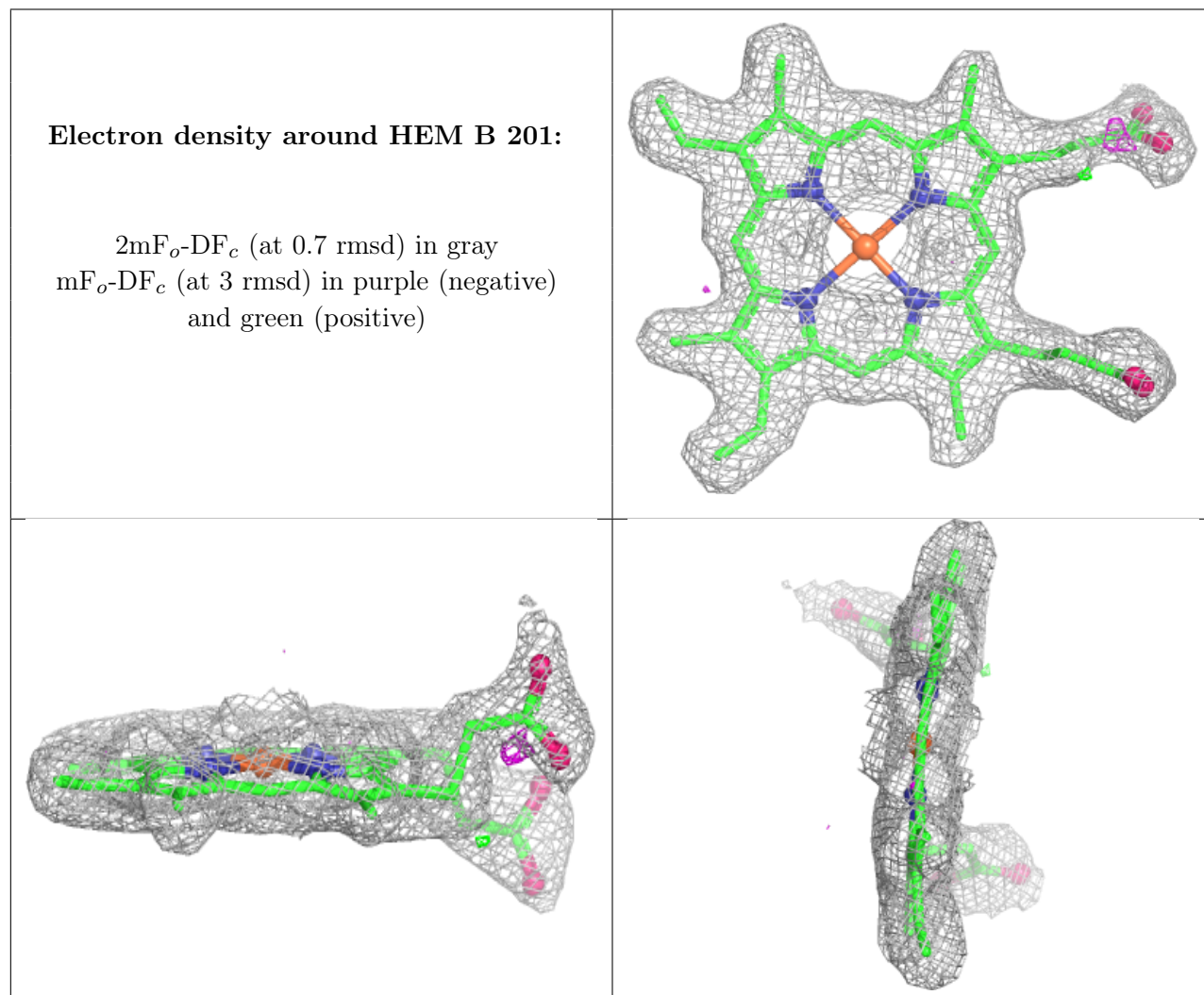


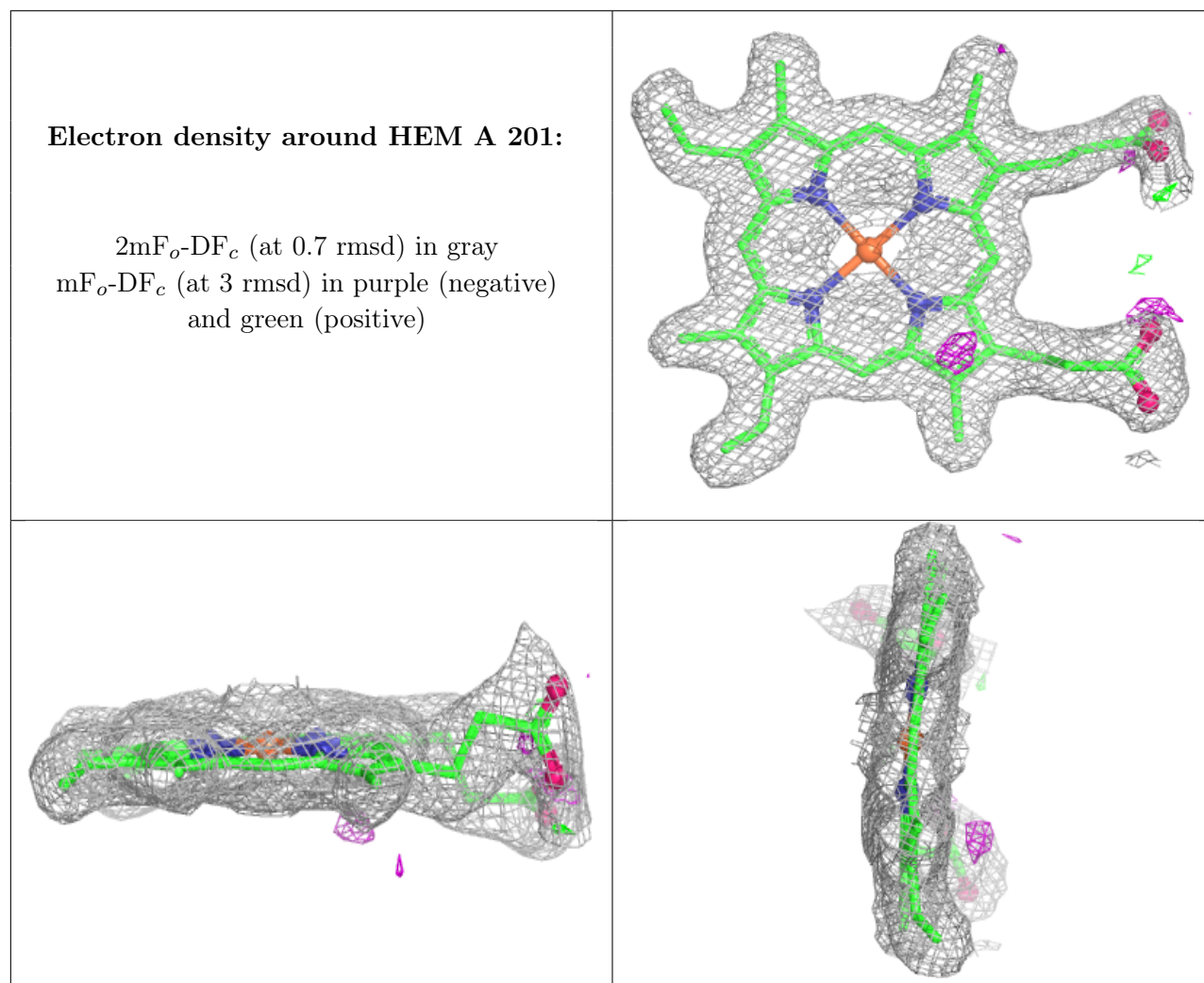
6.4 Ligands ⓘ

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($\text{\AA}^2$)	Q<0.9
9	CAC	C	505	5/5	0.71	0.40	47,137,178,198	2
7	GOL	C	504	6/6	0.89	0.10	23,24,28,32	0
7	GOL	B	203	6/6	0.92	0.11	32,35,37,44	0
6	OXY	A	202	2/2	0.97	0.15	31,31,31,48	0
5	HEM	B	201	43/43	0.98	0.07	19,26,41,47	0
5	HEM	A	201	43/43	0.98	0.06	12,15,32,43	0
6	OXY	B	202	2/2	0.98	0.11	23,23,23,29	0
8	SO4	C	503	5/5	0.99	0.04	15,20,21,21	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.