



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 10, 2020 – 08:58 AM BST

PDB ID : 3WAX  
Title : Crystal Structure of Autotaxin in Complex with 3BoA  
Authors : Nishimasu, H.; Ishitani, R.; Nureki, O.  
Deposited on : 2013-05-09  
Resolution : 1.90 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

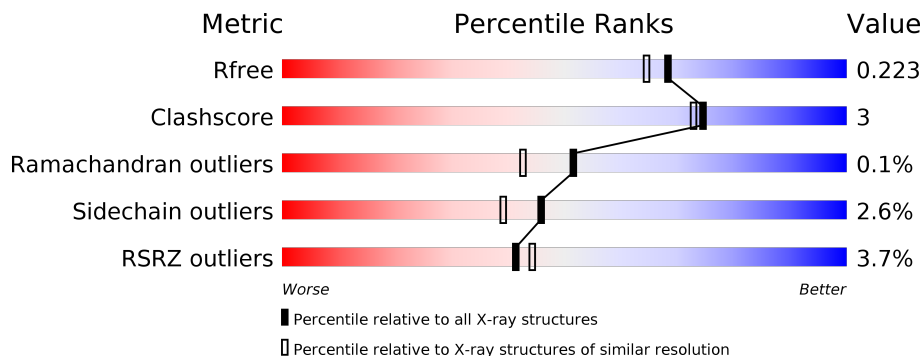
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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	831	 3% 87% 7% 5%
2	B	2	 50% 50%
2	D	2	 100%
3	C	7	 29% 71%

## 2 Entry composition [i](#)

There are 11 unique types of molecules in this entry. The entry contains 7037 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 Ectonucleotide pyrophosphatase/phosphodiesterase family member 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	789	6321	4015	1082	1176	48	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

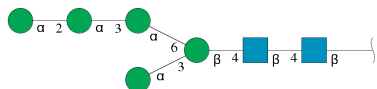
Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	LYS	SEE REMARK 999	UNP Q9R1E6
A	?	-	VAL	SEE REMARK 999	UNP Q9R1E6
A	?	-	GLU	SEE REMARK 999	UNP Q9R1E6
A	?	-	PRO	SEE REMARK 999	UNP Q9R1E6
A	859	SER	-	expression tag	UNP Q9R1E6
A	860	ARG	-	expression tag	UNP Q9R1E6
A	861	GLU	-	expression tag	UNP Q9R1E6
A	862	ASN	-	expression tag	UNP Q9R1E6
A	863	LEU	-	expression tag	UNP Q9R1E6
A	864	TYR	-	expression tag	UNP Q9R1E6
A	865	PHE	-	expression tag	UNP Q9R1E6
A	866	GLN	-	expression tag	UNP Q9R1E6

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

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]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
			Total	C	N	O			
3	C	7	83	46	2	35	0	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
4	A	2	2	2	0	0

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

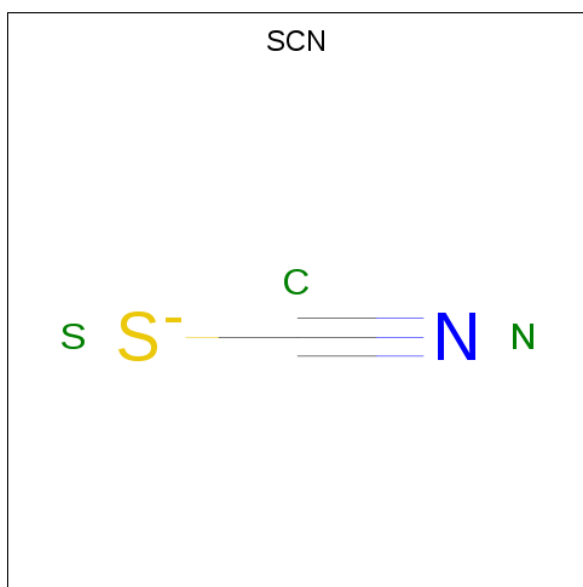
- Molecule 6 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
6	A	1	1	1	0	0

- Molecule 7 is POTASSIUM ION (three-letter code: K) (formula: K).

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

- Molecule 8 is THIOCYANATE ION (three-letter code: SCN) (formula: CNS).



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

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



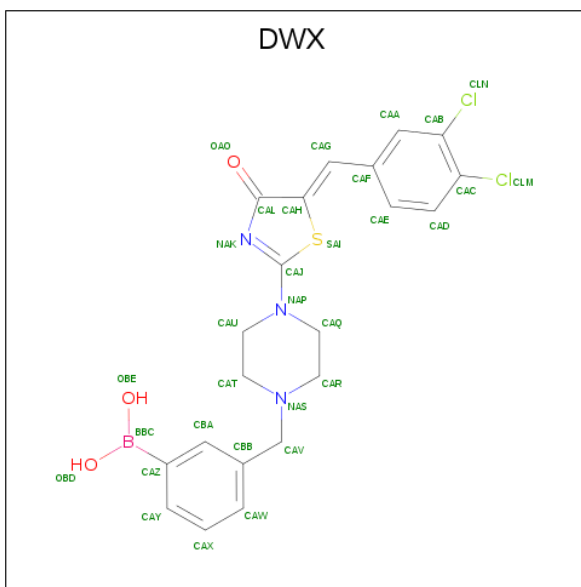
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	1	Total	C O	0	0
			4	2 2		
9	A	1	Total	C O	0	0
			4	2 2		

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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	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		

- Molecule 10 is [3-({4-[(5Z)-5-(3,4-dichlorobenzylidene)-4-oxo-4,5-dihydro-1,3-thiazol-2-yl]piperazin-1-yl}methyl)phenyl]boronic acid (three-letter code: DWX) (formula: C<sub>21</sub>H<sub>20</sub>BCl<sub>2</sub>N<sub>3</sub>O<sub>3</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf		
			Total	B	C	Cl	N			O	S
10	A	1	62	2	42	4	6	6	2	0	1

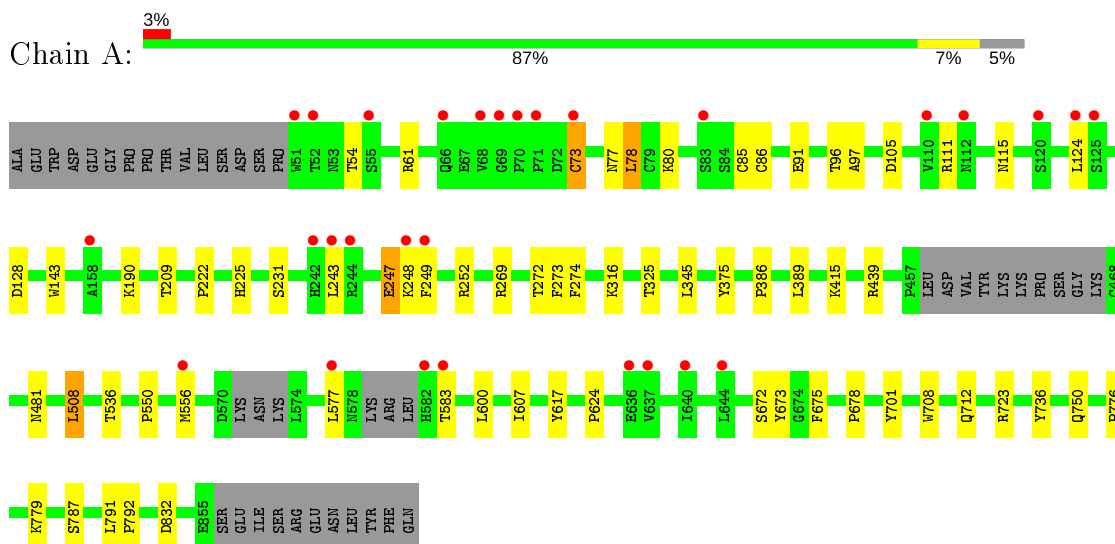
- Molecule 11 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
11	A	436	Total	O	0	0
			436	436		

### 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.

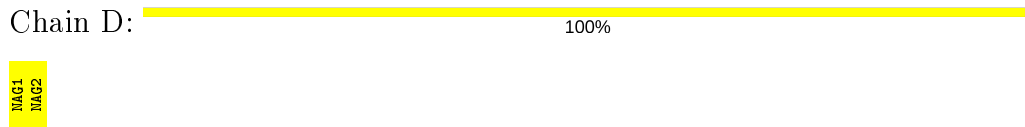
- Molecule 1: Ectonucleotide pyrophosphatase/phosphodiesterase family member 2



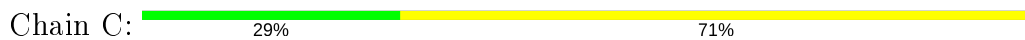
- Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



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





MA1
MA2
MA3
MA4
MA5
MA6
MA7

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	61.61Å 94.48Å 75.31Å 90.00° 93.90° 90.00°	Depositor
Resolution (Å)	49.24 – 1.90 49.24 – 1.90	Depositor EDS
% Data completeness (in resolution range)	98.8 (49.24-1.90) 98.8 (49.24-1.90)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.91 (at 1.90Å)	Xtrriage
Refinement program	PHENIX 1.7.2_869	Depositor
R, $R_{free}$	0.178 , 0.224 0.175 , 0.223	Depositor DCC
$R_{free}$ test set	3402 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	27.6	Xtrriage
Anisotropy	0.086	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7037	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.91% 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: ZN, BMA, NAG, NA, DWX, EDO, SCN, CA, K, 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	0.36	0/6503	0.53	0/8838

There are no bond length outliers.

There are no bond angle outliers.

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	6321	0	6005	37	0
2	B	28	0	25	0	0
2	D	28	0	25	0	0
3	C	83	0	70	0	0
4	A	2	0	0	0	0
5	A	1	0	0	0	0
6	A	1	0	0	0	0
7	A	1	0	0	0	0
8	A	6	0	0	0	0
9	A	68	0	102	7	0
10	A	62	0	36	9	0
11	A	436	0	0	1	0
All	All	7037	0	6263	41	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 3.

All (41) 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)
10:A:936[B]:DWX:CAZ	10:A:936[B]:DWX:BBC	1.79	1.56
10:A:936[A]:DWX:CAZ	10:A:936[A]:DWX:BBC	1.79	1.55
1:A:675:PHE:H	9:A:921:EDO:H11	1.35	0.90
1:A:209:THR:OG1	10:A:936[B]:DWX:BBC	2.28	0.82
1:A:209:THR:OG1	10:A:936[A]:DWX:BBC	2.28	0.80
1:A:78:LEU:HD21	1:A:274:PHE:HB2	1.69	0.74
1:A:247:GLU:OE1	1:A:252:ARG:NH2	2.26	0.64
1:A:97:ALA:HB3	1:A:115:ASN:HA	1.82	0.62
1:A:243:LEU:HD13	10:A:936[B]:DWX:H5	1.83	0.60
1:A:678:PRO:HB3	1:A:712:GLN:HB3	1.84	0.58
1:A:243:LEU:HD13	10:A:936[A]:DWX:H5	1.90	0.53
1:A:787:SER:HB3	9:A:934:EDO:H11	1.91	0.53
1:A:550:PRO:HB2	1:A:607:ILE:HG12	1.93	0.50
1:A:248:LYS:HE2	1:A:249:PHE:CZ	2.47	0.49
10:A:936[A]:DWX:BBC	10:A:936[A]:DWX:CAY	2.76	0.49
1:A:111:ARG:HH22	1:A:128:ASP:CG	2.16	0.49
1:A:439:ARG:CZ	9:A:933:EDO:H21	2.42	0.49
10:A:936[B]:DWX:CAY	10:A:936[B]:DWX:BBC	2.77	0.48
1:A:675:PHE:N	9:A:921:EDO:H11	2.17	0.48
1:A:77:ASN:HD21	1:A:272:THR:HB	1.79	0.47
1:A:222:PRO:HA	1:A:225:HIS:CE1	2.49	0.47
1:A:701:TYR:OH	1:A:750:GLN:NE2	2.43	0.47
1:A:61:ARG:HH22	1:A:73:CYS:HB3	1.80	0.47
1:A:708:TRP:CD1	9:A:921:EDO:H12	2.49	0.47
1:A:776:PRO:HG2	1:A:779:LYS:HB2	1.95	0.47
1:A:143:TRP:O	1:A:190:LYS:NZ	2.47	0.46
1:A:600:LEU:HD11	1:A:832:ASP:HB2	1.97	0.46
1:A:80:LYS:HG2	1:A:85:CYS:SG	2.55	0.46
1:A:375:TYR:OH	1:A:415:LYS:HD3	2.15	0.45
1:A:61:ARG:NH2	1:A:86:CYS:SG	2.91	0.43
1:A:389:LEU:N	1:A:389:LEU:HD23	2.33	0.43
1:A:617:TYR:HA	1:A:624:PRO:HA	1.99	0.43
1:A:750:GLN:OE1	9:A:924:EDO:O1	2.37	0.42
1:A:723:ARG:CZ	9:A:934:EDO:H21	2.50	0.42
1:A:736:TYR:OH	1:A:750:GLN:HB3	2.18	0.42
1:A:791:LEU:HA	1:A:792:PRO:HD3	1.93	0.42
1:A:273:PHE:O	10:A:936[B]:DWX:H18	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:508:LEU:HD23	1:A:508:LEU:HA	1.83	0.42
1:A:672:SER:OG	1:A:673:TYR:N	2.52	0.41
1:A:111:ARG:NH2	1:A:128:ASP:OD2	2.54	0.40
1:A:316:LYS:HE3	11:A:1359:HOH:O	2.22	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	781/831 (94%)	758 (97%)	22 (3%)	1 (0%)	51 43

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	386	PRO

### 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	703/756 (93%)	685 (97%)	18 (3%)	46 39

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	54	THR
1	A	73	CYS
1	A	78	LEU
1	A	91	GLU
1	A	96	THR
1	A	105	ASP
1	A	124	LEU
1	A	231	SER
1	A	247	GLU
1	A	269	ARG
1	A	325	THR
1	A	345	LEU
1	A	481	ASN
1	A	508	LEU
1	A	536	THR
1	A	556	MET
1	A	577	LEU
1	A	583	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

11 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	0.49	0	17,19,21	1.17	1 (5%)
2	NAG	B	2	2	14,14,15	0.59	0	17,19,21	0.71	0
3	NAG	C	1	1,3	14,14,15	0.61	0	17,19,21	0.92	1 (5%)
3	NAG	C	2	3	14,14,15	0.75	1 (7%)	17,19,21	0.84	0
3	BMA	C	3	3	11,11,12	0.71	0	15,15,17	0.96	0
3	MAN	C	4	3	11,11,12	0.65	0	15,15,17	1.03	1 (6%)
3	MAN	C	5	3	11,11,12	0.60	0	15,15,17	1.09	1 (6%)
3	MAN	C	6	3	11,11,12	0.59	0	15,15,17	0.76	0
3	MAN	C	7	3	11,11,12	0.92	1 (9%)	15,15,17	0.85	0
2	NAG	D	1	1,2	14,14,15	0.58	0	17,19,21	1.05	2 (11%)
2	NAG	D	2	2	14,14,15	0.52	0	17,19,21	1.27	2 (11%)

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	-	2/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1
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
3	BMA	C	3	3	-	2/2/19/22	0/1/1/1
3	MAN	C	4	3	-	0/2/19/22	0/1/1/1
3	MAN	C	5	3	-	2/2/19/22	0/1/1/1
3	MAN	C	6	3	-	0/2/19/22	0/1/1/1
3	MAN	C	7	3	-	2/2/19/22	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 (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	2	NAG	O5-C1	-2.14	1.40	1.43
3	C	7	MAN	O5-C1	-2.13	1.40	1.43

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	D	2	NAG	C1-O5-C5	4.04	117.66	112.19
2	B	1	NAG	C1-O5-C5	3.81	117.36	112.19
3	C	4	MAN	O5-C5-C6	2.58	111.25	107.20
3	C	5	MAN	O5-C1-C2	-2.49	106.92	110.77
3	C	1	NAG	O5-C1-C2	-2.38	107.53	111.29
2	D	2	NAG	C2-N2-C7	-2.29	119.64	122.90
2	D	1	NAG	C1-O5-C5	2.09	115.02	112.19
2	D	1	NAG	O5-C1-C2	-2.05	108.05	111.29

There are no chirality outliers.

All (10) torsion outliers are listed below:

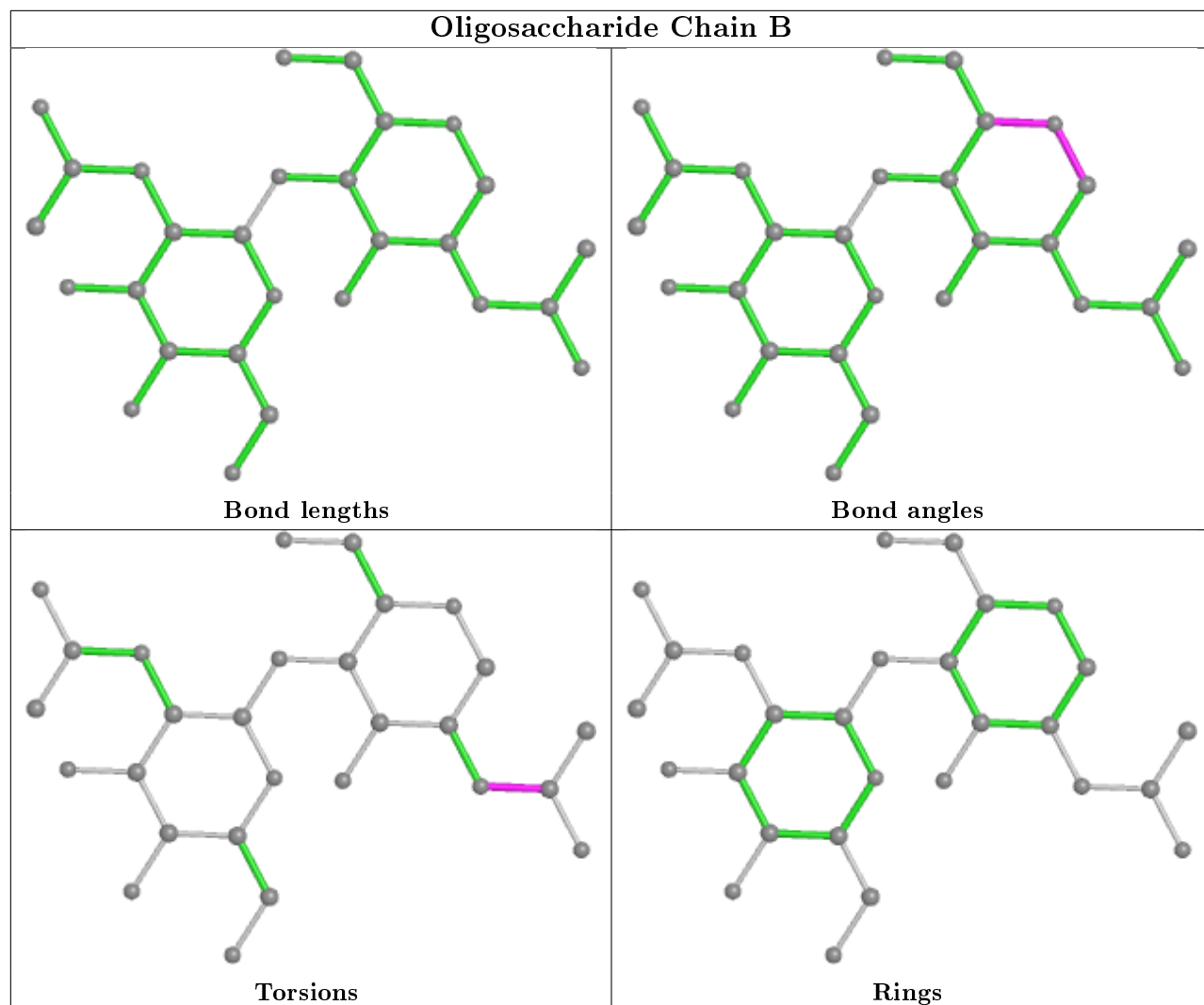
Mol	Chain	Res	Type	Atoms
2	B	1	NAG	C8-C7-N2-C2
2	B	1	NAG	O7-C7-N2-C2
3	C	7	MAN	O5-C5-C6-O6
3	C	5	MAN	O5-C5-C6-O6
3	C	5	MAN	C4-C5-C6-O6
2	D	2	NAG	O5-C5-C6-O6
2	D	2	NAG	C4-C5-C6-O6
3	C	7	MAN	C4-C5-C6-O6
3	C	3	BMA	O5-C5-C6-O6
3	C	3	BMA	C4-C5-C6-O6

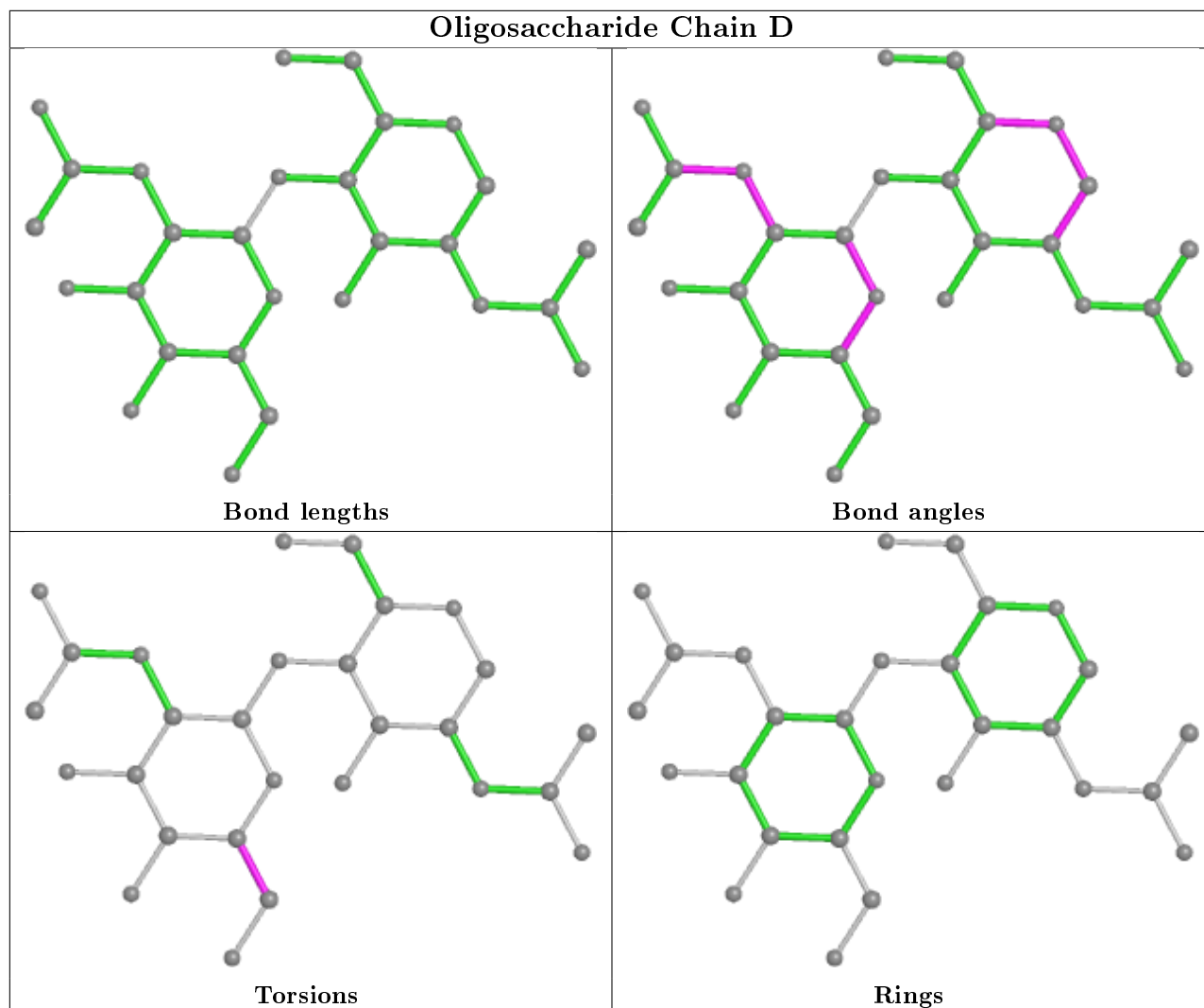
There are no ring outliers.

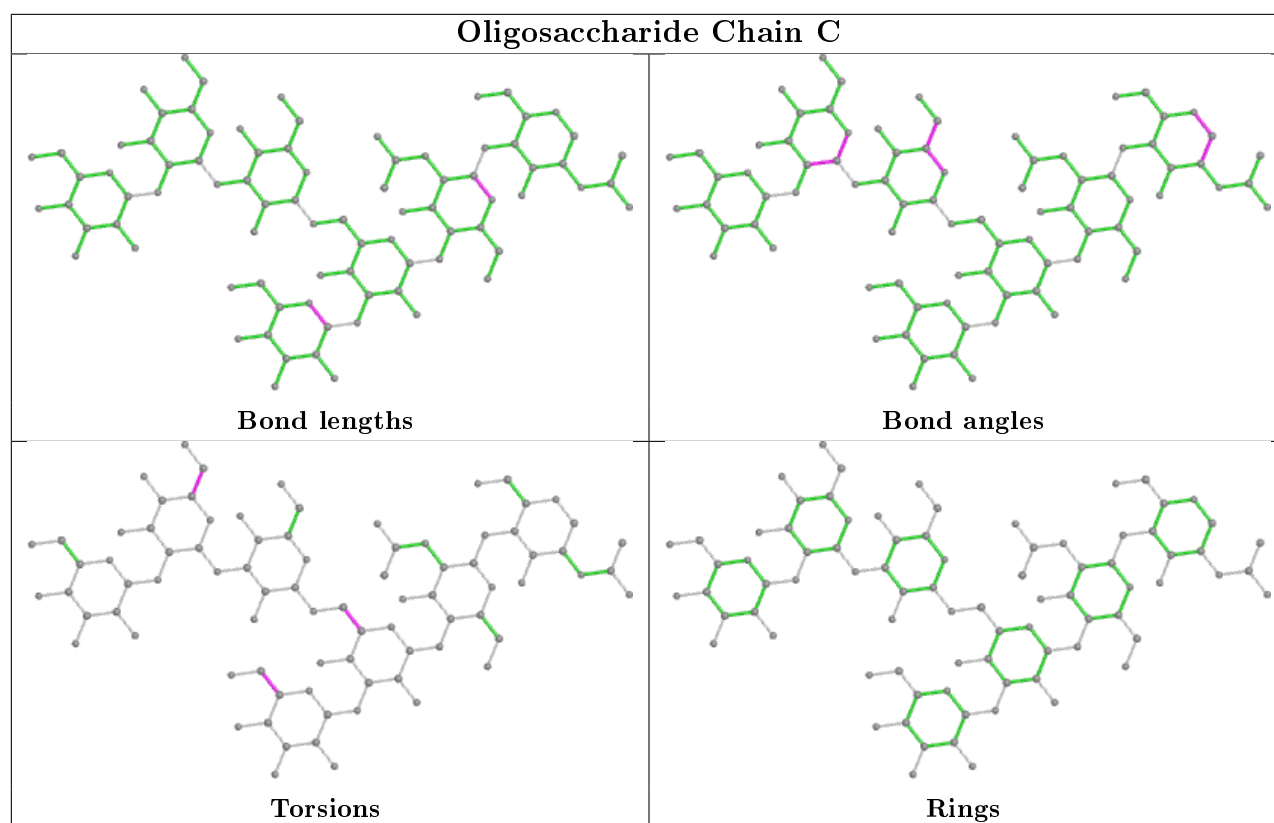
No monomer is involved in short contacts.

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](#)

Of 26 ligands modelled in this entry, 5 are monoatomic - leaving 21 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
9	EDO	A	926	-	3,3,3	0.58	0	2,2,2	0.25	0
9	EDO	A	933	-	3,3,3	0.51	0	2,2,2	0.25	0
8	SCN	A	917	-	1,2,2	0.92	0	0,1,1	0.00	-
9	EDO	A	919	-	3,3,3	0.50	0	2,2,2	0.52	0
9	EDO	A	925	-	3,3,3	0.46	0	2,2,2	0.54	0
9	EDO	A	928	-	3,3,3	0.49	0	2,2,2	0.33	0
9	EDO	A	930	-	3,3,3	0.42	0	2,2,2	0.37	0
9	EDO	A	932	-	3,3,3	0.48	0	2,2,2	0.35	0
10	DWX	A	936[B]	4	34,34,34	4.17	12 (35%)	47,48,48	2.45	10 (21%)
9	EDO	A	921	-	3,3,3	0.35	0	2,2,2	0.39	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
9	EDO	A	935	-	3,3,3	0.44	0	2,2,2	0.54	0
9	EDO	A	924	-	3,3,3	0.45	0	2,2,2	0.65	0
9	EDO	A	934	-	3,3,3	0.51	0	2,2,2	0.22	0
9	EDO	A	931	-	3,3,3	0.46	0	2,2,2	0.28	0
9	EDO	A	929	-	3,3,3	0.49	0	2,2,2	0.32	0
10	DWX	A	936[A]	4	34,34,34	4.21	14 (41%)	47,48,48	2.44	11 (23%)
9	EDO	A	923	-	3,3,3	0.48	0	2,2,2	0.27	0
9	EDO	A	927	-	3,3,3	0.44	0	2,2,2	0.44	0
8	SCN	A	918	-	1,2,2	0.91	0	0,1,1	0.00	-
9	EDO	A	920	-	3,3,3	0.59	0	2,2,2	0.16	0
9	EDO	A	922	-	3,3,3	0.50	0	2,2,2	0.34	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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	EDO	A	926	-	-	0/1/1/1	-
9	EDO	A	933	-	-	0/1/1/1	-
9	EDO	A	922	-	-	0/1/1/1	-
9	EDO	A	919	-	-	1/1/1/1	-
9	EDO	A	925	-	-	0/1/1/1	-
9	EDO	A	928	-	-	0/1/1/1	-
9	EDO	A	930	-	-	0/1/1/1	-
9	EDO	A	932	-	-	0/1/1/1	-
10	DWX	A	936[B]	4	-	2/16/38/38	0/4/4/4
9	EDO	A	921	-	-	0/1/1/1	-
9	EDO	A	935	-	-	1/1/1/1	-
9	EDO	A	934	-	-	1/1/1/1	-
9	EDO	A	931	-	-	0/1/1/1	-
9	EDO	A	929	-	-	0/1/1/1	-
10	DWX	A	936[A]	4	-	3/16/38/38	0/4/4/4
9	EDO	A	923	-	-	0/1/1/1	-
9	EDO	A	927	-	-	1/1/1/1	-
9	EDO	A	920	-	-	0/1/1/1	-
9	EDO	A	924	-	-	0/1/1/1	-

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	A	936[B]	DWX	BBC-CAZ	11.27	1.79	1.57

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	A	936[A]	DWX	BBC-CAZ	11.24	1.79	1.57
10	A	936[A]	DWX	OAO-CAL	10.92	1.41	1.23
10	A	936[A]	DWX	CAG-CAH	10.70	1.46	1.34
10	A	936[B]	DWX	OAO-CAL	10.67	1.41	1.23
10	A	936[B]	DWX	CAG-CAH	10.42	1.46	1.34
10	A	936[A]	DWX	BBC-OBE	7.59	1.49	1.36
10	A	936[B]	DWX	BBC-OBE	7.51	1.49	1.36
10	A	936[B]	DWX	CAL-CAH	-7.46	1.39	1.50
10	A	936[B]	DWX	BBC-OBD	7.37	1.49	1.36
10	A	936[A]	DWX	CAL-CAH	-7.33	1.40	1.50
10	A	936[A]	DWX	BBC-OBD	7.18	1.48	1.36
10	A	936[A]	DWX	CAJ-NAP	4.63	1.45	1.34
10	A	936[B]	DWX	CAJ-NAP	4.49	1.45	1.34
10	A	936[A]	DWX	CAQ-NAP	-2.94	1.41	1.47
10	A	936[B]	DWX	CBA-CAZ	2.94	1.43	1.40
10	A	936[B]	DWX	CAQ-NAP	-2.84	1.42	1.47
10	A	936[B]	DWX	CAJ-SAI	-2.79	1.68	1.75
10	A	936[A]	DWX	CBA-CAZ	2.71	1.43	1.40
10	A	936[A]	DWX	CAJ-SAI	-2.68	1.69	1.75
10	A	936[B]	DWX	CAJ-NAK	2.56	1.37	1.31
10	A	936[A]	DWX	CAJ-NAK	2.48	1.37	1.31
10	A	936[A]	DWX	CAF-CAG	2.18	1.51	1.46
10	A	936[A]	DWX	CAU-NAP	-2.15	1.43	1.47
10	A	936[A]	DWX	CAA-CAB	2.12	1.42	1.38
10	A	936[B]	DWX	CAU-NAP	-2.11	1.43	1.47

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	A	936[A]	DWX	CAL-CAH-SAI	-8.50	104.43	109.12
10	A	936[B]	DWX	CAL-CAH-SAI	-8.19	104.60	109.12
10	A	936[B]	DWX	CAF-CAG-CAH	-7.36	120.86	130.94
10	A	936[A]	DWX	SAI-CAJ-NAK	-5.73	108.11	116.31
10	A	936[B]	DWX	SAI-CAJ-NAK	-5.51	108.43	116.31
10	A	936[B]	DWX	CAH-CAL-NAK	5.36	116.36	113.56
10	A	936[A]	DWX	CAF-CAG-CAH	-5.35	123.63	130.94
10	A	936[A]	DWX	CAH-CAL-NAK	5.26	116.31	113.56
10	A	936[A]	DWX	SAI-CAJ-NAP	5.00	126.82	120.36
10	A	936[A]	DWX	CAJ-SAI-CAH	4.63	97.09	90.75
10	A	936[B]	DWX	CAJ-SAI-CAH	4.46	96.86	90.75
10	A	936[B]	DWX	SAI-CAJ-NAP	4.00	125.54	120.36
10	A	936[A]	DWX	CAG-CAH-SAI	2.94	132.99	129.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	A	936[A]	DWX	CAQ-NAP-CAJ	2.81	129.05	122.03
10	A	936[A]	DWX	CAY-CAZ-CBA	2.75	120.33	117.35
10	A	936[B]	DWX	CAY-CAZ-CBA	2.61	120.18	117.35
10	A	936[B]	DWX	CAQ-NAP-CAJ	2.51	128.31	122.03
10	A	936[A]	DWX	BBC-CAZ-CAY	-2.26	118.40	121.56
10	A	936[B]	DWX	CAV-NAS-CAR	2.19	115.92	111.06
10	A	936[A]	DWX	CAV-NAS-CAR	2.15	115.84	111.06
10	A	936[B]	DWX	CAG-CAH-SAI	2.04	131.83	129.22

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	934	EDO	O1-C1-C2-O2
10	A	936[B]	DWX	CAA-CAF-CAG-CAH
10	A	936[B]	DWX	CAE-CAF-CAG-CAH
10	A	936[A]	DWX	CAA-CAF-CAG-CAH
10	A	936[A]	DWX	OBE-BBC-CAZ-CAY
9	A	927	EDO	O1-C1-C2-O2
9	A	935	EDO	O1-C1-C2-O2
10	A	936[A]	DWX	CAE-CAF-CAG-CAH
9	A	919	EDO	O1-C1-C2-O2

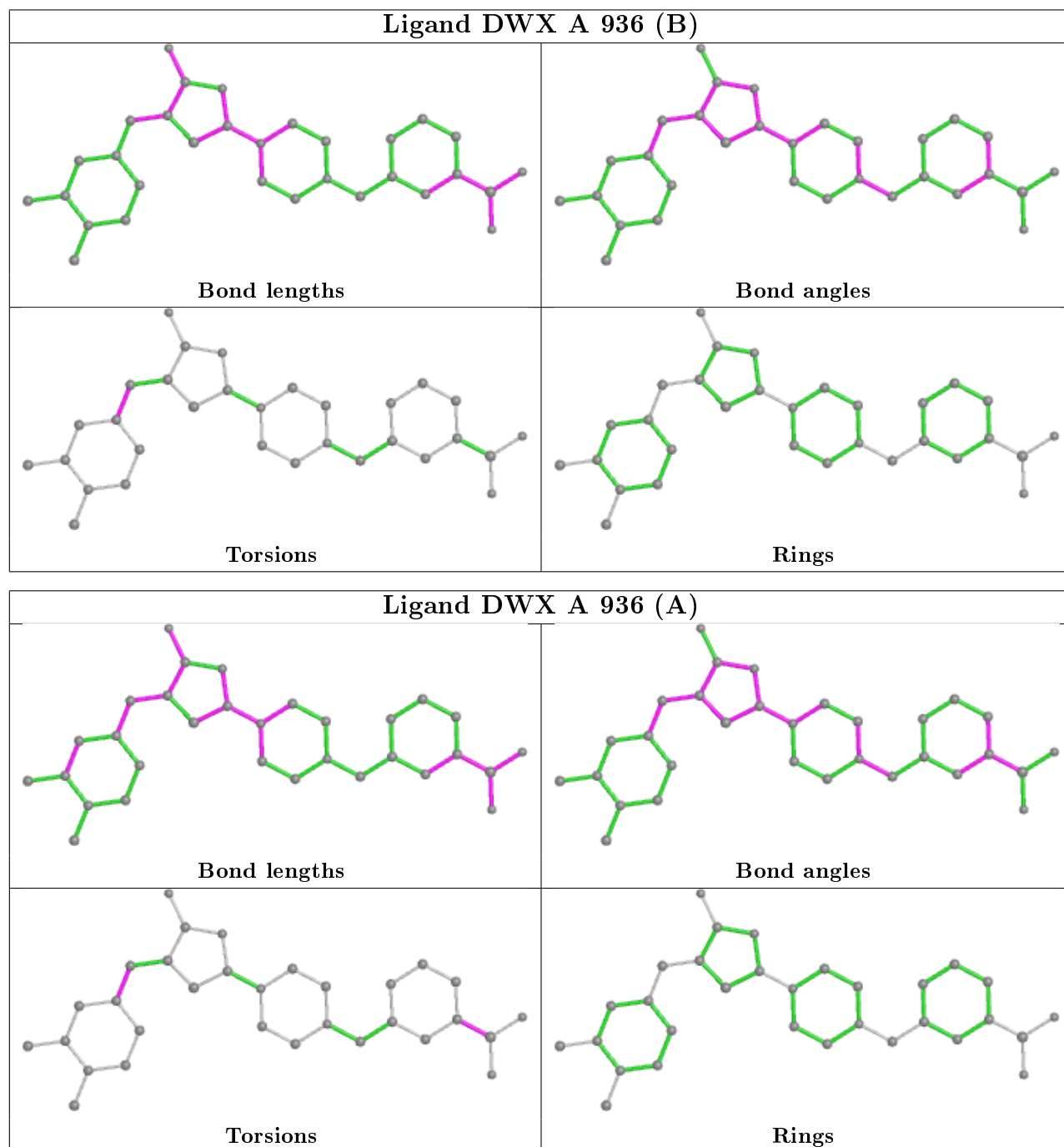
There are no ring outliers.

6 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	933	EDO	1	0
10	A	936[B]	DWX	5	0
9	A	921	EDO	3	0
9	A	924	EDO	1	0
9	A	934	EDO	2	0
10	A	936[A]	DWX	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.



## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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<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	789/831 (94%)	0.01	29 (3%) 41 44	17, 32, 61, 93	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	51	TRP	5.0
1	A	71	PRO	4.3
1	A	70	PRO	4.2
1	A	110	VAL	4.0
1	A	243	LEU	3.5
1	A	69	GLY	3.4
1	A	112	ASN	3.4
1	A	577	LEU	3.3
1	A	244	ARG	3.2
1	A	583	THR	3.2
1	A	55	SER	3.1
1	A	249	PHE	3.0
1	A	124	LEU	2.9
1	A	248	LYS	2.8
1	A	66	GLN	2.8
1	A	52	THR	2.8
1	A	640	ILE	2.7
1	A	73	CYS	2.7
1	A	125	SER	2.6
1	A	637	VAL	2.5
1	A	636	GLU	2.5
1	A	582	HIS	2.3
1	A	68	VAL	2.2
1	A	83	SER	2.2
1	A	242	HIS	2.1
1	A	158	ALA	2.1
1	A	120	SER	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	644	LEU	2.0
1	A	556	MET	2.0

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

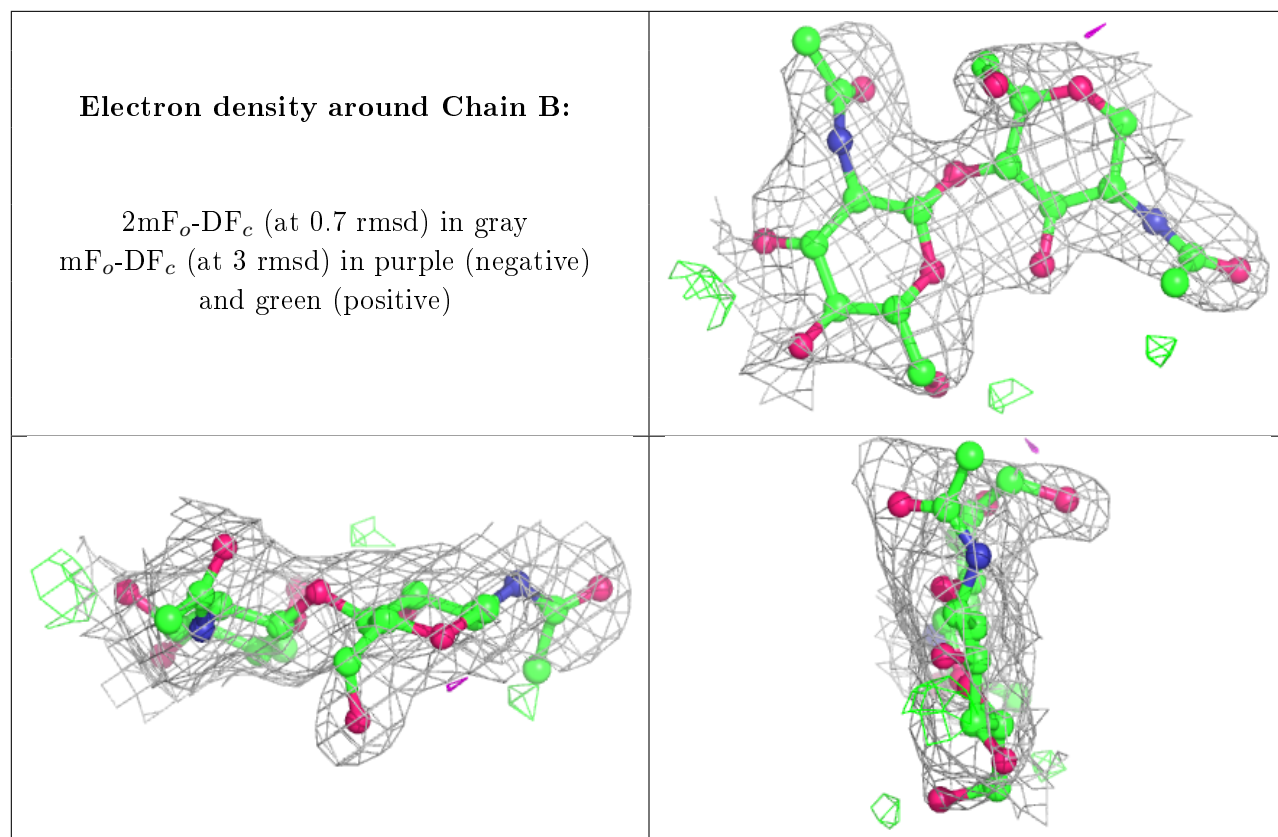
There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 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.

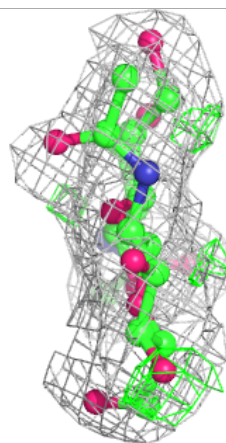
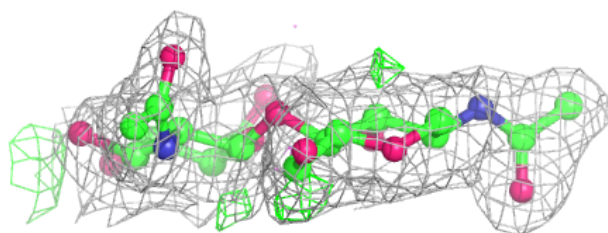
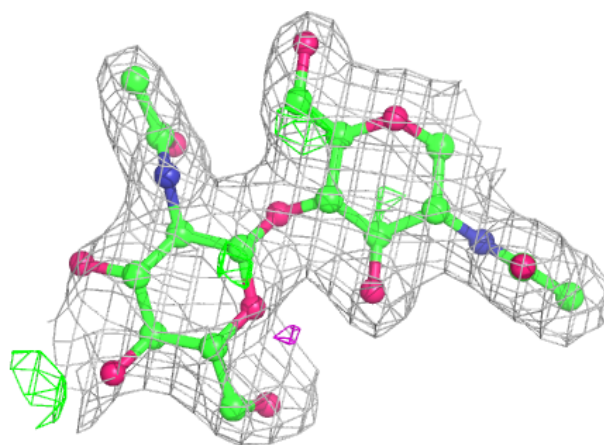
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	MAN	C	7	11/12	0.70	0.15	69,72,78,78	0
2	NAG	B	1	14/15	0.78	0.25	70,76,78,80	0
2	NAG	D	2	14/15	0.80	0.14	50,63,71,76	0
3	MAN	C	4	11/12	0.82	0.14	45,53,58,59	0
3	MAN	C	5	11/12	0.89	0.19	36,47,55,57	0
2	NAG	B	2	14/15	0.90	0.14	72,80,84,85	0
3	BMA	C	3	11/12	0.90	0.09	48,57,66,66	0
3	MAN	C	6	11/12	0.94	0.10	30,41,48,49	0
2	NAG	D	1	14/15	0.95	0.09	28,33,42,45	0
3	NAG	C	2	14/15	0.97	0.08	24,36,43,43	0
3	NAG	C	1	14/15	0.98	0.10	15,22,28,29	0

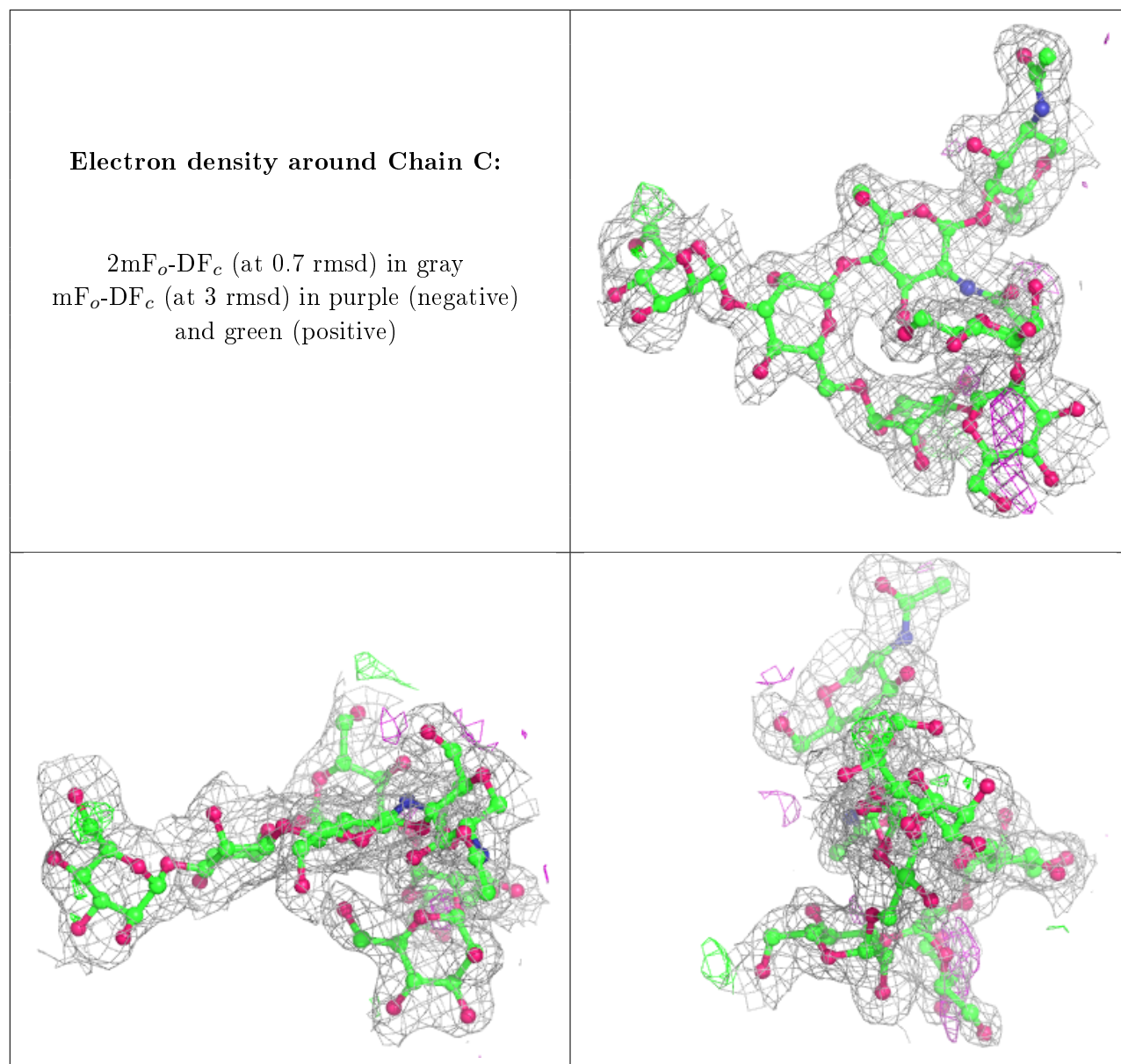
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



**Electron density around Chain D:**

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





## 6.4 Ligands 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
8	SCN	A	918	3/3	0.81	0.20	26,26,27,50	0
9	EDO	A	924	4/4	0.89	0.21	35,38,44,46	0
9	EDO	A	926	4/4	0.90	0.17	28,32,41,45	0
9	EDO	A	920	4/4	0.92	0.12	33,34,35,41	0
9	EDO	A	935	4/4	0.93	0.11	36,41,44,44	0

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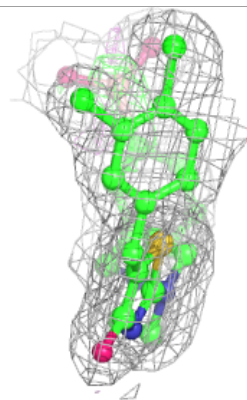
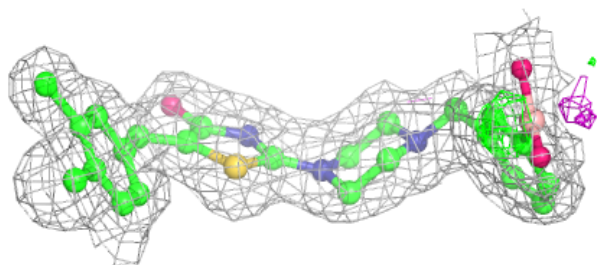
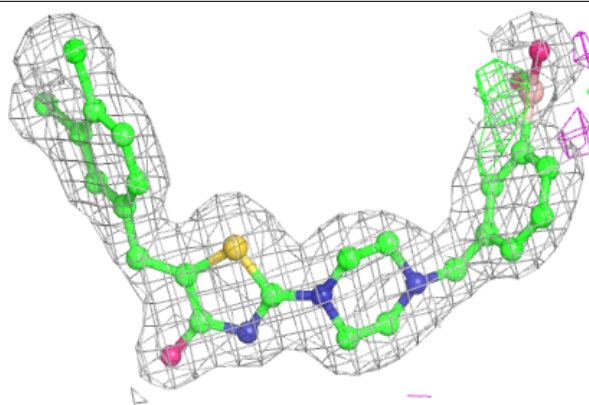
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
9	EDO	A	923	4/4	0.93	0.12	36,39,40,42	0
9	EDO	A	919	4/4	0.93	0.14	32,37,38,40	0
9	EDO	A	934	4/4	0.94	0.10	38,39,41,48	0
7	K	A	916	1/1	0.94	0.04	50,50,50,50	0
9	EDO	A	929	4/4	0.94	0.17	41,46,48,48	0
9	EDO	A	927	4/4	0.95	0.10	40,43,47,54	0
9	EDO	A	922	4/4	0.95	0.10	33,36,40,44	0
9	EDO	A	933	4/4	0.95	0.13	31,37,37,46	0
10	DWX	A	936[B]	31/31	0.95	0.14	22,26,31,43	31
9	EDO	A	921	4/4	0.95	0.16	31,32,38,47	0
10	DWX	A	936[A]	31/31	0.95	0.14	22,26,31,43	31
9	EDO	A	925	4/4	0.96	0.16	33,36,38,42	0
9	EDO	A	930	4/4	0.96	0.10	39,43,47,48	0
9	EDO	A	928	4/4	0.96	0.13	28,40,45,51	0
6	NA	A	915	1/1	0.98	0.07	26,26,26,26	0
8	SCN	A	917	3/3	0.98	0.14	38,38,56,69	0
9	EDO	A	932	4/4	0.99	0.10	23,24,28,35	0
9	EDO	A	931	4/4	0.99	0.08	23,26,28,28	0
5	CA	A	914	1/1	0.99	0.05	33,33,33,33	0
4	ZN	A	912	1/1	1.00	0.12	20,20,20,20	0
4	ZN	A	913	1/1	1.00	0.13	22,22,22,22	0

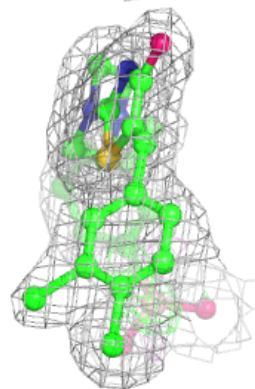
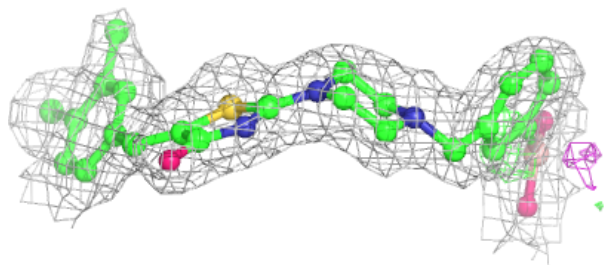
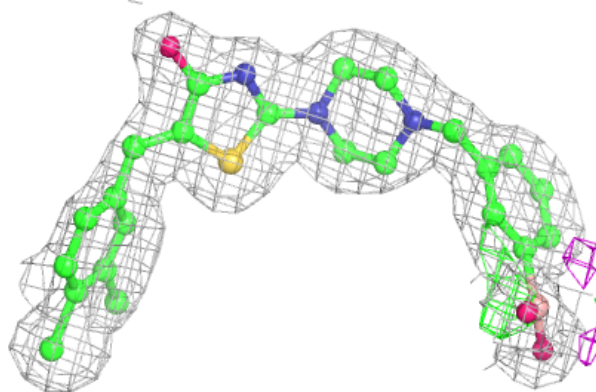
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

**Electron density around DWX A 936 (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 DWX A 936 (A):**

$2mF_o-DF_c$  (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.