Full wwPDB X-ray Structure Validation Report ⓘ

Oct 22, 2023 – 09:39 AM EDT

PDB ID	:	3FNL
Title	:	Crystal Structure of the Complex of Buffalo Lactoperoxidase with Salicylhydroxamic Acid at 2.48 A Resolution
Authors	:	Sheikh, I.A.; Vikram, G.; Singh, N.; Sinha, M.; Bhushan, A.; Sharma, S.; Kaur, P.; Singh, T.P.
Deposited on	:	2008-12-25
Resolution	:	2.48 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:

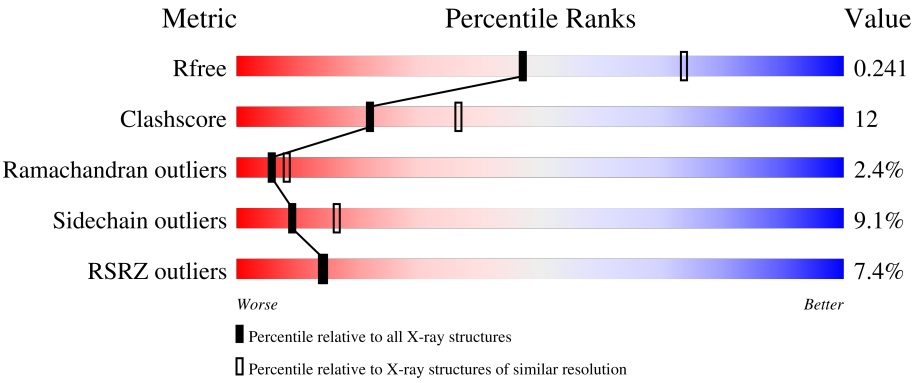
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber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

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.48 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	5857 (2.50-2.46)
Clashscore	141614	6594 (2.50-2.46)
Ramachandran outliers	138981	6469 (2.50-2.46)
Sidechain outliers	138945	6471 (2.50-2.46)
RSRZ outliers	127900	5738 (2.50-2.46)

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 <=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	7% 75% 19% 5%
2	B	3	33% 67%
2	D	3	100%
3	C	2	100%

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Mol	Chain	Length	Quality of chain
3	E	2	100%

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
2	NAG	B	2	-	-	-	X
2	MAN	B	3	-	-	-	X
2	MAN	D	3	-	-	-	X
3	NAG	C	2	-	-	-	X
3	NAG	E	2	-	-	-	X
5	IOD	A	609	-	-	X	-

2 Entry composition (i)

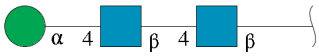
There are 9 unique types of molecules in this entry. The entry contains 5286 atoms, of which 0 are hydrogens and 0 are deuteriums.

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
			Total	C	N	O	P	S			
1	A	595	4770	3032	845	865	1	27	0	0	0

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	3	39	22	2	15	0	0	0
2	D	3	39	22	2	15	0	0	0

- Molecule 3 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
			Total	C	N	O			
3	C	2	28	16	2	10	0	0	0
3	E	2	28	16	2	10	0	0	0

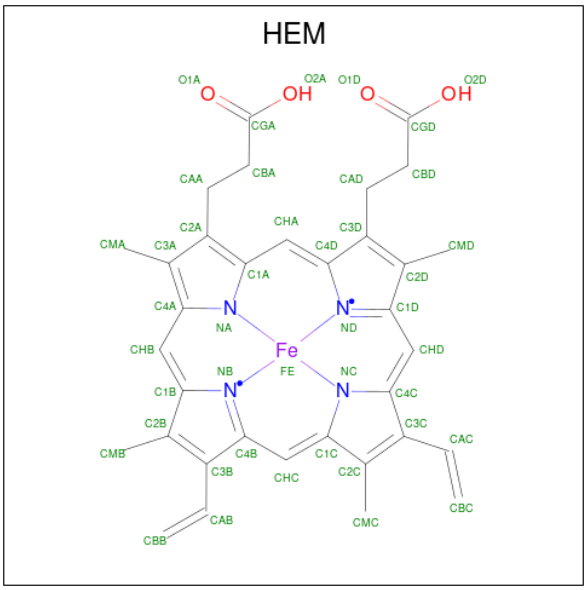
- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 5 is IODIDE ION (three-letter code: IOD) (formula: I).

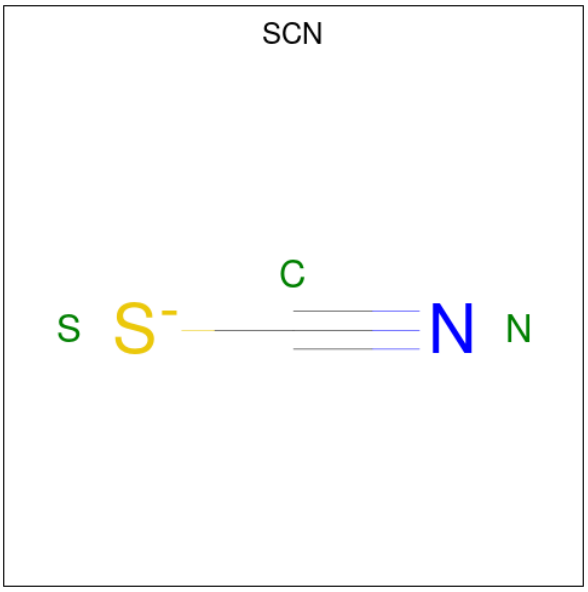
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	8	Total I 8 8	0	0

- Molecule 6 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



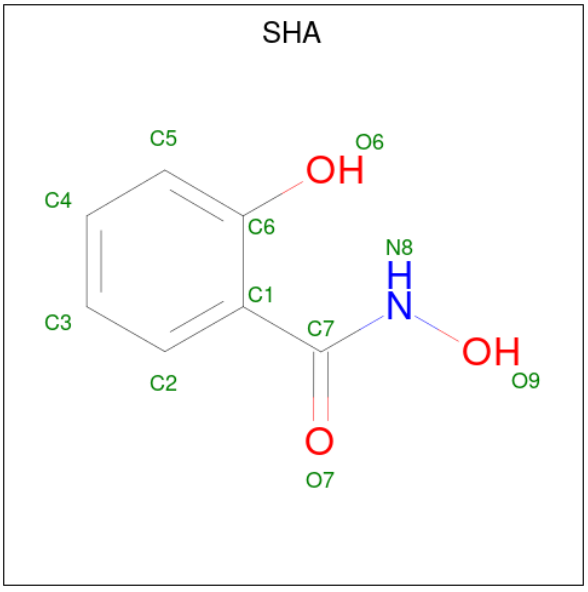
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C Fe N O 43 34 1 4 4	0	0

- Molecule 7 is THIOCYANATE ION (three-letter code: SCN) (formula: CNS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	N	S	0	0
			3	1	1	1		

- Molecule 8 is SALICYLHYDROXAMIC ACID (three-letter code: SHA) (formula: $C_7H_7NO_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	N	O	0	0
			11	7	1	3		

- Molecule 9 is water.

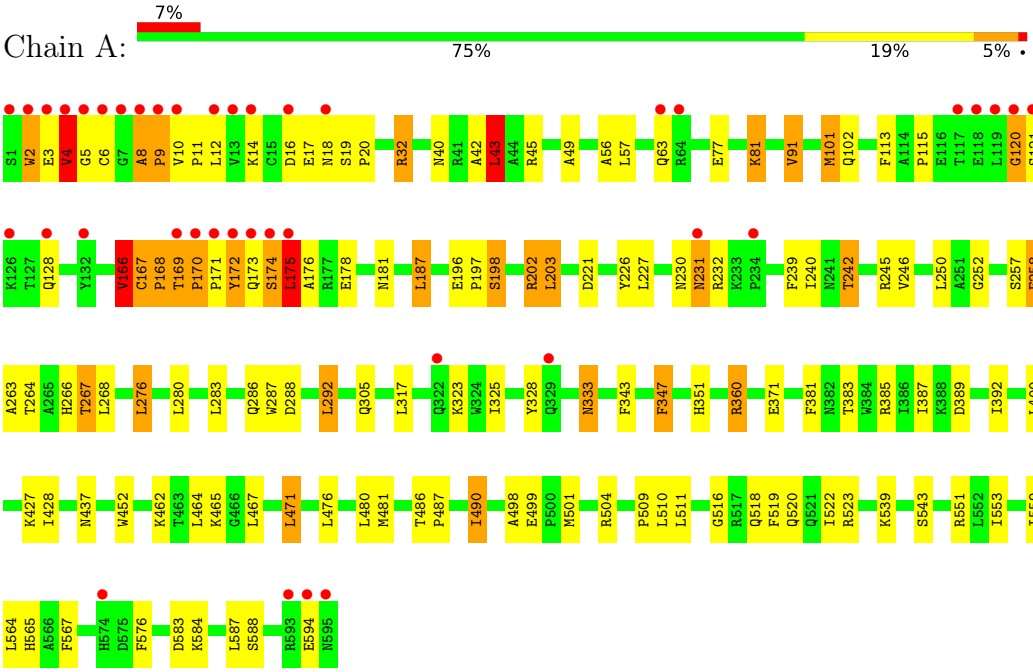
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	316	Total	O	0	0
			316	316		

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

Chain A:

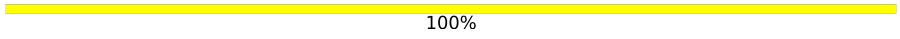


• Molecule 2: alpha-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain B:

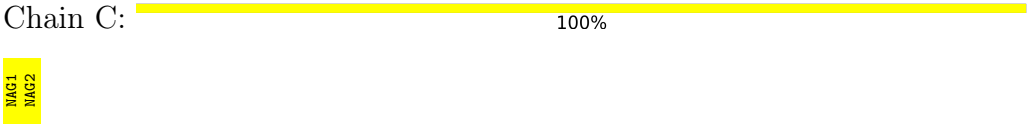
• Molecule 2: alpha-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:



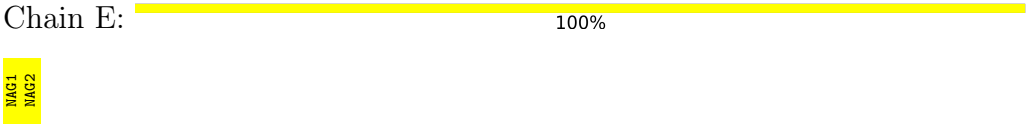
• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain C:



• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	54.48Å 80.63Å 78.12Å 90.00° 102.75° 90.00°	Depositor
Resolution (Å)	20.00 – 2.48 19.44 – 2.48	Depositor EDS
% Data completeness (in resolution range)	99.2 (20.00-2.48) 99.2 (19.44-2.48)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$< I/\sigma(I) >$ [1]	1.40 (at 2.49Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.200 , 0.240 0.198 , 0.241	Depositor DCC
R_{free} test set	1191 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å^2)	38.1	Xtriage
Anisotropy	0.083	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 46.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.52$, $< L^2 > = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	5286	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.95% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: SCN, SHA, MAN, HEM, CA, IOD, NAG, SEP

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	0.56	1/4886 (0.0%)	0.71	4/6627 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	14	LYS	CD-CE	5.18	1.64	1.51

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	258	GLU	N-CA-CB	6.00	121.41	110.60
1	A	43	LEU	CA-CB-CG	5.89	128.86	115.30
1	A	486	THR	O-C-N	-5.82	110.05	121.10
1	A	175	LEU	C-N-CA	-5.29	108.47	121.70

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	4770	0	4675	112	0
2	B	39	0	34	0	0
2	D	39	0	34	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	28	0	25	0	0
3	E	28	0	25	0	0
4	A	1	0	0	0	0
5	A	8	0	0	2	0
6	A	43	0	30	5	0
7	A	3	0	0	0	0
8	A	11	0	6	1	0
9	A	316	0	0	8	0
All	All	5286	0	4829	116	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 (116) 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:167:CYS:HB3	1:A:168:PRO:CD	1.69	1.21
1:A:32:ARG:CB	1:A:32:ARG:HH21	1.54	1.19
1:A:167:CYS:HB3	1:A:168:PRO:HD2	1.20	1.17
1:A:2:TRP:CB	1:A:4:VAL:HG22	1.76	1.16
1:A:32:ARG:HH21	1:A:32:ARG:HB3	1.07	1.15
1:A:8:ALA:HB1	1:A:9:PRO:HD2	1.28	1.09
1:A:167:CYS:CB	1:A:168:PRO:HD2	1.81	1.09
1:A:2:TRP:HB2	1:A:4:VAL:HG22	1.13	1.09
1:A:32:ARG:HB3	1:A:32:ARG:NH2	1.79	0.97
1:A:196:GLU:HB3	1:A:198:SEP:O2P	1.68	0.94
1:A:2:TRP:HB2	1:A:4:VAL:CG2	1.97	0.94
1:A:487:PRO:HA	1:A:490:ILE:HD13	1.51	0.93
1:A:8:ALA:CB	1:A:9:PRO:HD2	2.02	0.89
1:A:169:THR:HB	1:A:170:PRO:HD2	1.54	0.89
1:A:169:THR:HB	1:A:170:PRO:CD	2.05	0.86
1:A:8:ALA:HB1	1:A:9:PRO:CD	2.07	0.83
1:A:202:ARG:HD3	9:A:656:HOH:O	1.78	0.83
1:A:173:GLN:HG3	1:A:174:SER:H	1.43	0.83
1:A:32:ARG:CB	1:A:32:ARG:NH2	2.39	0.83
1:A:167:CYS:HB3	1:A:168:PRO:HD3	1.61	0.81
1:A:263:ALA:O	1:A:267:THR:HG22	1.84	0.77
1:A:32:ARG:HH21	1:A:32:ARG:HB2	1.49	0.74
1:A:231:ASN:HA	9:A:817:HOH:O	1.86	0.74
6:A:615:HEM:HMC1	6:A:615:HEM:HBC2	1.72	0.72
1:A:333:ASN:C	1:A:333:ASN:HD22	1.93	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:246:VAL:HG11	1:A:387:ILE:HD13	1.70	0.71
1:A:43:LEU:HD13	1:A:181:ASN:HB2	1.73	0.71
1:A:351:HIS:HD1	1:A:437:ASN:HD21	1.37	0.70
1:A:264:THR:HG23	1:A:392:ILE:HD12	1.75	0.69
1:A:487:PRO:HA	1:A:490:ILE:CD1	2.23	0.68
1:A:567:PHE:HB2	5:A:609:IOD:I	2.64	0.67
1:A:328:TYR:HD1	1:A:523:ARG:HD3	1.60	0.66
1:A:2:TRP:HB3	1:A:4:VAL:HG22	1.76	0.65
1:A:101:MET:HE2	1:A:102:GLN:HA	1.79	0.64
1:A:63:GLN:HG2	9:A:911:HOH:O	1.98	0.64
1:A:168:PRO:HG2	1:A:172:TYR:CZ	2.33	0.63
1:A:551:ARG:HD3	1:A:584:LYS:HA	1.78	0.63
1:A:2:TRP:C	1:A:4:VAL:H	2.01	0.63
1:A:259:GLN:HE22	1:A:261:LEU:HB2	1.62	0.62
1:A:167:CYS:HB2	1:A:168:PRO:HD2	1.77	0.62
1:A:8:ALA:O	1:A:10:VAL:HG22	1.99	0.61
1:A:101:MET:CE	1:A:102:GLN:HA	2.31	0.61
1:A:169:THR:O	1:A:170:PRO:O	2.19	0.61
1:A:328:TYR:CD1	1:A:523:ARG:HD3	2.36	0.59
1:A:42:ALA:HB2	1:A:166:VAL:HG21	1.86	0.57
6:A:615:HEM:HBC2	6:A:615:HEM:CMC	2.35	0.57
1:A:8:ALA:CB	1:A:9:PRO:CD	2.75	0.57
1:A:168:PRO:HG2	1:A:172:TYR:CE1	2.40	0.57
1:A:121:SER:O	1:A:122:ASN:HB2	2.06	0.55
1:A:2:TRP:C	1:A:4:VAL:N	2.60	0.55
1:A:169:THR:CB	1:A:170:PRO:CD	2.85	0.52
1:A:467:LEU:HD22	1:A:481:MET:CE	2.40	0.52
1:A:173:GLN:HG3	1:A:174:SER:N	2.20	0.51
1:A:588:SER:HB3	9:A:755:HOH:O	2.11	0.51
1:A:383:THR:O	1:A:387:ILE:HD12	2.11	0.51
1:A:187:LEU:HD13	1:A:305:GLN:HA	1.92	0.51
1:A:221:ASP:HB2	1:A:226:TYR:CZ	2.45	0.50
1:A:481:MET:HE1	1:A:487:PRO:HG3	1.92	0.50
1:A:232:ARG:O	1:A:232:ARG:HG3	2.11	0.50
1:A:11:PRO:HA	9:A:739:HOH:O	2.10	0.50
1:A:476:LEU:HD21	1:A:498:ALA:HB1	1.94	0.50
1:A:173:GLN:CG	1:A:174:SER:H	2.09	0.49
1:A:242:THR:O	1:A:245:ARG:CZ	2.59	0.49
1:A:276:LEU:O	1:A:280:LEU:HB2	2.13	0.49
6:A:615:HEM:HMB2	6:A:615:HEM:HBB2	1.95	0.49
1:A:8:ALA:O	1:A:10:VAL:N	2.47	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:120:GLY:C	1:A:122:ASN:H	2.14	0.48
6:A:615:HEM:HBB2	6:A:615:HEM:CMB	2.44	0.47
1:A:462:LYS:NZ	9:A:668:HOH:O	2.48	0.47
1:A:3:GLU:O	1:A:5:GLY:N	2.48	0.47
1:A:347:PHE:HB3	6:A:615:HEM:HMD2	1.97	0.47
1:A:8:ALA:O	1:A:9:PRO:C	2.53	0.47
1:A:197:PRO:HD2	1:A:198:SEP:O2P	2.16	0.46
1:A:101:MET:HE2	1:A:102:GLN:CA	2.46	0.45
1:A:467:LEU:HG	1:A:471:LEU:HD22	1.97	0.45
1:A:487:PRO:CA	1:A:490:ILE:HD13	2.35	0.45
1:A:258:GLU:HG3	8:A:617:SHA:H2	1.97	0.45
1:A:19:SER:HA	1:A:20:PRO:HD3	1.83	0.45
1:A:257:SER:O	1:A:381:PHE:HA	2.17	0.45
1:A:16:ASP:HB3	1:A:19:SER:HB2	1.98	0.45
1:A:563:PRO:HD3	1:A:576:PHE:CE2	2.52	0.44
1:A:325:ILE:HD11	1:A:516:GLY:HA2	1.99	0.44
1:A:400:LEU:HD11	1:A:553:ILE:HD13	2.00	0.44
1:A:287:TRP:HB3	1:A:292:LEU:HD22	1.99	0.44
1:A:333:ASN:C	1:A:333:ASN:ND2	2.65	0.44
1:A:10:VAL:HG12	1:A:40:ASN:O	2.17	0.44
1:A:203:LEU:HD21	1:A:252:GLY:HA2	1.99	0.44
1:A:259:GLN:HE21	1:A:259:GLN:HB2	1.50	0.44
1:A:227:LEU:HD11	1:A:266:HIS:HB3	2.01	0.43
1:A:276:LEU:HD12	1:A:587:LEU:HD11	1.99	0.43
1:A:360:ARG:NH2	1:A:371:GLU:O	2.48	0.43
1:A:239:PHE:CZ	1:A:427:LYS:HG2	2.54	0.43
1:A:565:HIS:HB3	5:A:609:IOD:I	2.88	0.43
1:A:175:LEU:HD23	1:A:176:ALA:H	1.83	0.43
1:A:230:ASN:CG	1:A:232:ARG:HG2	2.38	0.43
1:A:519:PHE:HA	1:A:522:ILE:HG12	2.01	0.43
1:A:91:VAL:HG13	1:A:405:LYS:HG3	2.00	0.42
1:A:360:ARG:HD2	9:A:803:HOH:O	2.19	0.42
1:A:407:MET:HB3	1:A:501:MET:CE	2.50	0.42
1:A:385:ARG:O	1:A:389:ASP:HB3	2.20	0.42
1:A:56:ALA:HB3	9:A:740:HOH:O	2.19	0.42
1:A:113:PHE:O	1:A:115:PRO:HD3	2.20	0.41
1:A:280:LEU:HB3	1:A:292:LEU:HD12	2.02	0.41
1:A:387:ILE:HD12	1:A:387:ILE:H	1.85	0.41
1:A:499:GLU:OE1	1:A:509:PRO:HD2	2.20	0.41
1:A:124:HIS:O	1:A:128:GLN:HB2	2.21	0.41
1:A:288:ASP:O	1:A:292:LEU:CD2	2.69	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:325:ILE:O	1:A:325:ILE:HG22	2.20	0.41
1:A:77:GLU:HG2	1:A:81:LYS:HD3	2.02	0.41
1:A:292:LEU:HD13	1:A:292:LEU:HA	1.92	0.41
1:A:452:TRP:HB3	1:A:510:LEU:HD11	2.03	0.41
1:A:202:ARG:HD2	1:A:250:LEU:HD21	2.03	0.41
1:A:45:ARG:CZ	1:A:49:ALA:HB2	2.52	0.40
1:A:343:PHE:CD1	1:A:518:GLN:HG2	2.56	0.40
1:A:166:VAL:HG22	1:A:178:GLU:O	2.22	0.40
1:A:170:PRO:HB3	1:A:171:PRO:CD	2.52	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	592/595 (100%)	554 (94%)	24 (4%)	14 (2%)	6 8

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	4	VAL
1	A	8	ALA
1	A	9	PRO
1	A	122	ASN
1	A	168	PRO
1	A	169	THR
1	A	170	PRO
1	A	174	SER
1	A	6	CYS
1	A	17	GLU
1	A	167	CYS
1	A	594	GLU

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Mol	Chain	Res	Type
1	A	166	VAL
1	A	120	GLY

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	516/516 (100%)	469 (91%)	47 (9%)	9 16

All (47) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	TRP
1	A	4	VAL
1	A	12	LEU
1	A	18	ASN
1	A	32	ARG
1	A	43	LEU
1	A	57	LEU
1	A	81	LYS
1	A	91	VAL
1	A	101	MET
1	A	166	VAL
1	A	172	TYR
1	A	175	LEU
1	A	187	LEU
1	A	202	ARG
1	A	203	LEU
1	A	231	ASN
1	A	240	ILE
1	A	242	THR
1	A	259	GLN
1	A	261	LEU
1	A	267	THR
1	A	268	LEU
1	A	276	LEU

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Mol	Chain	Res	Type
1	A	283	LEU
1	A	286	GLN
1	A	292	LEU
1	A	317	LEU
1	A	323	LYS
1	A	333	ASN
1	A	347	PHE
1	A	360	ARG
1	A	428	ILE
1	A	464	LEU
1	A	465	LYS
1	A	471	LEU
1	A	480	LEU
1	A	490	ILE
1	A	504	ARG
1	A	511	LEU
1	A	520	GLN
1	A	539	LYS
1	A	543	SER
1	A	559	ILE
1	A	561	LYS
1	A	564	LEU
1	A	583	ASP

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	217	GLN
1	A	259	GLN
1	A	333	ASN
1	A	364	ASN
1	A	497	ASN
1	A	520	GLN
1	A	545	GLN
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 (i)

1 non-standard protein/DNA/RNA residue is 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	$\#\|Z\| > 2$
1	SEP	A	198	1	8,9,10	1.54	1 (12%)	8,12,14	1.32	2 (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
1	SEP	A	198	1	-	4/5/8/10	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	198	SEP	P-O1P	3.12	1.60	1.50

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	198	SEP	OG-CB-CA	2.66	110.73	108.14
1	A	198	SEP	OG-P-O1P	2.01	112.11	106.47

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	198	SEP	CB-OG-P-O2P
1	A	198	SEP	CB-OG-P-O3P
1	A	198	SEP	CB-OG-P-O1P
1	A	198	SEP	CA-CB-OG-P

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	198	SEP	2	0

5.5 Carbohydrates (i)

10 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	1,2	14,14,15	0.58	0	17,19,21	1.69	4 (23%)
2	NAG	B	2	2	14,14,15	0.74	0	17,19,21	0.97	0
2	MAN	B	3	2	11,11,12	0.64	0	15,15,17	1.58	2 (13%)
3	NAG	C	1	1,3	14,14,15	0.59	0	17,19,21	0.83	1 (5%)
3	NAG	C	2	3	14,14,15	0.68	0	17,19,21	1.31	3 (17%)
2	NAG	D	1	1,2	14,14,15	0.58	0	17,19,21	1.19	1 (5%)
2	NAG	D	2	2	14,14,15	0.45	0	17,19,21	1.96	4 (23%)
2	MAN	D	3	2	11,11,12	0.64	0	15,15,17	1.59	2 (13%)
3	NAG	E	1	1,3	14,14,15	0.66	0	17,19,21	1.58	2 (11%)
3	NAG	E	2	3	14,14,15	0.65	0	17,19,21	1.31	3 (17%)

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	1,2	-	4/6/23/26	0/1/1/1
2	NAG	B	2	2	-	2/6/23/26	0/1/1/1
2	MAN	B	3	2	-	2/2/19/22	1/1/1/1
3	NAG	C	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	D	1	1,2	-	1/6/23/26	0/1/1/1
2	NAG	D	2	2	-	0/6/23/26	0/1/1/1
2	MAN	D	3	2	-	2/2/19/22	1/1/1/1
3	NAG	E	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	2	NAG	C1-O5-C5	6.23	120.64	112.19
2	D	3	MAN	C1-O5-C5	5.07	119.06	112.19
3	E	1	NAG	C4-C3-C2	5.04	118.41	111.02
2	B	3	MAN	C1-O5-C5	5.02	118.99	112.19
2	B	1	NAG	O5-C1-C2	-3.51	105.75	111.29
3	E	2	NAG	C1-O5-C5	-3.27	107.76	112.19
3	C	2	NAG	C1-O5-C5	3.25	116.59	112.19
2	D	2	NAG	O5-C5-C6	2.98	111.87	107.20
2	D	1	NAG	O5-C1-C2	-2.86	106.78	111.29
3	E	1	NAG	O5-C5-C6	2.77	111.54	107.20
2	B	1	NAG	C1-O5-C5	2.63	115.75	112.19
2	B	1	NAG	O4-C4-C5	2.47	115.43	109.30
2	D	2	NAG	C4-C3-C2	-2.42	107.47	111.02
3	C	2	NAG	C6-C5-C4	-2.41	107.37	113.00
2	B	1	NAG	C6-C5-C4	2.29	118.36	113.00
3	E	2	NAG	O5-C1-C2	-2.24	107.74	111.29
3	E	2	NAG	C2-N2-C7	-2.22	119.74	122.90
3	C	2	NAG	C3-C4-C5	2.18	114.13	110.24
3	C	1	NAG	C4-C3-C2	2.10	114.10	111.02
2	D	2	NAG	C1-C2-N2	2.06	114.00	110.49
2	D	3	MAN	O5-C5-C6	2.02	110.37	107.20
2	B	3	MAN	O5-C5-C6	2.01	110.36	107.20

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	E	2	NAG	O7-C7-N2-C2
3	E	2	NAG	C8-C7-N2-C2
2	B	1	NAG	C4-C5-C6-O6

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Mol	Chain	Res	Type	Atoms
2	B	1	NAG	O5-C5-C6-O6
3	E	1	NAG	C8-C7-N2-C2
2	B	3	MAN	C4-C5-C6-O6
2	D	3	MAN	C4-C5-C6-O6
2	B	1	NAG	C8-C7-N2-C2
2	B	1	NAG	O7-C7-N2-C2
3	E	1	NAG	O7-C7-N2-C2
2	B	2	NAG	O5-C5-C6-O6
2	B	3	MAN	O5-C5-C6-O6
2	D	3	MAN	O5-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6
2	D	1	NAG	C4-C5-C6-O6

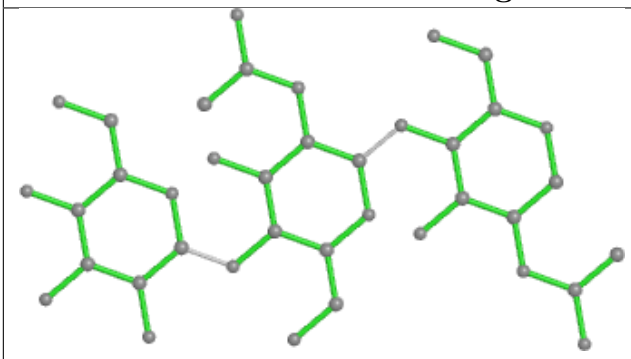
All (2) ring outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	3	MAN	C1-C2-C3-C4-C5-O5
2	D	3	MAN	C1-C2-C3-C4-C5-O5

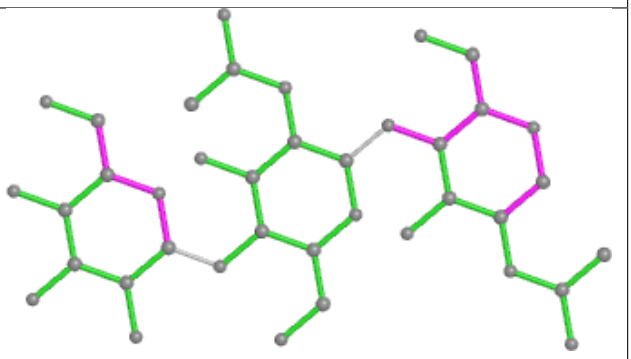
No monomer is involved in short contacts.

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

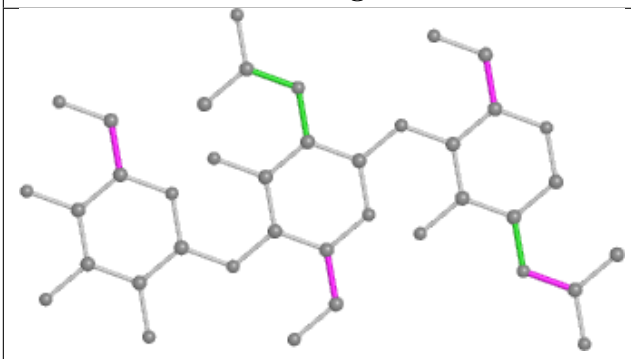
Oligosaccharide Chain B



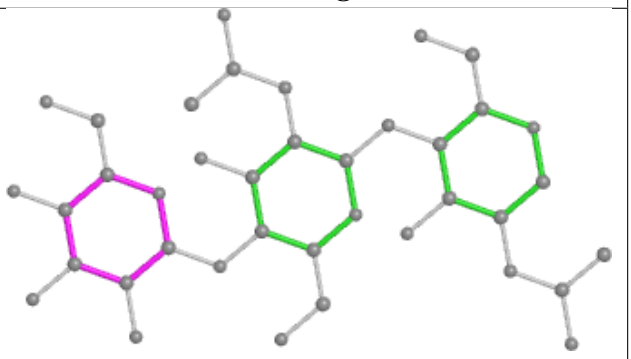
Bond lengths



Bond angles

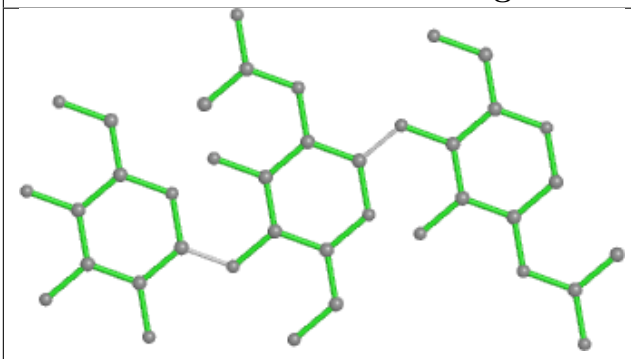


Torsions

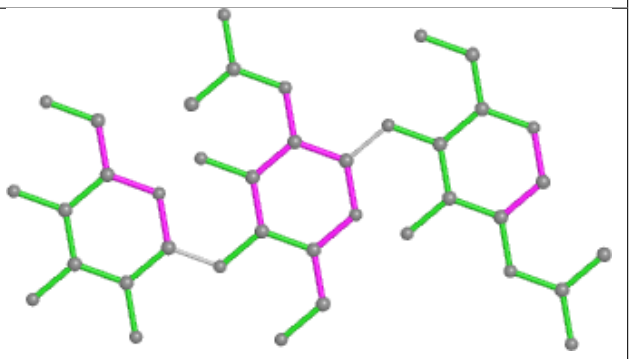


Rings

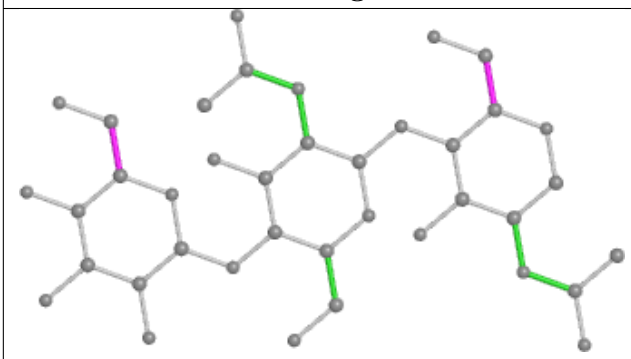
Oligosaccharide Chain D



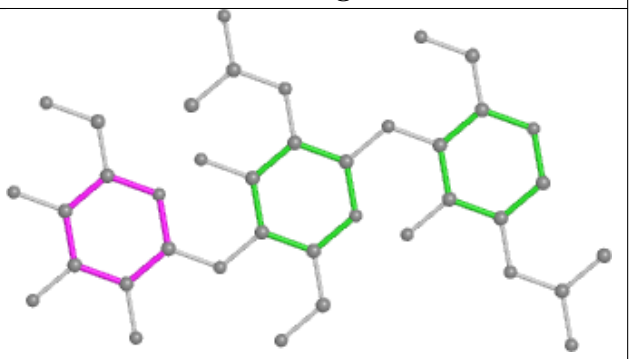
Bond lengths



Bond angles

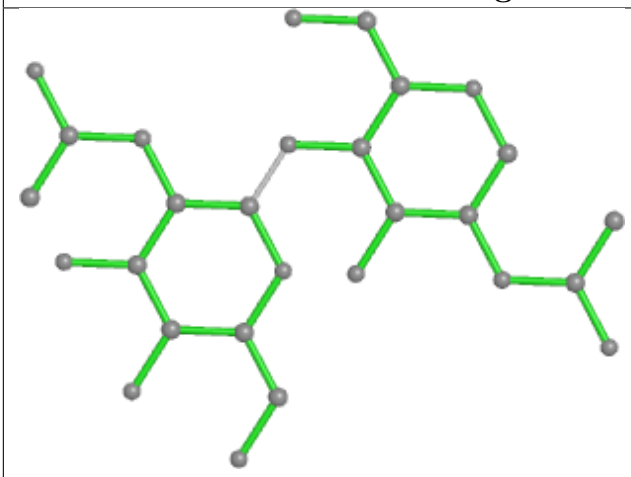


Torsions

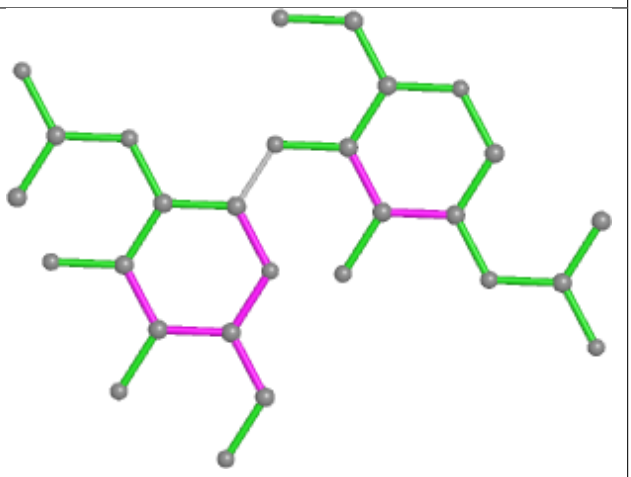


Rings

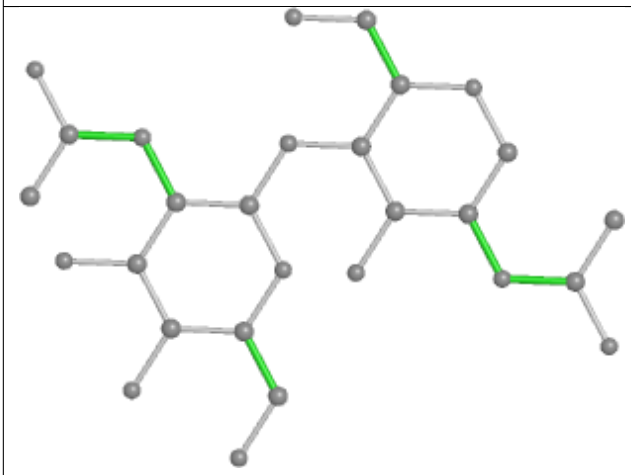
Oligosaccharide Chain C



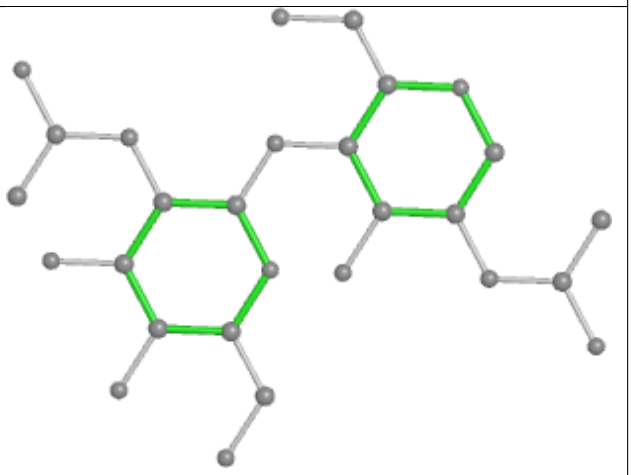
Bond lengths



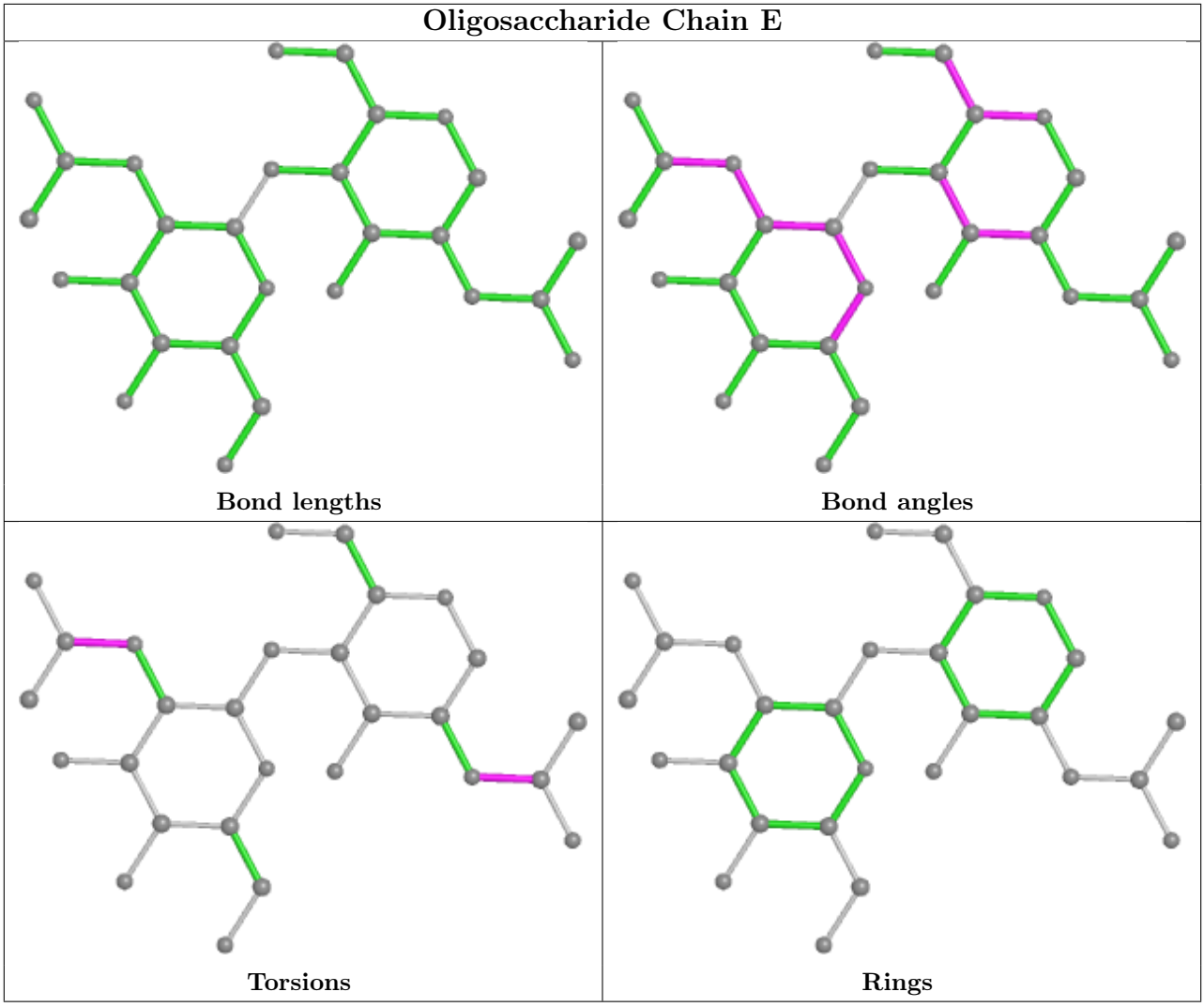
Bond angles



Torsions



Rings



5.6 Ligand geometry (i)

Of 12 ligands modelled in this entry, 9 are monoatomic - leaving 3 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	$\#\|Z\| > 2$
7	SCN	A	616	-	1,2,2	0.97	0	0,1,1	-	-
6	HEM	A	615	1,8	41,50,50	1.96	6 (14%)	45,82,82	1.83	10 (22%)
8	SHA	A	617	6	11,11,11	1.81	1 (9%)	13,14,14	0.70	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
6	HEM	A	615	1,8	-	4/12/54/54	-
8	SHA	A	617	6	-	0/6/6/6	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	615	HEM	C3D-C2D	7.77	1.53	1.36
8	A	617	SHA	C1-C6	5.45	1.49	1.40
6	A	615	HEM	C3C-C2C	-4.28	1.34	1.40
6	A	615	HEM	C3C-CAC	3.92	1.55	1.47
6	A	615	HEM	CAB-C3B	3.14	1.56	1.47
6	A	615	HEM	FE-NB	2.31	2.08	1.96
6	A	615	HEM	CAA-C2A	2.06	1.55	1.52

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	A	615	HEM	C4D-ND-C1D	6.17	111.45	105.07
6	A	615	HEM	C4C-CHD-C1D	3.69	127.43	122.56
6	A	615	HEM	CHD-C1D-ND	3.55	128.29	124.43
6	A	615	HEM	C3B-C2B-C1B	3.31	108.94	106.49
6	A	615	HEM	C1B-NB-C4B	2.83	108.00	105.07
6	A	615	HEM	C4B-CHC-C1C	2.71	126.14	122.56
6	A	615	HEM	CHC-C4B-NB	2.46	127.11	124.43
6	A	615	HEM	CBA-CAA-C2A	-2.40	108.52	112.62
6	A	615	HEM	C2B-C1B-NB	-2.37	107.03	109.84
6	A	615	HEM	CBD-CAD-C3D	-2.25	106.37	112.63

There are no chirality outliers.

All (4) torsion outliers are listed below:

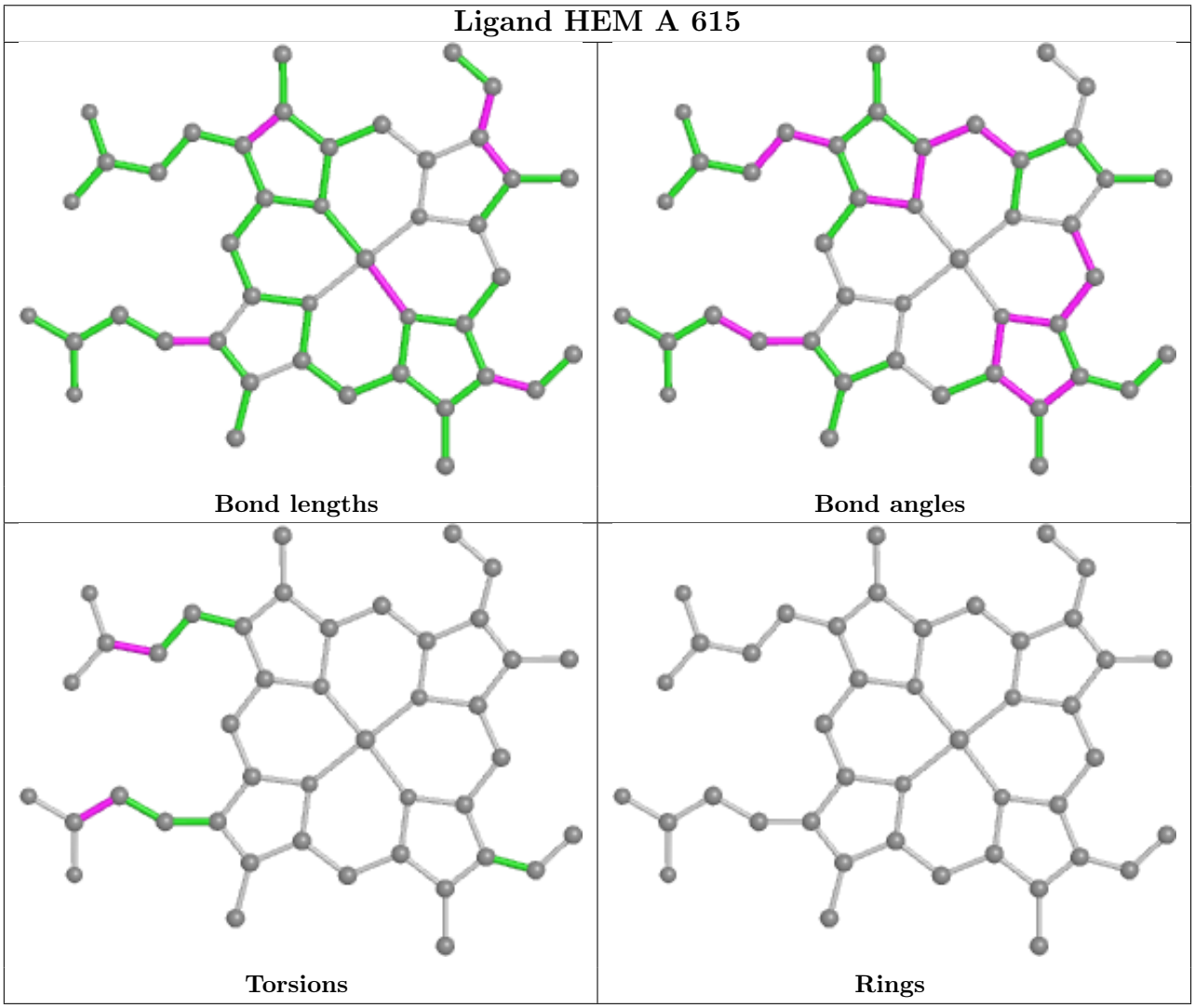
Mol	Chain	Res	Type	Atoms
6	A	615	HEM	CAD-CBD-CGD-O2D
6	A	615	HEM	CAA-CBA-CGA-O2A
6	A	615	HEM	CAD-CBD-CGD-O1D
6	A	615	HEM	CAA-CBA-CGA-O1A

There are no ring outliers.

2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	615	HEM	5	0
8	A	617	SHA	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 then 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

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, 95^{th} 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	594/595 (99%)	0.14	44 (7%)	14	14	21, 35, 68, 86	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	SER	15.2
1	A	2	TRP	9.5
1	A	7	GLY	8.9
1	A	121	SER	8.5
1	A	8	ALA	8.0
1	A	595	ASN	7.2
1	A	119	LEU	7.1
1	A	594	GLU	7.0
1	A	174	SER	7.0
1	A	122	ASN	6.9
1	A	120	GLY	6.7
1	A	593	ARG	6.6
1	A	125	SER	6.5
1	A	173	GLN	5.9
1	A	172	TYR	5.7
1	A	9	PRO	5.6
1	A	170	PRO	4.9
1	A	4	VAL	4.4
1	A	126	LYS	4.4
1	A	574	HIS	4.3
1	A	171	PRO	4.0
1	A	169	THR	3.8
1	A	6	CYS	3.7
1	A	175	LEU	3.7
1	A	124	HIS	3.6
1	A	3	GLU	3.5
1	A	118	GLU	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	13	VAL	3.4
1	A	16	ASP	3.3
1	A	231	ASN	2.9
1	A	128	GLN	2.9
1	A	123	GLU	2.6
1	A	234	PRO	2.5
1	A	18	ASN	2.5
1	A	12	LEU	2.4
1	A	5	GLY	2.4
1	A	322	GLN	2.3
1	A	10	VAL	2.3
1	A	64	ARG	2.2
1	A	117	THR	2.1
1	A	132	TYR	2.1
1	A	329	GLN	2.1
1	A	63	GLN	2.0
1	A	14	LYS	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (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^{th} 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
1	SEP	A	198	10/11	0.91	0.20	35,36,41,42	0

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, 95^{th} 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	MAN	B	3	11/12	0.66	0.73	76,78,78,78	0
2	NAG	D	2	14/15	0.70	0.36	66,69,72,74	0
2	MAN	D	3	11/12	0.72	0.47	76,78,78,78	0
3	NAG	E	1	14/15	0.75	0.29	58,66,69,74	0
2	NAG	B	2	14/15	0.76	0.46	78,82,84,88	0

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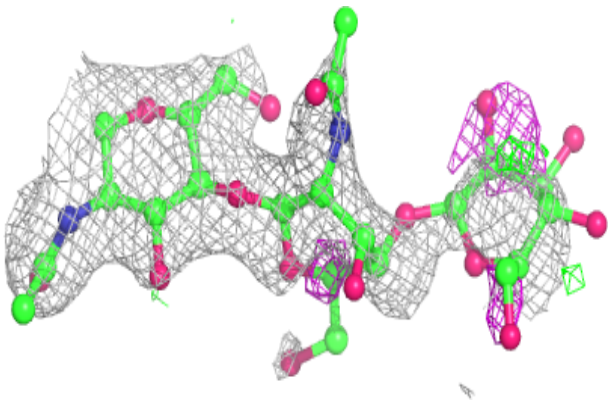
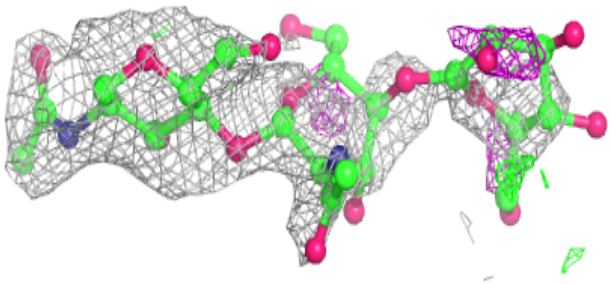
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	NAG	C	2	14/15	0.80	0.41	67,70,72,74	0
3	NAG	E	2	14/15	0.80	0.51	78,81,84,84	0
3	NAG	C	1	14/15	0.91	0.12	54,56,61,63	0
2	NAG	B	1	14/15	0.92	0.22	59,65,68,73	0
2	NAG	D	1	14/15	0.94	0.14	51,54,56,61	0

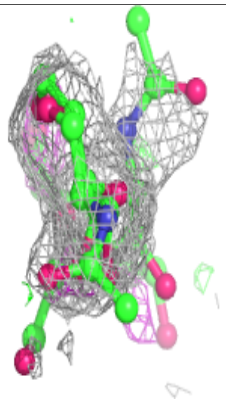
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

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)

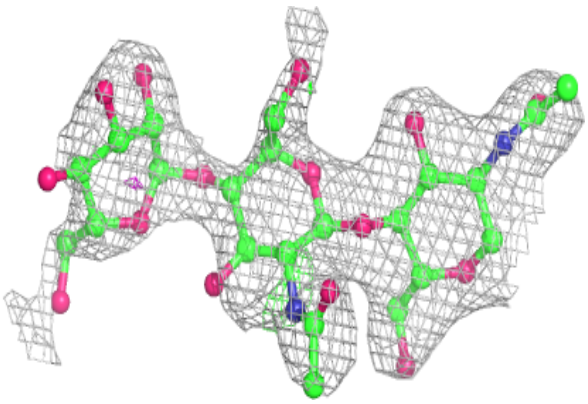


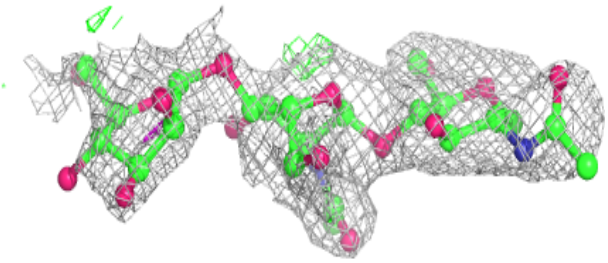


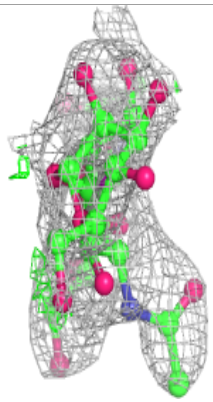


Electron density around Chain D:

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

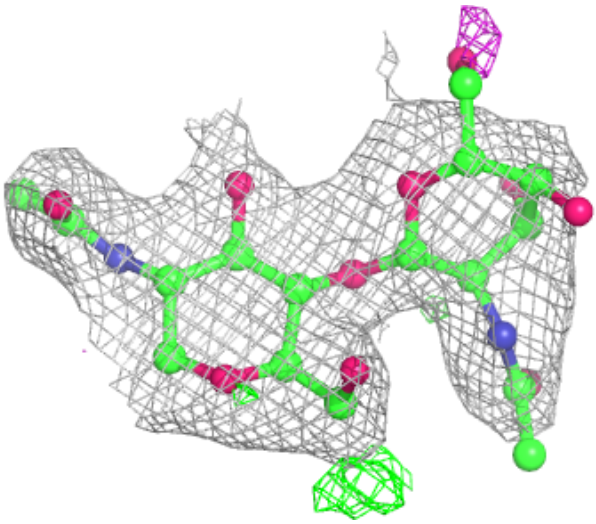


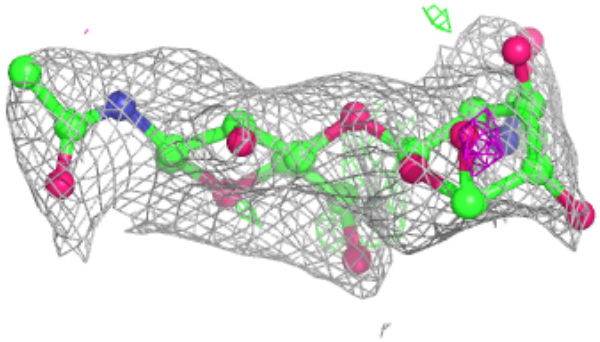


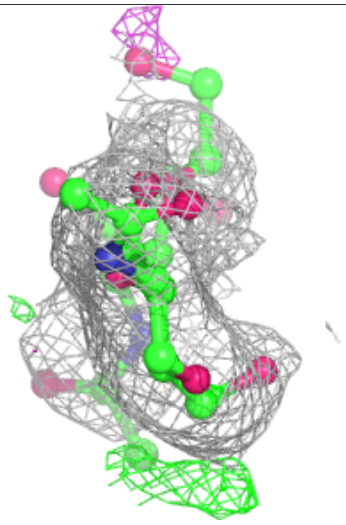


Electron density around Chain C:

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

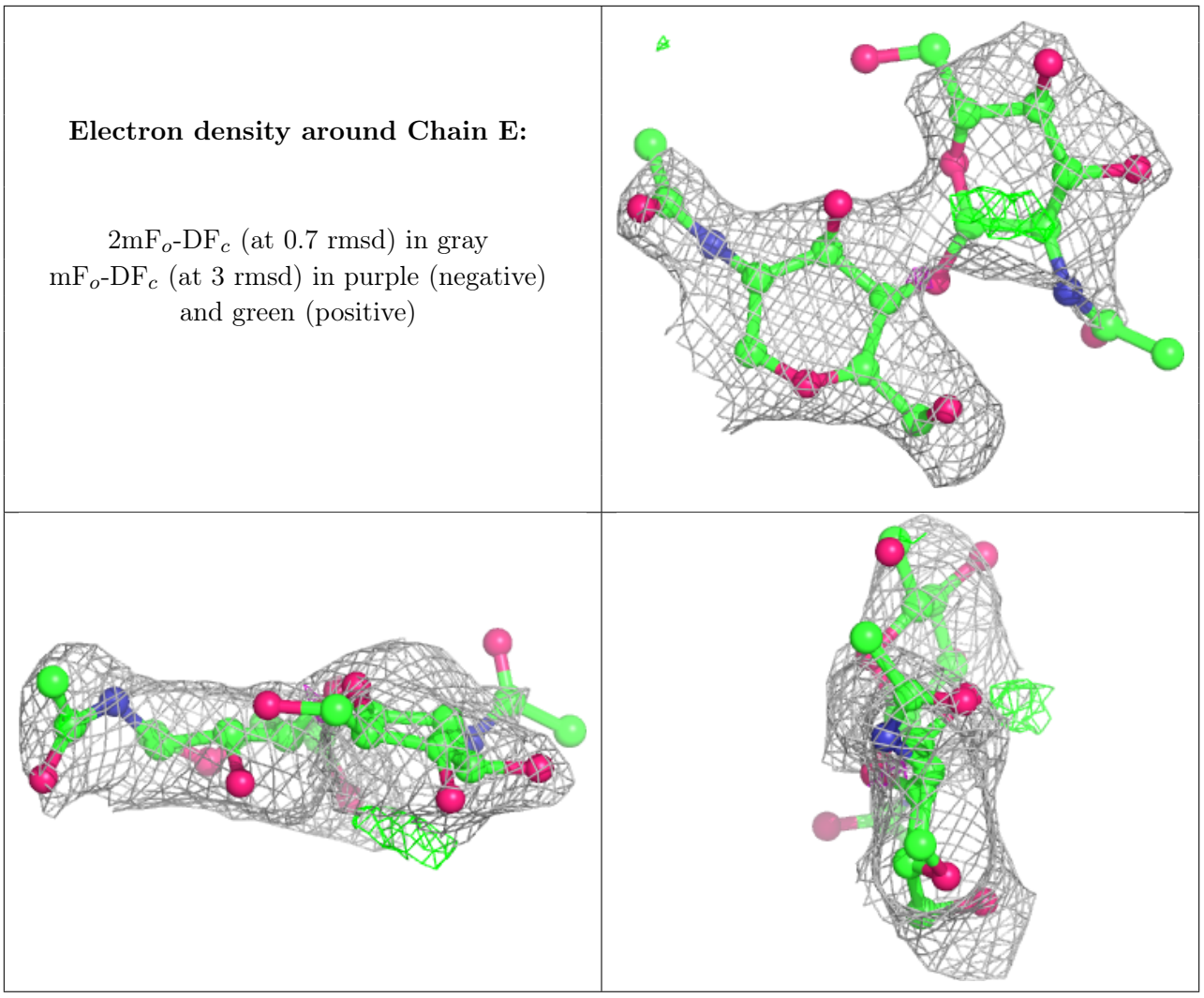






Electron density around Chain E:

$2mF_o$-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, 95^{th} 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
7	SCN	A	616	3/3	0.87	0.16	33,33,33,35	0
5	IOD	A	614	1/1	0.91	0.07	67,67,67,67	1
8	SHA	A	617	11/11	0.91	0.15	26,27,29,30	0
5	IOD	A	610	1/1	0.94	0.09	72,72,72,72	0
5	IOD	A	607	1/1	0.94	0.09	93,93,93,93	0
5	IOD	A	609	1/1	0.95	0.18	85,85,85,85	1
5	IOD	A	612	1/1	0.97	0.06	59,59,59,59	0
6	HEM	A	615	43/43	0.97	0.12	22,26,29,31	0
5	IOD	A	608	1/1	0.98	0.09	86,86,86,86	0

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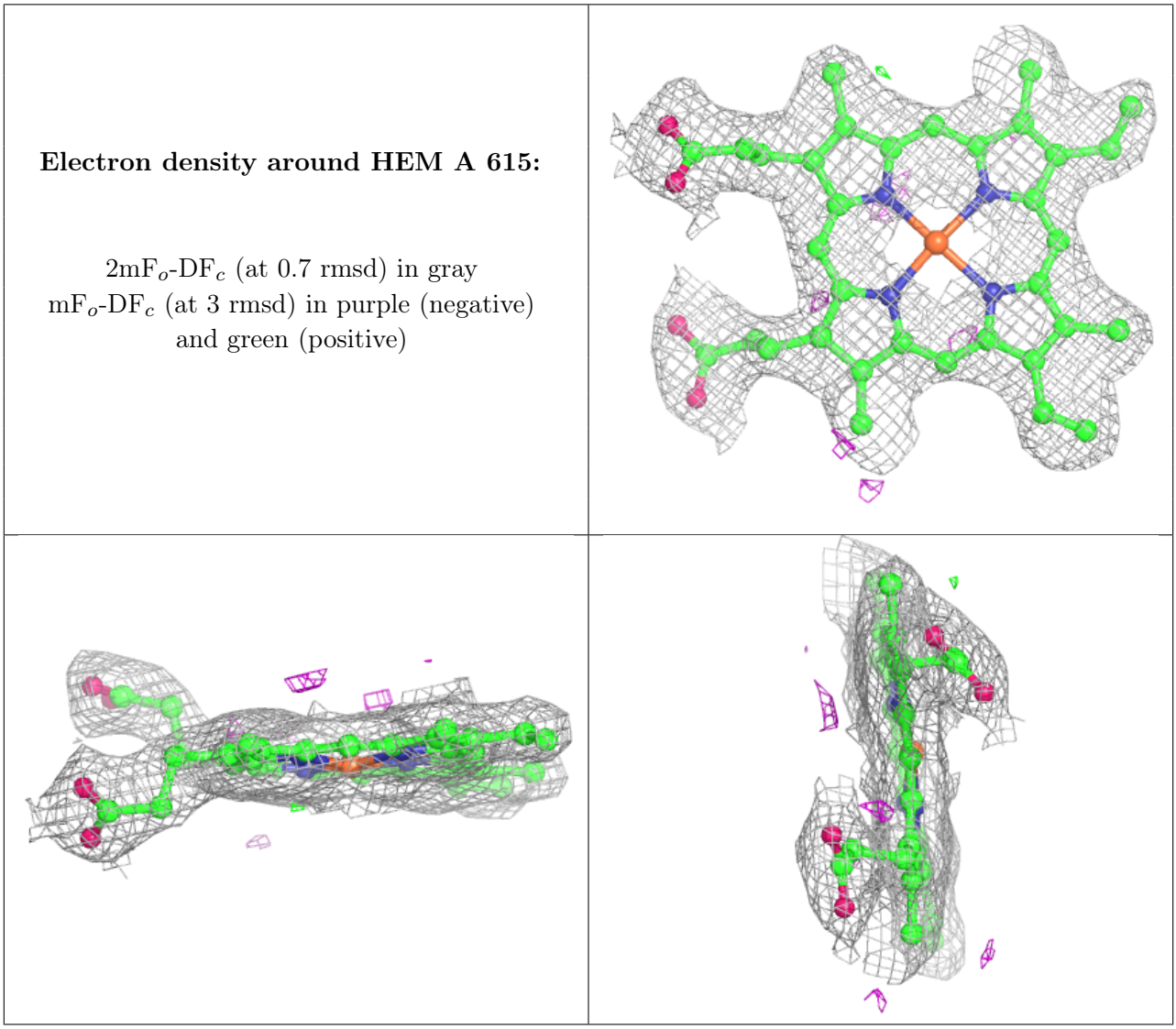
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	CA	A	606	1/1	0.98	0.09	29,29,29,29	0
5	IOD	A	613	1/1	0.99	0.07	72,72,72,72	0
5	IOD	A	611	1/1	1.00	0.08	30,30,30,30	0

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 615:

$2mF_o$-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.