Full wwPDB X-ray Structure Validation Report (i)

Feb 27, 2025 – 05:21 PM EST

PDB ID	:	9MHY
Title	:	Human TLR8 ectodomain with small molecule agonist 1
Authors	:	Critton, D.A.
Deposited on	:	2024-12-12
Resolution	:	1.66 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

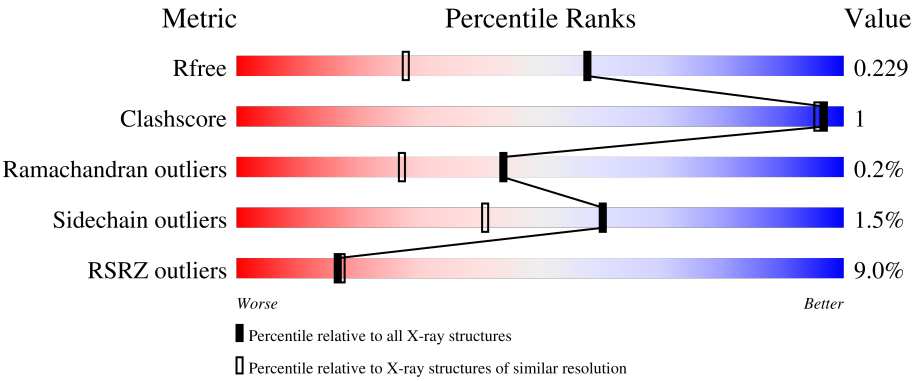
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.21
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.4

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.66 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}	164625	2328 (1.66-1.66)
Clashscore	180529	2515 (1.66-1.66)
Ramachandran outliers	177936	2475 (1.66-1.66)
Sidechain outliers	177891	2475 (1.66-1.66)
RSRZ outliers	164620	2328 (1.66-1.66)

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

Mol	Chain	Length	Quality of chain
1	A	807	9% 88% · 7%
1	B	807	8% 89% · 7%
2	C	5	40% 60%
2	F	5	40% 60%
3	D	3	67% 33%

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Mol	Chain	Length	Quality of chain
3	E	3	67% 33%
3	G	3	100%
3	H	3	100%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 26408 atoms, of which 12624 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 Toll-like receptor 8.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	747	Total	C	H	N	O	S	6036	4	0
			12078	3866	6036	1025	1131	20			
1	B	747	Total	C	H	N	O	S	6044	4	0
			12092	3868	6044	1029	1132	19			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	828	GLU	-	expression tag	UNP Q9NR97
A	829	PHE	-	expression tag	UNP Q9NR97
A	830	LEU	-	expression tag	UNP Q9NR97
A	831	VAL	-	expression tag	UNP Q9NR97
A	832	PRO	-	expression tag	UNP Q9NR97
A	833	ARG	-	expression tag	UNP Q9NR97
B	828	GLU	-	expression tag	UNP Q9NR97
B	829	PHE	-	expression tag	UNP Q9NR97
B	830	LEU	-	expression tag	UNP Q9NR97
B	831	VAL	-	expression tag	UNP Q9NR97
B	832	PRO	-	expression tag	UNP Q9NR97
B	833	ARG	-	expression tag	UNP Q9NR97

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(2-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

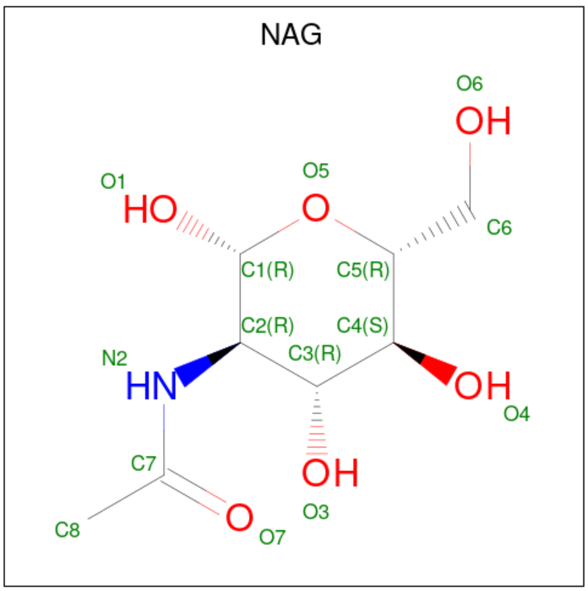
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	5	Total	C	H	N	O	52	0	0
			113	34	52	2	25			
2	F	5	Total	C	H	N	O	52	0	0
			113	34	52	2	25			

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

eta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
3	D	3	Total C H N O 73 22 34 2 15	34	0	0
3	E	3	Total C H N O 73 22 34 2 15	34	0	0
3	G	3	Total C H N O 73 22 34 2 15	34	0	0
3	H	3	Total C H N O 73 22 34 2 15	34	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0

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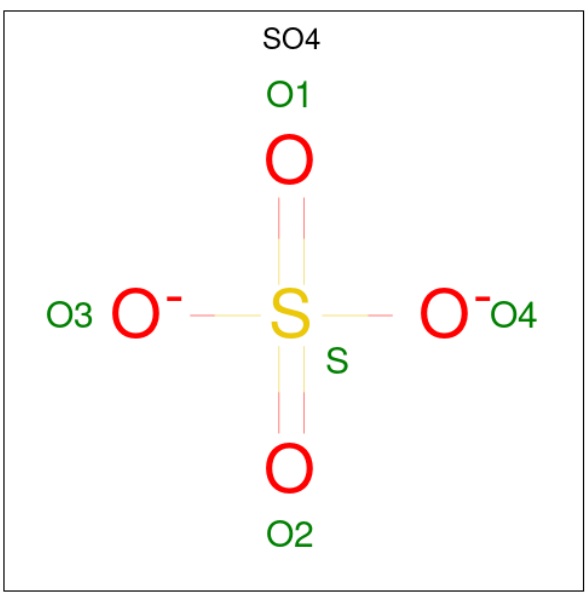
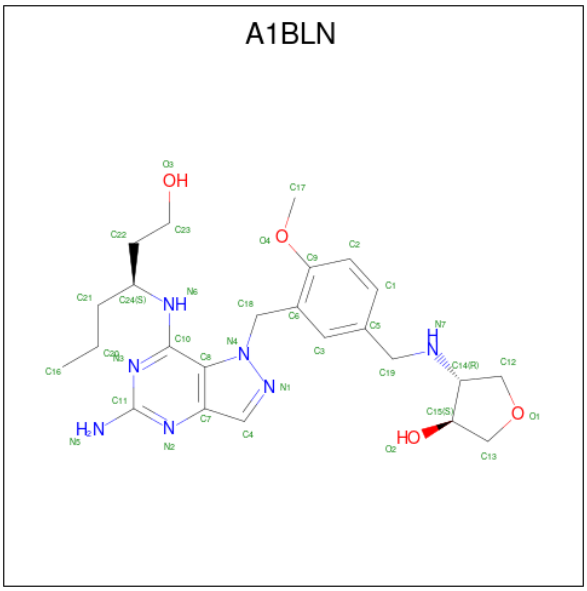
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	A	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0
4	B	1	Total C H N O 27 8 13 1 5	13	0

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



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

- Molecule 6 is (3S,4R)-4-[({3-[(5-amino-7-{[(3S)-1-hydroxyhexan-3-yl]amino}-1H-pyrazolo[4,3-d]pyrimidin-1-yl)methyl]-4-methoxyphenyl}methyl)amino]oxolan-3-ol (three-letter code: A1BLN) (formula: $C_{24}H_{35}N_7O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C H N O 70 24 35 7 4	35	0
6	B	1	Total C H N O 70 24 35 7 4	35	0

- Molecule 7 is water.

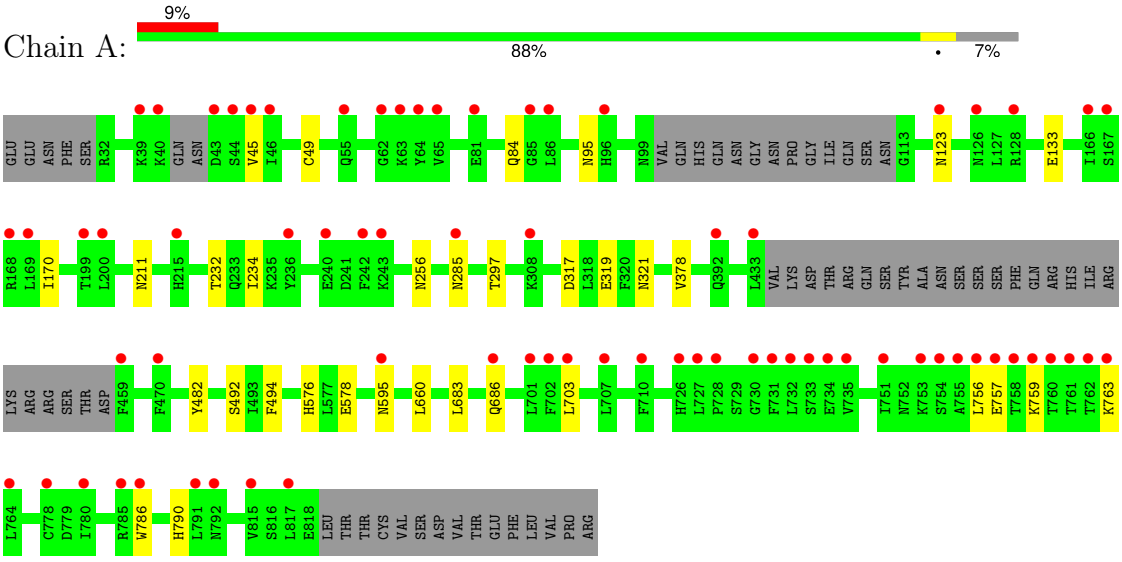
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	539	Total O 539 539	0	0
7	B	540	Total O 540 540	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

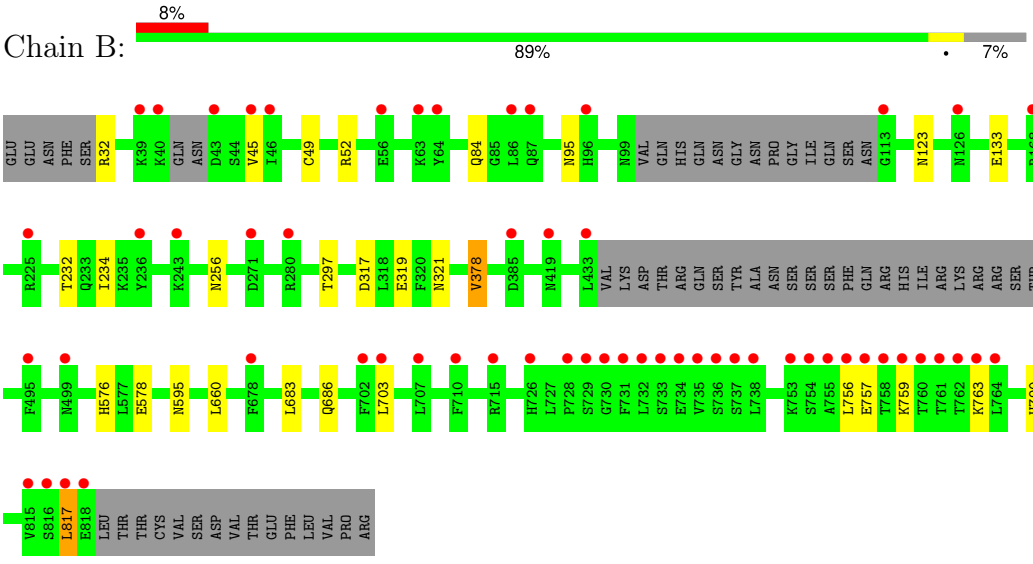
• Molecule 1: Toll-like receptor 8

Chain A:



• Molecule 1: Toll-like receptor 8

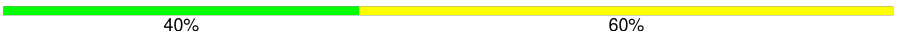
Chain B:



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

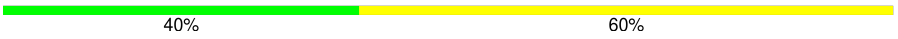
nose

Chain C:



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

Chain F:



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

Chain D:

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

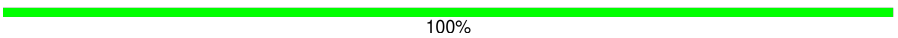
Chain E:

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

Chain G:

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

Chain H:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	72.58Å 82.41Å 83.44Å 116.05° 97.71° 98.68°	Depositor
Resolution (Å)	73.03 – 1.66 73.03 – 1.66	Depositor EDS
% Data completeness (in resolution range)	61.3 (73.03-1.66) 61.3 (73.03-1.66)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.60 (at 1.66Å)	Xtriage
Refinement program	BUSTER 2.11.7 (20-MAY-2020)	Depositor
R, R_{free}	0.201 , 0.223 0.204 , 0.229	Depositor DCC
R_{free} test set	82701 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	25.7	Xtriage
Anisotropy	0.028	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 36.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.001 for -h,-l,-k	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	26408	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.95% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BMA, NAG, SO4, MAN, A1BLN

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	0.41	0/6170	0.60	0/8364
1	B	0.41	0/6176	0.60	0/8372
All	All	0.41	0/12346	0.60	0/16736

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

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	6042	6036	6021	12	1
1	B	6048	6044	6029	11	0
2	C	61	52	52	0	0
2	F	61	52	52	0	0
3	D	39	34	34	0	0
3	E	39	34	34	0	0
3	G	39	34	34	0	0
3	H	39	34	34	0	0
4	A	126	117	117	0	0
4	B	126	117	117	0	1
5	A	10	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	5	0	0	0	0
6	A	35	35	0	1	0
6	B	35	35	0	0	0
7	A	539	0	0	1	0
7	B	540	0	0	0	0
All	All	13784	12624	12524	23	1

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 1.

All (23) 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:95:ASN:ND2	1:B:133:GLU:H	2.02	0.58
1:A:95:ASN:ND2	1:A:133:GLU:H	2.03	0.55
1:B:576:HIS:HB3	1:B:578:GLU:OE1	2.09	0.53
1:A:576:HIS:HB3	1:A:578:GLU:OE1	2.08	0.52
1:A:211:ASN:O	1:A:232:THR:HA	2.11	0.51
1:B:211:ASN:O	1:B:232:THR:HA	2.11	0.51
1:B:757:GLU:OE2	1:B:790:HIS:HE1	1.94	0.50
1:A:757:GLU:OE2	1:A:790:HIS:HE1	1.94	0.49
1:B:317:ASP:OD1	1:B:319:GLU:HG3	2.16	0.46
1:A:756:LEU:HB3	1:A:786:TRP:NE1	2.32	0.45
1:A:317:ASP:OD1	1:A:319:GLU:HG3	2.16	0.45
1:A:285:ASN:HB2	7:A:1006:HOH:O	2.17	0.45
1:A:660:LEU:HD21	1:A:683:LEU:HD22	1.99	0.45
1:B:660:LEU:HD21	1:B:683:LEU:HD22	1.99	0.45
1:B:234:ILE:O	1:B:256:ASN:HB3	2.18	0.43
1:A:492:SER:HB3	1:A:494[B]:PHE:CZ	2.53	0.43
1:A:660:LEU:HD22	1:A:686:GLN:HG3	2.00	0.43
1:B:52:ARG:HG2	1:B:799:VAL:HG21	2.01	0.43
1:A:297:THR:H	1:A:321:ASN:HD21	1.67	0.42
1:B:297:THR:H	1:B:321:ASN:HD21	1.67	0.42
1:A:234:ILE:O	1:A:256:ASN:HB3	2.18	0.42
1:B:660:LEU:HD22	1:B:686:GLN:HG3	2.01	0.42
6:A:912:A1BLN:O4	1:B:378:VAL:HG11	2.22	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:482:TYR:O	4:B:904:NAG:HO4[1_455]	1.34	0.26

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	743/807 (92%)	703 (95%)	39 (5%)	1 (0%)	48	30
1	B	743/807 (92%)	702 (94%)	39 (5%)	2 (0%)	37	21
All	All	1486/1614 (92%)	1405 (94%)	78 (5%)	3 (0%)	44	27

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	378	VAL
1	B	378	VAL
1	B	817	LEU

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	696/751 (93%)	687 (99%)	9 (1%)	65	47
1	B	697/751 (93%)	685 (98%)	12 (2%)	56	35
All	All	1393/1502 (93%)	1372 (98%)	21 (2%)	60	41

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	45	VAL
1	A	49	CYS
1	A	84	GLN
1	A	123	ASN
1	A	170	ILE
1	A	595	ASN
1	A	703	LEU
1	A	759	LYS
1	A	763	LYS
1	B	32	ARG
1	B	45	VAL
1	B	49	CYS
1	B	84	GLN
1	B	123	ASN
1	B	170	ILE
1	B	595	ASN
1	B	703	LEU
1	B	756	LEU
1	B	759	LYS
1	B	763	LYS
1	B	817	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	95	ASN
1	A	97	ASN
1	A	126	ASN
1	A	288	GLN
1	A	321	ASN
1	A	595	ASN
1	A	661	ASN
1	B	95	ASN
1	B	97	ASN
1	B	126	ASN
1	B	202	ASN
1	B	321	ASN
1	B	661	ASN
1	B	770	HIS

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)

22 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	2,1	14,14,15	0.33	0	17,19,21	0.76	1 (5%)
2	NAG	C	2	2	14,14,15	0.29	0	17,19,21	0.70	1 (5%)
2	BMA	C	3	2	11,11,12	0.25	0	15,15,17	0.41	0
2	MAN	C	4	2	11,11,12	0.24	0	15,15,17	0.74	1 (6%)
2	MAN	C	5	2	11,11,12	0.27	0	13,15,17	0.47	0
3	NAG	D	1	3,1	14,14,15	0.27	0	17,19,21	0.75	1 (5%)
3	NAG	D	2	3	14,14,15	0.31	0	17,19,21	0.55	0
3	BMA	D	3	3	11,11,12	0.25	0	15,15,17	0.34	0
3	NAG	E	1	3,1	14,14,15	0.42	0	17,19,21	0.85	1 (5%)
3	NAG	E	2	3	14,14,15	0.26	0	17,19,21	0.38	0
3	BMA	E	3	3	11,11,12	0.22	0	15,15,17	0.38	0
2	NAG	F	1	2,1	14,14,15	0.32	0	17,19,21	0.75	1 (5%)
2	NAG	F	2	2	14,14,15	0.30	0	17,19,21	0.66	1 (5%)
2	BMA	F	3	2	11,11,12	0.28	0	15,15,17	0.40	0
2	MAN	F	4	2	11,11,12	0.20	0	15,15,17	0.73	1 (6%)
2	MAN	F	5	2	11,11,12	0.23	0	13,15,17	0.48	0
3	NAG	G	1	3,1	14,14,15	0.33	0	17,19,21	0.71	0
3	NAG	G	2	3	14,14,15	0.32	0	17,19,21	0.56	0
3	BMA	G	3	3	11,11,12	0.25	0	15,15,17	0.34	0
3	NAG	H	1	3,1	14,14,15	0.44	0	17,19,21	0.54	0
3	NAG	H	2	3	14,14,15	0.26	0	17,19,21	0.39	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
3	BMA	H	3	3	11,11,12	0.23	0	15,15,17	0.40	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
2	NAG	C	1	2,1	-	0/6/23/26	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
2	MAN	C	4	2	-	0/2/19/22	0/1/1/1
2	MAN	C	5	2	-	0/2/18/22	0/1/1/1
3	NAG	D	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	0/6/23/26	0/1/1/1
3	BMA	D	3	3	-	0/2/19/22	0/1/1/1
3	NAG	E	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	E	2	3	-	0/6/23/26	0/1/1/1
3	BMA	E	3	3	-	0/2/19/22	0/1/1/1
2	NAG	F	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	F	2	2	-	0/6/23/26	0/1/1/1
2	BMA	F	3	2	-	0/2/19/22	0/1/1/1
2	MAN	F	4	2	-	0/2/19/22	0/1/1/1
2	MAN	F	5	2	-	0/2/18/22	0/1/1/1
3	NAG	G	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1
3	BMA	G	3	3	-	0/2/19/22	0/1/1/1
3	NAG	H	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	H	2	3	-	0/6/23/26	0/1/1/1
3	BMA	H	3	3	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	4	MAN	C1-O5-C5	2.55	115.60	112.19
2	C	2	NAG	O5-C1-C2	-2.51	107.41	111.29
2	F	4	MAN	C1-O5-C5	2.50	115.54	112.19
2	F	2	NAG	O5-C1-C2	-2.36	107.64	111.29
3	D	1	NAG	O5-C1-C2	-2.05	108.13	111.29
3	E	1	NAG	C1-C2-N2	-2.01	107.27	110.43
2	F	1	NAG	O5-C1-C2	-2.00	108.19	111.29

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	1	NAG	O5-C1-C2	-2.00	108.19	111.29

There are no chirality outliers.

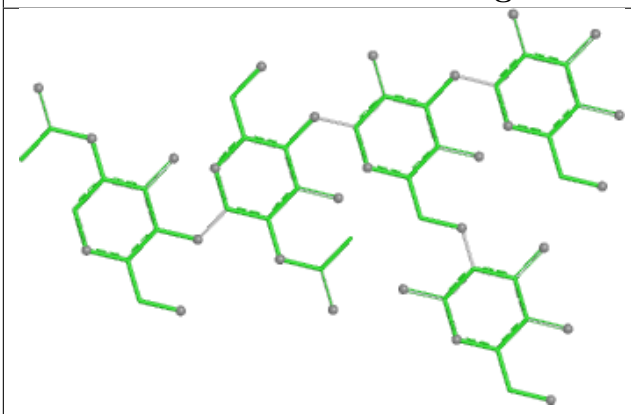
There are no torsion outliers.

There are no ring outliers.

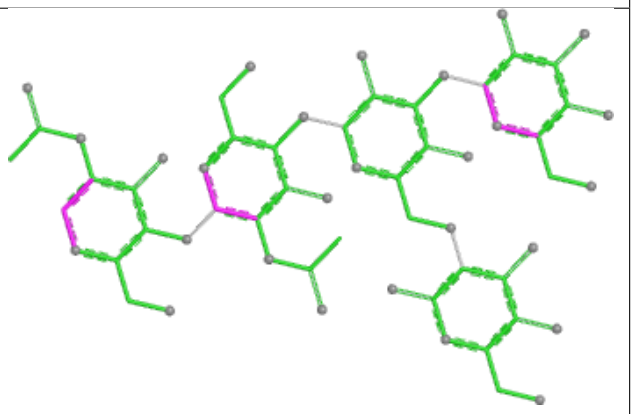
No monomer is involved in short contacts.

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

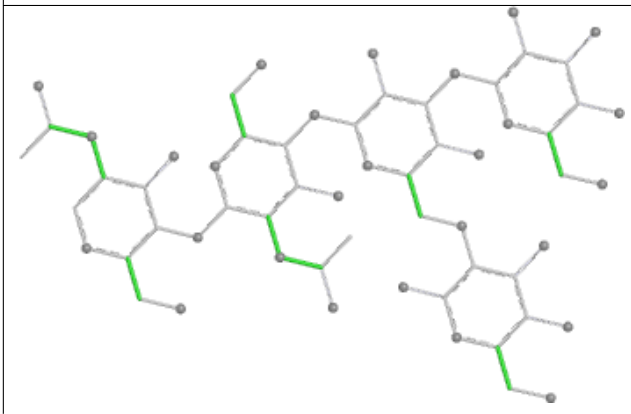
Oligosaccharide Chain C



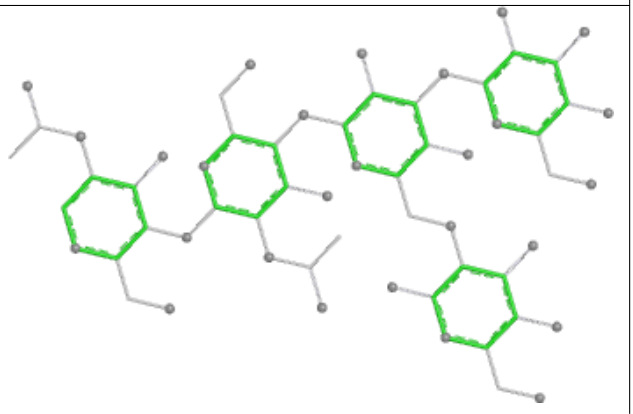
Bond lengths



Bond angles

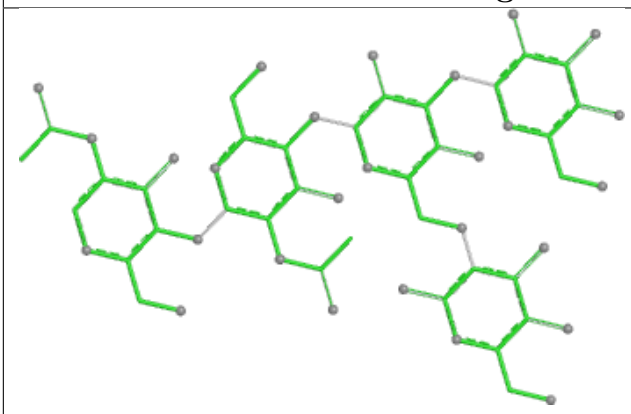


Torsions

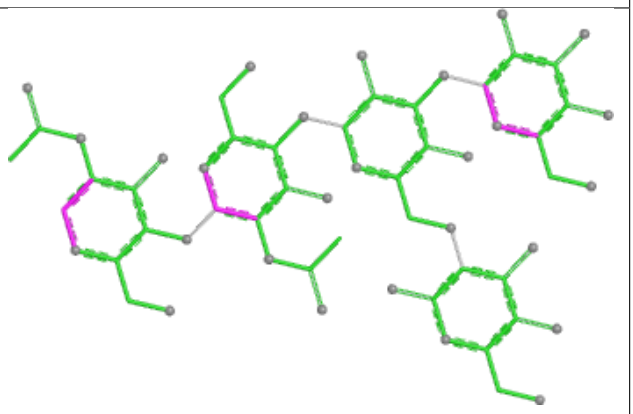


Rings

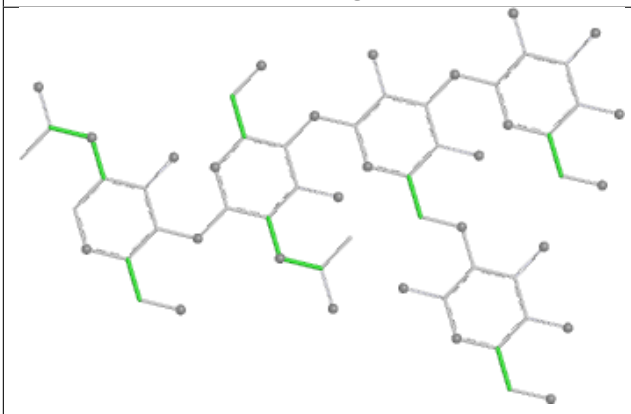
Oligosaccharide Chain F



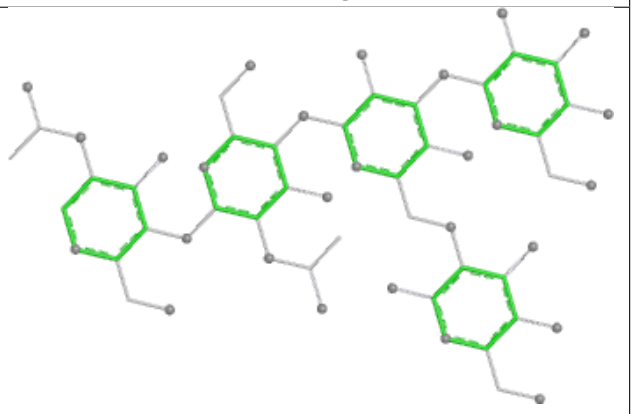
Bond lengths



Bond angles

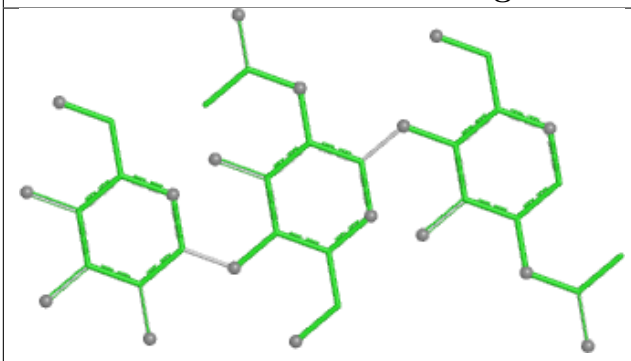


Torsions

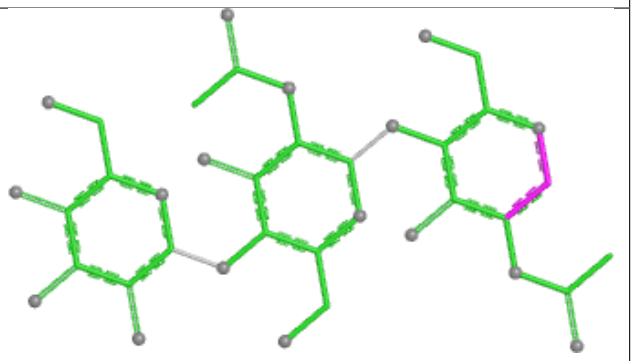


Rings

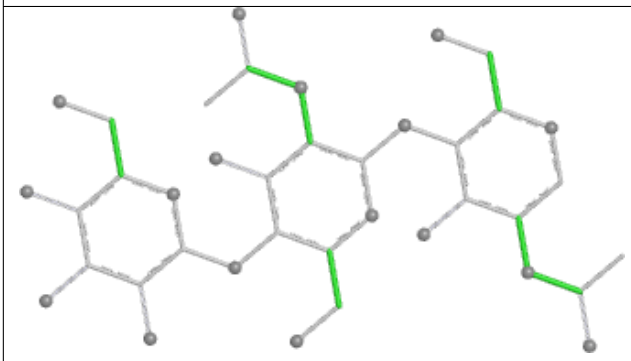
Oligosaccharide Chain D



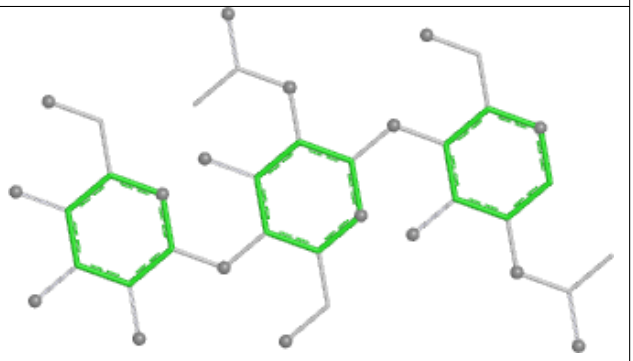
Bond lengths



Bond angles

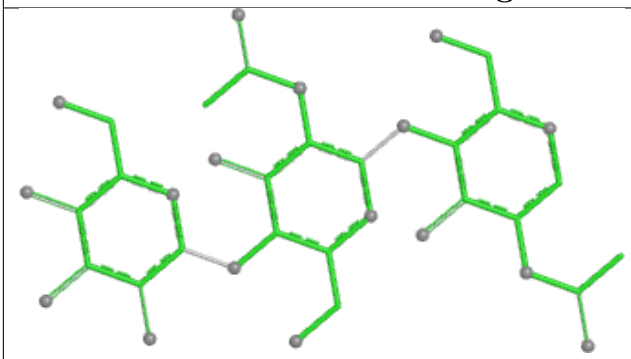


Torsions

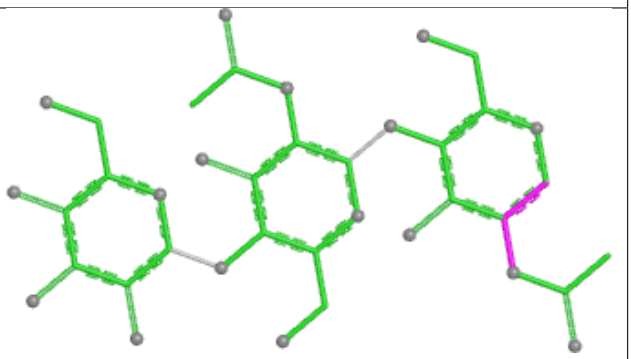


Rings

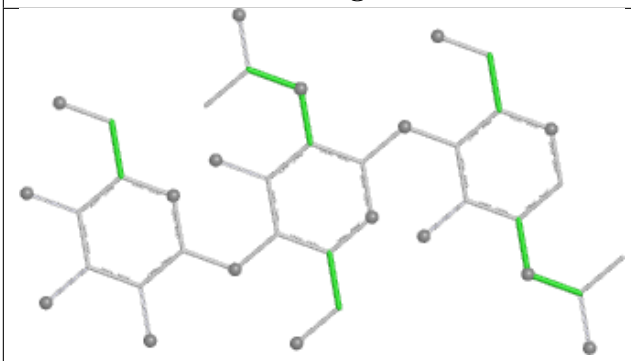
Oligosaccharide Chain E



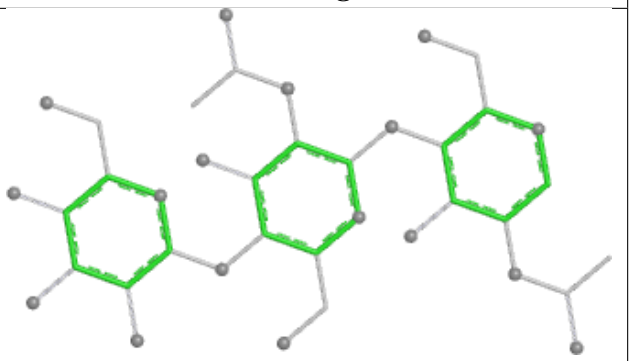
Bond lengths



Bond angles

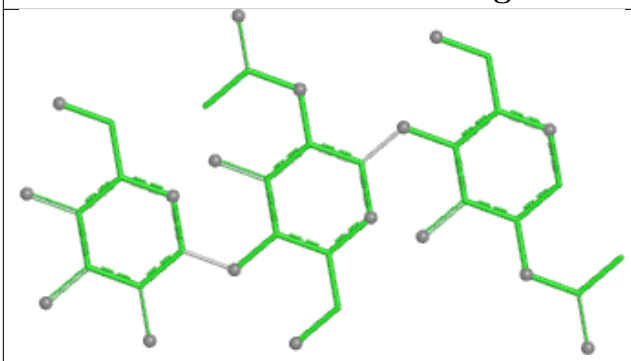


Torsions

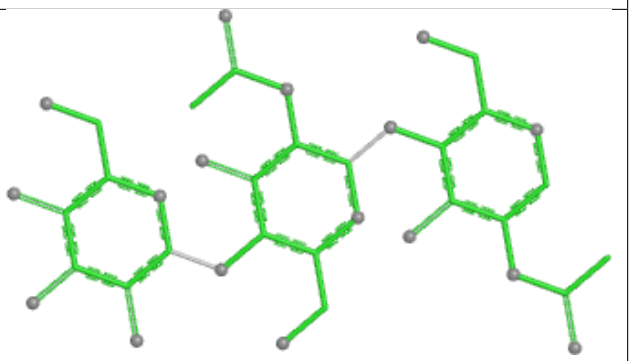


Rings

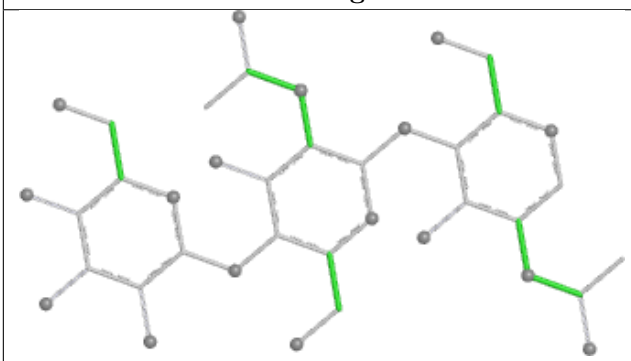
Oligosaccharide Chain G



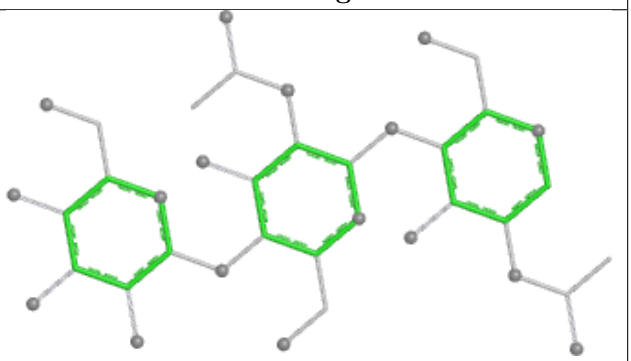
Bond lengths



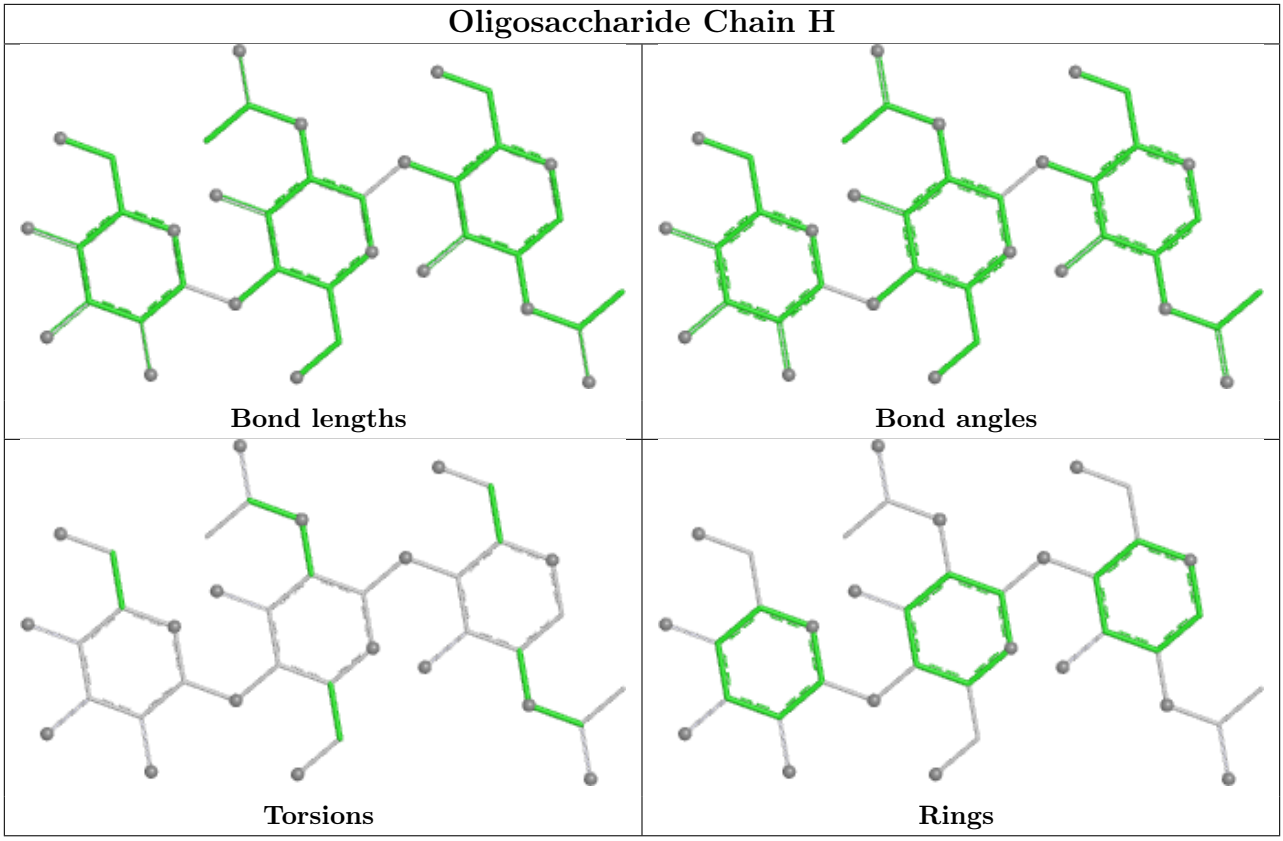
Bond angles



Torsions



Rings



5.6 Ligand geometry (i)

23 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	NAG	B	909	1	14,14,15	0.26	0	17,19,21	0.73	1 (5%)
4	NAG	A	908	1	14,14,15	0.33	0	17,19,21	0.67	0
4	NAG	A	903	1	14,14,15	0.29	0	17,19,21	0.94	1 (5%)
4	NAG	B	904	1	14,14,15	0.29	0	17,19,21	0.56	0
4	NAG	A	905	1	14,14,15	0.31	0	17,19,21	0.58	0
4	NAG	B	902	1	14,14,15	0.30	0	17,19,21	0.82	1 (5%)
6	A1BLN	B	911	-	33,38,38	0.65	1 (3%)	41,52,52	0.80	1 (2%)
5	SO4	A	910	-	4,4,4	0.25	0	6,6,6	0.08	0
4	NAG	A	901	1	14,14,15	0.28	0	17,19,21	0.66	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
4	NAG	B	903	1	14,14,15	0.29	0	17,19,21	0.95	1 (5%)
4	NAG	B	906	1	14,14,15	0.30	0	17,19,21	0.54	0
4	NAG	A	902	1	14,14,15	0.32	0	17,19,21	0.81	1 (5%)
4	NAG	A	907	1	14,14,15	0.30	0	17,19,21	0.90	1 (5%)
5	SO4	B	910	-	4,4,4	0.24	0	6,6,6	0.27	0
6	A1BLN	A	912	-	33,38,38	0.88	2 (6%)	41,52,52	0.77	1 (2%)
4	NAG	B	908	1	14,14,15	0.33	0	17,19,21	0.71	0
4	NAG	B	901	1	14,14,15	0.29	0	17,19,21	0.66	0
5	SO4	A	911	-	4,4,4	0.50	0	6,6,6	0.35	0
4	NAG	B	907	1	14,14,15	0.30	0	17,19,21	0.90	1 (5%)
4	NAG	A	904	1	14,14,15	0.28	0	17,19,21	0.50	0
4	NAG	A	906	1	14,14,15	0.30	0	17,19,21	0.54	0
4	NAG	A	909	1	14,14,15	0.26	0	17,19,21	0.73	1 (5%)
4	NAG	B	905	1	14,14,15	0.32	0	17,19,21	0.59	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
4	NAG	B	909	1	-	0/6/23/26	0/1/1/1
4	NAG	A	908	1	-	0/6/23/26	0/1/1/1
4	NAG	A	903	1	-	0/6/23/26	0/1/1/1
4	NAG	B	904	1	-	0/6/23/26	0/1/1/1
4	NAG	A	905	1	-	0/6/23/26	0/1/1/1
4	NAG	B	902	1	-	0/6/23/26	0/1/1/1
6	A1BLN	B	911	-	-	2/21/31/31	0/4/4/4
4	NAG	A	901	1	-	0/6/23/26	0/1/1/1
4	NAG	B	903	1	-	0/6/23/26	0/1/1/1
4	NAG	B	906	1	-	0/6/23/26	0/1/1/1
4	NAG	A	902	1	-	0/6/23/26	0/1/1/1
4	NAG	A	907	1	-	0/6/23/26	0/1/1/1
6	A1BLN	A	912	-	-	2/21/31/31	0/4/4/4
4	NAG	B	908	1	-	0/6/23/26	0/1/1/1
4	NAG	B	901	1	-	0/6/23/26	0/1/1/1
4	NAG	B	907	1	-	0/6/23/26	0/1/1/1
4	NAG	A	904	1	-	0/6/23/26	0/1/1/1
4	NAG	A	906	1	-	0/6/23/26	0/1/1/1
4	NAG	A	909	1	-	0/6/23/26	0/1/1/1
4	NAG	B	905	1	-	0/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	912	A1BLN	C15-C14	3.86	1.57	1.54
6	A	912	A1BLN	C4-C7	2.22	1.46	1.40
6	B	911	A1BLN	C15-C14	2.10	1.56	1.54

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	903	NAG	O5-C1-C2	-3.55	105.80	111.29
4	B	903	NAG	O5-C1-C2	-3.54	105.82	111.29
4	B	902	NAG	O5-C1-C2	-2.80	106.96	111.29
4	A	902	NAG	O5-C1-C2	-2.71	107.10	111.29
4	A	907	NAG	O5-C1-C2	-2.47	107.48	111.29
4	B	907	NAG	O5-C1-C2	-2.33	107.69	111.29
4	A	909	NAG	O5-C1-C2	-2.07	108.09	111.29
6	B	911	A1BLN	C11-N3-C10	2.02	119.39	114.59
4	B	909	NAG	O5-C1-C2	-2.02	108.17	111.29
6	A	912	A1BLN	C7-C4-N1	2.00	111.70	107.53

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	911	A1BLN	C5-C19-N7-C14
6	A	912	A1BLN	C5-C19-N7-C14
6	A	912	A1BLN	N4-C18-C6-C9
6	B	911	A1BLN	N4-C18-C6-C9

There are no ring outliers.

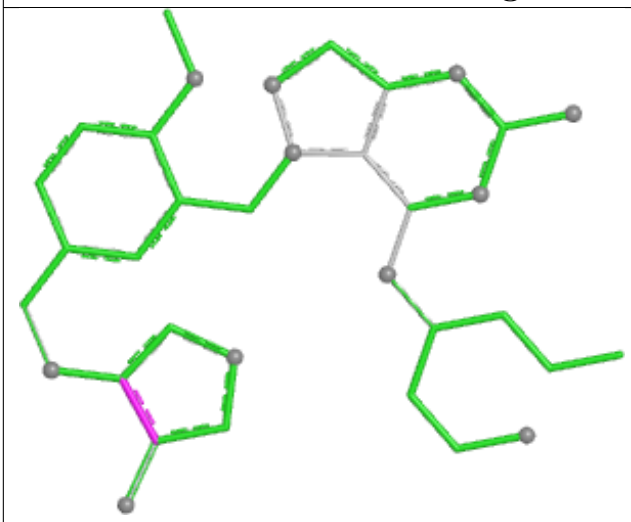
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	904	NAG	0	1
6	A	912	A1BLN	1	0

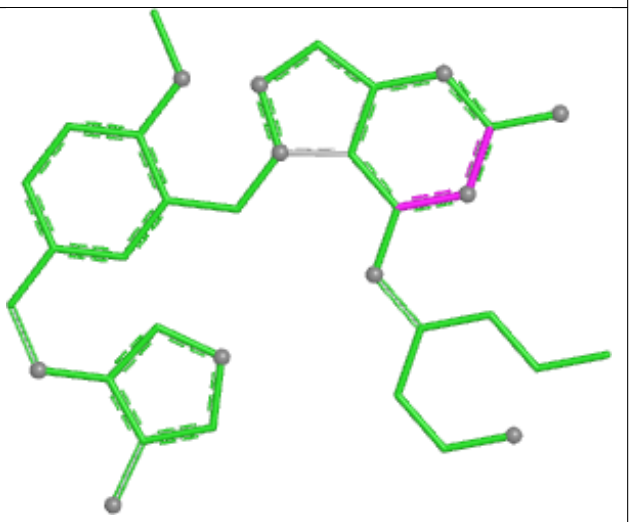
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be

highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

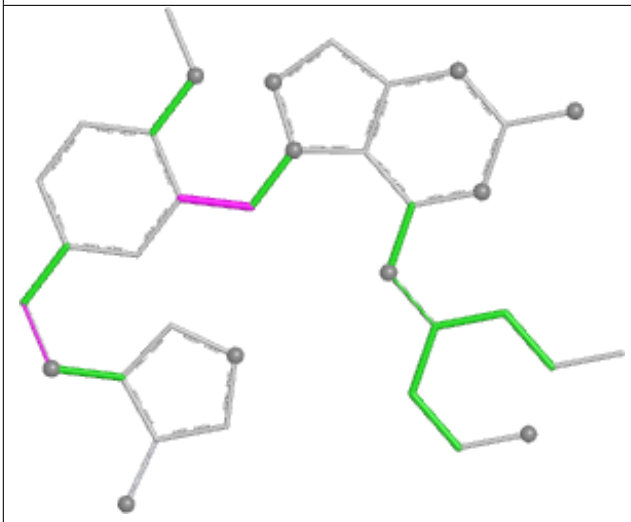
Ligand A1BLN B 911



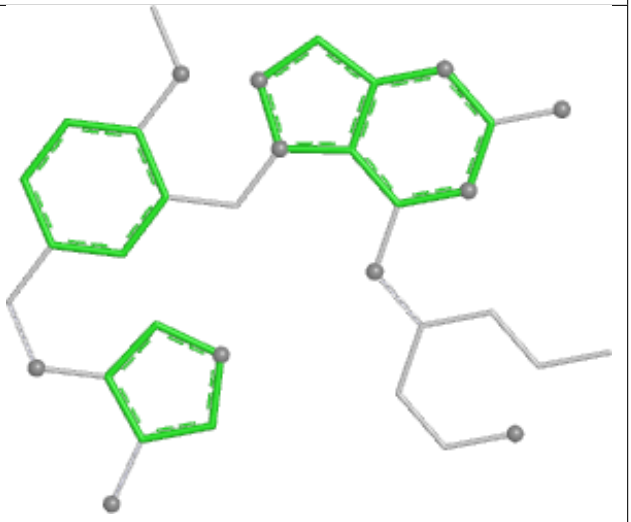
Bond lengths



Bond angles

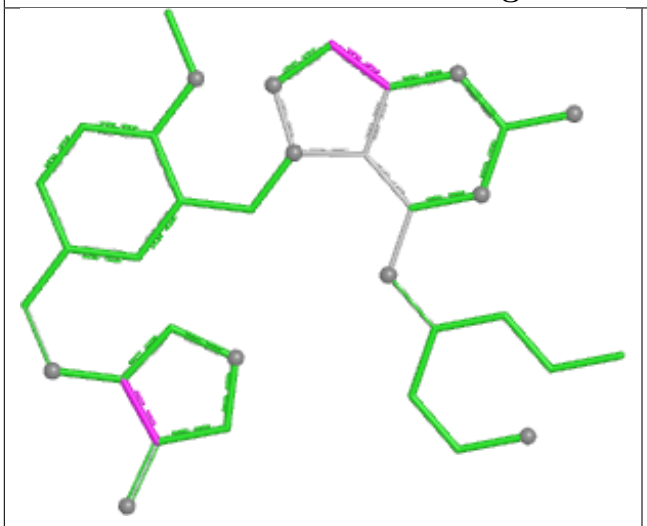


Torsions

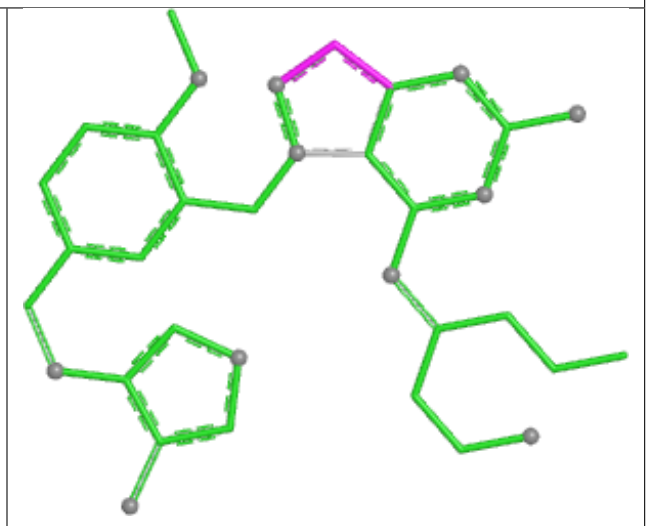


Rings

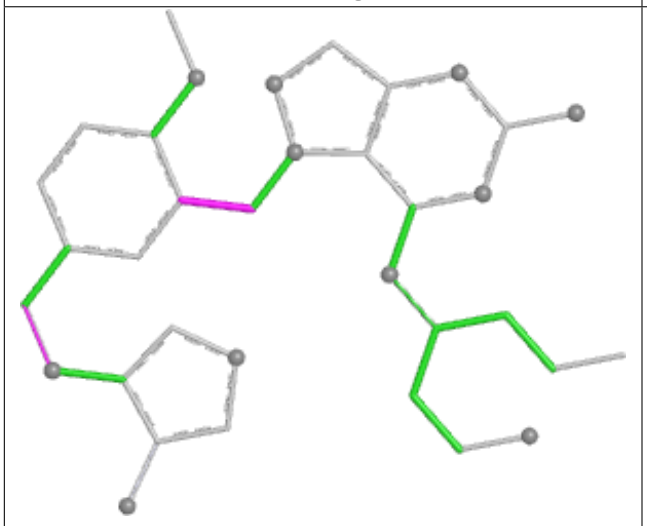
Ligand A1BLN A 912



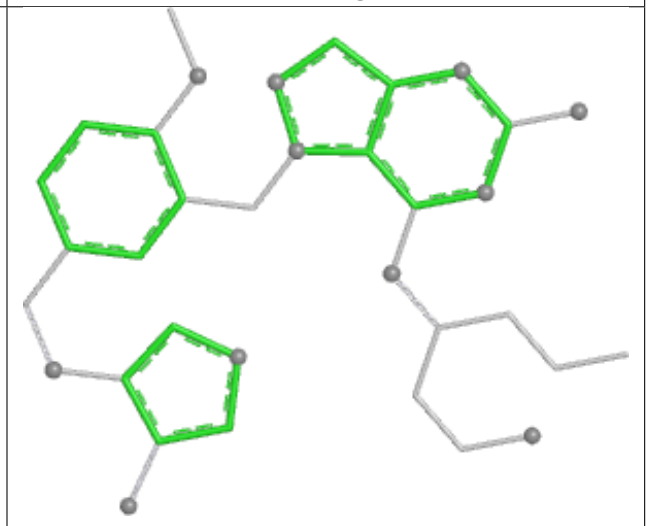
Bond lengths



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

6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	747/807 (92%)	0.53	72 (9%)	15	16	6, 15, 29, 51	4 (0%)
1	B	747/807 (92%)	0.54	62 (8%)	19	20	6, 15, 28, 49	4 (0%)
All	All	1494/1614 (92%)	0.54	134 (8%)	17	17	6, 15, 29, 51	8 (0%)

All (134) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	732	LEU	11.9
1	A	732	LEU	8.3
1	B	733	SER	7.6
1	B	735	VAL	7.5
1	B	731	PHE	7.2
1	A	756	LEU	7.0
1	A	735	VAL	7.0
1	B	756	LEU	6.6
1	A	459	PHE	6.2
1	B	817	LEU	6.2
1	B	758	THR	6.0
1	B	761	THR	5.5
1	B	762	THR	5.4
1	A	731	PHE	5.3
1	B	433	LEU	5.2
1	B	64	TYR	5.1
1	A	702	PHE	5.0
1	B	730	GLY	4.9
1	B	459	PHE	4.9
1	A	762	THR	4.9
1	A	761	THR	4.7
1	A	758	THR	4.6
1	A	243	LYS	4.4
1	A	792	ASN	4.4

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Mol	Chain	Res	Type	RSRZ
1	B	737	SER	4.3
1	A	730	GLY	4.3
1	A	734	GLU	4.2
1	B	470	PHE	4.2
1	B	702	PHE	4.0
1	B	736	SER	4.0
1	A	733	SER	4.0
1	A	703	LEU	3.9
1	A	126	ASN	3.7
1	A	753	LYS	3.7
1	B	45	VAL	3.7
1	A	285	ASN	3.6
1	A	200	LEU	3.6
1	B	168	ARG	3.6
1	B	755	ALA	3.5
1	A	64	TYR	3.5
1	A	433	LEU	3.5
1	B	764	LEU	3.5
1	B	56	GLU	3.5
1	B	726	HIS	3.5
1	A	780	ILE	3.3
1	A	755	ALA	3.3
1	B	815	VAL	3.2
1	B	759	LYS	3.2
1	A	701	LEU	3.2
1	B	703	LEU	3.2
1	A	215	HIS	3.2
1	A	392	GLN	3.1
1	A	63	LYS	3.1
1	B	734	GLU	3.1
1	B	738	LEU	3.0
1	B	43	ASP	3.0
1	B	763	LYS	3.0
1	B	40	LYS	3.0
1	A	707	LEU	2.9
1	A	817	LEU	2.9
1	B	760	THR	2.9
1	B	707	LEU	2.9
1	A	754	SER	2.9
1	B	126	ASN	2.9
1	A	726	HIS	2.9
1	A	39	LYS	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	243	LYS	2.9
1	B	816	SER	2.8
1	B	818	GLU	2.8
1	A	763	LYS	2.8
1	B	39	LYS	2.8
1	A	785	ARG	2.8
1	A	236	TYR	2.8
1	B	792	ASN	2.8
1	B	63	LYS	2.8
1	A	169	LEU	2.7
1	B	757	GLU	2.7
1	A	710	PHE	2.7
1	A	764	LEU	2.7
1	A	791	LEU	2.7
1	A	46	ILE	2.7
1	A	43	ASP	2.7
1	B	280	ARG	2.7
1	B	236	TYR	2.6
1	B	419	ASN	2.6
1	A	727	LEU	2.6
1	A	96	HIS	2.5
1	A	240	GLU	2.5
1	B	385	ASP	2.5
1	A	470	PHE	2.5
1	B	678	PHE	2.5
1	A	308	LYS	2.5
1	A	85	GLY	2.5
1	B	710	PHE	2.4
1	B	46	ILE	2.4
1	A	81	GLU	2.4
1	B	499	ASN	2.4
1	A	86	LEU	2.4
1	A	815	VAL	2.4
1	B	86	LEU	2.4
1	B	271	ASP	2.4
1	A	168	ARG	2.3
1	A	728	PRO	2.3
1	A	45	VAL	2.3
1	A	123	ASN	2.3
1	B	225	ARG	2.3
1	A	757	GLU	2.3
1	A	760	THR	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	495	PHE	2.3
1	B	753	LYS	2.3
1	B	113	GLY	2.3
1	B	96	HIS	2.3
1	A	65	VAL	2.3
1	A	167	SER	2.3
1	A	786	TRP	2.2
1	A	128	ARG	2.2
1	A	62	GLY	2.2
1	B	170	ILE	2.2
1	B	728	PRO	2.2
1	A	40	LYS	2.2
1	A	199	THR	2.2
1	B	715	ARG	2.2
1	B	754	SER	2.1
1	A	759	LYS	2.1
1	A	55	GLN	2.1
1	A	686	GLN	2.1
1	A	595	ASN	2.1
1	A	166	ILE	2.1
1	A	751	ILE	2.1
1	B	87	GLN	2.1
1	A	242	PHE	2.0
1	A	778	CYS	2.0
1	A	44	SER	2.0
1	B	729	SER	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^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	BMA	G	3	11/12	0.51	0.17	49,53,58,59	10
3	BMA	D	3	11/12	0.58	0.17	49,52,57,58	10

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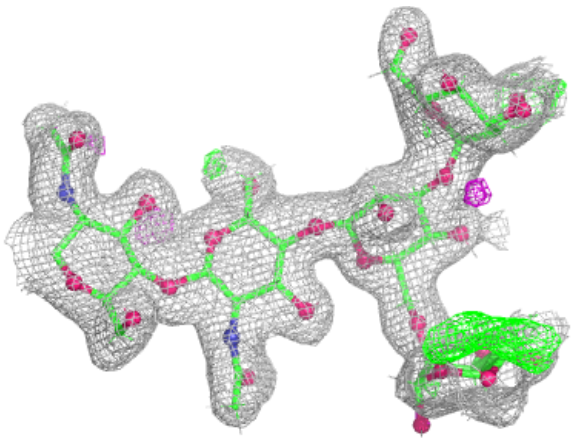
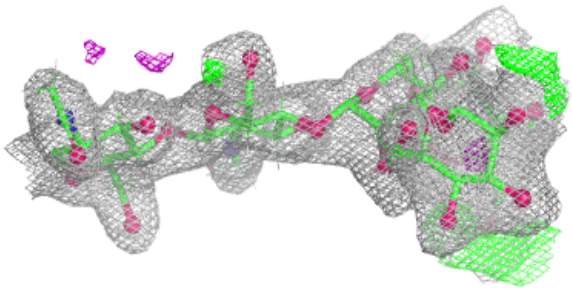
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	MAN	C	5	11/12	0.65	0.16	48,51,61,61	10
2	MAN	F	5	11/12	0.75	0.14	49,53,62,63	10
3	NAG	D	2	14/15	0.77	0.14	36,42,46,47	12
3	BMA	H	3	11/12	0.78	0.13	38,43,49,50	10
3	NAG	G	2	14/15	0.82	0.12	36,42,46,47	12
3	BMA	E	3	11/12	0.87	0.11	37,41,47,47	10
2	MAN	F	4	11/12	0.89	0.09	37,39,43,44	10
2	MAN	C	4	11/12	0.90	0.10	38,40,45,46	10
2	BMA	C	3	11/12	0.91	0.09	36,40,50,50	8
3	NAG	E	2	14/15	0.91	0.09	25,28,32,33	12
2	BMA	F	3	11/12	0.92	0.09	35,39,50,50	8
2	NAG	F	2	14/15	0.93	0.08	25,29,35,36	12
2	NAG	C	1	14/15	0.95	0.06	20,22,26,26	12
3	NAG	H	2	14/15	0.95	0.08	25,29,34,35	12
2	NAG	C	2	14/15	0.95	0.07	24,29,34,35	12
3	NAG	H	1	14/15	0.96	0.06	21,22,23,24	12
3	NAG	D	1	14/15	0.96	0.08	21,23,26,31	12
3	NAG	G	1	14/15	0.96	0.07	23,25,27,31	12
2	NAG	F	1	14/15	0.97	0.05	21,23,27,28	12
3	NAG	E	1	14/15	0.97	0.05	19,20,22,23	12

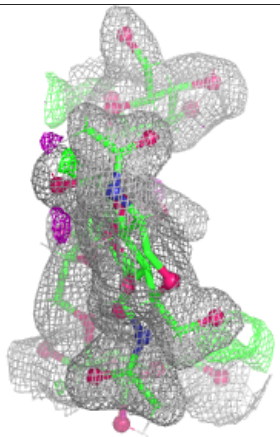
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

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)

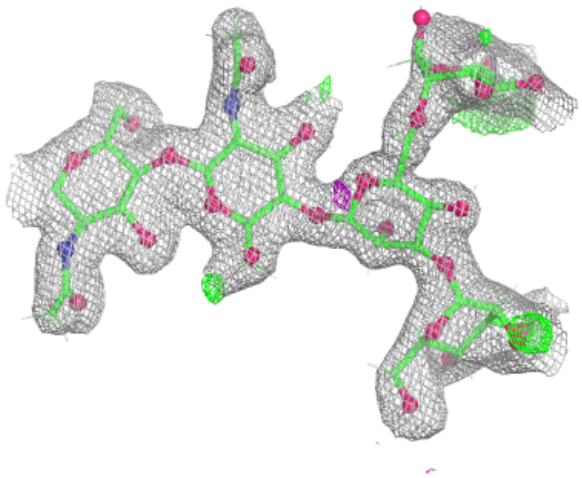


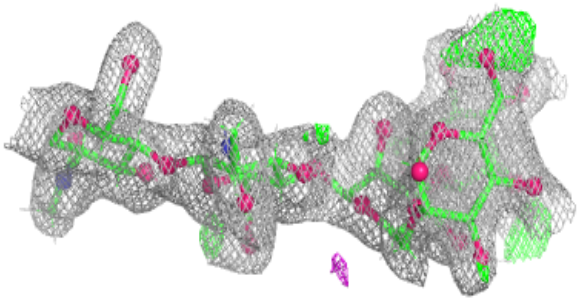


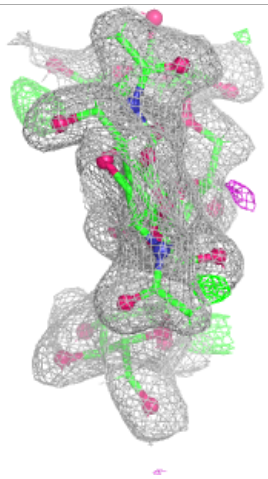


Electron density around Chain F:

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

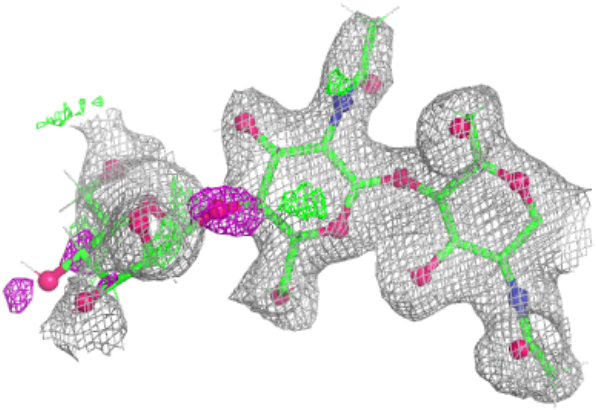


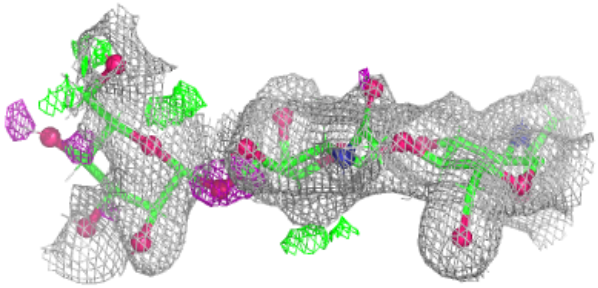


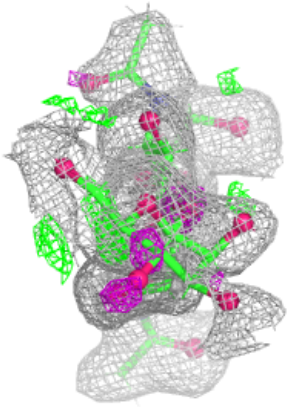


Electron density around Chain D:

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

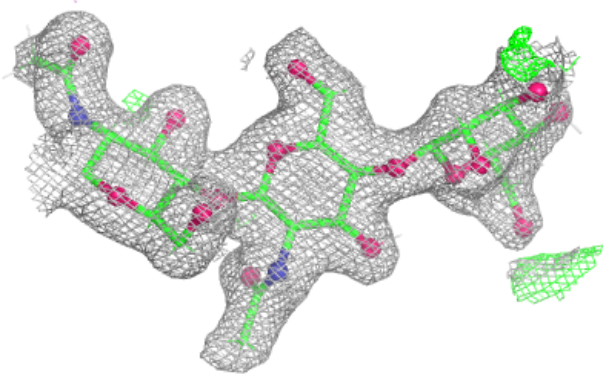


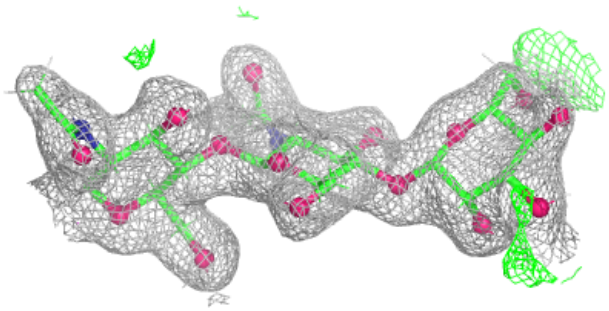


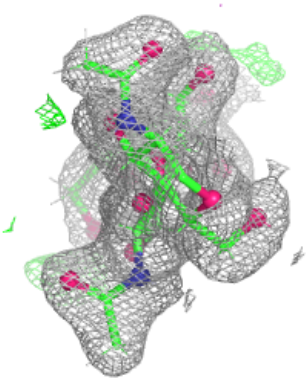


Electron density around Chain E:

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

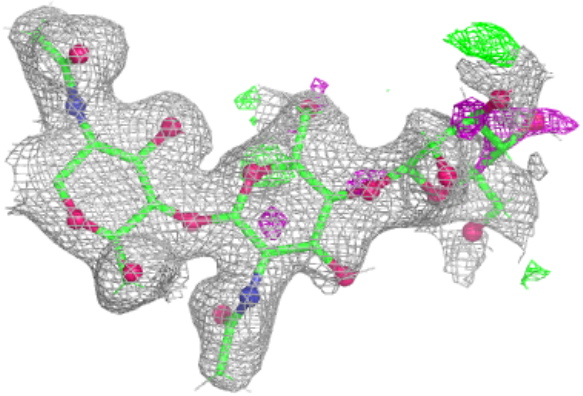


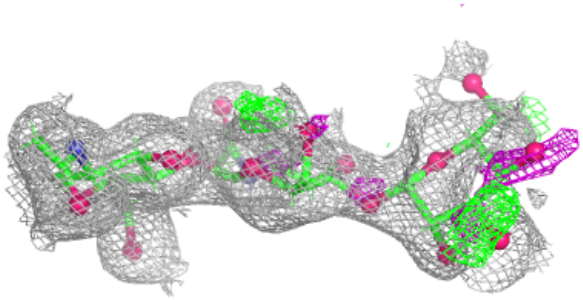


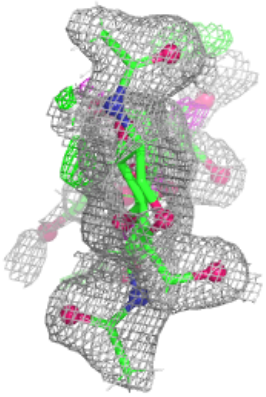


Electron density around Chain G:

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

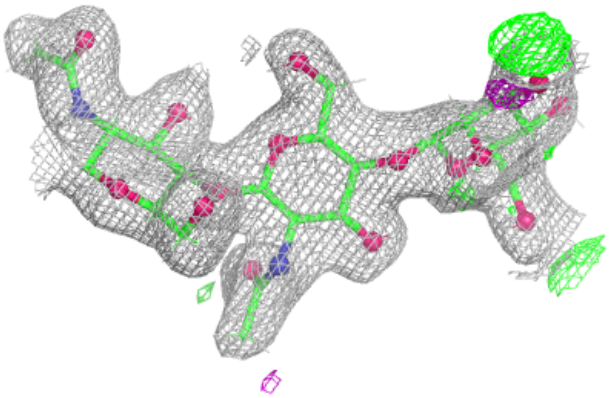


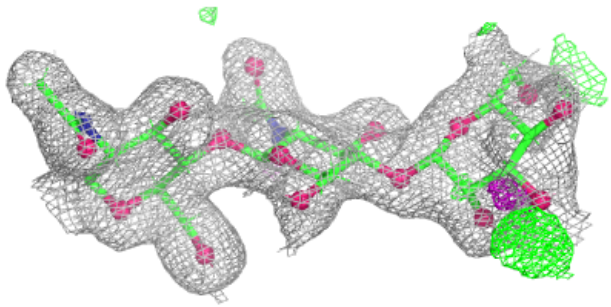


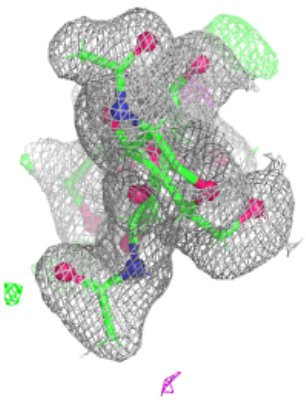


Electron density around Chain H:

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







6.4 Ligands (i)

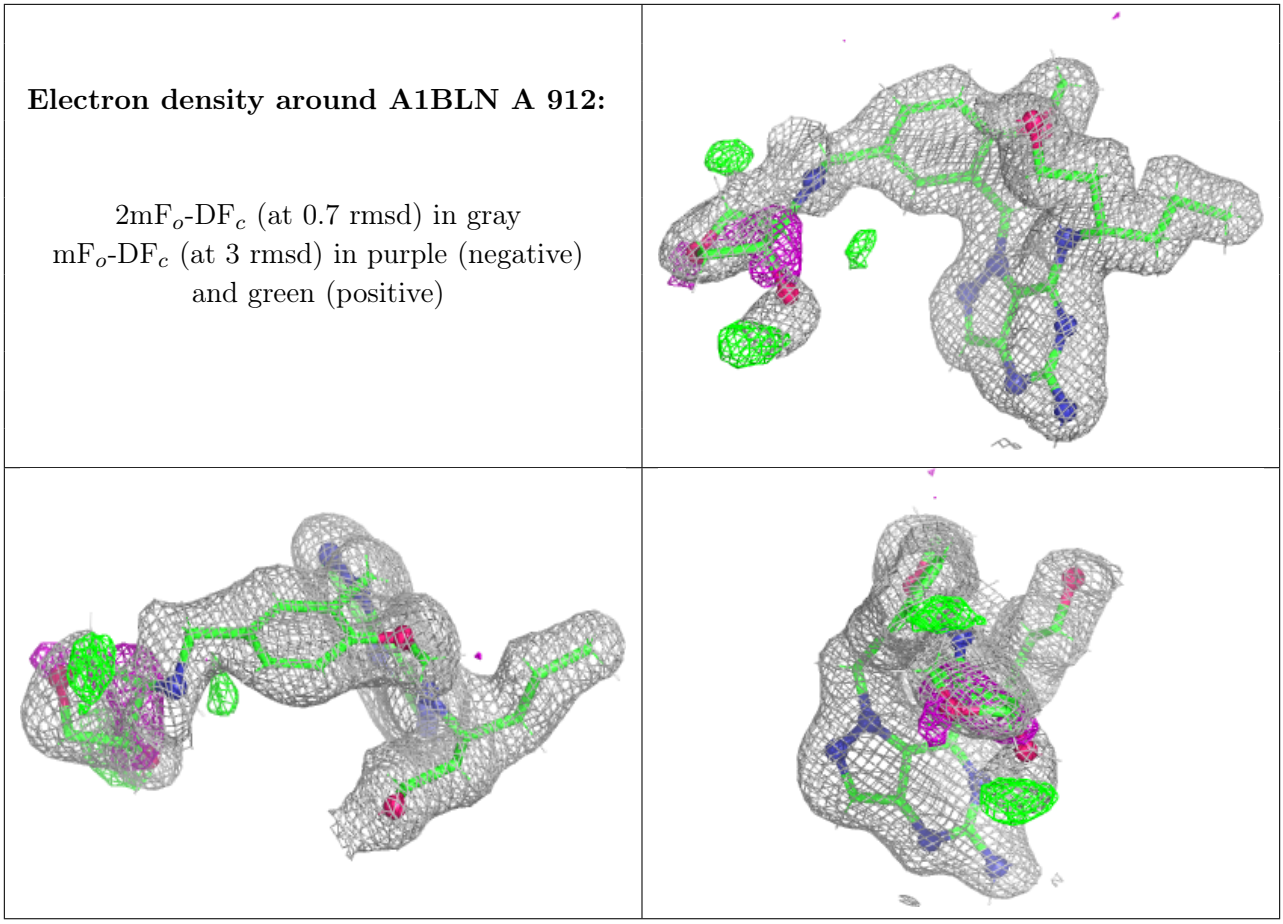
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	NAG	A	905	14/15	0.52	0.17	61,62,82,82	13
4	NAG	B	905	14/15	0.56	0.19	60,62,83,83	13
4	NAG	B	903	14/15	0.64	0.17	48,49,65,65	13
4	NAG	B	902	14/15	0.65	0.17	60,63,83,84	13
5	SO4	A	910	5/5	0.66	0.16	99,99,99,99	0
4	NAG	A	901	14/15	0.70	0.15	62,64,92,93	13
4	NAG	B	907	14/15	0.71	0.14	49,52,67,68	13
4	NAG	B	901	14/15	0.77	0.14	55,56,79,80	13
4	NAG	A	907	14/15	0.77	0.13	45,48,60,61	13
4	NAG	B	906	14/15	0.80	0.13	43,46,59,59	13
4	NAG	A	906	14/15	0.82	0.13	38,42,53,53	13
4	NAG	A	903	14/15	0.83	0.12	45,47,64,65	13
4	NAG	B	909	14/15	0.86	0.11	42,45,62,63	13
4	NAG	B	904	14/15	0.86	0.10	37,40,51,52	13
4	NAG	A	909	14/15	0.88	0.10	37,41,55,56	13
4	NAG	A	908	14/15	0.88	0.09	27,31,40,41	13
4	NAG	A	902	14/15	0.89	0.11	36,39,59,60	13
4	NAG	B	908	14/15	0.89	0.10	33,36,48,48	13
4	NAG	A	904	14/15	0.90	0.09	33,35,46,47	13
5	SO4	A	911	5/5	0.91	0.10	41,41,42,42	0
6	A1BLN	A	912	35/35	0.91	0.09	19,26,47,48	35
5	SO4	B	910	5/5	0.92	0.09	41,41,42,42	0
6	A1BLN	B	911	35/35	0.93	0.09	18,27,48,48	35

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.

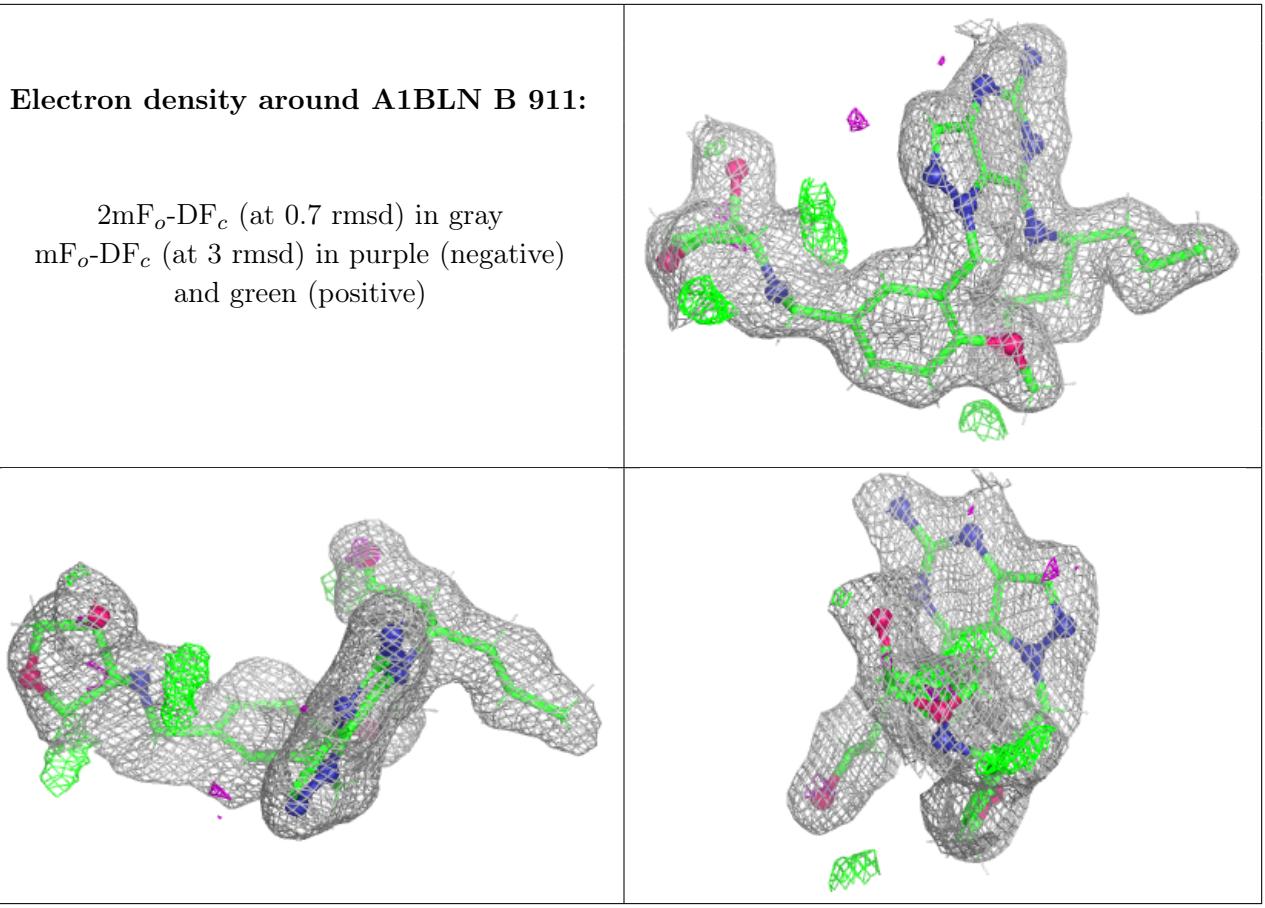
Electron density around A1BLN A 912:

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



Electron density around A1BLN B 911:

$2mF_o$-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.