



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 9, 2020 – 03:10 AM BST

PDB ID : 6IBM  
Title : Crystal structure of human alpha-galactosidase A in complex with alpha-galactose configured cyclosulfate ME776  
Authors : Rowland, R.J.; Wu, L.; Davies, G.J.  
Deposited on : 2018-11-30  
Resolution : 2.07 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

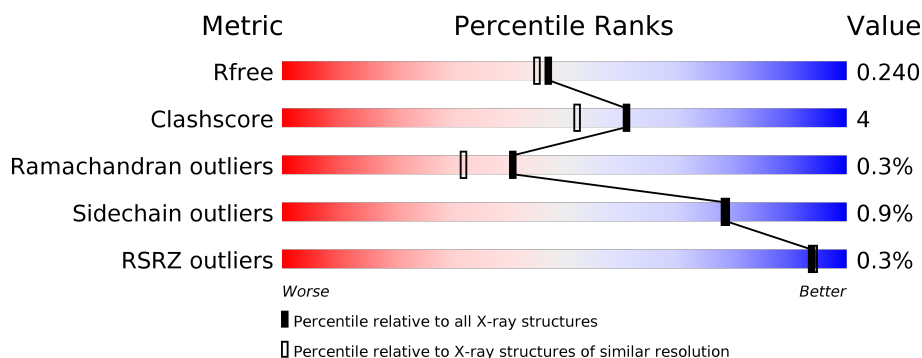
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.07 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.



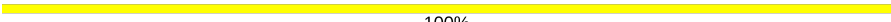

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	2684 (2.08-2.04)
Clashscore	141614	2801 (2.08-2.04)
Ramachandran outliers	138981	2768 (2.08-2.04)
Sidechain outliers	138945	2768 (2.08-2.04)
RSRZ outliers	127900	2646 (2.08-2.04)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments 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	398	<div> <div>86%</div> <div>12%</div> <div>•</div> </div>
1	B	398	<div> <div>89%</div> <div>9%</div> <div>•</div> </div>
2	C	3	<div> <div>100%</div> </div>
2	E	3	<div> <div>67%</div> <div>33%</div> </div>
2	H	3	<div> <div>100%</div> </div>
3	D	2	<div> <div>100%</div> </div>

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Mol	Chain	Length	Quality of chain
3	G	2	 100%
4	F	6	 33% 67%

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
4	MAN	F	6	-	-	-	X
5	PEG	A	509	-	-	X	-

## 2 Entry composition [i](#)

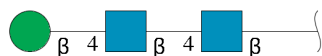
There are 10 unique types of molecules in this entry. The entry contains 6948 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Alpha-galactosidase A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	390	Total	C	N	O	S	0	3	0
			3139	1998	537	578	26			
1	B	392	Total	C	N	O	S	0	0	0
			3128	1992	532	577	27			

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



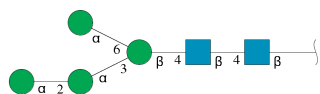
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	3	Total	C	N	O	0	0	0
			39	22	2	15			
2	E	3	Total	C	N	O	0	0	0
			39	22	2	15			
2	H	3	Total	C	N	O	0	0	0
			39	22	2	15			

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



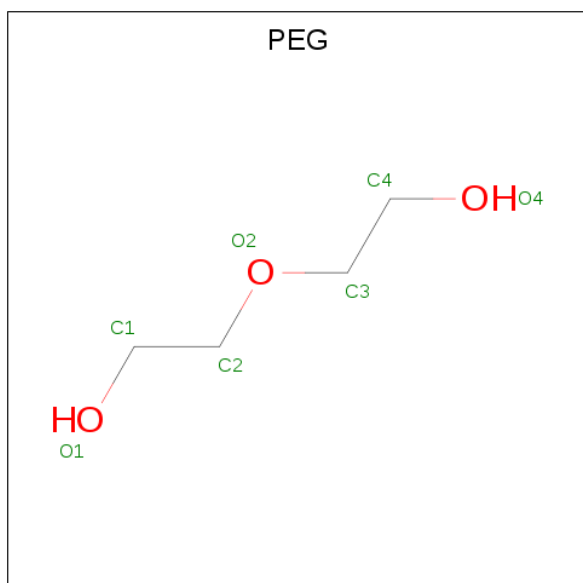
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	D	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	G	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-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
4	F	6	Total	C	N	O	0	0	0
			72	40	2	30			

- Molecule 5 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			7	4	3		
5	A	1	Total	C	O	0	0
			7	4	3		

- Molecule 6 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).



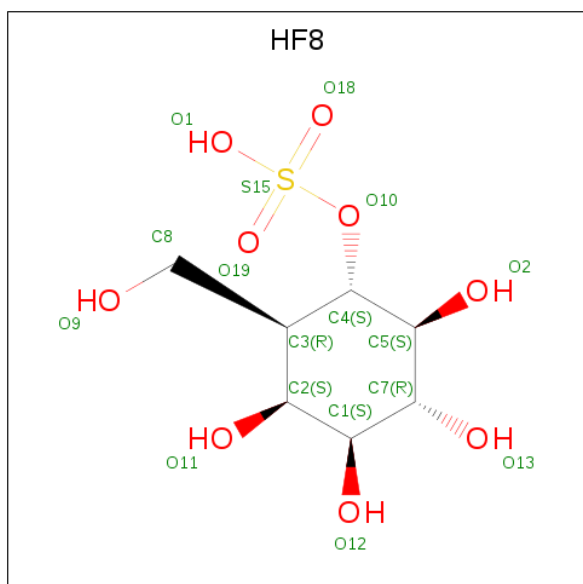
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 7 is SULFATE ION (three-letter code: SO<sub>4</sub>) (formula: O<sub>4</sub>S).



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

- Molecule 8 is [(1 {S},2 {R},3 {S},4 {S},5 {R},6 {S})-2-(hydroxymethyl)-3,4,5,6-tetrakis(oxidanyl)cyclohexyl] hydrogen sulfate (three-letter code: HF8) (formula: C<sub>7</sub>H<sub>14</sub>O<sub>9</sub>S).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	O	S	0	0
			16	7	8	1		
8	B	1	Total	C	O	S	0	0
			16	7	8	1		

- Molecule 9 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



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

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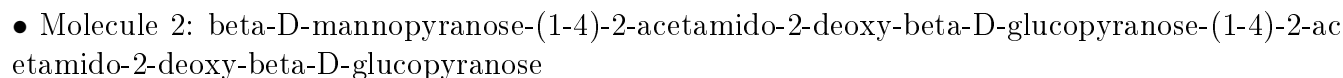
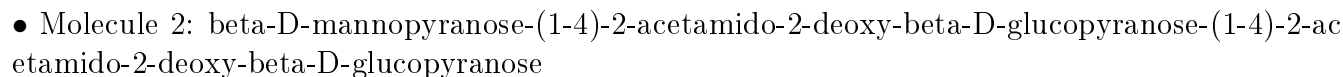
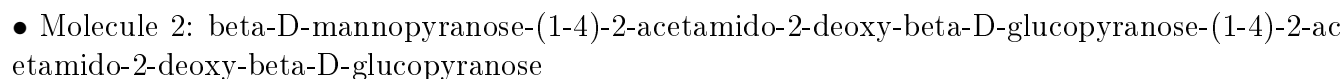
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	C	O	0	0
			4	2	2		
9	B	1	Total	C	O	0	0
			4	2	2		
9	B	1	Total	C	O	0	0
			4	2	2		
9	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	157	Total	O	0	0
			157	157		
10	B	115	Total	O	0	0
			115	115		

**i**


- Molecule 1: Alpha-galactosidase A



Chain H:  100%


HA01  
HA02  
BOA3

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

Chain D:  100%

HA01  
HA02

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

Chain G:  100%

HA01  
HA02

- Molecule 4: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain F:  33%  67%

HA01  
HA02  
BOA3  
MAN4  
MAN5  
MAN6

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.34Å 90.34Å 216.00Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	78.36 – 2.07 78.24 – 2.07	Depositor EDS
% Data completeness (in resolution range)	99.9 (78.36-2.07) 100.0 (78.24-2.07)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.50 (at 2.07Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.180 , 0.242 0.186 , 0.240	Depositor DCC
$R_{free}$ test set	3073 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	44.1	Xtriage
Anisotropy	0.483	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 54.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.025 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	6948	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% of the height of the origin peak. No significant pseudotranslation is detected.*

<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: HF8, BMA, NAG, EDO, SO4, ACT, PEG, MAN

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	0.68	1/3226 (0.0%)	0.81	1/4382 (0.0%)
1	B	0.71	1/3215 (0.0%)	0.81	0/4368
All	All	0.70	2/6441 (0.0%)	0.81	1/8750 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	170	ASP	CG-OD2	8.73	1.45	1.25
1	A	170	ASP	CG-OD2	8.33	1.44	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	220	ARG	CG-CD-NE	-6.57	98.01	111.80

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	3139	0	2979	33	0
1	B	3128	0	2971	25	0
2	C	39	0	34	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	E	39	0	34	1	0
2	H	39	0	34	0	0
3	D	28	0	25	0	0
3	G	28	0	25	0	0
4	F	72	0	61	0	0
5	A	14	0	20	5	0
6	A	12	0	9	1	0
6	B	4	0	3	0	0
7	A	15	0	0	1	0
7	B	15	0	0	1	0
8	A	16	0	0	0	0
8	B	16	0	0	0	0
9	A	36	0	54	0	0
9	B	36	0	54	0	0
10	A	157	0	0	2	0
10	B	115	0	0	0	0
All	All	6948	0	6303	58	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.

The worst 5 of 58 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:B:369:VAL:HG13	1:B:378:CYS:SG	2.25	0.77
1:A:403:LEU:HD21	1:A:415:LEU:CD1	2.22	0.69
1:B:209:TRP:N	1:B:210:PRO:HD2	2.15	0.62
1:A:277:TRP:H	5:A:509:PEG:C3	2.13	0.62
1:A:403:LEU:HD21	1:A:415:LEU:HD11	1.84	0.60

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	391/398 (98%)	378 (97%)	12 (3%)	1 (0%)	41	32
1	B	390/398 (98%)	372 (95%)	17 (4%)	1 (0%)	41	32
All	All	781/796 (98%)	750 (96%)	29 (4%)	2 (0%)	41	32

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	266	ASP
1	A	266	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	330/339 (97%)	327 (99%)	3 (1%)	78	78
1	B	330/339 (97%)	326 (99%)	4 (1%)	71	69
All	All	660/678 (97%)	653 (99%)	7 (1%)	78	72

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	51	MET
1	B	364	SER
1	B	53	ASN
1	A	51[B]	MET
1	B	225	HIS

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	46	HIS

### 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 ⓘ

19 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	0.66	0	17,19,21	1.05	1 (5%)
2	NAG	C	2	2	14,14,15	0.54	0	17,19,21	1.39	4 (23%)
2	BMA	C	3	2	11,11,12	0.47	0	15,15,17	1.33	1 (6%)
3	NAG	D	1	1,3	14,14,15	0.43	0	17,19,21	1.28	2 (11%)
3	NAG	D	2	3	14,14,15	0.40	0	17,19,21	1.60	6 (35%)
2	NAG	E	1	1,2	14,14,15	0.56	0	17,19,21	1.21	2 (11%)
2	NAG	E	2	2	14,14,15	0.39	0	17,19,21	1.08	1 (5%)
2	BMA	E	3	2	11,11,12	0.46	0	15,15,17	1.24	1 (6%)
4	NAG	F	1	1,4	14,14,15	0.45	0	17,19,21	1.21	1 (5%)
4	NAG	F	2	4	14,14,15	0.54	0	17,19,21	0.92	0
4	BMA	F	3	4	11,11,12	0.44	0	15,15,17	0.74	0
4	MAN	F	4	4	11,11,12	0.47	0	15,15,17	1.14	1 (6%)
4	MAN	F	5	4	11,11,12	0.28	0	15,15,17	0.78	1 (6%)
4	MAN	F	6	4	11,11,12	0.71	0	15,15,17	1.13	2 (13%)
3	NAG	G	1	1,3	14,14,15	0.46	0	17,19,21	1.06	2 (11%)
3	NAG	G	2	3	14,14,15	0.30	0	17,19,21	1.36	2 (11%)
2	NAG	H	1	1,2	14,14,15	0.49	0	17,19,21	1.25	2 (11%)
2	NAG	H	2	2	14,14,15	0.64	0	17,19,21	1.47	1 (5%)
2	BMA	H	3	2	11,11,12	0.45	0	15,15,17	1.17	1 (6%)



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	-	0/6/23/26	0/1/1/1
2	BMA	C	3	2	-	0/2/19/22	0/1/1/1
3	NAG	D	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	0/6/23/26	0/1/1/1
2	NAG	E	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	E	2	2	-	2/6/23/26	0/1/1/1
2	BMA	E	3	2	-	0/2/19/22	0/1/1/1
4	NAG	F	1	1,4	-	2/6/23/26	0/1/1/1
4	NAG	F	2	4	-	0/6/23/26	0/1/1/1
4	BMA	F	3	4	-	0/2/19/22	0/1/1/1
4	MAN	F	4	4	-	1/2/19/22	0/1/1/1
4	MAN	F	5	4	-	1/2/19/22	0/1/1/1
4	MAN	F	6	4	-	2/2/19/22	0/1/1/1
3	NAG	G	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	G	2	3	-	1/6/23/26	0/1/1/1
2	NAG	H	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	H	2	2	-	3/6/23/26	0/1/1/1
2	BMA	H	3	2	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

The worst 5 of 31 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	2	NAG	C2-N2-C7	4.39	129.15	122.90
2	C	3	BMA	O5-C5-C6	3.64	112.91	107.20
2	E	3	BMA	C1-O5-C5	3.54	116.99	112.19
3	G	2	NAG	O5-C5-C6	3.53	112.74	107.20
4	F	4	MAN	O2-C2-C1	3.13	115.55	109.15

There are no chirality outliers.

5 of 16 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	H	2	NAG	C3-C2-N2-C7
4	F	6	MAN	O5-C5-C6-O6

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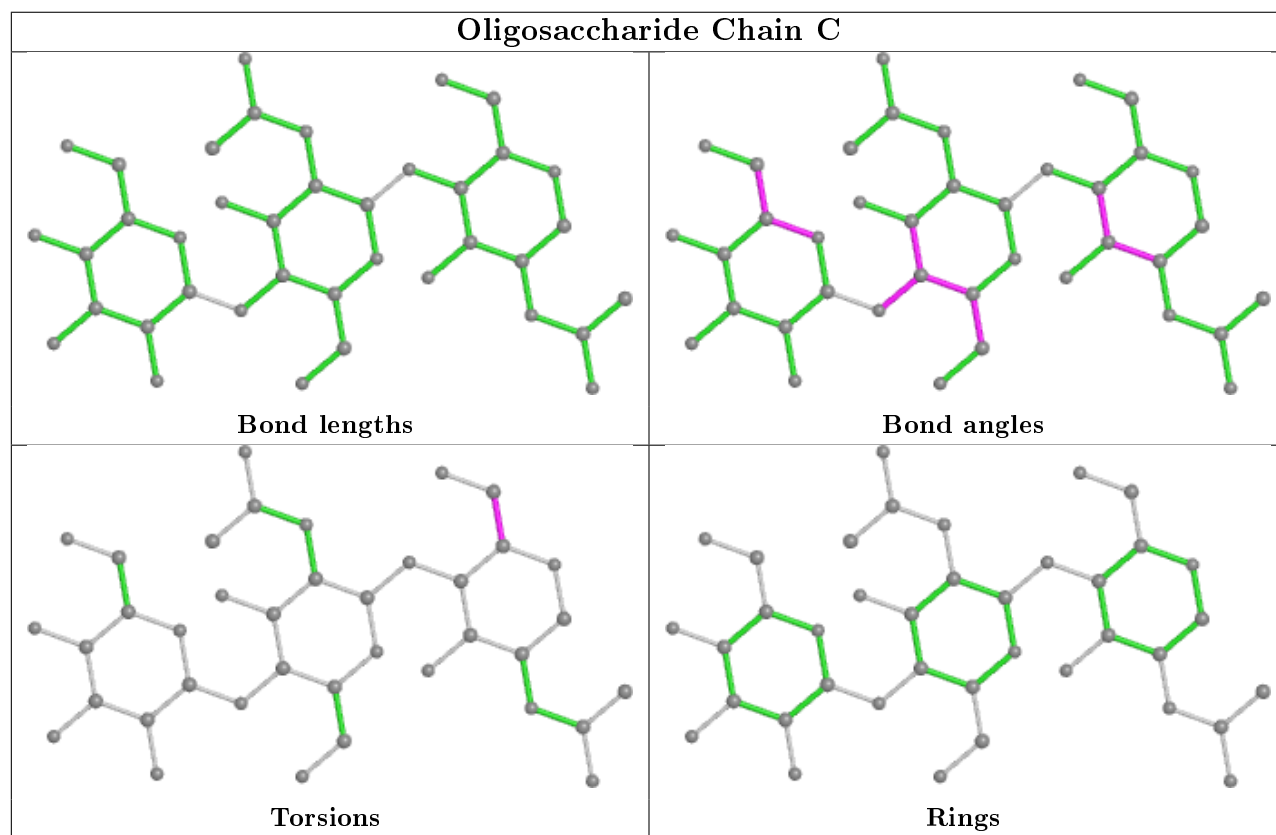
Mol	Chain	Res	Type	Atoms
2	E	2	NAG	C4-C5-C6-O6
2	H	2	NAG	C4-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6

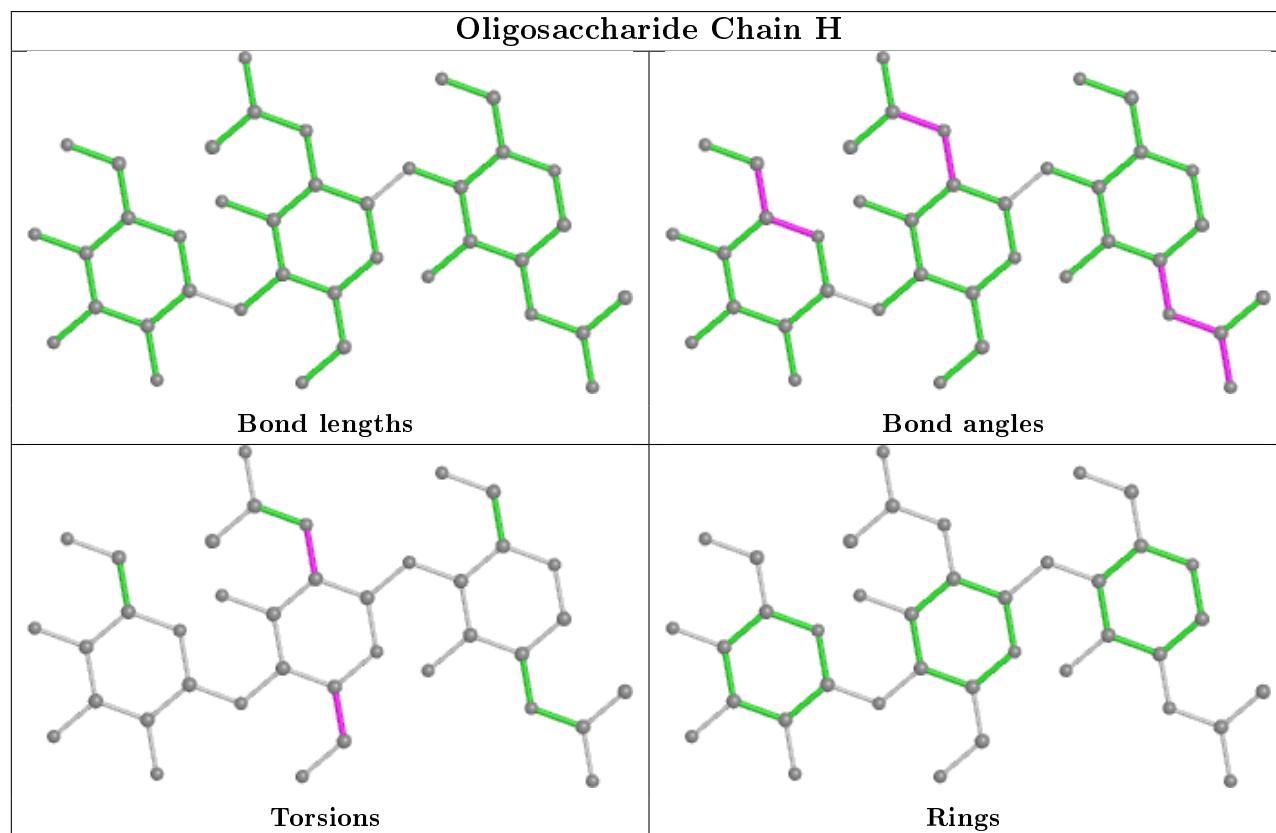
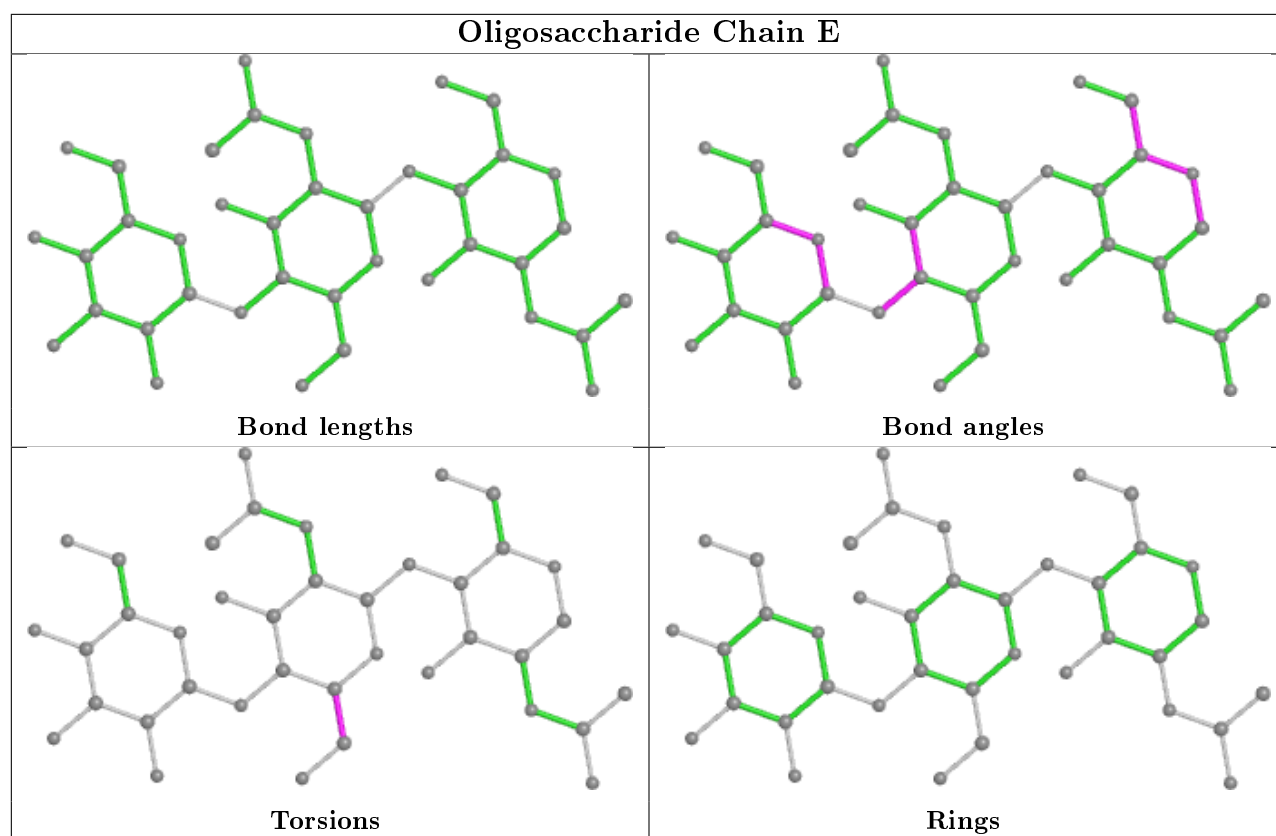
There are no ring outliers.

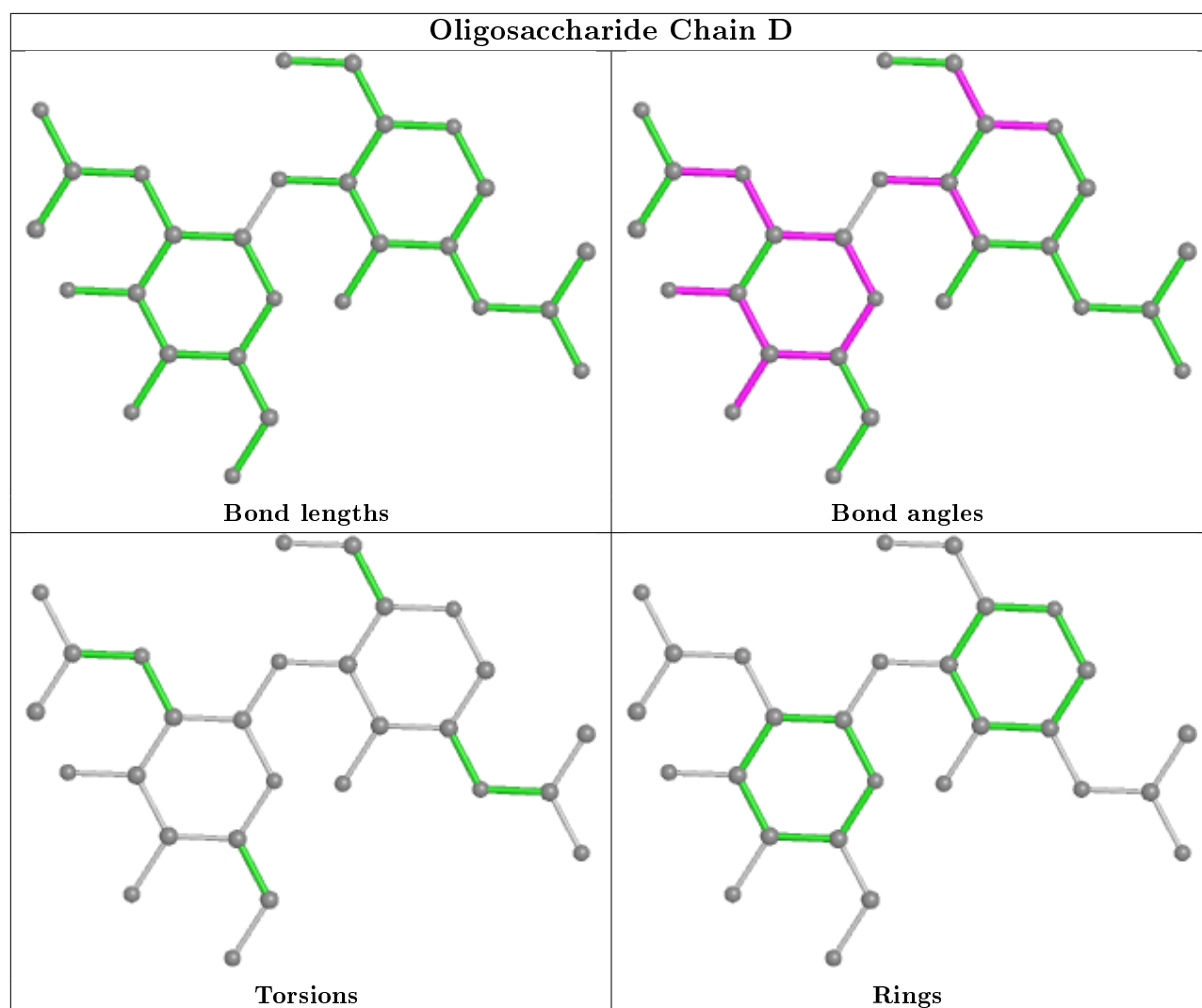
1 monomer is involved in 1 short contact:

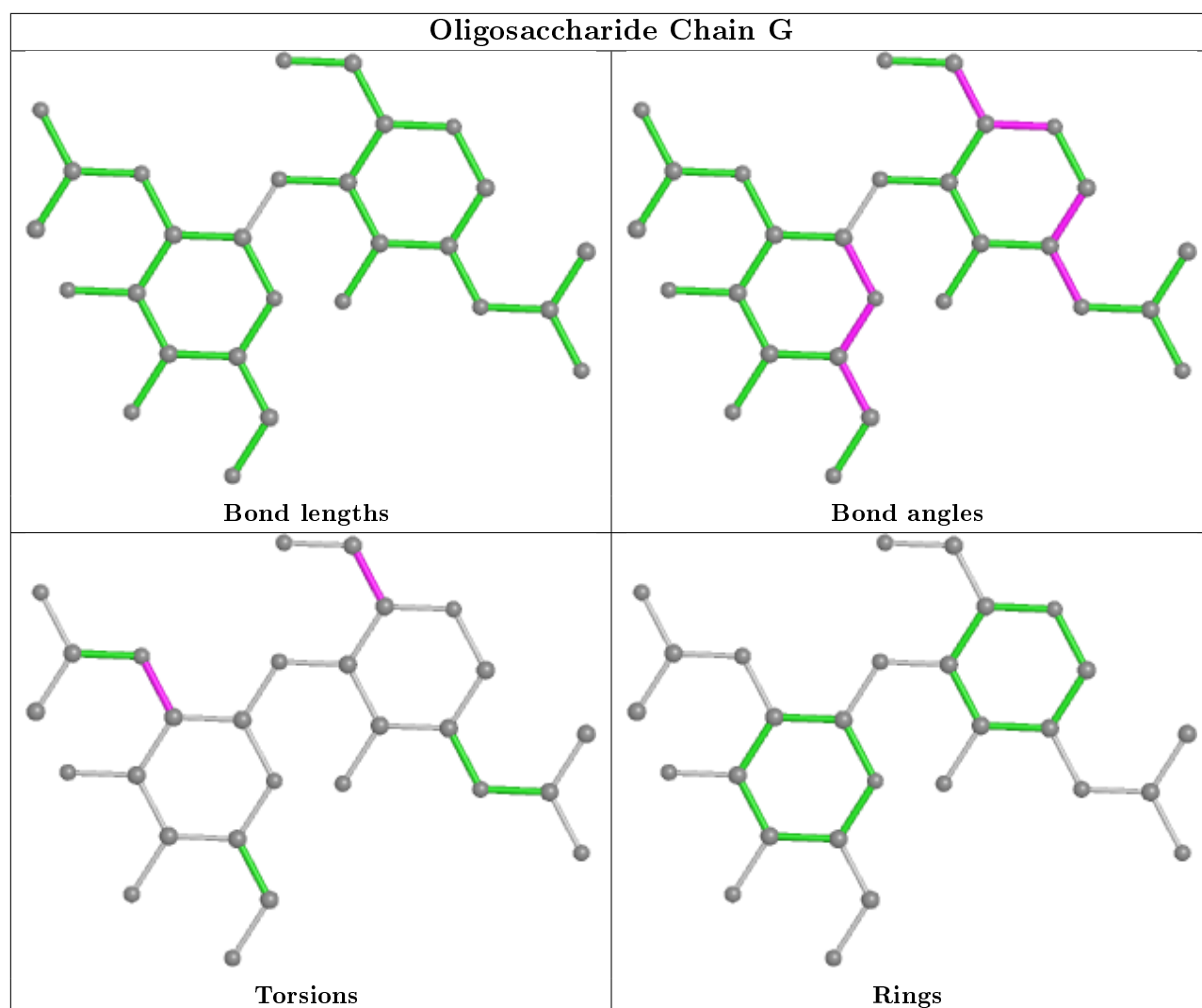
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	1	NAG	1	0

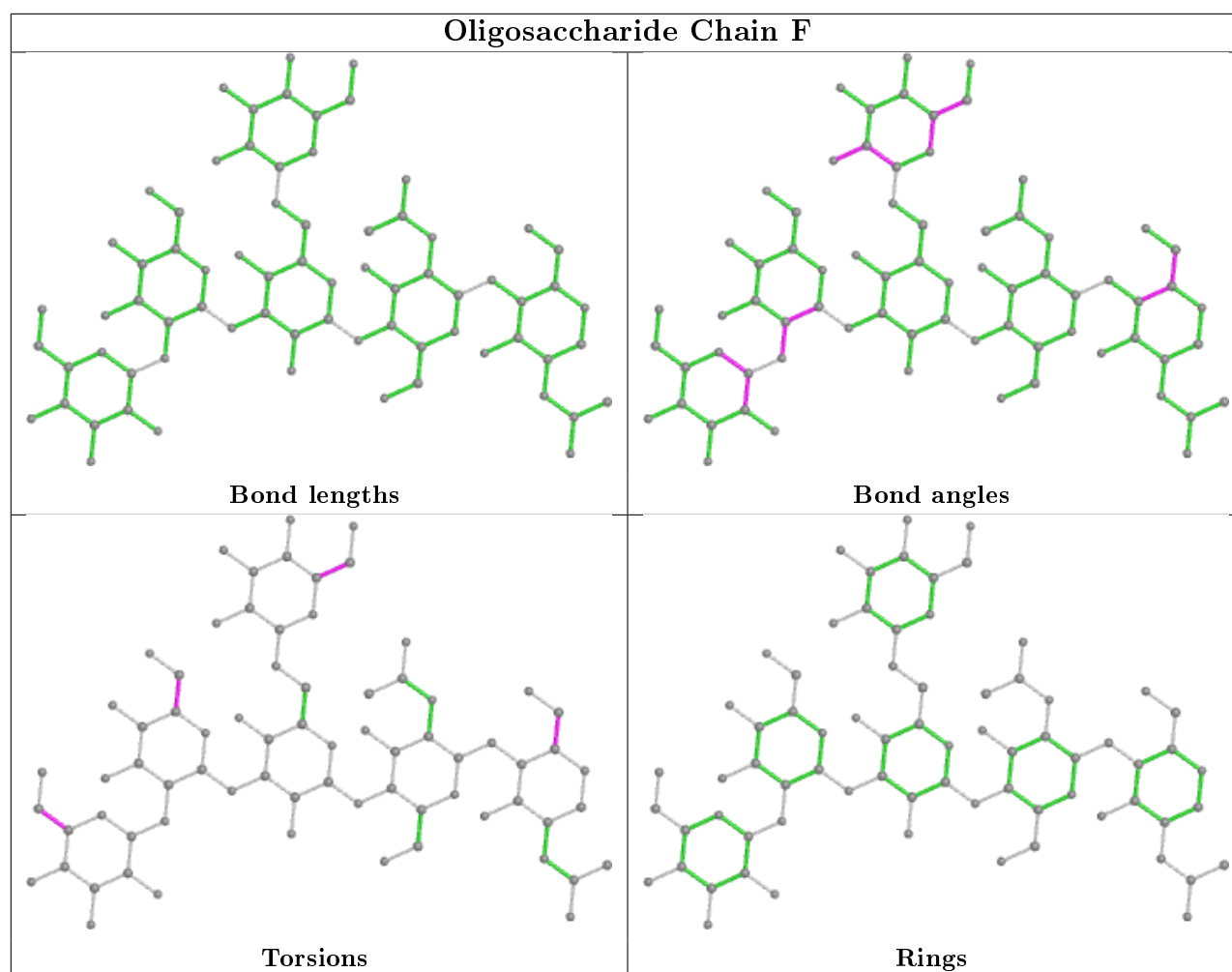
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.











## 5.6 Ligand geometry [i](#)

32 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	$\# Z  > 2$
9	EDO	A	525	-	3,3,3	0.14	0	2,2,2	0.34	0
5	PEG	A	510	-	6,6,6	0.52	0	5,5,5	0.41	0
9	EDO	A	524	-	3,3,3	0.16	0	2,2,2	0.31	0
7	SO4	A	514	-	4,4,4	0.50	0	6,6,6	0.14	0
8	HF8	B	516	1	16,16,17	0.89	1 (6%)	18,24,26	1.36	3 (16%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
6	ACT	A	513	-	1,3,3	5.10	1 (100%)	0,3,3	0.00	-
7	SO4	A	515	-	4,4,4	0.28	0	6,6,6	0.16	0
7	SO4	A	516	-	4,4,4	0.33	0	6,6,6	0.08	0
9	EDO	B	522	-	3,3,3	0.06	0	2,2,2	0.09	0
6	ACT	A	511	-	1,3,3	4.36	1 (100%)	0,3,3	0.00	-
9	EDO	B	523	-	3,3,3	0.41	0	2,2,2	0.64	0
6	ACT	A	512	-	1,3,3	3.15	1 (100%)	0,3,3	0.00	-
9	EDO	A	526	-	3,3,3	0.30	0	2,2,2	0.28	0
9	EDO	B	520	-	3,3,3	0.10	0	2,2,2	0.03	0
9	EDO	B	519	-	3,3,3	0.13	0	2,2,2	0.17	0
9	EDO	B	517	-	3,3,3	0.03	0	2,2,2	0.20	0
9	EDO	B	525	-	3,3,3	0.14	0	2,2,2	0.35	0
9	EDO	A	518	-	3,3,3	0.39	0	2,2,2	0.29	0
9	EDO	A	520	-	3,3,3	0.14	0	2,2,2	0.15	0
9	EDO	A	519	-	3,3,3	0.11	0	2,2,2	0.54	0
9	EDO	A	522	-	3,3,3	0.21	0	2,2,2	0.42	0
7	SO4	B	513	-	4,4,4	0.50	0	6,6,6	0.16	0
7	SO4	B	514	-	4,4,4	0.47	0	6,6,6	0.15	0
9	EDO	A	521	-	3,3,3	0.24	0	2,2,2	0.27	0
8	HF8	A	517	1	16,16,17	1.11	1 (6%)	18,24,26	1.28	2 (11%)
7	SO4	B	515	-	4,4,4	0.36	0	6,6,6	0.07	0
9	EDO	A	523	-	3,3,3	0.04	0	2,2,2	0.23	0
5	PEG	A	509	-	6,6,6	0.16	0	5,5,5	0.30	0
6	ACT	B	512	-	1,3,3	3.51	1 (100%)	0,3,3	0.00	-
9	EDO	B	521	-	3,3,3	0.14	0	2,2,2	0.33	0
9	EDO	B	524	-	3,3,3	0.12	0	2,2,2	0.19	0
9	EDO	B	518	-	3,3,3	0.17	0	2,2,2	0.29	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
9	EDO	A	525	-	-	0/1/1/1	-
5	PEG	A	510	-	-	2/4/4/4	-
9	EDO	A	524	-	-	1/1/1/1	-
8	HF8	B	516	1	-	1/7/27/31	0/1/1/1
9	EDO	B	522	-	-	1/1/1/1	-
9	EDO	B	523	-	-	0/1/1/1	-
9	EDO	A	526	-	-	1/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	EDO	B	520	-	-	0/1/1/1	-
9	EDO	B	519	-	-	1/1/1/1	-
9	EDO	B	517	-	-	1/1/1/1	-
9	EDO	B	525	-	-	1/1/1/1	-
9	EDO	A	518	-	-	1/1/1/1	-
9	EDO	A	520	-	-	1/1/1/1	-
9	EDO	A	519	-	-	0/1/1/1	-
9	EDO	A	522	-	-	1/1/1/1	-
9	EDO	A	521	-	-	1/1/1/1	-
8	HF8	A	517	1	-	0/7/27/31	0/1/1/1
9	EDO	A	523	-	-	0/1/1/1	-
5	PEG	A	509	-	-	2/4/4/4	-
9	EDO	B	521	-	-	1/1/1/1	-
9	EDO	B	524	-	-	1/1/1/1	-
9	EDO	B	518	-	-	0/1/1/1	-

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	513	ACT	CH3-C	5.10	1.55	1.48
6	A	511	ACT	CH3-C	4.36	1.54	1.48
8	A	517	HF8	O10-C4	-3.82	1.41	1.47
6	B	512	ACT	CH3-C	3.51	1.53	1.48
6	A	512	ACT	CH3-C	3.15	1.52	1.48

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	517	HF8	C4-O10-S15	3.02	121.85	117.91
8	A	517	HF8	O10-C4-C5	-2.83	102.53	108.54
8	B	516	HF8	O10-C4-C5	-2.80	102.59	108.54
8	B	516	HF8	O11-C2-C3	2.68	115.59	110.05
8	B	516	HF8	O11-C2-C1	-2.25	105.16	110.35

There are no chirality outliers.

5 of 17 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	526	EDO	O1-C1-C2-O2
5	A	510	PEG	C1-C2-O2-C3
9	A	524	EDO	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
9	A	520	EDO	O1-C1-C2-O2
5	A	510	PEG	O1-C1-C2-O2

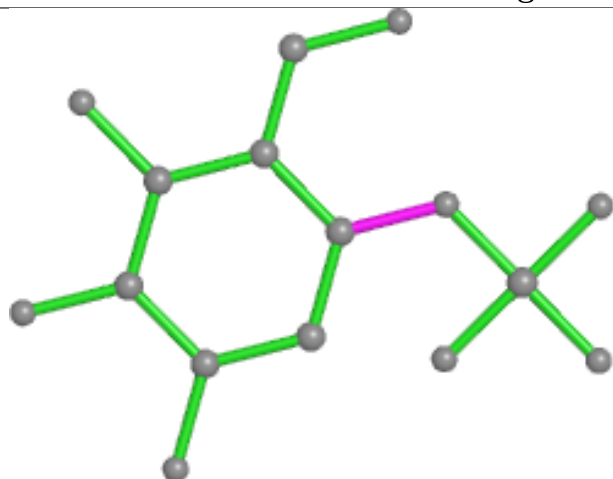
There are no ring outliers.

5 monomers are involved in 8 short contacts:

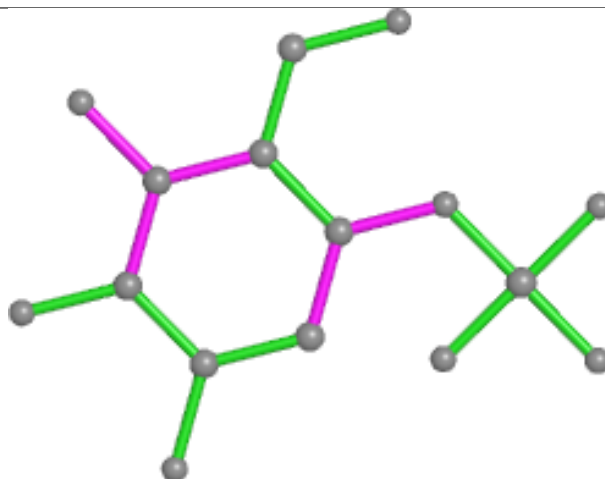
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	510	PEG	1	0
7	A	514	SO4	1	0
6	A	512	ACT	1	0
7	B	513	SO4	1	0
5	A	509	PEG	4	0

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

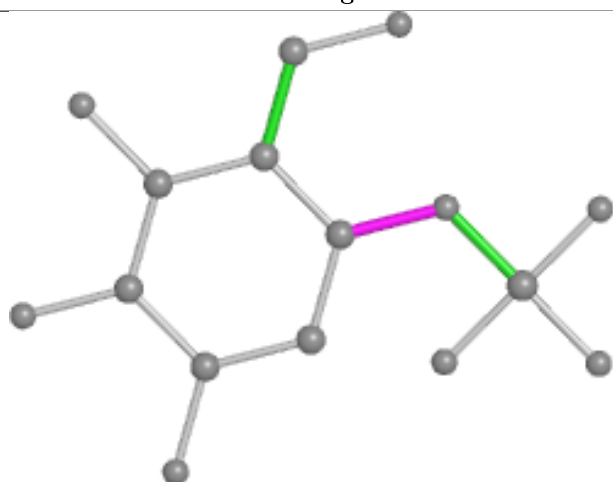
## Ligand HF8 B 516



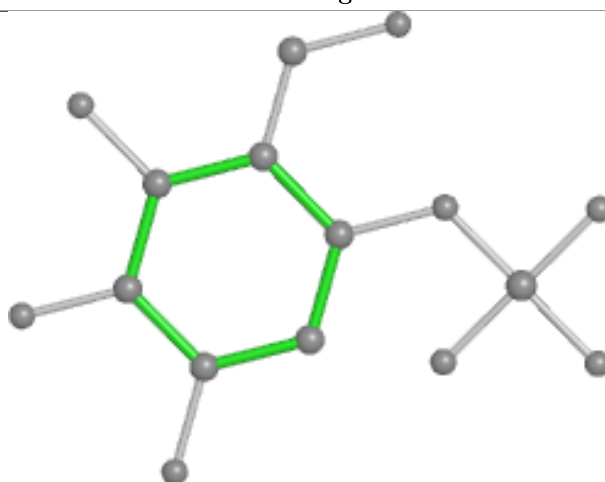
Bond lengths



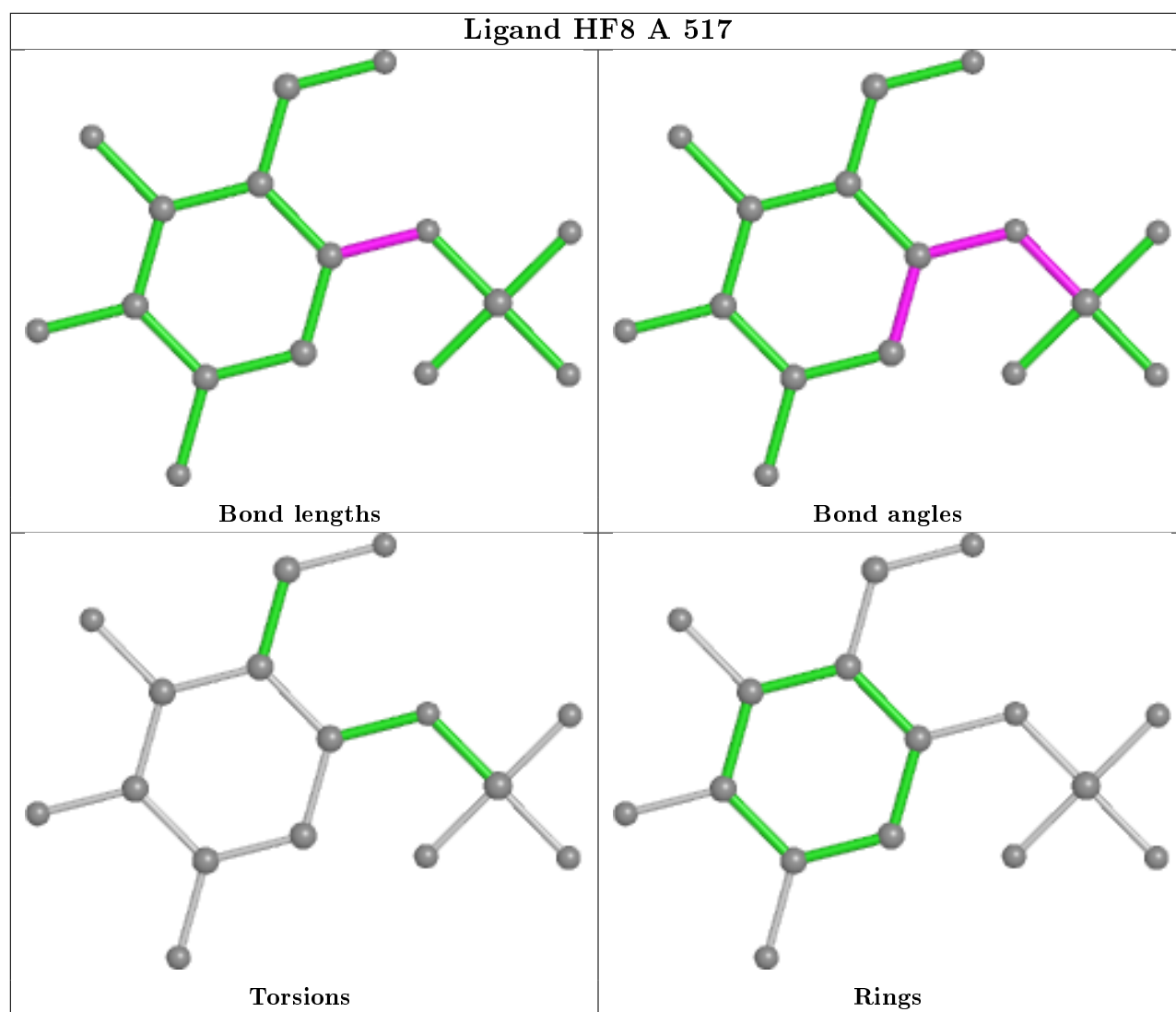
Bond angles



Torsions



Rings



## 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	390/398 (97%)	-0.12	1 (0%) 94 94	40, 53, 70, 100	7 (1%)
1	B	392/398 (98%)	-0.09	1 (0%) 94 94	42, 59, 86, 116	4 (1%)
All	All	782/796 (98%)	-0.11	2 (0%) 94 94	40, 55, 81, 116	11 (1%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	209	TRP	2.2
1	A	102	SER	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.

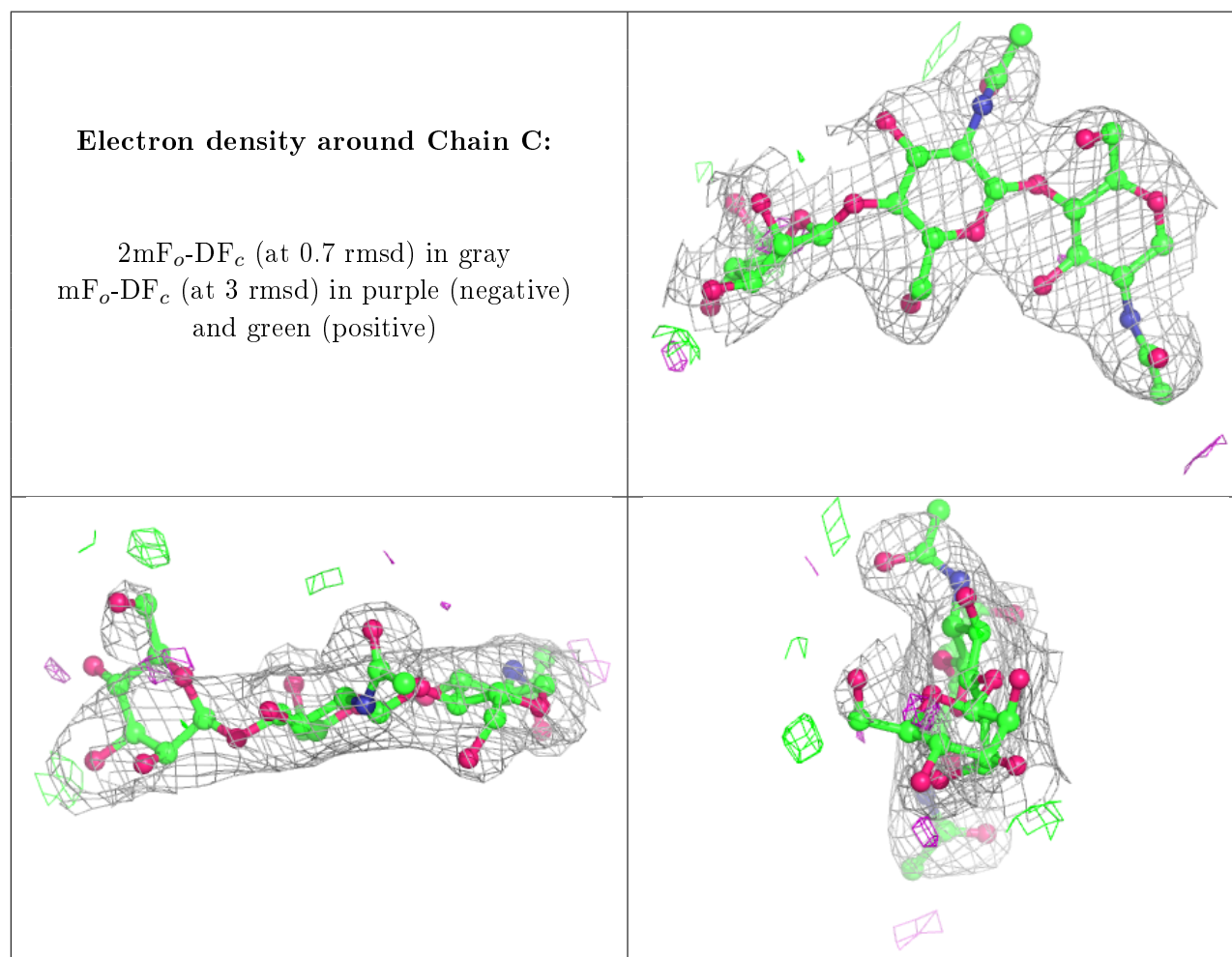
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	BMA	H	3	11/12	0.33	0.26	122,136,146,150	0
2	BMA	E	3	11/12	0.61	0.18	114,124,137,137	0
2	BMA	C	3	11/12	0.64	0.24	94,106,119,128	0
4	MAN	F	6	11/12	0.75	0.46	95,111,121,121	0
2	NAG	H	1	14/15	0.75	0.16	78,102,112,120	0
4	MAN	F	5	11/12	0.79	0.30	125,134,139,150	0
2	NAG	H	2	14/15	0.81	0.23	112,124,137,140	0

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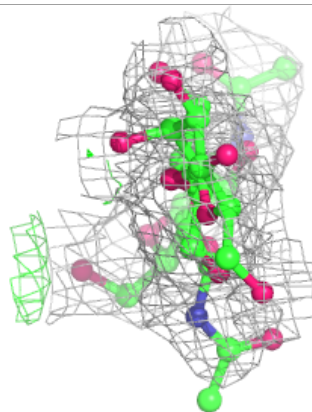
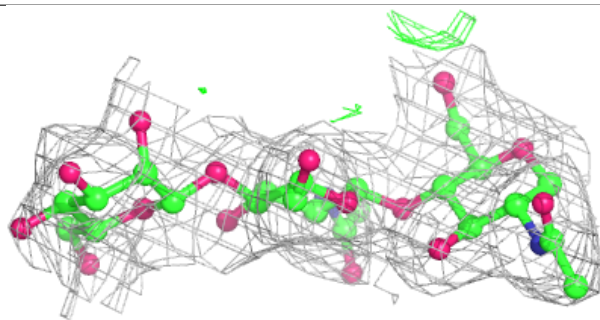
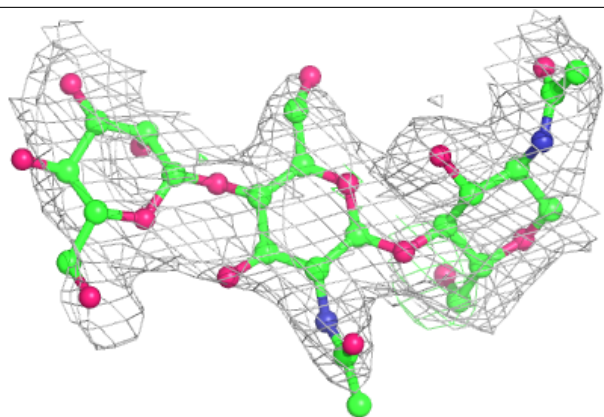
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	G	2	14/15	0.84	0.20	130,139,143,155	0
3	NAG	D	2	14/15	0.84	0.18	91,100,106,109	0
2	NAG	E	1	14/15	0.88	0.09	71,81,87,91	0
2	NAG	E	2	14/15	0.89	0.15	91,104,119,130	0
4	BMA	F	3	11/12	0.89	0.13	75,95,105,106	0
4	MAN	F	4	11/12	0.90	0.12	82,100,112,117	0
4	NAG	F	1	14/15	0.92	0.11	64,74,83,83	0
3	NAG	G	1	14/15	0.92	0.09	83,107,117,126	0
4	NAG	F	2	14/15	0.92	0.11	79,85,89,89	0
3	NAG	D	1	14/15	0.93	0.09	72,76,94,96	0
2	NAG	C	2	14/15	0.95	0.10	62,79,91,96	0
2	NAG	C	1	14/15	0.98	0.11	57,61,66,68	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.



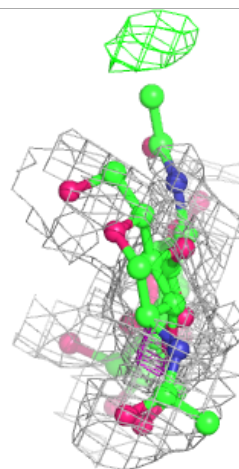
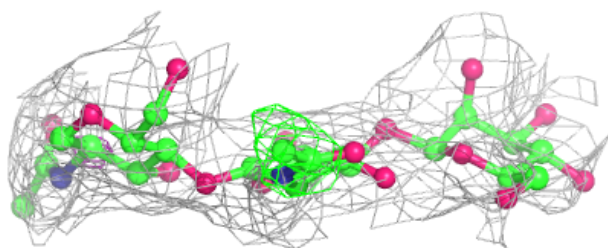
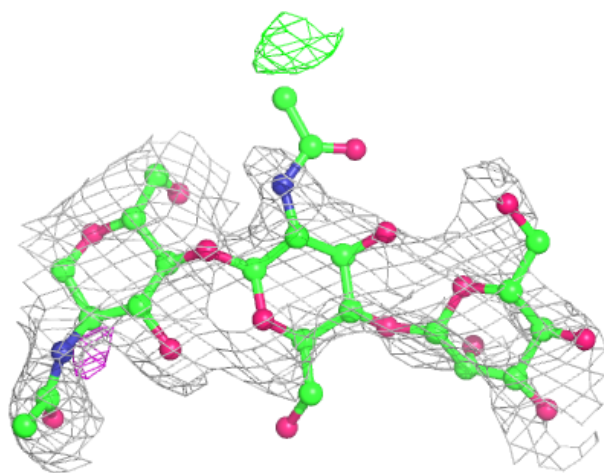
**Electron density around Chain E:**

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



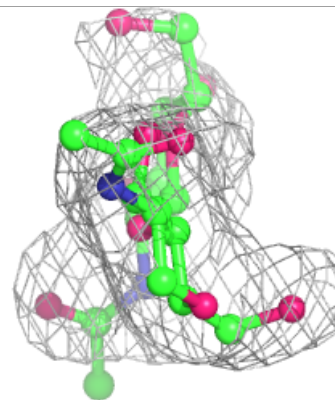
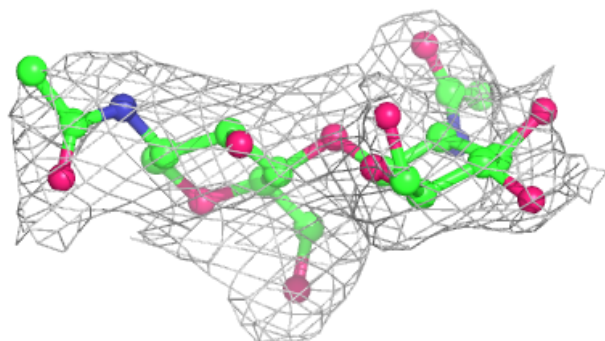
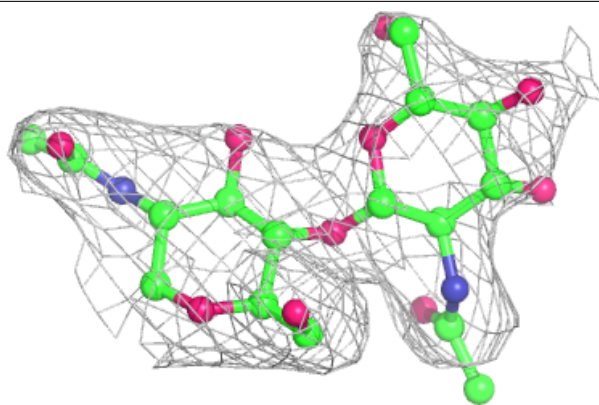
**Electron density around Chain H:**

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



**Electron density around Chain D:**

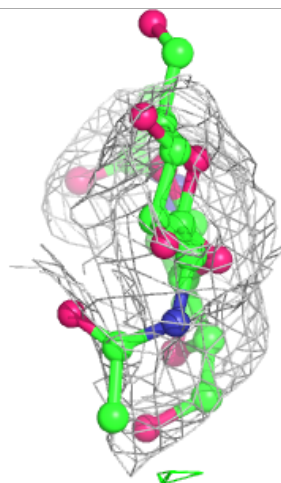
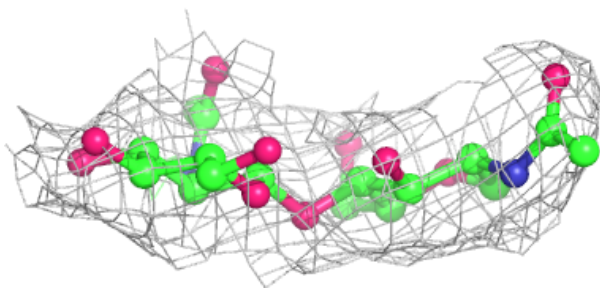
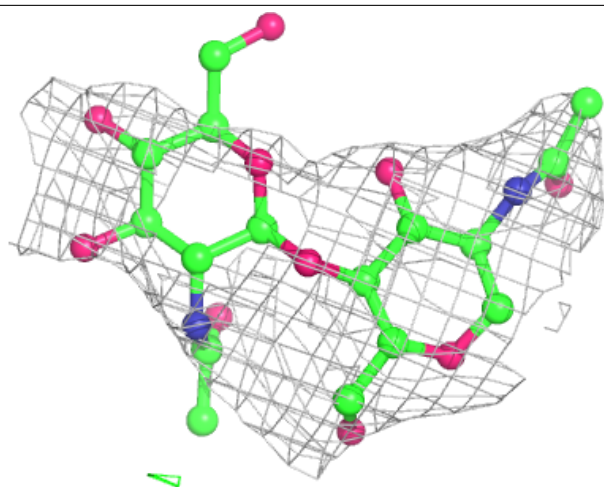
$2mF_o - DF_c$  (at 0.7 rmsd) in gray  
 $mF_o - DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

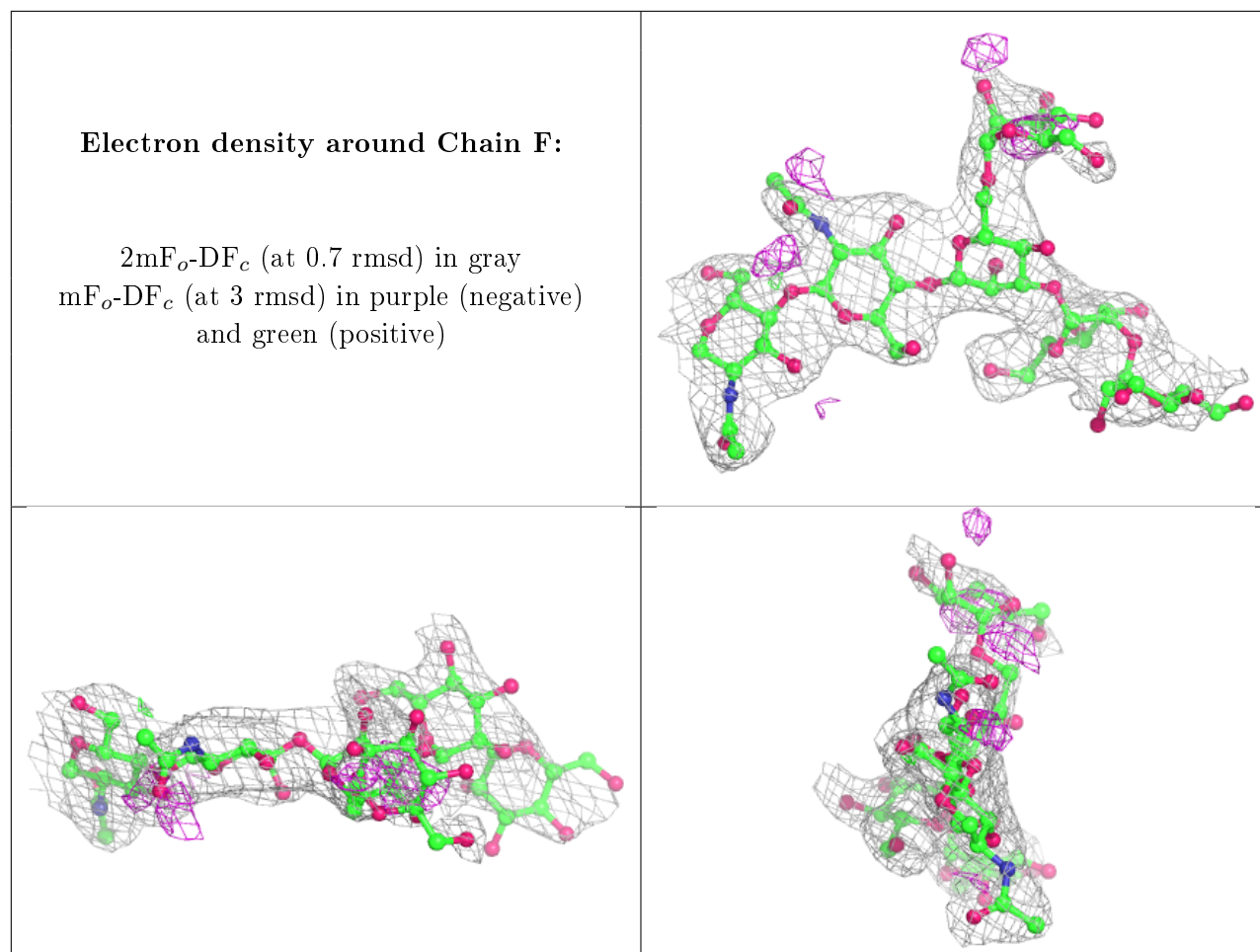




**Electron density around Chain G:**

$2mF_o-DF_c$  (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
5	PEG	A	510	7/7	0.58	0.23	65,87,91,93	0
6	ACT	A	511	4/4	0.63	0.16	82,91,92,96	0
9	EDO	B	525	4/4	0.70	0.17	85,98,102,106	0
9	EDO	A	518	4/4	0.70	0.24	64,67,70,70	0
9	EDO	B	518	4/4	0.77	0.15	91,94,95,95	0
9	EDO	B	524	4/4	0.80	0.14	74,75,77,83	0
9	EDO	A	526	4/4	0.81	0.25	74,83,84,84	0
9	EDO	A	524	4/4	0.83	0.31	64,80,81,84	0
5	PEG	A	509	7/7	0.84	0.12	63,71,75,86	0
6	ACT	A	512	4/4	0.84	0.23	57,68,72,76	0
9	EDO	A	523	4/4	0.84	0.18	74,74,75,81	0

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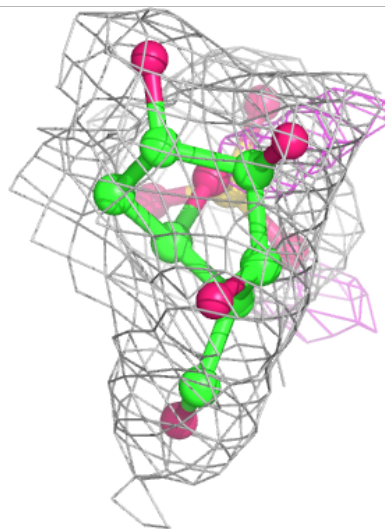
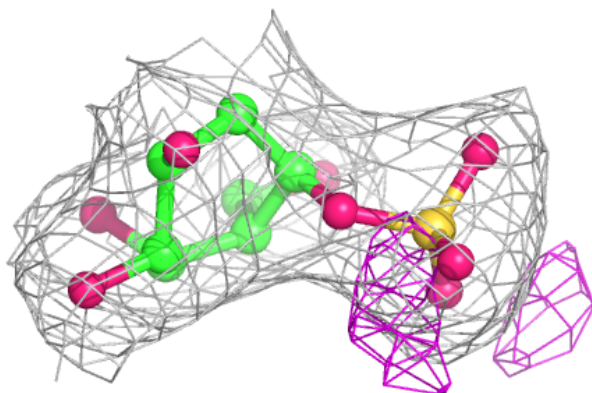
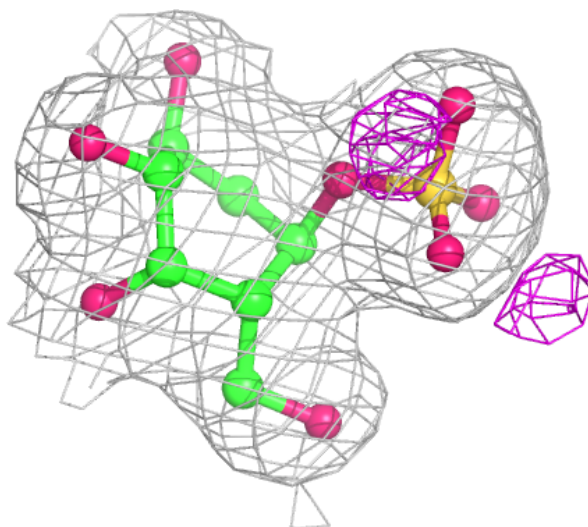
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
9	EDO	B	517	4/4	0.85	0.13	78,82,83,83	0
9	EDO	B	521	4/4	0.85	0.18	90,94,97,104	0
7	SO4	B	515	5/5	0.85	0.26	122,123,129,142	0
6	ACT	A	513	4/4	0.85	0.21	69,78,78,87	0
9	EDO	B	523	4/4	0.87	0.18	69,74,75,76	0
9	EDO	A	522	4/4	0.87	0.29	63,75,77,80	0
9	EDO	A	519	4/4	0.88	0.24	56,69,70,73	0
9	EDO	A	521	4/4	0.88	0.30	43,45,49,53	4
9	EDO	A	525	4/4	0.89	0.13	80,81,82,87	0
7	SO4	A	516	5/5	0.90	0.15	94,102,118,120	0
9	EDO	B	522	4/4	0.92	0.27	65,70,72,74	0
9	EDO	B	520	4/4	0.92	0.11	84,87,89,99	0
7	SO4	B	514	5/5	0.93	0.16	58,59,63,66	5
9	EDO	A	520	4/4	0.94	0.18	61,62,64,72	0
7	SO4	A	515	5/5	0.94	0.10	74,78,81,92	0
6	ACT	B	512	4/4	0.94	0.11	77,81,84,86	0
9	EDO	B	519	4/4	0.96	0.24	70,73,73,77	0
7	SO4	A	514	5/5	0.97	0.11	63,74,82,83	0
8	HF8	A	517	16/17	0.98	0.09	45,53,62,68	0
8	HF8	B	516	16/17	0.98	0.09	48,54,64,74	0
7	SO4	B	513	5/5	0.99	0.09	69,72,79,88	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.

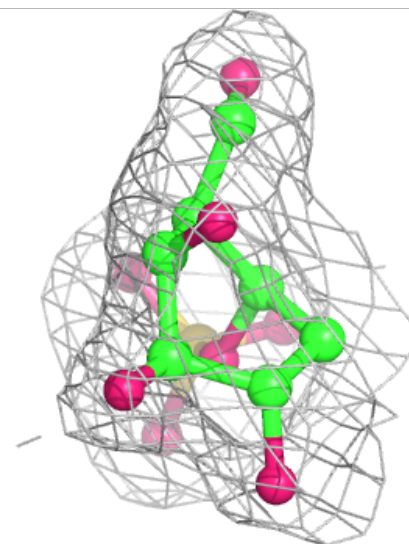
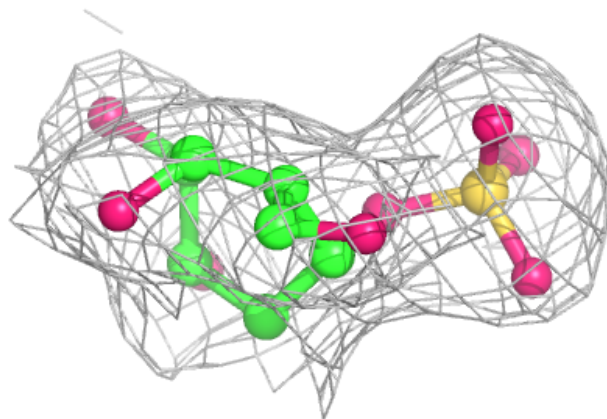
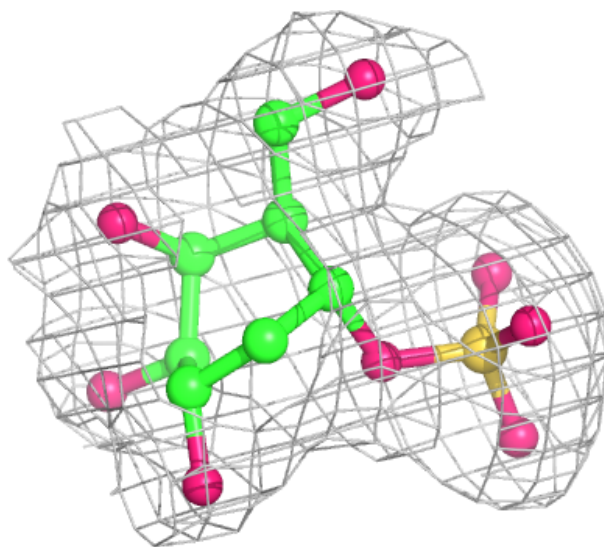
**Electron density around HF8 A 517:**

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



**Electron density around HF8 B 516:**

$2mF_o-DF_c$  (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.