



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 02:48 PM UTC

PDB ID : 6L32 / pdb_00006l32
Title : Crystal structure of potassium induced heme modification in yak lactoperoxidase at 2.30 Å resolution
Authors : Singh, P.K.; Rani, C.; Sharma, P.; Sharma, S.; Singh, T.P.
Deposited on : 2019-10-08
Resolution : 2.30 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

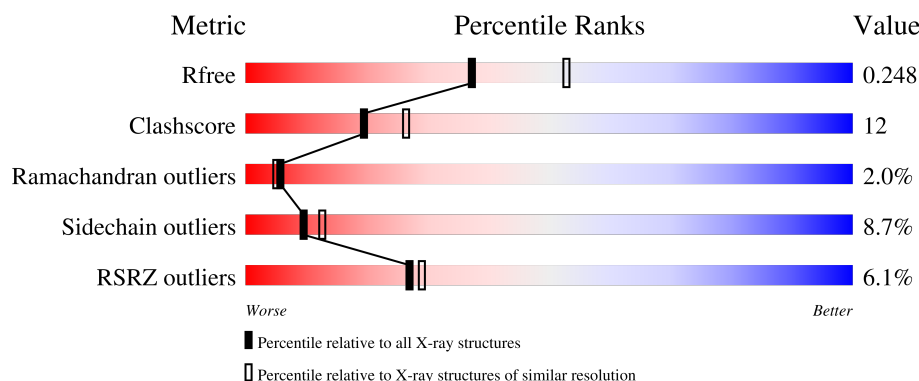
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	595	6% 79% 17% • •
2	B	2	50% 50%
2	C	2	50% 50%

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 5237 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 Lactoperoxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	595	Total	C	N	O	S	0	0	0
			4770	3037	847	860	26			

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	2	Total	C	N	O	0	0	0
			28	16	2	10			
2	C	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 4 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Ca	0	0
			1	1		

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C₃₄H₃₂FeN₄O₄) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	Fe	N	O	0	1
			50	38	1	5	6		

- Molecule 6 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	2	Total K 2 2	0	0

- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total Zn 1 1	0	0

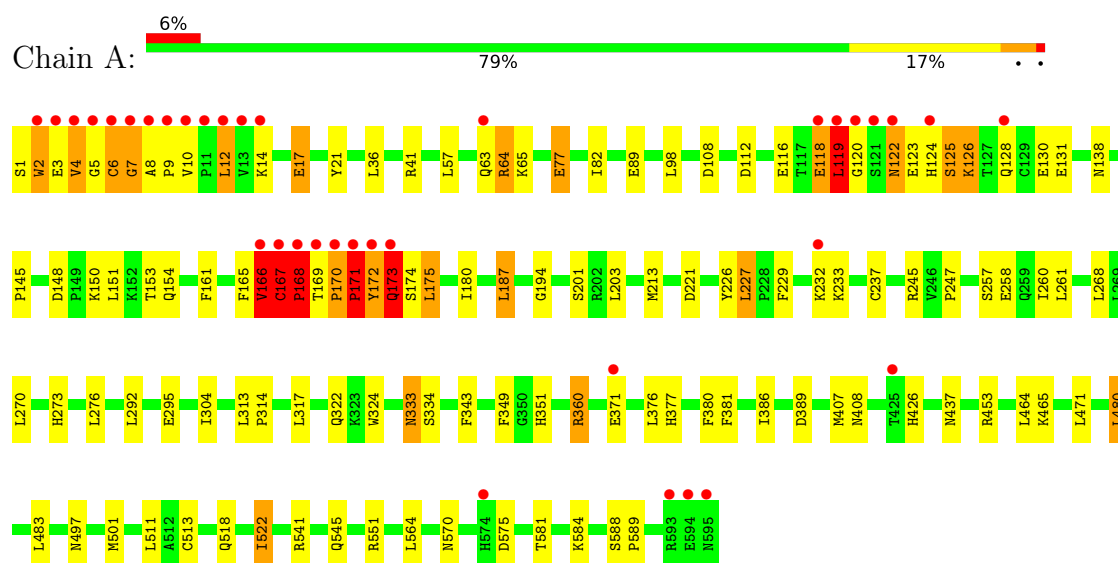
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	329	Total O 329 329	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: Lactoperoxidase



- Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	79.70Å 84.71Å 98.75Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	58.11 – 2.30 58.11 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (58.11-2.30) 99.9 (58.11-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.20	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.78 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.8.0257	Depositor
R, R_{free}	0.190 , 0.244 0.195 , 0.248	Depositor DCC
R_{free} test set	663 reflections (2.18%)	wwPDB-VP
Wilson B-factor (Å ²)	21.3	Xtriage
Anisotropy	0.510	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 42.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5237	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% 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, NAG, ZN, CA, K

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	0.99	0/4898	1.42	19/6645 (0.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	170	PRO	N-CA-C	10.88	123.97	110.70
1	A	168	PRO	N-CA-C	10.20	133.47	112.47
1	A	171	PRO	N-CA-CB	-8.19	94.65	103.25
1	A	168	PRO	N-CA-CB	-7.38	95.50	103.25
1	A	167	CYS	CA-C-N	7.01	128.60	119.84
1	A	167	CYS	C-N-CA	7.01	128.60	119.84
1	A	6	CYS	CB-CA-C	5.92	122.20	110.42
1	A	2	TRP	N-CA-CB	5.76	118.44	109.85
1	A	170	PRO	N-CA-CB	-5.66	97.59	103.08
1	A	2	TRP	CA-CB-CG	-5.64	102.88	113.60
1	A	122	ASN	CA-CB-CG	5.30	117.91	112.60
1	A	581	THR	CA-CB-OG1	-5.26	101.70	109.60
1	A	122	ASN	CB-CA-C	5.22	121.40	112.27
1	A	2	TRP	CA-C-N	5.15	129.67	122.41
1	A	2	TRP	C-N-CA	5.15	129.67	122.41
1	A	453	ARG	CA-C-N	5.13	125.64	119.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	453	ARG	C-N-CA	5.13	125.64	119.94
1	A	173	GLN	N-CA-C	-5.03	107.29	112.93
1	A	194	GLY	CA-C-O	-5.03	118.76	122.23

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	166	VAL	Peptide

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	4770	0	4688	106	0
2	B	28	0	25	0	0
2	C	28	0	25	1	0
3	A	28	0	26	0	0
4	A	1	0	0	0	0
5	A	50	0	10	1	0
6	A	2	0	0	0	0
7	A	1	0	0	0	0
8	A	329	0	0	6	0
All	All	5237	0	4774	107	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 12.

All (107) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:7:GLY:N	1:A:167:CYS:HB3	1.32	1.40
1:A:7:GLY:N	1:A:167:CYS:CB	2.22	1.03
1:A:116:GLU:OE2	8:A:704:HOH:O	1.76	1.02
1:A:165:PHE:O	1:A:167:CYS:N	1.92	1.02

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:7:GLY:H	1:A:167:CYS:HB3	1.27	0.99
1:A:165:PHE:C	1:A:167:CYS:H	1.70	0.99
1:A:120:GLY:O	1:A:126:LYS:HE2	1.75	0.86
1:A:351:HIS:HD1	1:A:437:ASN:HD21	1.24	0.85
1:A:120:GLY:O	1:A:126:LYS:CE	2.26	0.84
1:A:6:CYS:C	1:A:167:CYS:HB3	2.04	0.83
1:A:166:VAL:CG2	8:A:832:HOH:O	2.26	0.82
1:A:119:LEU:O	1:A:123:GLU:OE1	2.01	0.79
1:A:7:GLY:CA	1:A:167:CYS:HB3	2.14	0.78
1:A:7:GLY:CA	1:A:167:CYS:CB	2.63	0.76
1:A:7:GLY:HA3	1:A:180:ILE:HD11	1.67	0.75
1:A:6:CYS:SG	1:A:167:CYS:O	2.44	0.75
1:A:150:LYS:HZ2	1:A:154:GLN:HE22	1.36	0.74
1:A:360:ARG:NH1	1:A:371:GLU:O	2.20	0.74
1:A:360:ARG:NH2	1:A:389:ASP:OD2	2.21	0.72
1:A:82:ILE:HD13	1:A:480:LEU:HD13	1.73	0.70
1:A:227:LEU:HD22	1:A:270:LEU:HD22	1.73	0.69
1:A:6:CYS:SG	1:A:167:CYS:C	2.76	0.69
1:A:118:GLU:C	1:A:119:LEU:HG	2.16	0.68
1:A:551:ARG:HD3	1:A:584:LYS:HA	1.75	0.68
1:A:150:LYS:NZ	1:A:154:GLN:HE22	1.92	0.67
1:A:7:GLY:CA	1:A:180:ILE:HD11	2.25	0.67
1:A:173:GLN:O	1:A:173:GLN:NE2	2.24	0.67
1:A:1:SER:O	1:A:3:GLU:OE2	2.15	0.65
1:A:118:GLU:OE1	1:A:118:GLU:HA	1.95	0.65
1:A:8:ALA:HB1	1:A:9:PRO:HD2	1.79	0.63
1:A:166:VAL:HG22	8:A:832:HOH:O	1.93	0.63
1:A:522:ILE:HD12	1:A:522:ILE:C	2.24	0.63
1:A:119:LEU:CD2	1:A:168:PRO:HG3	2.30	0.61
1:A:173:GLN:HE21	1:A:173:GLN:C	2.07	0.61
1:A:3:GLU:O	1:A:5:GLY:N	2.32	0.60
1:A:377:HIS:HA	1:A:380:PHE:CE2	2.37	0.59
1:A:3:GLU:C	1:A:5:GLY:H	2.11	0.59
1:A:77:GLU:HG2	1:A:145:PRO:HB3	1.84	0.58
1:A:120:GLY:O	1:A:126:LYS:NZ	2.37	0.58
1:A:7:GLY:CA	1:A:167:CYS:HB2	2.35	0.57
1:A:173:GLN:HE22	1:A:175:LEU:HD13	1.70	0.57
1:A:118:GLU:O	1:A:119:LEU:HG	2.05	0.56
1:A:169:THR:HG22	1:A:171:PRO:HD3	1.88	0.56
1:A:7:GLY:HA3	1:A:180:ILE:CD1	2.35	0.54
1:A:130:GLU:CD	1:A:426:HIS:HD1	2.16	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:4:VAL:HG13	1:A:4:VAL:O	2.08	0.54
1:A:7:GLY:HA2	1:A:167:CYS:CB	2.38	0.54
1:A:82:ILE:CD1	1:A:480:LEU:HD13	2.37	0.53
1:A:120:GLY:HA2	1:A:123:GLU:CB	2.38	0.53
1:A:221:ASP:HB2	1:A:226:TYR:CZ	2.42	0.53
1:A:120:GLY:HA2	1:A:123:GLU:HB2	1.91	0.53
1:A:541:ARG:O	1:A:545:GLN:HG3	2.09	0.52
1:A:7:GLY:CA	1:A:180:ILE:CD1	2.87	0.52
1:A:407:MET:HE3	1:A:501:MET:HE3	1.91	0.52
1:A:123:GLU:HG3	1:A:125:SER:H	1.76	0.51
1:A:7:GLY:H	1:A:166:VAL:C	2.20	0.49
1:A:130:GLU:OE1	1:A:426:HIS:ND1	2.44	0.49
1:A:333:ASN:C	1:A:333:ASN:HD22	2.20	0.48
1:A:257:SER:O	1:A:381:PHE:HA	2.14	0.47
1:A:570:ASN:HD22	1:A:575:ASP:HB3	1.78	0.47
1:A:118:GLU:C	1:A:120:GLY:H	2.20	0.47
1:A:169:THR:C	1:A:171:PRO:HD3	2.39	0.47
1:A:408:ASN:HB2	8:A:858:HOH:O	2.14	0.47
1:A:165:PHE:C	1:A:167:CYS:N	2.39	0.47
1:A:172:TYR:CD1	1:A:172:TYR:N	2.83	0.46
1:A:313:LEU:N	1:A:314:PRO:CD	2.79	0.45
1:A:148:ASP:O	1:A:151:LEU:HB2	2.15	0.45
1:A:333:ASN:HD22	1:A:334:SER:N	2.14	0.45
1:A:63:GLN:O	1:A:64:ARG:HB2	2.16	0.45
1:A:120:GLY:HA2	1:A:123:GLU:CG	2.47	0.45
1:A:82:ILE:HD11	1:A:483:LEU:HD12	1.99	0.45
1:A:588:SER:N	1:A:589:PRO:CD	2.81	0.44
1:A:407:MET:HB3	1:A:501:MET:HE3	1.99	0.44
1:A:3:GLU:C	1:A:5:GLY:N	2.73	0.44
1:A:237:CYS:HA	1:A:381:PHE:O	2.17	0.44
1:A:6:CYS:O	1:A:8:ALA:N	2.51	0.44
1:A:10:VAL:HG11	1:A:41:ARG:NH2	2.32	0.43
1:A:138:ASN:O	1:A:161:PHE:HA	2.19	0.42
1:A:213:MET:HG2	1:A:273:HIS:CD2	2.54	0.42
1:A:165:PHE:CZ	1:A:168:PRO:HA	2.54	0.42
1:A:343:PHE:CD1	1:A:518:GLN:HG2	2.54	0.42
1:A:349:PHE:CB	1:A:497:ASN:HD21	2.32	0.42
1:A:112:ASP:OD2	5:A:608[B]:HEM:O1D	2.38	0.42
1:A:187:LEU:HD22	1:A:304:ILE:HG22	2.02	0.42
1:A:21:TYR:OH	1:A:295:GLU:OE1	2.19	0.41
1:A:89:GLU:CD	8:A:813:HOH:O	2.62	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:518:GLN:O	1:A:522:ILE:HG23	2.20	0.41
1:A:118:GLU:C	1:A:120:GLY:N	2.78	0.41
1:A:4:VAL:O	1:A:166:VAL:O	2.39	0.41
1:A:229:PHE:CG	1:A:247:PRO:HG2	2.55	0.41
8:A:1025:HOH:O	2:C:2:NAG:H82	2.20	0.41
1:A:4:VAL:HG21	1:A:169:THR:O	2.21	0.41
1:A:150:LYS:NZ	1:A:154:GLN:NE2	2.65	0.41
1:A:324:TRP:CE2	1:A:513:CYS:HA	2.55	0.41
1:A:64:ARG:NH1	1:A:65:LYS:HE2	2.36	0.41
1:A:227:LEU:CD2	1:A:270:LEU:HD22	2.46	0.41
1:A:313:LEU:HD23	1:A:313:LEU:HA	1.91	0.40
1:A:333:ASN:C	1:A:333:ASN:ND2	2.80	0.40
1:A:119:LEU:HD21	1:A:168:PRO:HG3	2.03	0.40
1:A:260:ILE:HD11	1:A:386:ILE:HG13	2.04	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	593/595 (100%)	558 (94%)	23 (4%)	12 (2%)	6 5

All (12) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	4	VAL
1	A	7	GLY
1	A	64	ARG
1	A	166	VAL
1	A	168	PRO
1	A	171	PRO
1	A	118	GLU

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Mol	Chain	Res	Type
1	A	119	LEU
1	A	12	LEU
1	A	17	GLU
1	A	170	PRO
1	A	167	CYS

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	518/518 (100%)	473 (91%)	45 (9%)	9 12

All (45) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	TRP
1	A	12	LEU
1	A	14	LYS
1	A	17	GLU
1	A	36	LEU
1	A	57	LEU
1	A	77	GLU
1	A	98	LEU
1	A	119	LEU
1	A	122	ASN
1	A	124	HIS
1	A	125	SER
1	A	126	LYS
1	A	128	GLN
1	A	131	GLU
1	A	153	THR
1	A	167	CYS
1	A	168	PRO
1	A	172	TYR
1	A	173	GLN
1	A	174	SER

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Mol	Chain	Res	Type
1	A	175	LEU
1	A	187	LEU
1	A	201	SER
1	A	203	LEU
1	A	227	LEU
1	A	232	LYS
1	A	233	LYS
1	A	245	ARG
1	A	261	LEU
1	A	268	LEU
1	A	276	LEU
1	A	292	LEU
1	A	317	LEU
1	A	322	GLN
1	A	333	ASN
1	A	360	ARG
1	A	376	LEU
1	A	464	LEU
1	A	465	LYS
1	A	471	LEU
1	A	480	LEU
1	A	511	LEU
1	A	522	ILE
1	A	564	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	147	ASN
1	A	154	GLN
1	A	173	GLN
1	A	230	ASN
1	A	231	ASN
1	A	333	ASN
1	A	423	GLN
1	A	468	GLN
1	A	497	ASN
1	A	556	ASN
1	A	570	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 ⓘ

4 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	NAG	B	1	2,1	14,14,15	0.41	0	17,19,21	1.00	0
2	NAG	B	2	2	14,14,15	0.49	0	17,19,21	1.37	2 (11%)
2	NAG	C	1	2,1	14,14,15	0.54	0	17,19,21	1.42	2 (11%)
2	NAG	C	2	2	14,14,15	0.72	0	17,19,21	1.73	4 (23%)

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	NAG	B	1	2,1	-	1/6/23/26	0/1/1/1
2	NAG	B	2	2	-	1/6/23/26	0/1/1/1
2	NAG	C	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	C	2	2	-	5/6/23/26	0/1/1/1

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	NAG	C4-C3-C2	4.33	117.36	111.02
2	B	2	NAG	C1-O5-C5	3.61	117.02	112.19
2	C	2	NAG	C8-C7-N2	3.38	121.72	116.12
2	C	2	NAG	C4-C3-C2	-3.24	106.28	111.02
2	C	2	NAG	C2-N2-C7	2.98	126.89	122.90
2	B	2	NAG	C1-C2-N2	-2.63	106.28	110.43
2	C	2	NAG	O5-C1-C2	-2.50	107.42	111.29
2	C	1	NAG	C1-C2-N2	-2.13	107.07	110.43

There are no chirality outliers.

All (7) torsion outliers are listed below:

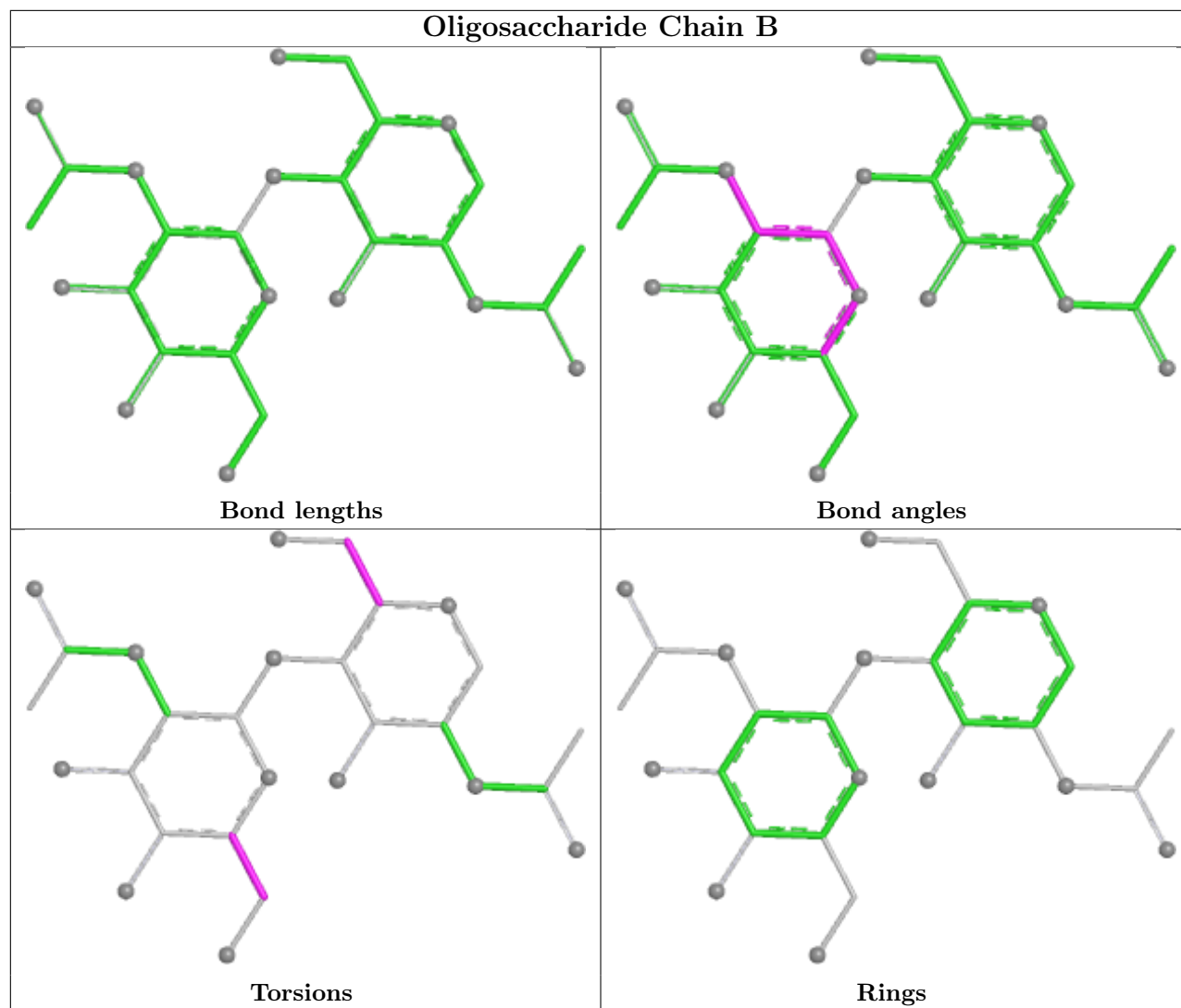
Mol	Chain	Res	Type	Atoms
2	C	2	NAG	C4-C5-C6-O6
2	C	2	NAG	O5-C5-C6-O6
2	C	2	NAG	C8-C7-N2-C2
2	C	2	NAG	O7-C7-N2-C2
2	C	2	NAG	C3-C2-N2-C7
2	B	1	NAG	C4-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6

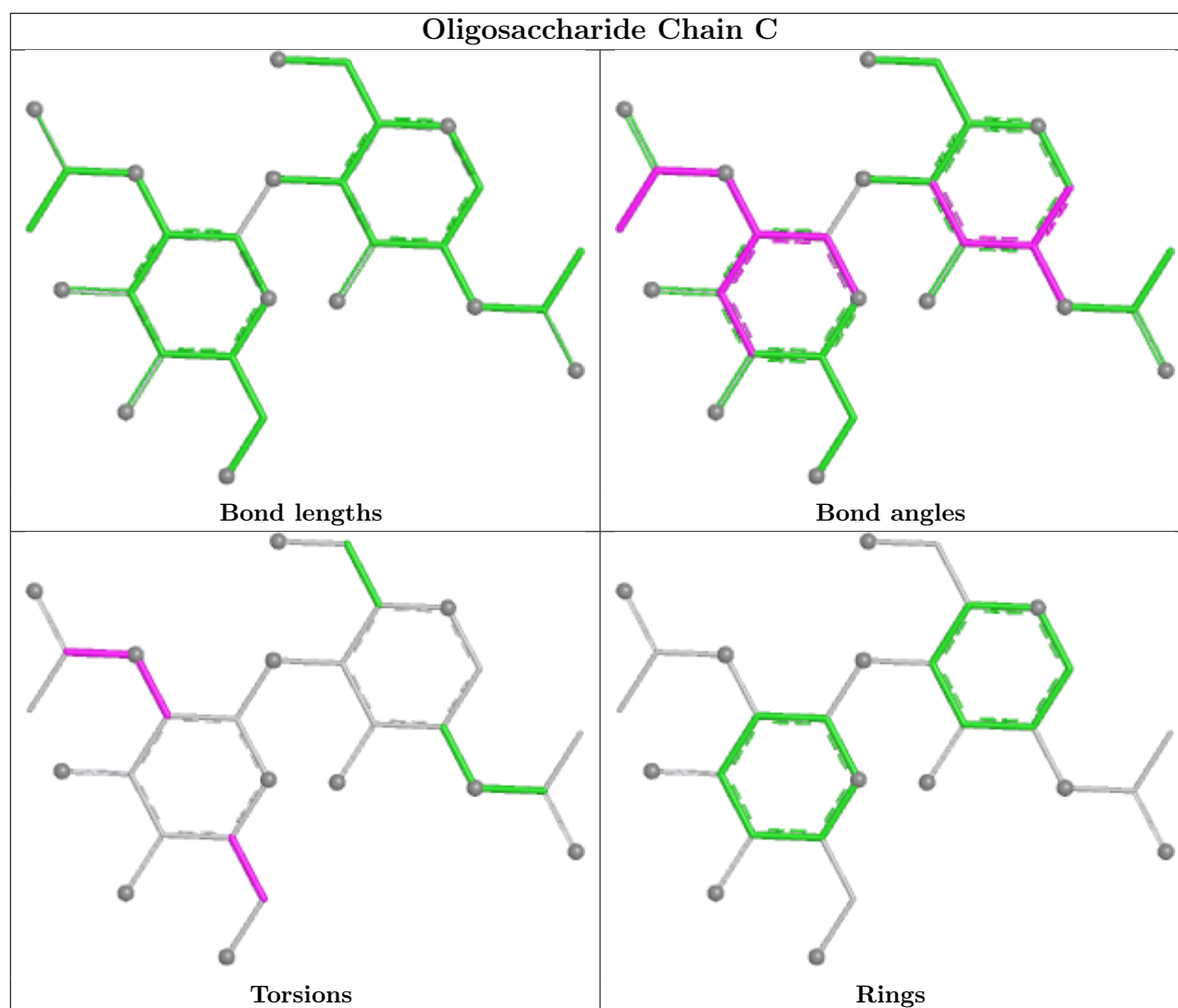
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	2	NAG	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 oligosaccharide.





5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 4 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	$\# Z > 2$
3	NAG	A	604	1	14,14,15	0.59	0	17,19,21	1.85	6 (35%)
5	HEM	A	608[A]	6	50,50,50	1.62	9 (18%)	67,82,82	1.69	17 (25%)
3	NAG	A	601	1	14,14,15	0.40	0	17,19,21	1.40	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	HEM	A	608[B]	-	50,50,50	1.62	9 (18%)	67,82,82	1.66	17 (25%)

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	NAG	A	604	1	-	1/6/23/26	0/1/1/1
5	HEM	A	608[A]	6	-	5/14/54/54	-
3	NAG	A	601	1	-	2/6/23/26	0/1/1/1
5	HEM	A	608[B]	-	-	4/14/54/54	-

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	608[A]	HEM	FE-NB	5.27	2.11	1.94
5	A	608[B]	HEM	FE-NB	5.27	2.11	1.94
5	A	608[A]	HEM	FE-NC	3.96	2.08	1.95
5	A	608[B]	HEM	FE-NC	3.96	2.08	1.95
5	A	608[A]	HEM	C1B-NB	-2.89	1.35	1.40
5	A	608[B]	HEM	C1B-NB	-2.89	1.35	1.40
5	A	608[A]	HEM	FE-ND	-2.88	1.86	1.94
5	A	608[B]	HEM	FE-ND	-2.88	1.86	1.94
5	A	608[A]	HEM	C4D-ND	-2.80	1.35	1.40
5	A	608[B]	HEM	C4D-ND	-2.80	1.35	1.40
5	A	608[A]	HEM	C3C-C4C	-2.36	1.41	1.46
5	A	608[B]	HEM	C3C-C4C	-2.36	1.41	1.46
5	A	608[A]	HEM	C1C-C2C	-2.30	1.40	1.45
5	A	608[B]	HEM	C1C-C2C	-2.30	1.40	1.45
5	A	608[A]	HEM	C1D-ND	-2.29	1.34	1.38
5	A	608[B]	HEM	C1D-ND	-2.29	1.34	1.38
5	A	608[A]	HEM	C3B-C4B	2.10	1.49	1.44
5	A	608[B]	HEM	C3B-C4B	2.10	1.49	1.44

All (41) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	608[A]	HEM	CHC-C4B-NB	4.76	129.55	124.42
5	A	608[B]	HEM	CHC-C4B-NB	4.76	129.55	124.42
5	A	608[A]	HEM	CHD-C1D-ND	4.32	129.07	124.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	608[B]	HEM	CHD-C1D-ND	4.32	129.07	124.42
5	A	608[A]	HEM	CHA-C4D-ND	4.12	129.46	124.37
5	A	608[B]	HEM	CHA-C4D-ND	4.12	129.46	124.37
3	A	601	NAG	C1-O5-C5	4.00	117.55	112.19
3	A	604	NAG	C1-C2-N2	-3.38	105.11	110.43
5	A	608[A]	HEM	C1B-NB-C4B	3.08	108.86	105.21
5	A	608[B]	HEM	C1B-NB-C4B	3.08	108.86	105.21
3	A	604	NAG	O7-C7-N2	2.99	127.27	121.98
5	A	608[A]	HEM	O2A-CGA-O1A	-2.82	116.07	123.33
5	A	608[B]	HEM	O2A-CGA-O1A	-2.82	116.07	123.33
5	A	608[A]	HEM	CHB-C1B-NB	2.75	127.77	124.37
5	A	608[B]	HEM	CHB-C1B-NB	2.75	127.77	124.37
5	A	608[A]	HEM	O2D-CGD-O1D	-2.75	116.27	123.33
5	A	608[A]	HEM	O2D-CGD-CBD	2.72	122.61	114.00
5	A	608[A]	HEM	CBD-CAD-C3D	-2.70	105.08	112.53
5	A	608[A]	HEM	O2A-CGA-CBA	2.69	122.51	114.00
5	A	608[B]	HEM	O2A-CGA-CBA	2.69	122.51	114.00
5	A	608[A]	HEM	CMD-C2D-C1D	2.68	129.22	125.03
5	A	608[B]	HEM	CMD-C2D-C1D	2.68	129.22	125.03
5	A	608[A]	HEM	CHA-C4D-C3D	-2.56	120.50	125.23
5	A	608[B]	HEM	CHA-C4D-C3D	-2.56	120.50	125.23
5	A	608[A]	HEM	C3B-C4B-NB	-2.50	107.67	109.47
5	A	608[B]	HEM	C3B-C4B-NB	-2.50	107.67	109.47
3	A	604	NAG	C2-N2-C7	2.49	126.24	122.90
3	A	604	NAG	O7-C7-C8	-2.36	117.84	122.05
5	A	608[A]	HEM	CMB-C2B-C1B	2.35	128.71	125.03
5	A	608[B]	HEM	CMB-C2B-C1B	2.35	128.71	125.03
5	A	608[B]	HEM	O2D-CGD-O1D	-2.34	117.31	123.33
3	A	604	NAG	O5-C5-C6	-2.34	103.12	107.66
5	A	608[A]	HEM	C1A-CHA-C4D	-2.31	120.81	126.25
5	A	608[A]	HEM	CHD-C1D-C2D	-2.27	121.45	125.03
5	A	608[B]	HEM	CHD-C1D-C2D	-2.27	121.45	125.03
5	A	608[B]	HEM	C1A-CHA-C4D	-2.26	120.94	126.25
5	A	608[B]	HEM	O2D-CGD-CBD	2.22	121.02	114.00
5	A	608[A]	HEM	CMA-C3A-C4A	2.19	128.75	125.42
5	A	608[B]	HEM	CMA-C3A-C4A	2.19	128.75	125.42
5	A	608[B]	HEM	CBD-CAD-C3D	-2.10	106.74	112.53
3	A	604	NAG	O6-C6-C5	-2.08	104.25	111.33

There are no chirality outliers.

All (12) torsion outliers are listed below:

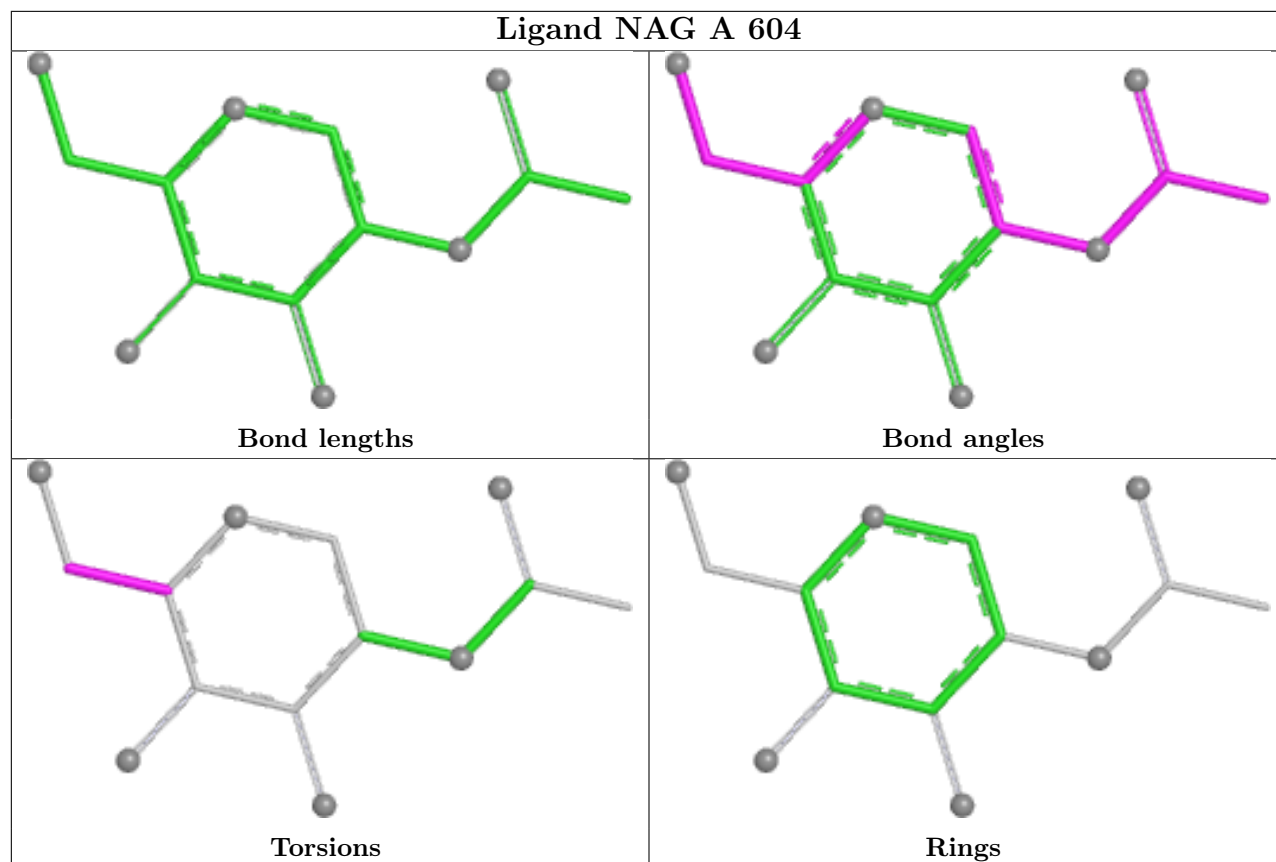
Mol	Chain	Res	Type	Atoms
3	A	601	NAG	C8-C7-N2-C2
3	A	601	NAG	O7-C7-N2-C2
5	A	608[A]	HEM	C3D-CAD-CBD-CGD
5	A	608[A]	HEM	CAD-CBD-CGD-O2D
5	A	608[A]	HEM	CAD-CBD-CGD-O1D
5	A	608[A]	HEM	CAA-CBA-CGA-O1A
5	A	608[A]	HEM	CAA-CBA-CGA-O2A
5	A	608[B]	HEM	CAA-CBA-CGA-O1A
5	A	608[B]	HEM	CAA-CBA-CGA-O2A
5	A	608[B]	HEM	CAD-CBD-CGD-O2D
5	A	608[B]	HEM	CAD-CBD-CGD-O1D
3	A	604	NAG	O5-C5-C6-O6

There are no ring outliers.

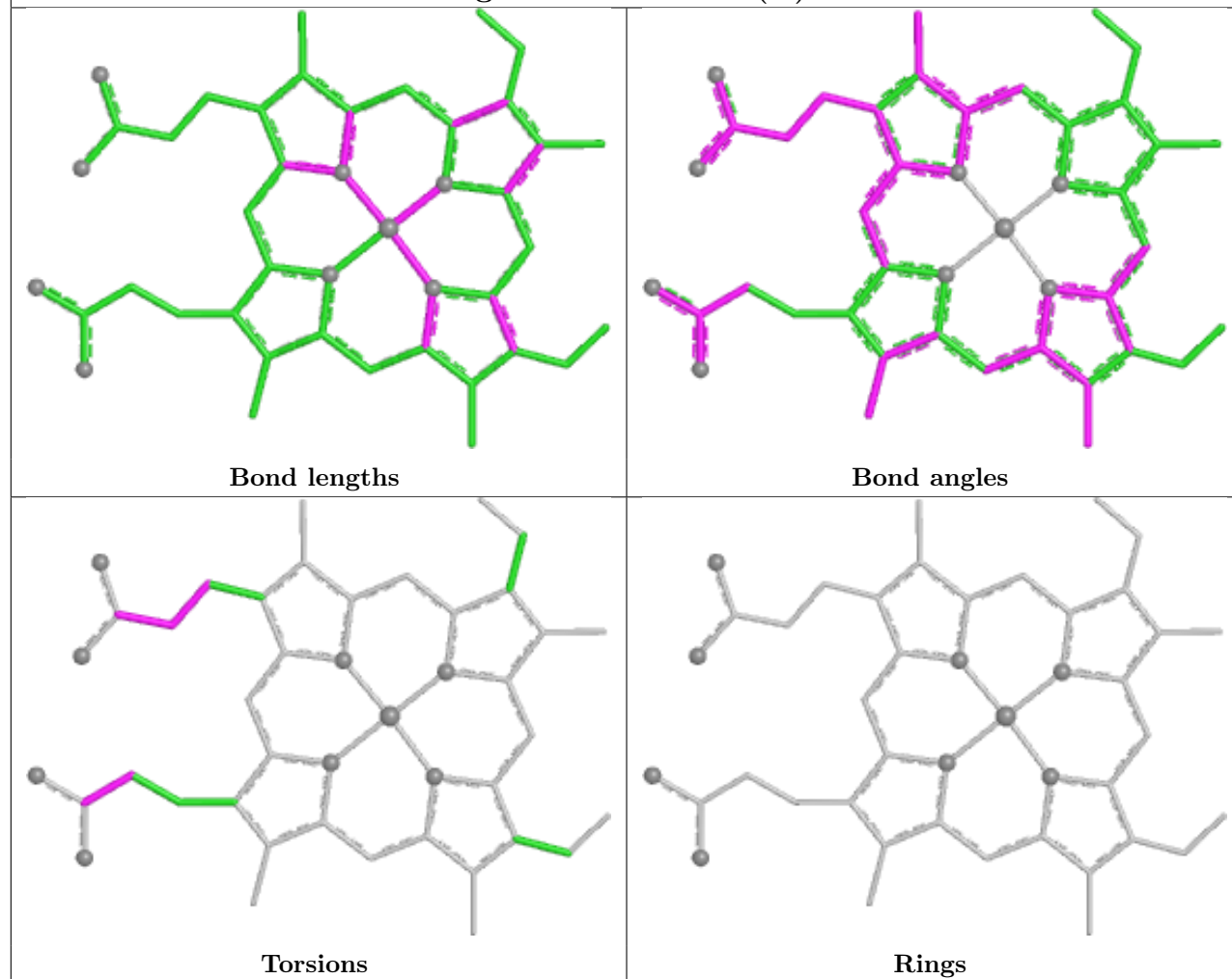
1 monomer is involved in 1 short contact:

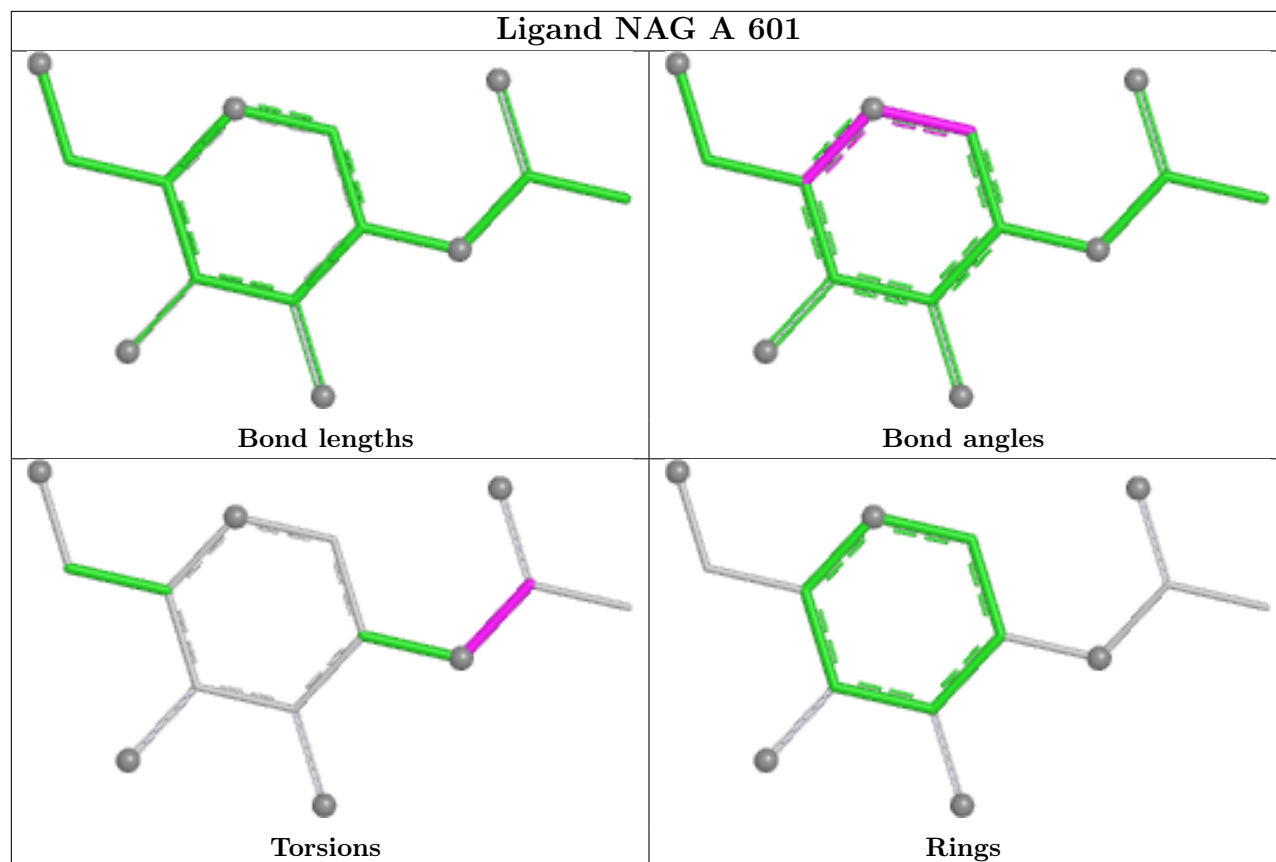
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	608[B]	HEM	1	0

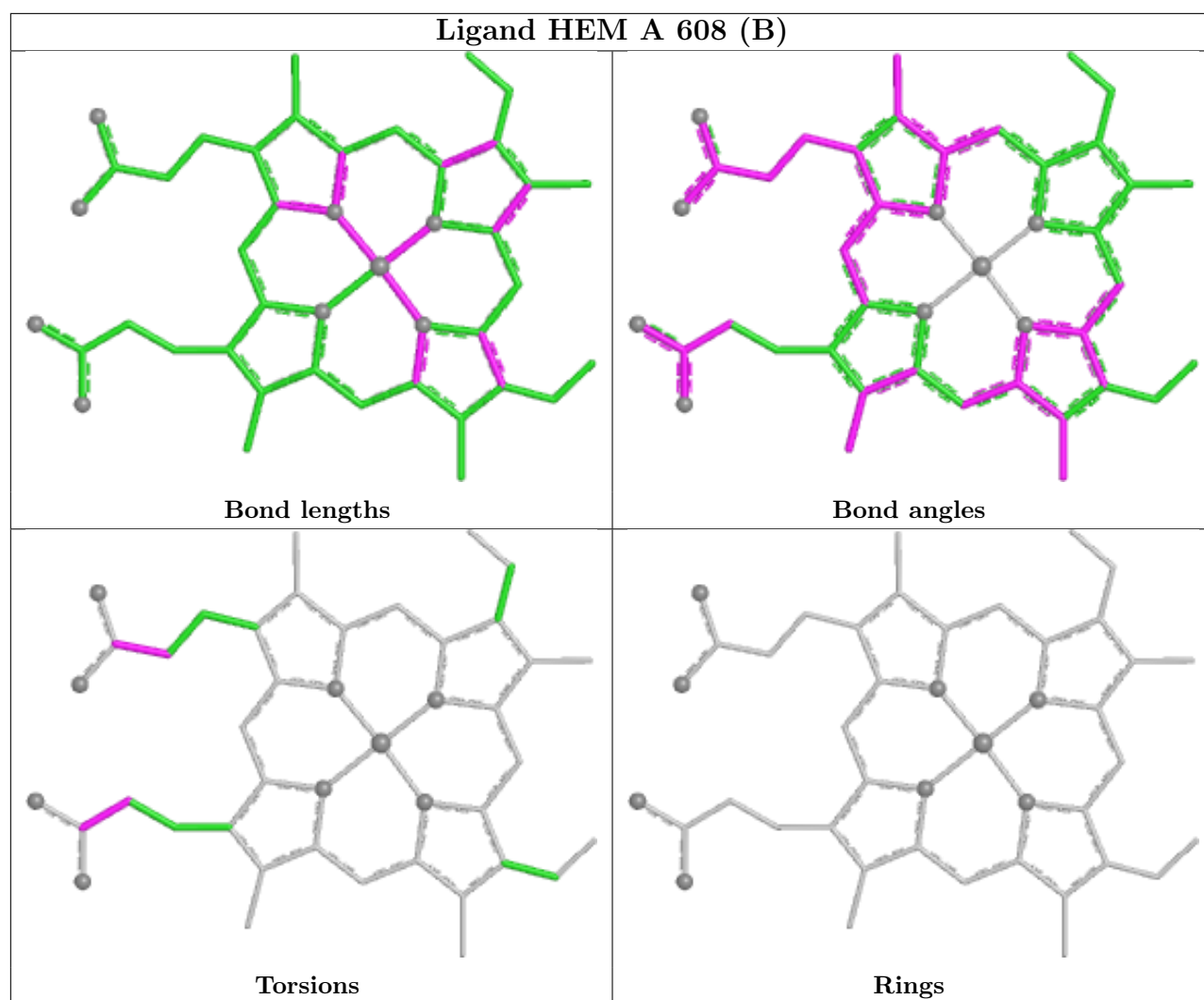
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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



Ligand HEM A 608 (A)







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	595/595 (100%)	0.07	36 (6%)	27 29	14, 23, 62, 149	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	5	GLY	7.5
1	A	167	CYS	7.5
1	A	122	ASN	7.2
1	A	4	VAL	7.0
1	A	168	PRO	6.8
1	A	169	THR	6.7
1	A	119	LEU	6.5
1	A	170	PRO	6.4
1	A	166	VAL	6.4
1	A	172	TYR	5.9
1	A	171	PRO	5.8
1	A	6	CYS	5.8
1	A	13	VAL	5.5
1	A	9	PRO	5.4
1	A	12	LEU	5.2
1	A	10	VAL	5.1
1	A	11	PRO	5.1
1	A	2	TRP	4.4
1	A	8	ALA	4.0
1	A	7	GLY	3.9
1	A	124	HIS	3.8
1	A	173	GLN	3.7
1	A	595	ASN	3.6
1	A	121	SER	3.3
1	A	594	GLU	3.1
1	A	593	ARG	3.1
1	A	120	GLY	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	14	LYS	2.8
1	A	63	GLN	2.7
1	A	574	HIS	2.4
1	A	3	GLU	2.4
1	A	232	LYS	2.4
1	A	118	GLU	2.3
1	A	128	GLN	2.1
1	A	425	THR	2.0
1	A	371	GLU	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](#)

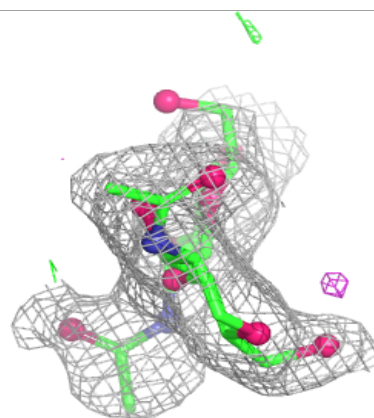
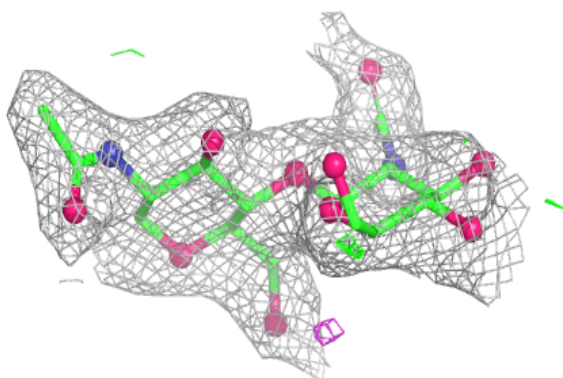
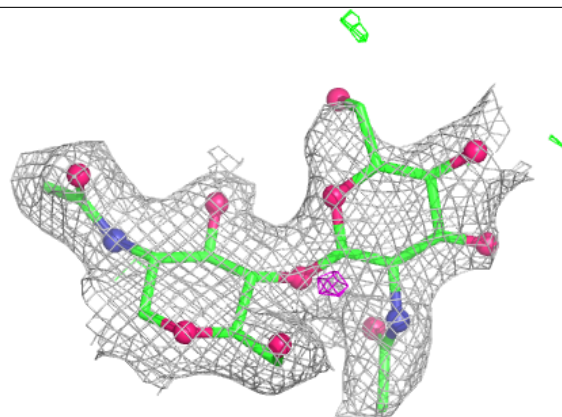
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

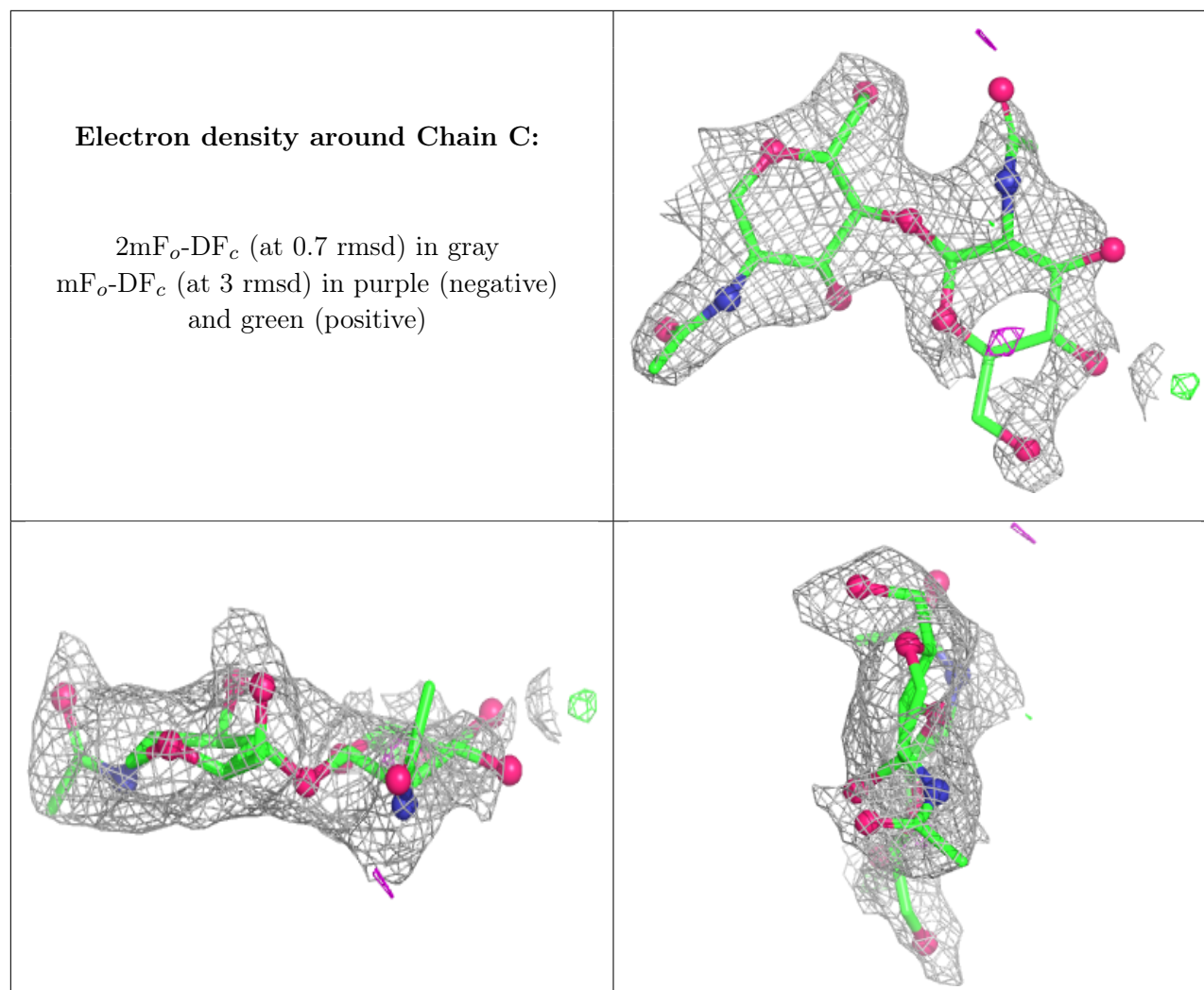
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	C	2	14/15	0.66	0.20	72,79,84,84	0
2	NAG	B	2	14/15	0.80	0.15	44,54,61,66	0
2	NAG	C	1	14/15	0.83	0.13	42,48,57,61	0
2	NAG	B	1	14/15	0.94	0.08	25,30,35,35	0

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.

Electron density around Chain B:

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





6.4 Ligands ⓘ

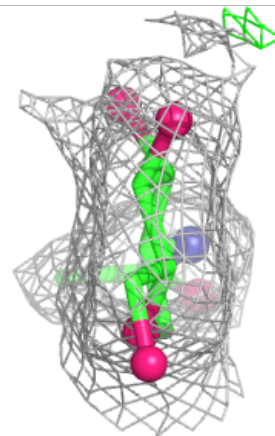
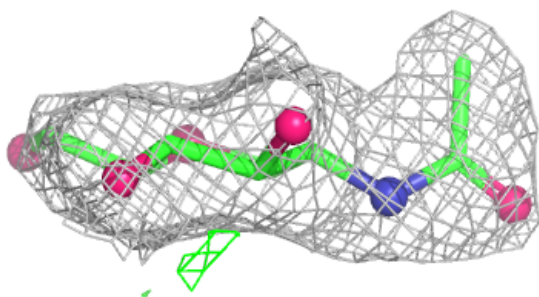
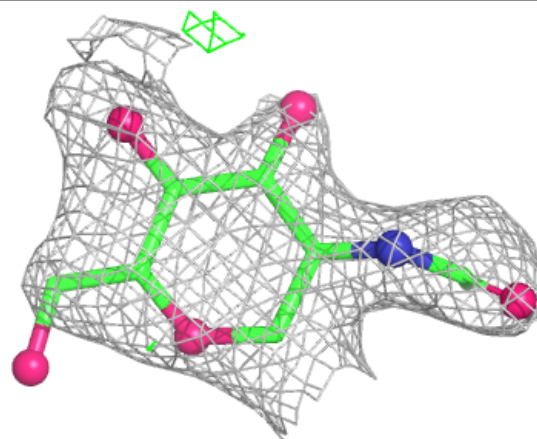
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q < 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	NAG	A	601	14/15	0.79	0.16	46,53,61,70	0
3	NAG	A	604	14/15	0.88	0.12	31,35,43,48	0
5	HEM	A	608[A]	43/43	0.98	0.07	14,16,19,20	7
5	HEM	A	608[B]	43/43	0.98	0.07	14,16,17,19	7
6	K	A	610	1/1	0.98	0.04	14,14,14,14	1
6	K	A	609	1/1	0.99	0.03	16,16,16,16	0
4	CA	A	607	1/1	0.99	0.01	16,16,16,16	0
7	ZN	A	611	1/1	1.00	0.01	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.

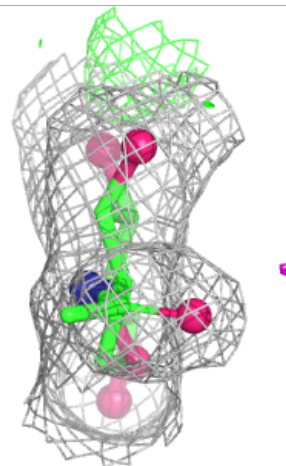
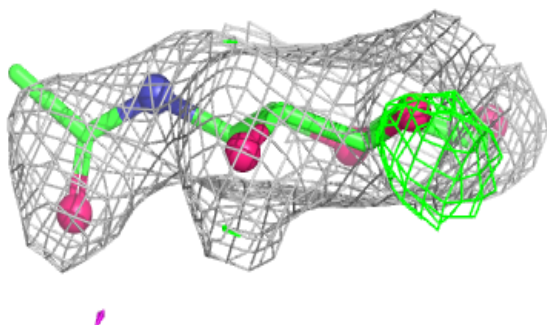
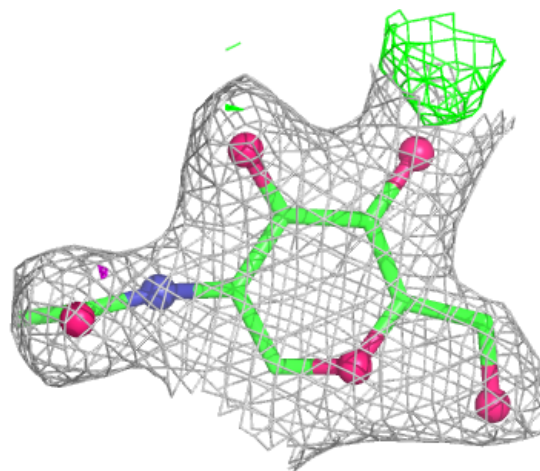
Electron density around NAG A 601:

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



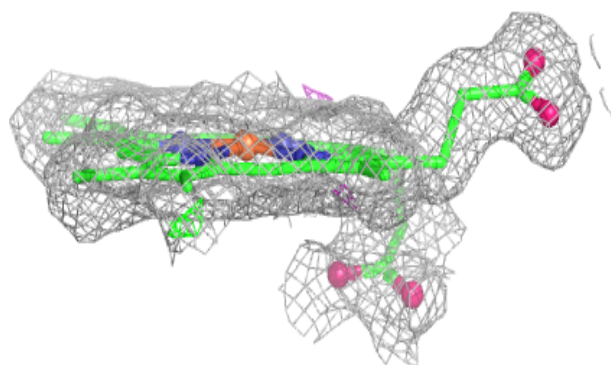
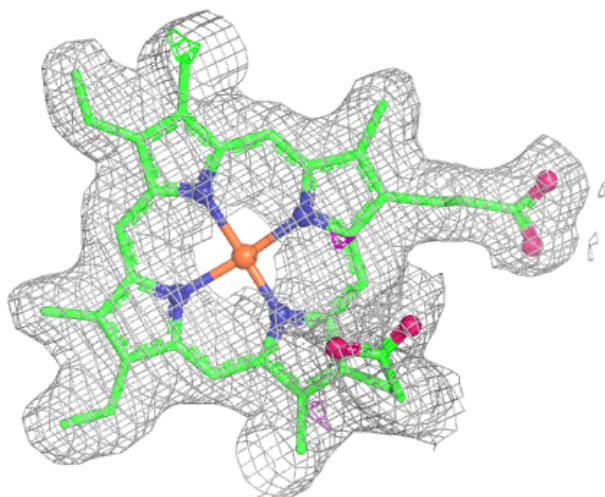
Electron density around NAG A 604:

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



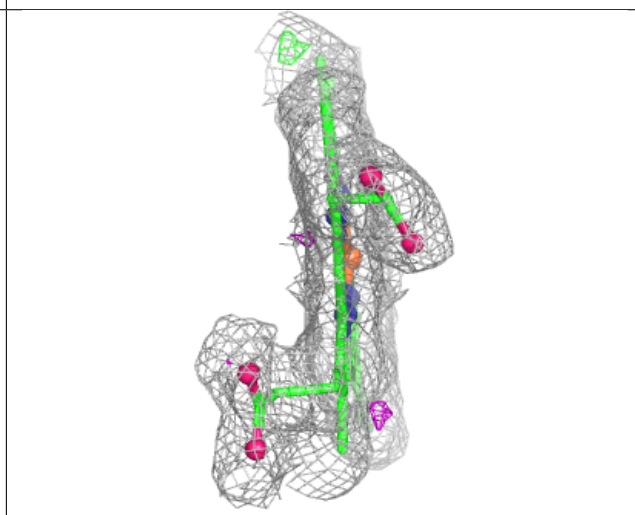
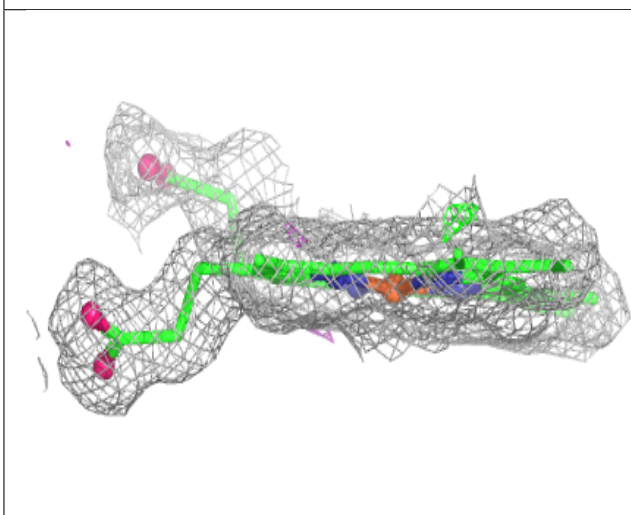
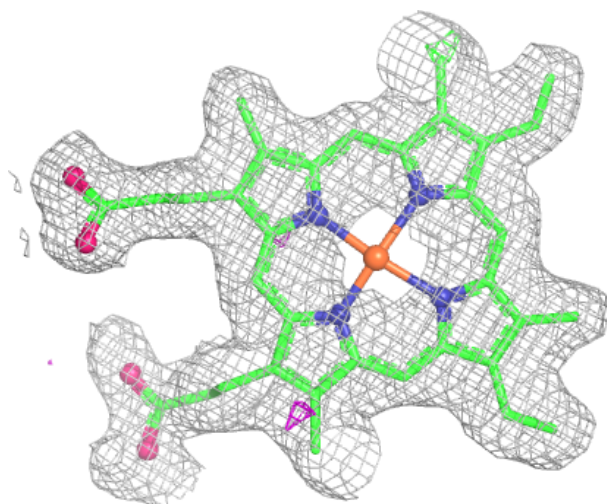
Electron density around HEM A 608 (A):

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



Electron density around HEM A 608 (B):

$2mF_o-DF_c$ (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.