Full wwPDB X-ray Structure Validation Report ⓘ

Sep 8, 2025 – 02:30 pm BST

PDB ID	:	9GPF / pdb_00009gpf
Title	:	ManDH5 E303Q in complex with mannopentaose after co-crystalliztion with mannopentaose at 1.6 angstroms resolution a beta-D-Mannanase of GH5 family from Dictyoglomus thermophilium
Authors	:	Sivron, Y.; Romano, A.; Shoham, Y.; Shoham, G.
Deposited on	:	2024-09-07
Resolution	:	1.60 Å(reported)

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

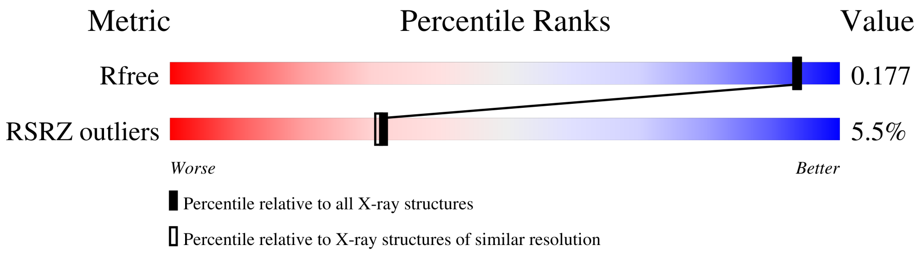
MolProbity	:	FAILED
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.45.1

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 1.60 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	4274 (1.60-1.60)
RSRZ outliers	164620	4272 (1.60-1.60)

MolProbity failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5425 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.

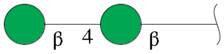
- Molecule 1 is a protein called DUF5060 domain-containing protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	563	4755	3129	766	851	9	0	2	0

There is a discrepancy between the modelled and reference sequences:

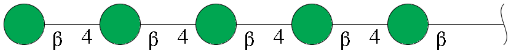
Chain	Residue	Modelled	Actual	Comment	Reference
A	303	GLN	GLU	engineered mutation	UNP A0A7C3MIF0

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



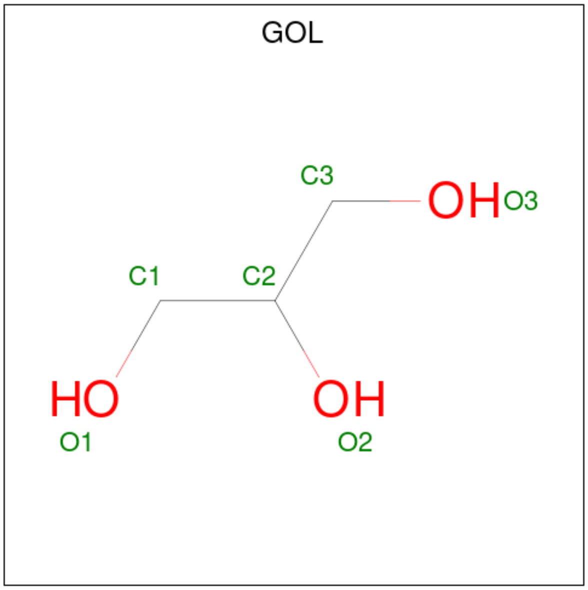
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
			Total	C	O			
2	B	2	23	12	11	0	0	0

- Molecule 3 is an oligosaccharide called beta-D-mannopyranose-(1-4)-beta-D-mannopyranose-(1-4)-beta-D-mannopyranose-(1-4)-beta-D-mannopyranose-(1-4)-beta-D-mannopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
			Total	C	O			
3	C	5	56	30	26	0	0	0

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0
4	A	1	Total C O 6 3 3	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	573	Total O 573 573	0	0

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3 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	94.57Å 98.90Å 153.25Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	76.62 – 1.60 76.62 – 1.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (76.62-1.60) 99.9 (76.62-1.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	5.19 (at 1.60Å)	Xtriage
Refinement program	PHENIX 1.14_3228	Depositor
R, R_{free}	0.159 , 0.174 0.162 , 0.177	Depositor DCC
R_{free} test set	4844 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	14.6	Xtriage
Anisotropy	0.747	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 42.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.014 for k,h,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	5425	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.67% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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.

4 Model quality (i)

4.1 Standard geometry (i)

MolProbity failed to run properly - this section is therefore empty.

4.2 Too-close contacts (i)

MolProbity failed to run properly - this section is therefore empty.

4.3 Torsion angles (i)

4.3.1 Protein backbone (i)

MolProbity failed to run properly - this section is therefore empty.

4.3.2 Protein sidechains (i)

MolProbity failed to run properly - this section is therefore empty.

4.3.3 RNA (i)

MolProbity failed to run properly - this section is therefore empty.

4.4 Non-standard residues in protein, DNA, RNA chains (i)

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

4.5 Carbohydrates (i)

7 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	BMA	B	1	2	12,12,12	0.48	0	17,17,17	0.68	0
2	BMA	B	2	2	11,11,12	0.26	0	15,15,17	0.66	0
3	BMA	C	1	3	12,12,12	0.42	0	17,17,17	0.89	0
3	BMA	C	2	3	11,11,12	0.34	0	15,15,17	1.13	2 (13%)
3	BMA	C	3	3	11,11,12	0.45	0	15,15,17	0.98	1 (6%)
3	BMA	C	4	3	11,11,12	0.45	0	15,15,17	0.87	0
3	BMA	C	5	3	11,11,12	0.24	0	15,15,17	0.98	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	BMA	B	1	2	-	0/2/22/22	0/1/1/1
2	BMA	B	2	2	-	0/2/19/22	0/1/1/1
3	BMA	C	1	3	-	0/2/22/22	0/1/1/1
3	BMA	C	2	3	-	0/2/19/22	0/1/1/1
3	BMA	C	3	3	-	0/2/19/22	1/1/1/1
3	BMA	C	4	3	-	0/2/19/22	0/1/1/1
3	BMA	C	5	3	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	3	BMA	C1-O5-C5	2.81	115.99	112.19
3	C	2	BMA	O4-C4-C5	2.49	115.48	109.30
3	C	2	BMA	O4-C4-C3	-2.15	105.38	110.35

There are no chirality outliers.

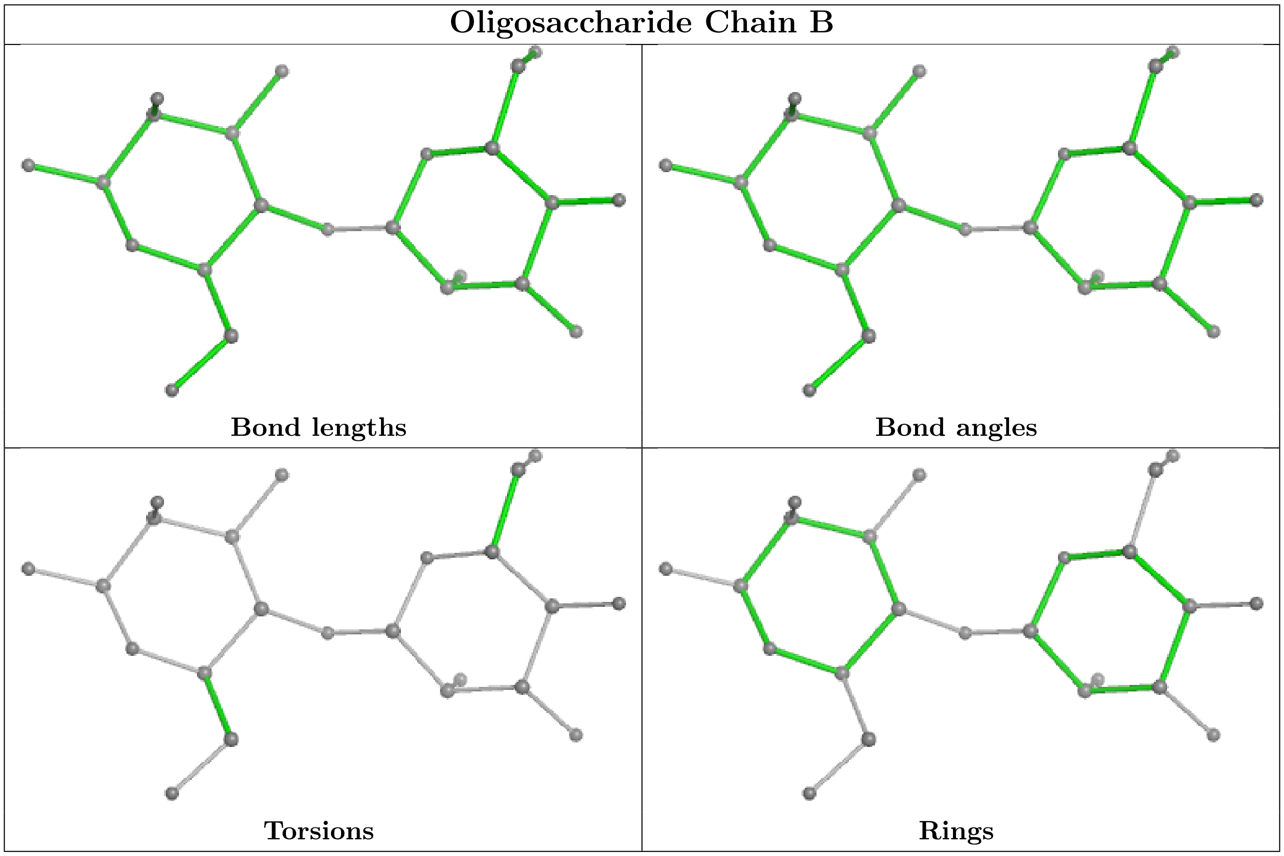
There are no torsion outliers.

All (1) ring outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	3	BMA	C1-C2-C3-C4-C5-O5

No monomer is involved in short contacts.

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



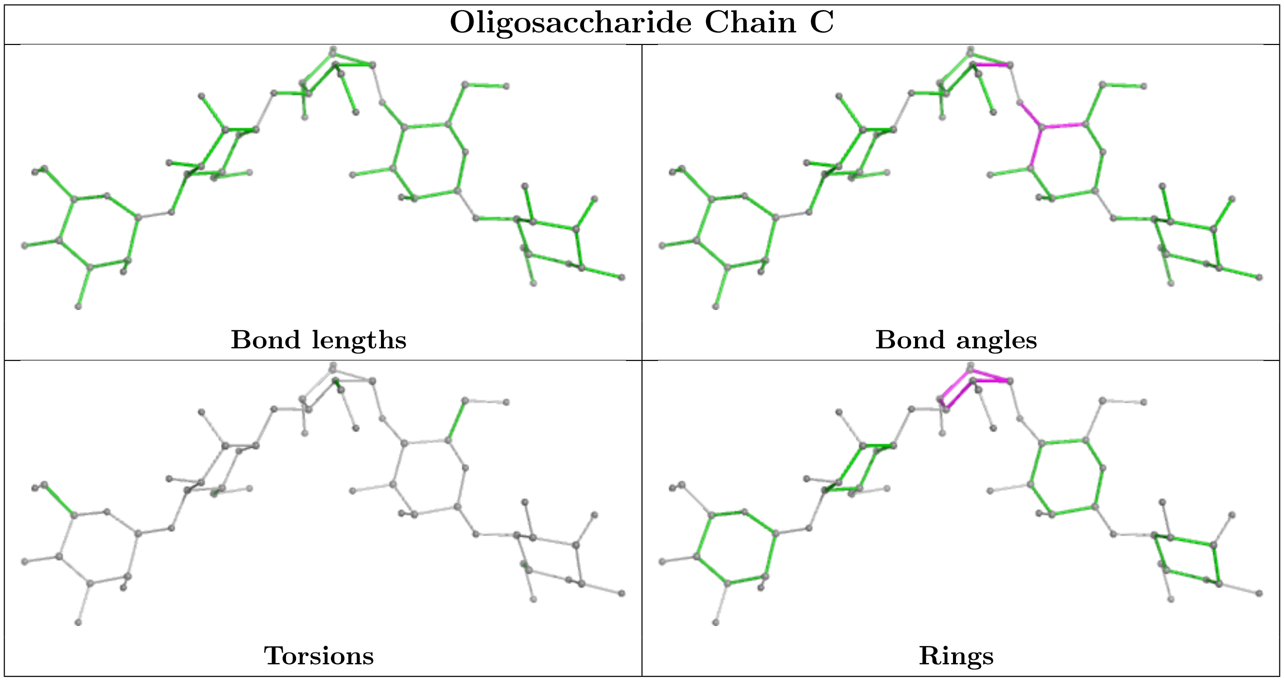
Oligosaccharide Chain B

Bond lengths

Bond angles

Torsions

Rings



Oligosaccharide Chain C

Bond lengths

Bond angles

Torsions

Rings

4.6 Ligand geometry

3 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	GOL	A	603	-	5,5,5	1.13	1 (20%)	5,5,5	0.65	0
4	GOL	A	601	-	5,5,5	0.70	0	5,5,5	1.44	1 (20%)
4	GOL	A	602	-	5,5,5	1.05	0	5,5,5	1.00	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	GOL	A	603	-	-	2/4/4/4	-
4	GOL	A	601	-	-	2/4/4/4	-
4	GOL	A	602	-	-	2/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	603	GOL	O2-C2	-2.07	1.37	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	601	GOL	C3-C2-C1	-2.44	102.23	111.70

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	601	GOL	O1-C1-C2-C3
4	A	602	GOL	C1-C2-C3-O3
4	A	601	GOL	O1-C1-C2-O2
4	A	603	GOL	C1-C2-C3-O3
4	A	602	GOL	O2-C2-C3-O3

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Mol	Chain	Res	Type	Atoms
4	A	603	GOL	O1-C1-C2-O2

There are no ring outliers.

No monomer is involved in short contacts.

4.7 Other polymers ⓘ

There are no such residues in this entry.

4.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

5 Fit of model and data ⓘ

5.1 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	563/568 (99%)	-0.07	31 (5%)	32	31	10, 16, 36, 57	2 (0%)

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	403[A]	TRP	7.1
1	A	508	MET	5.2
1	A	509	ASP	4.3
1	A	511	SER	4.2
1	A	510	SER	3.9
1	A	520	LEU	3.6
1	A	397	ALA	3.4
1	A	547	VAL	3.3
1	A	507	ASN	3.2
1	A	400	ASN	3.2
1	A	545	LYS	3.1
1	A	402	LEU	3.0
1	A	466	THR	3.0
1	A	521	ILE	3.0
1	A	563	LEU	2.9
1	A	58	GLY	2.9
1	A	524	PRO	2.9
1	A	544	ASP	2.7
1	A	546	ASN	2.6
1	A	124	TYR	2.5
1	A	505	ILE	2.5
1	A	469	LYS	2.3
1	A	522	LYS	2.3
1	A	564	LEU	2.3
1	A	419	ILE	2.3
1	A	519	LEU	2.3
1	A	396	ASP	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	398	GLY	2.1
1	A	523	PRO	2.1
1	A	454	ASP	2.0
1	A	506	PRO	2.0

5.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.3 Carbohydrates ⓘ

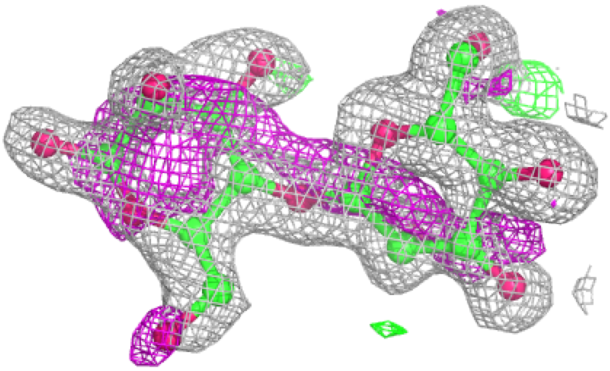
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

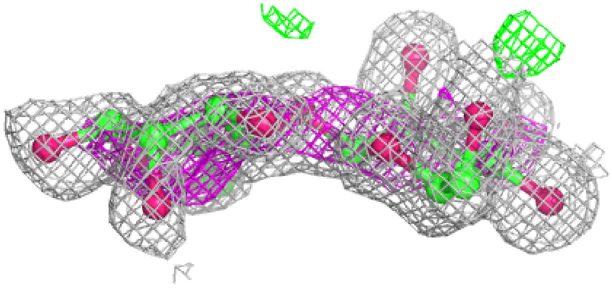
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
2	BMA	B	1	12/12	0.79	0.13	30,32,38,41	0
3	BMA	C	1	12/12	0.82	0.18	25,31,37,40	0
2	BMA	B	2	11/12	0.88	0.12	19,29,31,34	0
3	BMA	C	2	11/12	0.95	0.07	19,21,25,25	0
3	BMA	C	5	11/12	0.95	0.08	19,21,24,25	0
3	BMA	C	4	11/12	0.97	0.09	19,19,20,20	0
3	BMA	C	3	11/12	0.97	0.09	19,19,19,19	0

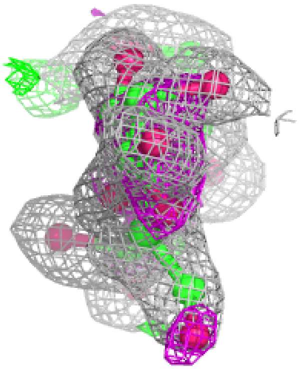
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around Chain B:

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

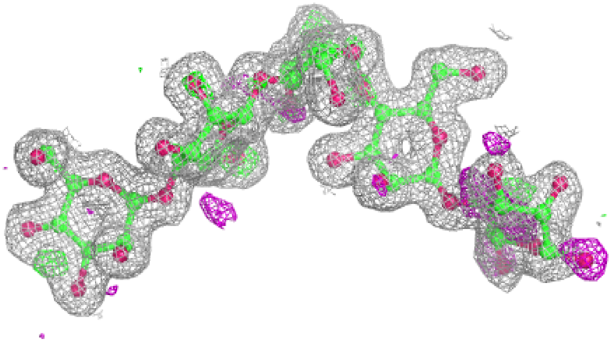


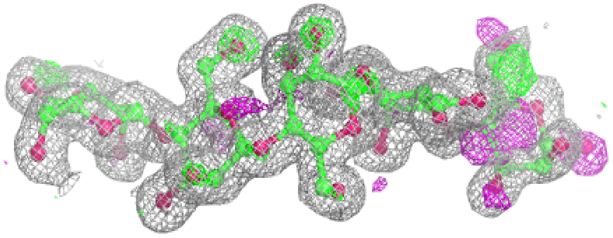


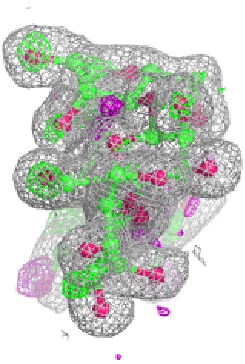


Electron density around Chain C:

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







5.4 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	GOL	A	603	6/6	0.74	0.19	26,30,46,48	0
4	GOL	A	601	6/6	0.89	0.13	22,31,32,41	0
4	GOL	A	602	6/6	0.90	0.13	20,29,34,43	0

5.5 Other polymers (i)

There are no such residues in this entry.