



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 7, 2020 – 03:22 AM BST

PDB ID : 6Q6K  
Title : Crystal structure of recombinant human beta-glucocerebrosidase in complex with cyclophellitol activity based probe with Cy5 tag (ME569)  
Authors : Rowland, R.J.; Davies, G.J.  
Deposited on : 2018-12-11  
Resolution : 1.92 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.13.1  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.13.1

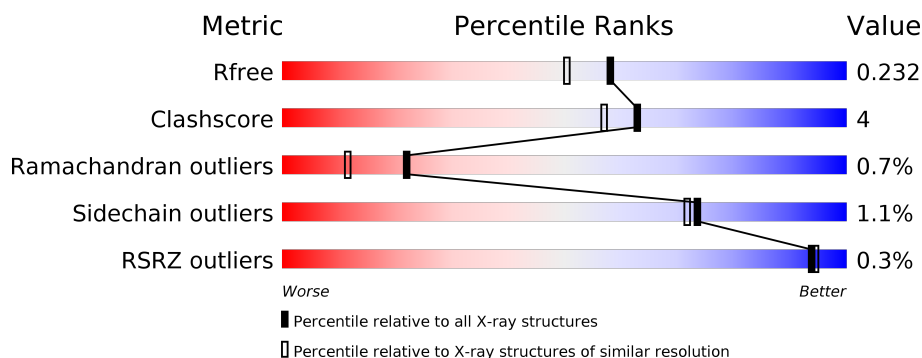
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.92 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	7937 (1.94-1.90)
Clashscore	141614	8644 (1.94-1.90)
Ramachandran outliers	138981	8530 (1.94-1.90)
Sidechain outliers	138945	8530 (1.94-1.90)
RSRZ outliers	127900	7793 (1.94-1.90)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	497	<div> <div style="width: 92%;"></div> <div style="width: 8%;"></div> </div> <div>92% 8%</div>
1	B	497	<div> <div style="width: 90%;"></div> <div style="width: 8%;"></div> <div style="width: 2%;"></div> </div> <div>90% 8% .</div>
2	C	2	<div> <div style="width: 100%;"></div> </div> <div>100%</div>
2	D	2	<div> <div style="width: 100%;"></div> </div> <div>100%</div>

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	ACT	A	503	-	-	X	-
3	ACT	A	510	-	-	X	-
4	SO4	A	524	-	-	X	-

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 8992 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 Glucosylceramidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	496	Total	C	N	O	S	0	9	0
			3996	2569	688	722	17			
1	B	491	Total	C	N	O	S	0	11	0
			3943	2534	676	717	16			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	495	HIS	ARG	conflict	UNP P04062
B	495	HIS	ARG	conflict	UNP P04062

- 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	C	2	Total	C	N	O	0	0	0
			28	16	2	10			
2	D	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 3 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

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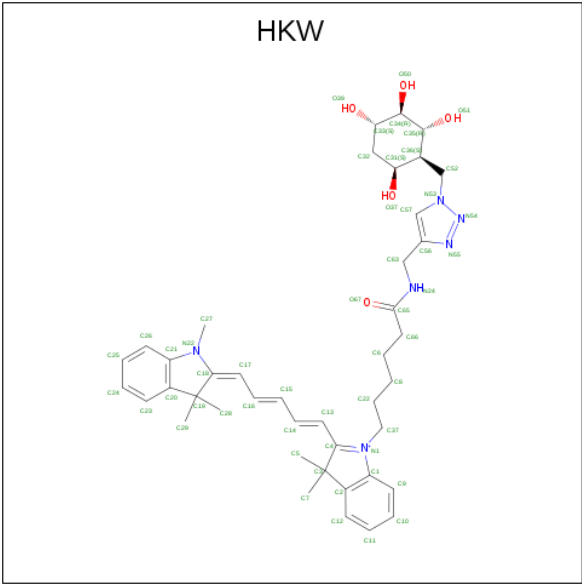
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total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

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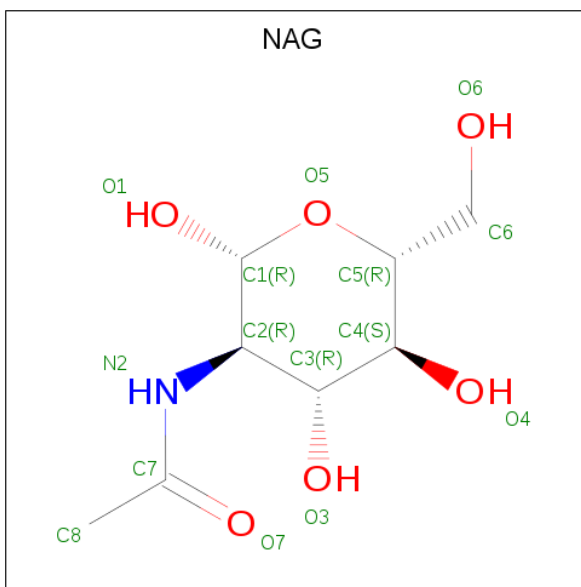
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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is 6-[3,3-dimethyl-2-[(1 {E},3 {E},5 {E})-5-(1,3,3-trimethylindol-2-ylidene)penta-1,3-dienyl]indol-1-ium-1-yl]- {N}-[[1-[[1 (1 {S},2 {R},3 {R},4 {S},6 {S})-2,3,4,6-tetrakis(oxidanyl)cyclohexyl)methyl]-1,2,3-triazol-4-yl)methyl]hexanamide (three-letter code: HKW) (formula: C<sub>42</sub>H<sub>55</sub>N<sub>6</sub>O<sub>5</sub>) (labeled as "Ligand of Interest" by author).







Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	B	1	Total	C	N	O	0	0
			14	8	1	5		

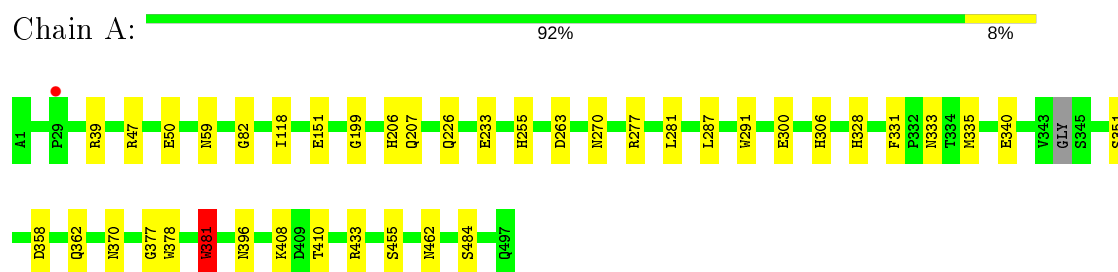
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	375	Total	O	0	0
			375	375		
7	B	324	Total	O	0	0
			324	324		

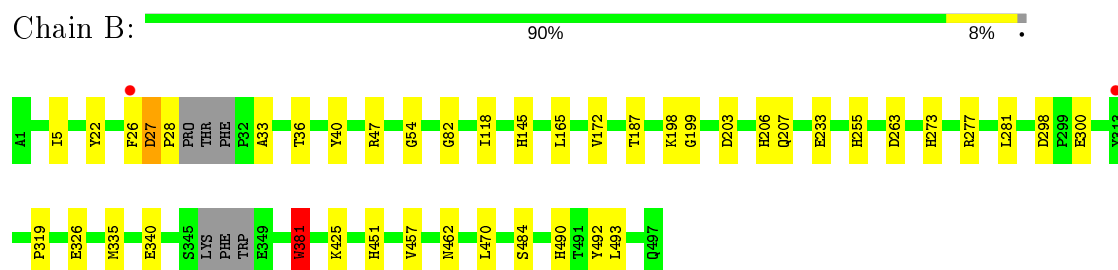
### 3 Residue-property plots

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.

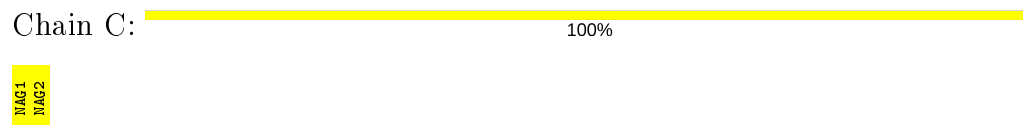
- Molecule 1: Glucosylceramidase



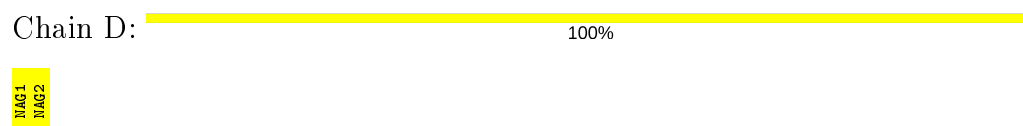
- Molecule 1: Glucosylceramidase



- 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	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	110.61Å 285.93Å 92.26Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	77.64 – 1.92 77.52 – 1.92	Depositor EDS
% Data completeness (in resolution range)	100.0 (77.64-1.92) 100.0 (77.52-1.92)	Depositor EDS
$R_{merge}$	0.19	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.03 (at 1.92Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.185 , 0.221 0.204 , 0.232	Depositor DCC
$R_{free}$ test set	5680 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.9	Xtriage
Anisotropy	0.398	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	8992	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% of the height of the origin peak. No significant pseudotranslation is detected.*

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

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

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, NAG, HKW, ACT

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	0.74	1/4116 (0.0%)	0.83	2/5609 (0.0%)
1	B	0.76	1/4060 (0.0%)	0.82	0/5534
All	All	0.75	2/8176 (0.0%)	0.82	2/11143 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	340	GLU	CD-OE2	16.48	1.43	1.25
1	A	340	GLU	CD-OE2	16.06	1.43	1.25

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	433	ARG	NE-CZ-NH1	-6.40	117.10	120.30
1	A	433	ARG	NE-CZ-NH2	6.10	123.35	120.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3996	0	3890	27	0
1	B	3943	0	3818	42	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	28	0	25	0	0
2	D	28	0	25	0	0
3	A	56	0	42	4	0
3	B	24	0	18	1	0
4	A	80	0	0	6	0
4	B	55	0	0	3	0
5	A	50	0	0	0	0
5	B	19	0	0	0	0
6	B	14	0	13	2	0
7	A	375	0	0	6	0
7	B	324	0	0	3	0
All	All	8992	0	7831	70	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 4.

All (70) 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:226:GLN:NE2	4:A:522:SO4:O4	2.13	0.82
1:A:151[A]:GLU:H	3:A:503:ACT:H3	1.48	0.77
1:B:277:ARG:NH1	4:B:616:SO4:O4	2.19	0.76
1:A:207:GLN:NE2	1:A:263:ASP:OD1	2.19	0.76
1:A:151[B]:GLU:H	3:A:503:ACT:H3	1.53	0.73
1:B:26:PHE:HB3	1:B:28:PRO:HD3	1.74	0.70
1:B:33:ALA:O	1:B:36[A]:THR:HG22	1.91	0.70
1:A:328:HIS:HD2	7:A:863:HOH:O	1.74	0.70
1:B:5:ILE:HD12	1:B:22:TYR:CE1	2.28	0.69
3:A:510:ACT:H2	7:A:703:HOH:O	1.95	0.66
1:B:298:ASP:OD1	1:B:300:GLU:CG	2.46	0.64
1:A:331:PHE:C	4:A:524:SO4:O4	2.35	0.64
1:B:298:ASP:OD1	1:B:300:GLU:HG2	1.98	0.64
1:B:451:HIS:NE2	1:B:457[B]:VAL:CG2	2.61	0.63
1:B:457[B]:VAL:HG22	1:B:493[B]:LEU:HD12	1.81	0.62
1:B:27:ASP:N	1:B:28:PRO:CD	2.62	0.61
1:B:207:GLN:OE1	1:B:263:ASP:OD1	2.18	0.61
1:A:410:THR:HG21	7:A:949:HOH:O	2.01	0.60
1:A:270:ASN:ND2	7:A:602:HOH:O	2.34	0.59
1:B:47:ARG:NH2	4:B:619:SO4:O2	2.35	0.59
1:A:199:GLY:N	4:A:526:SO4:O1	2.33	0.58
1:B:27:ASP:N	1:B:28:PRO:HD3	2.20	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:82:GLY:HA3	1:A:118:ILE:O	2.04	0.56
1:B:165:LEU:HD22	1:B:172:VAL:HB	1.87	0.55
1:A:333:ASN:N	4:A:524:SO4:O4	2.40	0.54
1:A:47:ARG:NH1	3:A:510:ACT:H3	2.23	0.53
1:B:298:ASP:OD1	1:B:300:GLU:HG3	2.09	0.52
1:B:5:ILE:HD12	1:B:22:TYR:CD1	2.45	0.52
1:B:451:HIS:NE2	1:B:457[B]:VAL:HG21	2.24	0.51
1:B:145[A]:HIS:HE2	6:B:608:NAG:HO6	1.58	0.51
1:B:273:HIS:ND1	4:B:617:SO4:O4	2.29	0.50
1:B:145[B]:HIS:NE2	7:B:701:HOH:O	2.24	0.50
1:B:26:PHE:CD1	1:B:425:LYS:HE2	2.48	0.49
1:B:82:GLY:HA3	1:B:118[B]:ILE:O	2.14	0.48
1:B:199:GLY:HA3	1:B:203:ASP:OD2	2.13	0.47
1:A:277[A]:ARG:NH1	4:A:523:SO4:O3	2.47	0.47
1:B:206:HIS:NE2	1:B:255[A]:HIS:NE2	2.62	0.47
1:B:187:THR:HG22	3:B:602:ACT:H2	1.97	0.47
1:B:381:TRP:CE3	1:B:381:TRP:HA	2.49	0.47
1:A:377:GLY:C	1:A:378:TRP:CE3	2.89	0.46
1:A:39[A]:ARG:NH1	1:A:50:GLU:O	2.48	0.46
1:B:462:ASN:HB2	1:B:484:SER:OG	2.15	0.46
1:B:26:PHE:CG	1:B:425:LYS:HE2	2.51	0.46
1:B:493[B]:LEU:HD22	1:B:493[B]:LEU:N	2.31	0.45
1:B:319:PRO:HB2	7:B:914:HOH:O	2.17	0.45
1:A:59:ASN:ND2	7:A:614:HOH:O	2.50	0.45
1:A:287:LEU:HB3	1:A:291:TRP:CD1	2.52	0.45
1:A:277[A]:ARG:HD2	1:A:306:HIS:CG	2.51	0.45
1:B:381:TRP:HE3	1:B:381:TRP:HA	1.81	0.45
1:B:145[A]:HIS:NE2	6:B:608:NAG:O6	2.46	0.45
1:A:39[A]:ARG:C	1:A:39[A]:ARG:HE	2.20	0.44
1:B:26:PHE:HB3	1:B:28:PRO:CD	2.47	0.43
1:B:451:HIS:CD2	1:B:457[B]:VAL:HG23	2.54	0.43
1:A:255[B]:HIS:CD2	7:A:845:HOH:O	2.72	0.42
1:A:408:LYS:O	1:A:410:THR:HG23	2.20	0.42
1:B:326:GLU:OE1	1:B:326:GLU:HA	2.19	0.42
1:B:5:ILE:CD1	1:B:22:TYR:CE1	3.02	0.42
1:A:381:TRP:HA	1:A:381:TRP:CE3	2.55	0.41
1:B:203:ASP:C	1:B:203:ASP:OD1	2.58	0.41
1:B:457[B]:VAL:HG13	1:B:493[B]:LEU:CD1	2.49	0.41
1:B:298:ASP:OD1	1:B:298:ASP:C	2.59	0.41
1:B:40:TYR:O	1:B:490:HIS:HA	2.20	0.41
1:A:358[A]:ASP:OD2	1:A:362:GLN:NE2	2.53	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:378:TRP:CE3	1:A:378:TRP:N	2.89	0.41
1:A:462:ASN:HB2	1:A:484:SER:OG	2.21	0.40
1:B:492:TYR:O	1:B:493[B]:LEU:HD13	2.22	0.40
1:A:206:HIS:HE2	1:A:255[A]:HIS:CE1	2.39	0.40
1:A:455:SER:HA	4:A:525:SO4:O4	2.22	0.40
1:B:198:LYS:NZ	7:B:710:HOH:O	2.45	0.40
1:B:36[B]:THR:HG23	1:B:54:GLY:O	2.21	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	501/497 (101%)	478 (95%)	20 (4%)	3 (1%)	25	14
1	B	496/497 (100%)	473 (95%)	19 (4%)	4 (1%)	19	9
All	All	997/994 (100%)	951 (95%)	39 (4%)	7 (1%)	22	11

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	233	GLU
1	A	281	LEU
1	A	381	TRP
1	B	233	GLU
1	B	381	TRP
1	B	281	LEU
1	B	27	ASP

### 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	430/424 (101%)	424 (99%)	6 (1%)	67	63
1	B	422/424 (100%)	419 (99%)	3 (1%)	84	83
All	All	852/848 (100%)	843 (99%)	9 (1%)	73	72

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	300	GLU
1	A	335	MET
1	A	351	SER
1	A	370	ASN
1	A	381	TRP
1	A	396	ASN
1	B	335	MET
1	B	381	TRP
1	B	470	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	59	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	C	1	1,2	14,14,15	0.96	1 (7%)	17,19,21	1.12	2 (11%)
2	NAG	C	2	2	14,14,15	0.49	0	17,19,21	1.19	2 (11%)
2	NAG	D	1	1,2	14,14,15	0.56	0	17,19,21	1.35	3 (17%)
2	NAG	D	2	2	14,14,15	0.41	0	17,19,21	1.46	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	C	1	1,2	-	2/6/23/26	0/1/1/1
2	NAG	C	2	2	-	1/6/23/26	0/1/1/1
2	NAG	D	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	D	2	2	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	1	NAG	C1-C2	2.19	1.55	1.52

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	2	NAG	O5-C1-C2	-3.91	105.12	111.29
2	C	1	NAG	C3-C4-C5	-2.74	105.34	110.24
2	D	1	NAG	O5-C1-C2	-2.66	107.09	111.29
2	C	2	NAG	C1-O5-C5	2.51	115.60	112.19
2	D	1	NAG	O5-C5-C6	2.29	110.79	107.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	NAG	C2-N2-C7	2.22	126.06	122.90
2	D	2	NAG	C4-C3-C2	2.21	114.25	111.02
2	D	2	NAG	C2-N2-C7	-2.15	119.84	122.90
2	C	2	NAG	O4-C4-C5	2.15	114.63	109.30
2	C	1	NAG	O5-C5-C6	2.03	110.39	107.20
2	D	2	NAG	C1-O5-C5	-2.02	109.45	112.19

There are no chirality outliers.

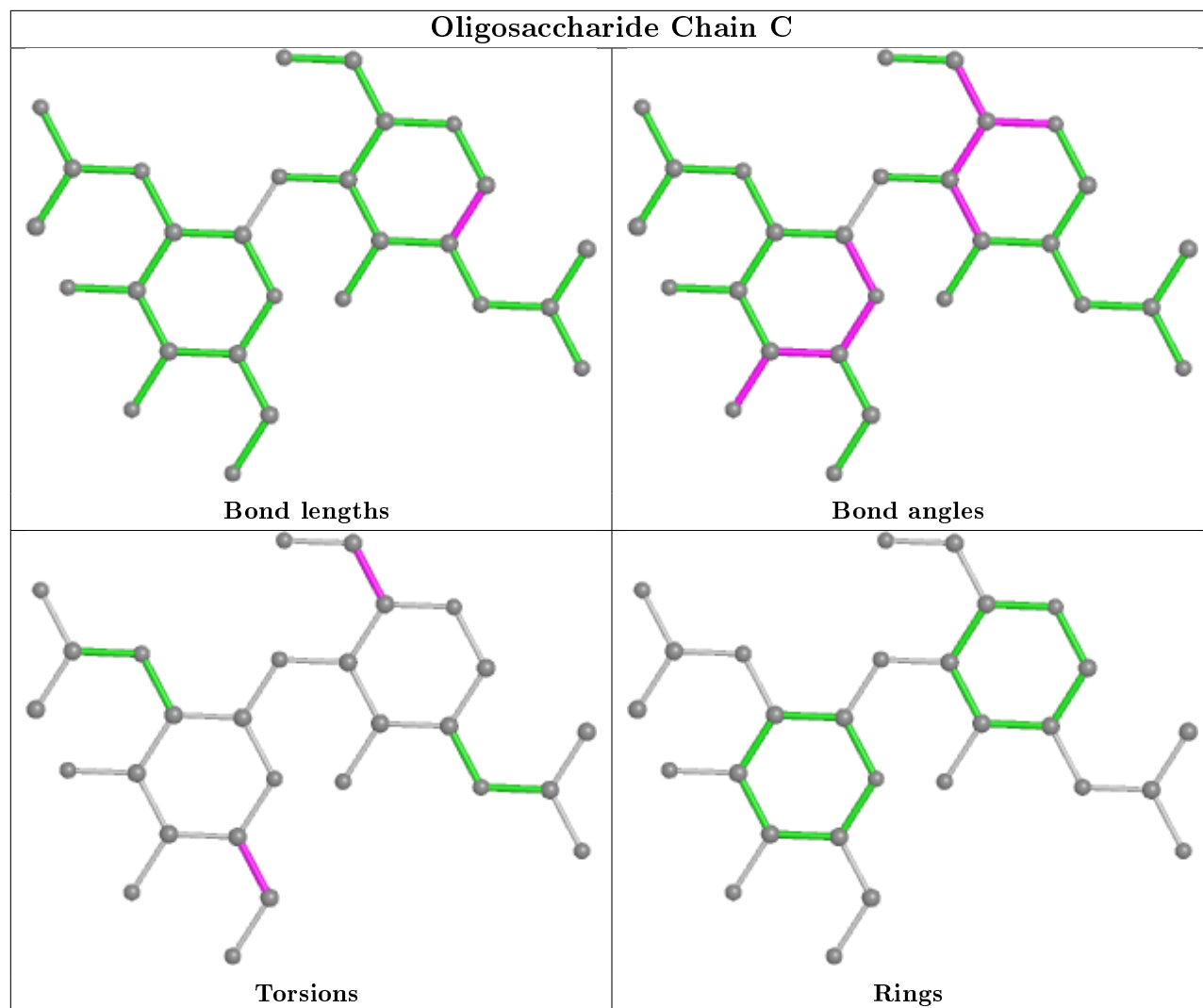
All (5) torsion outliers are listed below:

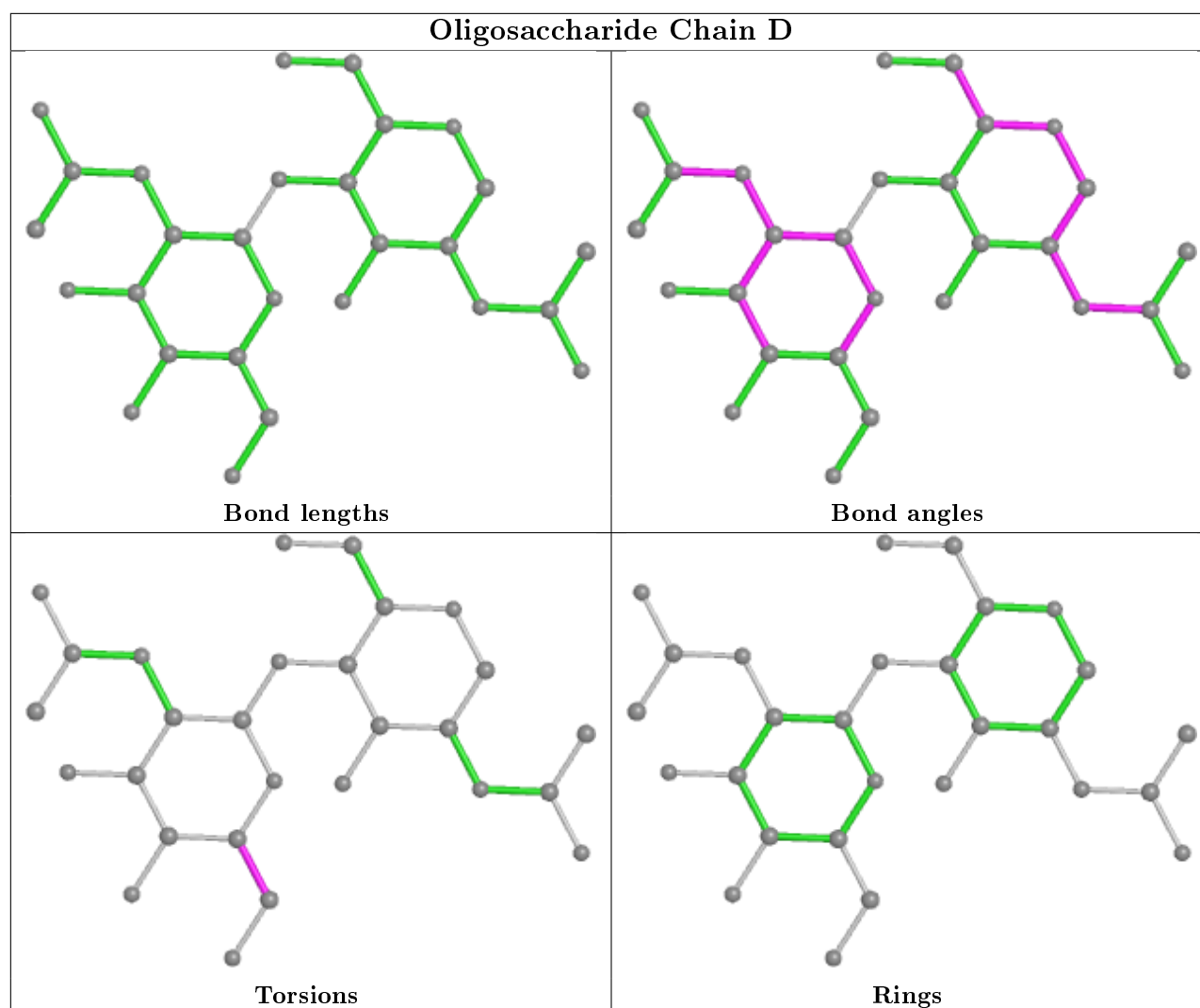
Mol	Chain	Res	Type	Atoms
2	D	2	NAG	O5-C5-C6-O6
2	D	2	NAG	C4-C5-C6-O6
2	C	1	NAG	O5-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6
2	C	2	NAG	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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





## 5.6 Ligand geometry [i](#)

50 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
4	SO4	A	524	-	4,4,4	0.57	0	6,6,6	0.16	0
4	SO4	A	513	-	4,4,4	0.43	0	6,6,6	0.24	0
3	ACT	A	531	-	1,3,3	4.53	1 (100%)	0,3,3	0.00	-

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	SO4	A	514	-	4,4,4	0.34	0	6,6,6	0.11	0
4	SO4	B	618	-	4,4,4	0.34	0	6,6,6	0.07	0
4	SO4	A	521	-	4,4,4	0.37	0	6,6,6	0.06	0
3	ACT	A	532	-	1,3,3	5.21	1 (100%)	0,3,3	0.00	-
3	ACT	A	504	-	1,3,3	4.56	1 (100%)	0,3,3	0.00	-
5	HKW	A	528	1	53,54,58	2.16	9 (16%)	71,80,85	1.94	15 (21%)
3	ACT	A	510	-	1,3,3	4.40	1 (100%)	0,3,3	0.00	-
4	SO4	B	617	-	4,4,4	0.37	0	6,6,6	0.10	0
4	SO4	B	613	-	4,4,4	0.33	0	6,6,6	0.08	0
3	ACT	A	533	-	1,3,3	4.35	1 (100%)	0,3,3	0.00	-
3	ACT	A	530	-	1,3,3	5.30	1 (100%)	0,3,3	0.00	-
3	ACT	A	506	-	1,3,3	4.74	1 (100%)	0,3,3	0.00	-
4	SO4	A	525	-	4,4,4	0.48	0	6,6,6	0.28	0
4	SO4	A	519	-	4,4,4	0.41	0	6,6,6	0.23	0
4	SO4	B	619	-	4,4,4	0.39	0	6,6,6	0.12	0
4	SO4	B	612	-	4,4,4	0.39	0	6,6,6	0.16	0
3	ACT	B	604	-	1,3,3	3.90	1 (100%)	0,3,3	0.00	-
4	SO4	A	517	-	4,4,4	0.35	0	6,6,6	0.15	0
3	ACT	A	529	-	1,3,3	4.98	1 (100%)	0,3,3	0.00	-
4	SO4	A	520	-	4,4,4	0.32	0	6,6,6	0.08	0
3	ACT	B	621	-	1,3,3	5.04	1 (100%)	0,3,3	0.00	-
4	SO4	B	614	-	4,4,4	0.36	0	6,6,6	0.09	0
3	ACT	A	503	-	1,3,3	0.29	0	0,3,3	0.00	-
3	ACT	A	508	-	1,3,3	5.35	1 (100%)	0,3,3	0.00	-
3	ACT	B	601	-	1,3,3	3.87	1 (100%)	0,3,3	0.00	-
3	ACT	A	505	-	1,3,3	6.36	1 (100%)	0,3,3	0.00	-
3	ACT	B	605	-	1,3,3	4.37	1 (100%)	0,3,3	0.00	-
4	SO4	A	523	-	4,4,4	0.36	0	6,6,6	0.11	0
3	ACT	B	603	-	1,3,3	4.65	1 (100%)	0,3,3	0.00	-
4	SO4	B	609	-	4,4,4	0.38	0	6,6,6	0.19	0
4	SO4	A	518	-	4,4,4	0.36	0	6,6,6	0.09	0
4	SO4	A	522	-	4,4,4	0.39	0	6,6,6	0.08	0
4	SO4	B	611	-	4,4,4	0.35	0	6,6,6	0.27	0
4	SO4	A	526	-	4,4,4	0.42	0	6,6,6	0.16	0
4	SO4	B	616	-	4,4,4	0.35	0	6,6,6	0.21	0
3	ACT	A	509	-	1,3,3	5.19	1 (100%)	0,3,3	0.00	-
3	ACT	A	511	-	1,3,3	5.23	1 (100%)	0,3,3	0.00	-
4	SO4	B	610	-	4,4,4	0.39	0	6,6,6	0.18	0
6	NAG	B	608	1	14,14,15	0.71	0	17,19,21	1.65	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	ACT	B	602	-	1,3,3	5.14	1 (100%)	0,3,3	0.00	-
3	ACT	A	507	-	1,3,3	4.43	1 (100%)	0,3,3	0.00	-
4	SO4	A	527	-	4,4,4	0.31	0	6,6,6	0.12	0
4	SO4	B	615	-	4,4,4	0.32	0	6,6,6	0.11	0
4	SO4	A	516	-	4,4,4	0.31	0	6,6,6	0.12	0
5	HKW	B	620	1	19,20,58	1.84	5 (26%)	17,28,85	1.17	2 (11%)
4	SO4	A	512	-	4,4,4	0.39	0	6,6,6	0.21	0
4	SO4	A	515	-	4,4,4	0.44	0	6,6,6	0.12	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	NAG	B	608	1	-	2/6/23/26	0/1/1/1
5	HKW	A	528	1	-	0/15/77/85	0/6/6/6
5	HKW	B	620	1	-	2/4/27/85	0/2/2/6

All (33) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	528	HKW	C21-C20	8.35	1.49	1.39
5	A	528	HKW	C1-C2	6.77	1.50	1.38
3	A	505	ACT	CH3-C	6.36	1.56	1.48
5	A	528	HKW	C17-C18	6.18	1.50	1.38
3	A	508	ACT	CH3-C	5.35	1.55	1.48
3	A	530	ACT	CH3-C	5.30	1.55	1.48
3	A	511	ACT	CH3-C	5.23	1.55	1.48
3	A	532	ACT	CH3-C	5.21	1.55	1.48
3	A	509	ACT	CH3-C	5.19	1.55	1.48
3	B	602	ACT	CH3-C	5.14	1.55	1.48
3	B	621	ACT	CH3-C	5.04	1.55	1.48
3	A	529	ACT	CH3-C	4.98	1.55	1.48
3	A	506	ACT	CH3-C	4.74	1.54	1.48
3	B	603	ACT	CH3-C	4.65	1.54	1.48
3	A	504	ACT	CH3-C	4.56	1.54	1.48
3	A	531	ACT	CH3-C	4.53	1.54	1.48
3	A	507	ACT	CH3-C	4.43	1.54	1.48
3	A	510	ACT	CH3-C	4.40	1.54	1.48
3	B	605	ACT	CH3-C	4.37	1.54	1.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	533	ACT	CH3-C	4.35	1.54	1.48
5	B	620	HKW	C57-C56	3.91	1.42	1.36
3	B	604	ACT	CH3-C	3.90	1.53	1.48
3	B	601	ACT	CH3-C	3.87	1.53	1.48
5	A	528	HKW	C13-C4	3.64	1.52	1.41
5	B	620	HKW	N55-N54	3.56	1.40	1.34
5	A	528	HKW	N55-N54	3.39	1.40	1.34
5	B	620	HKW	C65-N24	-3.29	1.34	1.47
5	A	528	HKW	N54-N53	2.95	1.40	1.34
5	B	620	HKW	N54-N53	2.93	1.40	1.34
5	A	528	HKW	C57-C56	2.87	1.40	1.36
5	A	528	HKW	C36-C35	2.15	1.55	1.53
5	B	620	HKW	C56-N55	2.07	1.36	1.34
5	A	528	HKW	C37-N1	2.07	1.50	1.47

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	528	HKW	C19-C18-N22	6.85	115.09	108.30
5	A	528	HKW	C20-C19-C18	-6.28	97.02	101.41
5	A	528	HKW	C19-C18-C17	-5.55	123.30	129.01
6	B	608	NAG	O5-C5-C6	4.36	114.03	107.20
5	A	528	HKW	C9-C1-C2	-4.07	118.23	123.20
5	A	528	HKW	C20-C21-N22	-3.98	106.97	109.85
5	A	528	HKW	C3-C4-N1	3.40	113.92	109.42
5	A	528	HKW	C14-C15-C16	-2.78	118.63	124.81
5	A	528	HKW	C3-C4-C13	-2.63	124.18	128.94
5	B	620	HKW	C57-C56-N55	-2.58	107.50	111.34
5	A	528	HKW	C9-C1-N1	2.52	134.38	129.25
5	B	620	HKW	C52-N53-C57	2.47	135.63	129.82
5	A	528	HKW	C26-C21-C20	-2.35	119.42	121.76
6	B	608	NAG	C1-O5-C5	2.25	115.24	112.19
5	A	528	HKW	C5-C3-C2	-2.14	107.29	110.53
5	A	528	HKW	C27-N22-C18	2.11	127.94	125.12
5	A	528	HKW	O37-C31-C32	-2.10	104.74	109.94
5	A	528	HKW	C52-N53-C57	2.07	134.67	129.82
5	A	528	HKW	N55-N54-N53	-2.05	105.77	107.31

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	608	NAG	O5-C5-C6-O6
6	B	608	NAG	C4-C5-C6-O6
5	B	620	HKW	C31-C36-C52-N53
5	B	620	HKW	C36-C52-N53-C57

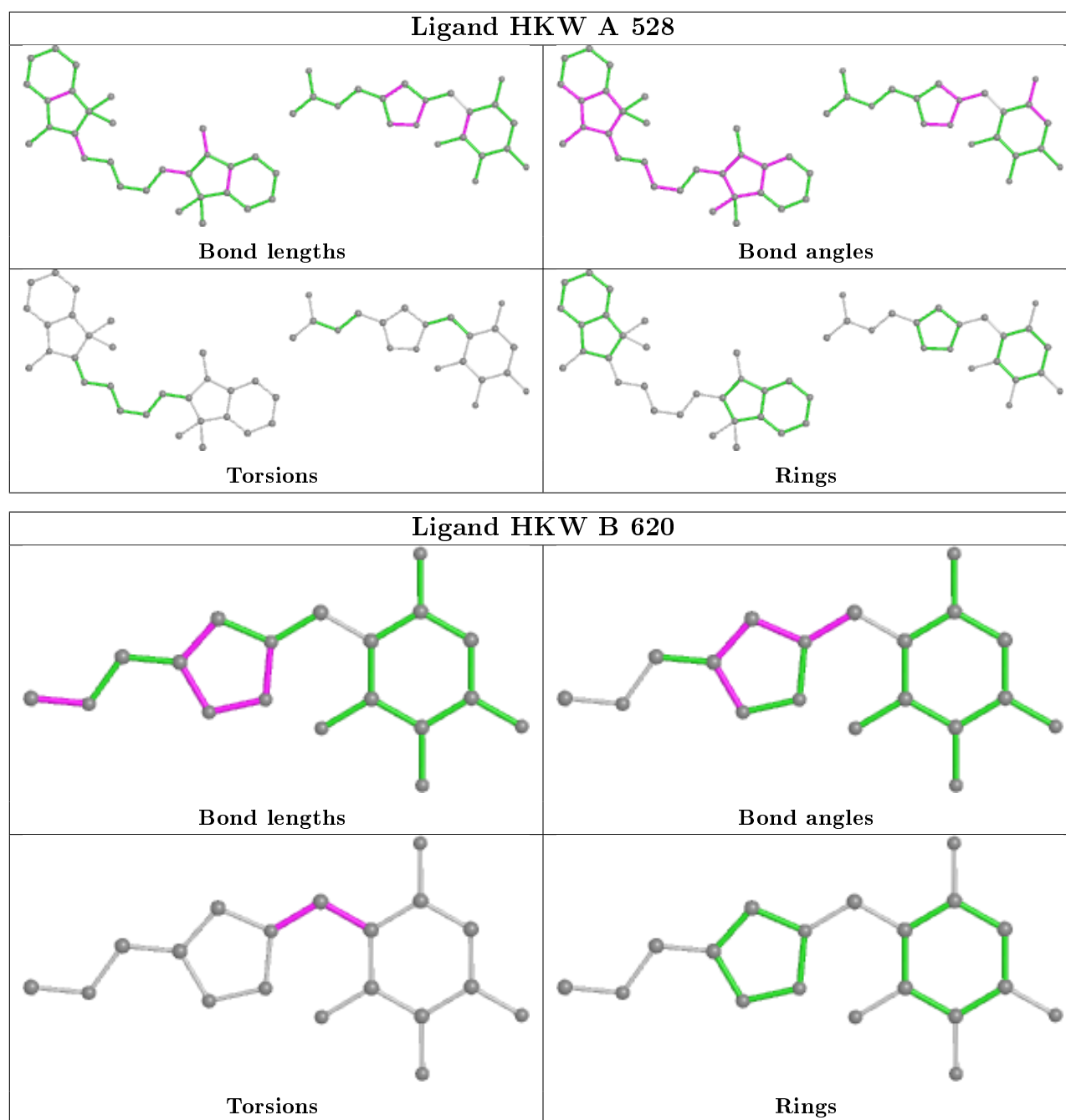
There are no ring outliers.

12 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	524	SO4	2	0
3	A	510	ACT	2	0
4	B	617	SO4	1	0
4	A	525	SO4	1	0
4	B	619	SO4	1	0
3	A	503	ACT	2	0
4	A	523	SO4	1	0
4	A	522	SO4	1	0
4	A	526	SO4	1	0
4	B	616	SO4	1	0
6	B	608	NAG	2	0
3	B	602	ACT	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, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	496/497 (99%)	-0.21	1 (0%) 95 95	25, 35, 59, 99	7 (1%)
1	B	491/497 (98%)	-0.18	2 (0%) 92 93	27, 37, 64, 95	5 (1%)
All	All	987/994 (99%)	-0.19	3 (0%) 94 94	25, 36, 62, 99	12 (1%)

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	313[A]	TYR	2.7
1	B	26	PHE	2.6
1	A	29	PRO	2.1

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

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

### 6.3 Carbohydrates [i](#)

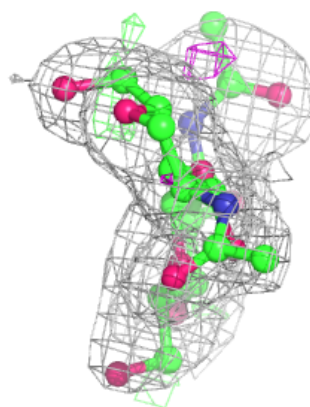
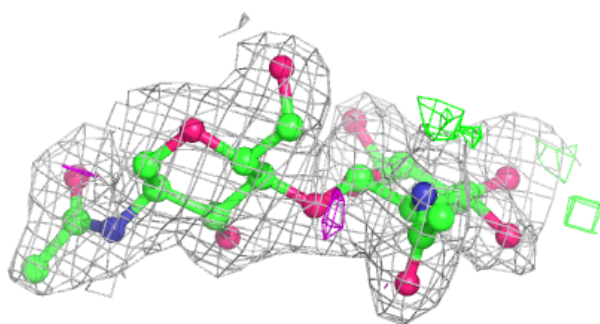
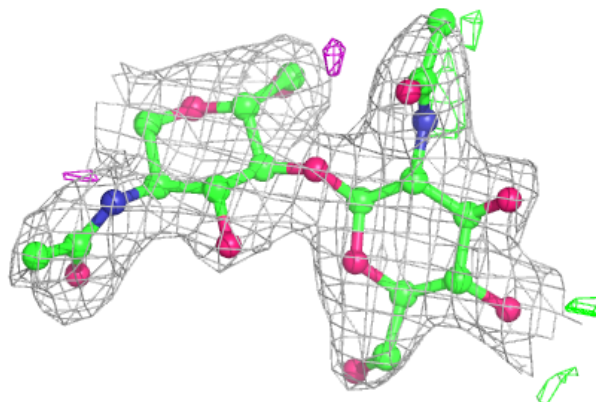
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q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

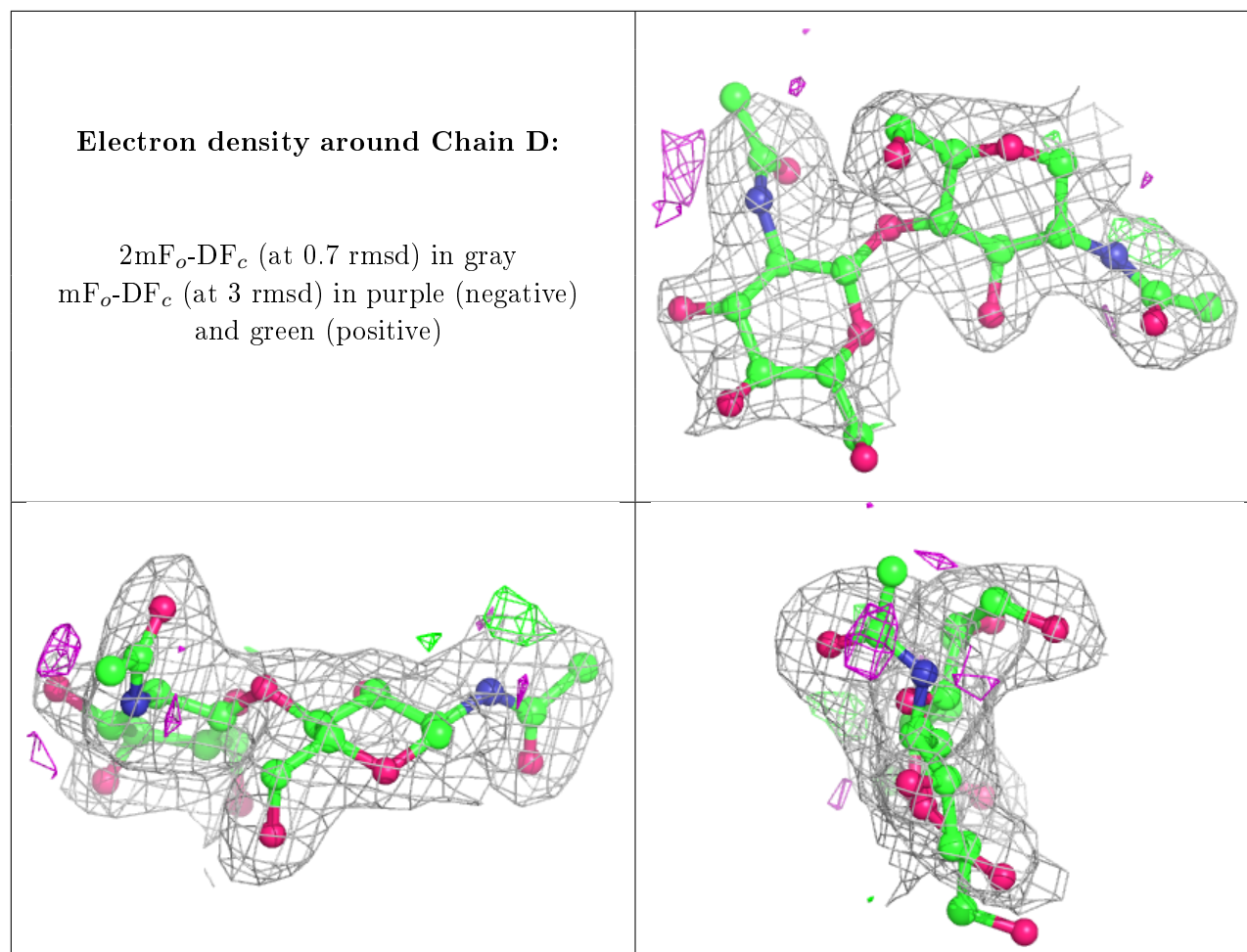
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	NAG	C	2	14/15	0.86	0.13	61,71,79,79	0
2	NAG	D	2	14/15	0.89	0.15	59,81,100,107	0
2	NAG	C	1	14/15	0.91	0.12	45,50,64,65	0
2	NAG	D	1	14/15	0.93	0.10	42,49,55,68	0

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 C:**

$2mF_o - DF_c$  (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<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	ACT	B	621	4/4	0.56	0.17	67,73,76,77	0
3	ACT	A	533	4/4	0.78	0.20	75,77,82,83	0
3	ACT	A	509	4/4	0.78	0.20	58,62,65,74	0
4	SO4	A	527	5/5	0.79	0.19	105,108,121,129	0
3	ACT	A	530	4/4	0.82	0.19	44,55,59,73	0
3	ACT	A	511	4/4	0.83	0.15	67,68,70,71	0
3	ACT	A	508	4/4	0.83	0.15	62,69,72,75	0
4	SO4	B	616	5/5	0.84	0.20	44,45,49,50	5
6	NAG	B	608	14/15	0.84	0.15	60,70,82,86	0
3	ACT	A	505	4/4	0.84	0.20	55,57,57,58	0
3	ACT	B	601	4/4	0.86	0.16	62,64,65,66	0

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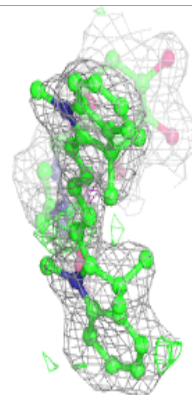
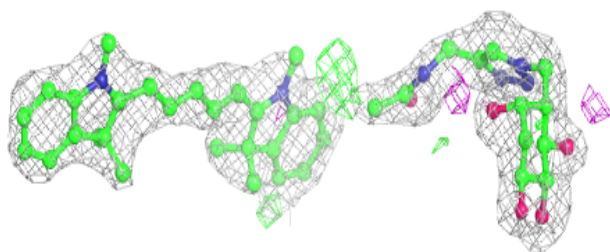
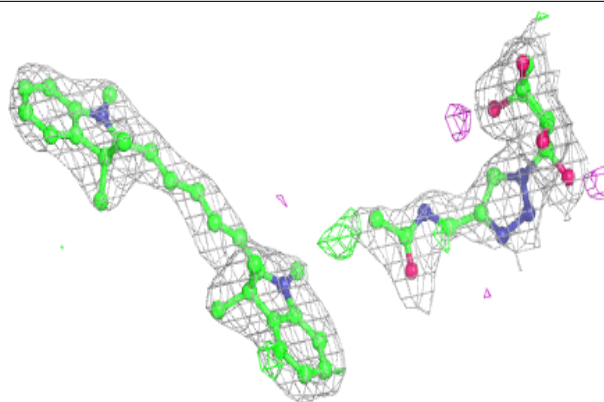
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	ACT	A	529	4/4	0.87	0.17	62,73,74,79	0
3	ACT	A	510	4/4	0.87	0.10	63,69,69,75	0
4	SO4	B	618	5/5	0.87	0.12	101,110,113,117	0
3	ACT	A	532	4/4	0.88	0.14	66,72,73,73	0
4	SO4	A	526	5/5	0.88	0.18	44,48,52,55	5
3	ACT	A	504	4/4	0.88	0.08	66,70,71,71	0
3	ACT	A	506	4/4	0.89	0.15	61,67,68,81	0
4	SO4	B	619	5/5	0.89	0.20	46,52,55,56	5
3	ACT	A	507	4/4	0.90	0.23	52,58,60,62	0
4	SO4	A	523	5/5	0.90	0.12	43,43,46,48	5
3	ACT	B	605	4/4	0.90	0.11	74,75,79,80	0
3	ACT	B	604	4/4	0.91	0.12	74,76,78,80	0
4	SO4	A	522	5/5	0.91	0.17	48,50,56,56	5
4	SO4	A	519	5/5	0.91	0.26	40,43,46,47	5
3	ACT	B	602	4/4	0.91	0.11	48,52,52,59	0
4	SO4	A	521	5/5	0.91	0.16	100,101,108,109	0
3	ACT	B	603	4/4	0.92	0.11	60,62,64,67	0
3	ACT	A	503	4/4	0.92	0.16	48,50,51,62	0
4	SO4	A	517	5/5	0.93	0.12	66,67,71,88	0
5	HKW	A	528	50/53	0.93	0.11	33,65,76,79	0
4	SO4	B	612	5/5	0.94	0.15	64,68,73,81	0
3	ACT	A	531	4/4	0.94	0.26	60,65,72,73	0
4	SO4	B	617	5/5	0.94	0.27	82,89,95,106	0
4	SO4	B	615	5/5	0.94	0.08	71,78,89,95	0
4	SO4	B	613	5/5	0.95	0.06	70,76,86,87	0
4	SO4	A	516	5/5	0.95	0.12	68,75,76,89	0
4	SO4	B	614	5/5	0.96	0.33	78,88,98,101	0
4	SO4	A	514	5/5	0.96	0.11	63,68,69,84	0
4	SO4	A	525	5/5	0.96	0.21	32,36,40,44	5
4	SO4	A	520	5/5	0.96	0.21	82,82,87,101	0
5	HKW	B	620	19/53	0.96	0.09	30,37,82,83	0
4	SO4	A	518	5/5	0.97	0.08	63,70,72,77	0
4	SO4	A	524	5/5	0.97	0.23	27,30,38,39	5
4	SO4	B	610	5/5	0.97	0.09	51,54,69,73	0
4	SO4	A	513	5/5	0.97	0.08	53,58,61,62	0
4	SO4	B	611	5/5	0.98	0.07	55,56,59,63	0
4	SO4	A	515	5/5	0.98	0.11	52,53,66,69	0
4	SO4	A	512	5/5	0.99	0.09	39,41,42,43	0
4	SO4	B	609	5/5	0.99	0.08	41,42,45,48	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.

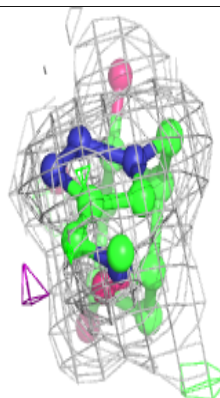
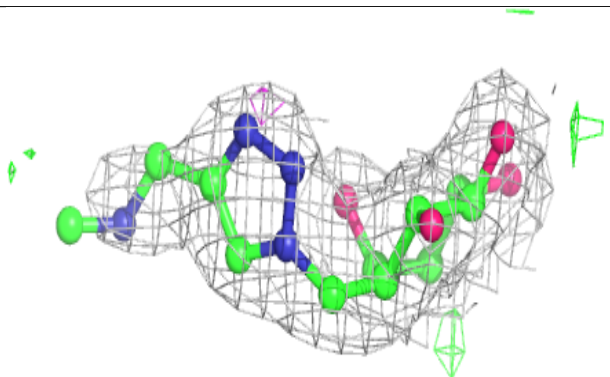
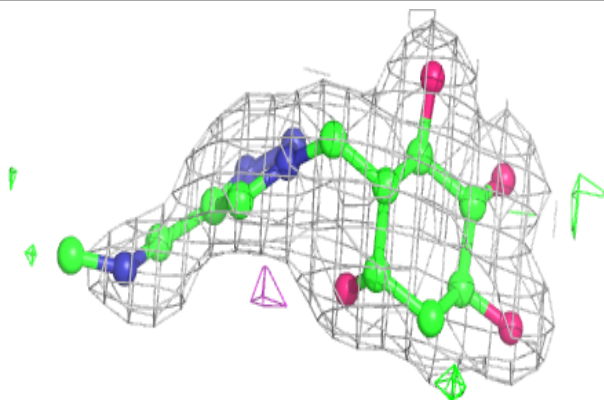
**Electron density around HKW A 528:**

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



**Electron density around HKW B 620:**

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



## 6.5 Other polymers

There are no such residues in this entry.