



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:06 PM UTC

PDB ID : 8IP2 / pdb\_00008ip2  
Title : Escherichia coli OpgG mutant-D361N with beta-1,2-glucan  
Authors : Motouchi, S.; Nakajima, M.  
Deposited on : 2023-03-13  
Resolution : 1.81 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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

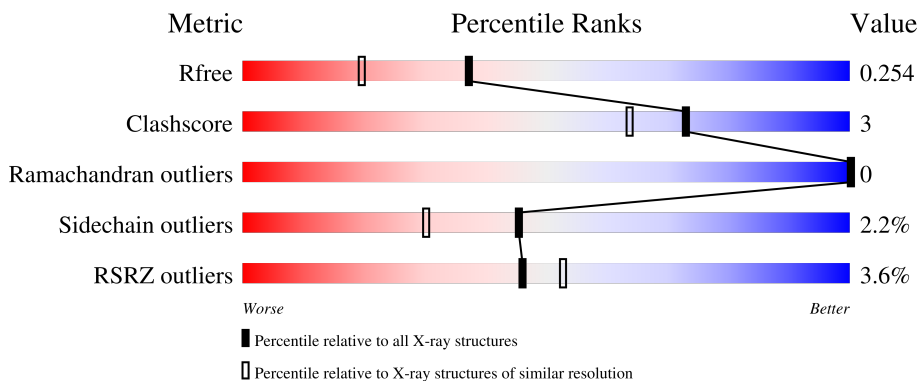
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.81 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))
$R_{free}$	180053	1112 (1.82-1.82)
Clashscore	190562	1148 (1.82-1.82)
Ramachandran outliers	187476	1140 (1.82-1.82)
Sidechain outliers	187428	1140 (1.82-1.82)
RSRZ outliers	180081	1112 (1.82-1.82)

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  $\geq 3$ , 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	519	 3% 83% 9% 8%
2	Y	16	 31% 69%



<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	A	122	Total 122	O 122	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	62.82Å 80.97Å 213.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.34 – 1.81 48.34 – 1.81	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.34-1.81) 99.9 (48.34-1.81)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.27 (at 1.81Å)	Xtrriage
Refinement program	REFMAC 5.8.0267	Depositor
R, $R_{free}$	0.213 , 0.254 0.218 , 0.254	Depositor DCC
$R_{free}$ test set	2536 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.5	Xtrriage
Anisotropy	0.267	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 42.9	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	4118	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.61% 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: BGC

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	0.59	0/3919	1.00	1/5318 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	318	ASP	CA-CB-CG	6.12	118.72	112.60

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	3819	0	3730	25	0
2	Y	177	0	147	0	0
3	A	122	0	0	0	0
All	All	4118	0	3877	25	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 (25) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:276:GLY:HA3	1:A:288:TRP:CH2	2.25	0.71
1:A:211:SER:O	1:A:239:ARG:NH2	2.29	0.65
1:A:407:ARG:HH12	1:A:511:GLU:CG	2.15	0.59
1:A:459:GLU:OE2	1:A:476:ARG:HD3	2.02	0.58
1:A:171:ARG:HB2	1:A:249:PRO:HG2	1.88	0.56
1:A:407:ARG:HH12	1:A:511:GLU:HG2	1.73	0.52
1:A:211:SER:O	1:A:212:PRO:C	2.53	0.51
1:A:115:PHE:O	1:A:116:GLY:C	2.55	0.49
1:A:248:ALA:N	1:A:249:PRO:CD	2.76	0.47
1:A:431:PHE:CD1	1:A:492:LEU:HD11	2.49	0.47
1:A:407:ARG:HH12	1:A:511:GLU:HG3	1.79	0.46
1:A:248:ALA:N	1:A:249:PRO:HD3	2.31	0.45
1:A:142:LYS:HB2	1:A:142:LYS:HE2	1.79	0.45
1:A:55:LYS:O	1:A:56:TYR:C	2.60	0.44
1:A:339:PRO:HB3	1:A:343:TRP:CE2	2.52	0.44
1:A:137:TYR:CG	1:A:138:PRO:HD2	2.53	0.44
1:A:276:GLY:HA3	1:A:288:TRP:CZ2	2.53	0.43
1:A:206:TYR:HA	1:A:218:TYR:O	2.20	0.42
1:A:253:MET:HE2	1:A:358:GLU:HB2	2.02	0.42
1:A:150:SER:O	1:A:157:PHE:HA	2.20	0.41
1:A:277:LEU:HD22	1:A:350:LEU:HB2	2.02	0.40
1:A:493:VAL:HG12	1:A:498:THR:HA	2.03	0.40
1:A:494:ASN:O	1:A:495:ALA:HB2	2.21	0.40
1:A:154:ALA:C	1:A:187:ARG:HA	2.47	0.40
1:A:279:ILE:HG21	1:A:304:MET:HE1	2.04	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	472/519 (91%)	453 (96%)	19 (4%)	0	<b>100</b> <b>100</b>

There are no Ramachandran outliers to report.

### 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	412/451 (91%)	403 (98%)	9 (2%)	45 30

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

Mol	Chain	Res	Type
1	A	70	TYR
1	A	141	SER
1	A	142	LYS
1	A	151	MET
1	A	201	LYS
1	A	300	SER
1	A	478	LYS
1	A	486	THR
1	A	488	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	60	GLN
1	A	85	GLN
1	A	96	ASN
1	A	306	ASN
1	A	361	ASN
1	A	403	GLN

### 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](#)

16 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	BGC	Y	1	2	12,12,12	0.74	0	17,17,17	1.03	0
2	BGC	Y	10	2	11,11,12	0.90	1 (9%)	15,15,17	0.63	0
2	BGC	Y	11	2	11,11,12	1.22	1 (9%)	15,15,17	1.30	1 (6%)
2	BGC	Y	12	2	11,11,12	0.80	0	15,15,17	0.68	0
2	BGC	Y	13	2	11,11,12	0.95	1 (9%)	15,15,17	1.59	3 (20%)
2	BGC	Y	14	2	11,11,12	0.89	0	15,15,17	1.33	3 (20%)
2	BGC	Y	15	2	11,11,12	0.36	0	15,15,17	0.67	1 (6%)
2	BGC	Y	16	2	11,11,12	0.54	0	15,15,17	0.46	0
2	BGC	Y	2	2	11,11,12	0.72	0	15,15,17	0.59	0
2	BGC	Y	3	2	11,11,12	0.52	0	15,15,17	0.91	1 (6%)
2	BGC	Y	4	2	11,11,12	1.14	1 (9%)	15,15,17	1.21	1 (6%)
2	BGC	Y	5	2	11,11,12	0.50	0	15,15,17	0.90	0
2	BGC	Y	6	2	11,11,12	0.71	0	15,15,17	1.35	1 (6%)
2	BGC	Y	7	2	11,11,12	1.02	1 (9%)	15,15,17	1.03	1 (6%)
2	BGC	Y	8	2	11,11,12	0.84	0	15,15,17	2.12	1 (6%)
2	BGC	Y	9	2	11,11,12	0.94	0	15,15,17	1.27	3 (20%)

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	BGC	Y	1	2	-	2/2/22/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	BGC	Y	10	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	11	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	12	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	13	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	14	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	15	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	16	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	2	2	-	2/2/19/22	0/1/1/1
2	BGC	Y	3	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	4	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	5	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	6	2	-	2/2/19/22	0/1/1/1
2	BGC	Y	7	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	8	2	-	0/2/19/22	0/1/1/1
2	BGC	Y	9	2	-	0/2/19/22	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	Y	13	BGC	C4-C5	-2.77	1.47	1.53
2	Y	7	BGC	C2-C3	2.75	1.56	1.52
2	Y	10	BGC	C2-C3	-2.43	1.48	1.52
2	Y	11	BGC	C1-C2	2.41	1.58	1.52
2	Y	4	BGC	C1-C2	2.35	1.57	1.52

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	Y	8	BGC	C1-O5-C5	7.15	121.78	112.19
2	Y	13	BGC	O3-C3-C4	-3.79	101.44	110.38
2	Y	11	BGC	C1-C2-C3	3.70	115.03	109.64
2	Y	13	BGC	O2-C2-C3	2.94	116.23	110.15
2	Y	9	BGC	O6-C6-C5	-2.46	102.97	111.33
2	Y	9	BGC	O4-C4-C5	-2.44	103.31	109.32
2	Y	6	BGC	O3-C3-C2	2.43	115.02	110.05
2	Y	13	BGC	O5-C5-C4	-2.39	105.00	110.83
2	Y	14	BGC	O2-C2-C3	-2.38	105.23	110.15
2	Y	4	BGC	C1-O5-C5	-2.33	109.06	112.19
2	Y	9	BGC	O5-C1-C2	-2.27	105.38	110.79
2	Y	7	BGC	C1-O5-C5	2.26	115.22	112.19
2	Y	14	BGC	C1-C2-C3	2.21	112.87	109.64
2	Y	3	BGC	O3-C3-C2	2.19	114.52	110.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	Y	15	BGC	C1-C2-C3	2.17	112.80	109.64
2	Y	14	BGC	C1-O5-C5	2.11	115.02	112.19

There are no chirality outliers.

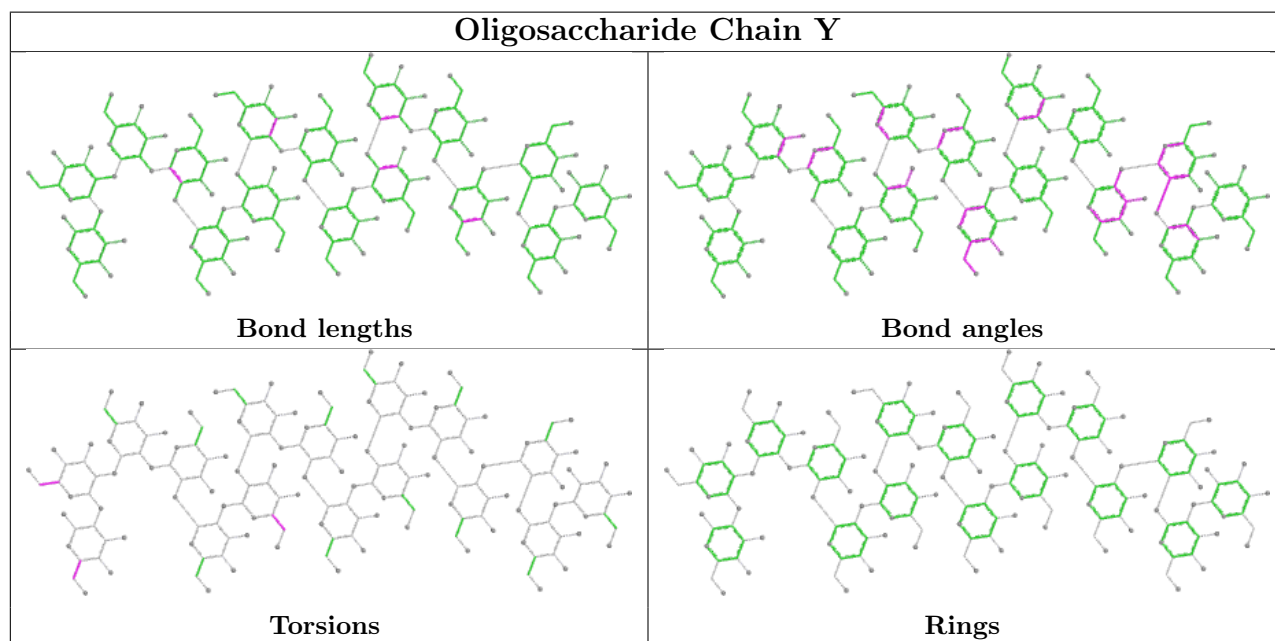
All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	Y	2	BGC	O5-C5-C6-O6
2	Y	1	BGC	O5-C5-C6-O6
2	Y	2	BGC	C4-C5-C6-O6
2	Y	1	BGC	C4-C5-C6-O6
2	Y	6	BGC	O5-C5-C6-O6
2	Y	6	BGC	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](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	478/519 (92%)	0.51	17 (3%) 46 53	23, 43, 71, 92	0

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	495	ALA	5.1
1	A	116	GLY	4.4
1	A	22	ALA	3.1
1	A	46	ASN	3.0
1	A	479	VAL	2.8
1	A	127	ASP	2.6
1	A	438	LYS	2.5
1	A	88	TYR	2.5
1	A	439	LEU	2.4
1	A	68	LYS	2.4
1	A	482	ALA	2.4
1	A	457	ILE	2.3
1	A	494	ASN	2.3
1	A	52	ARG	2.3
1	A	493	VAL	2.2
1	A	142	LYS	2.2
1	A	511	GLU	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.

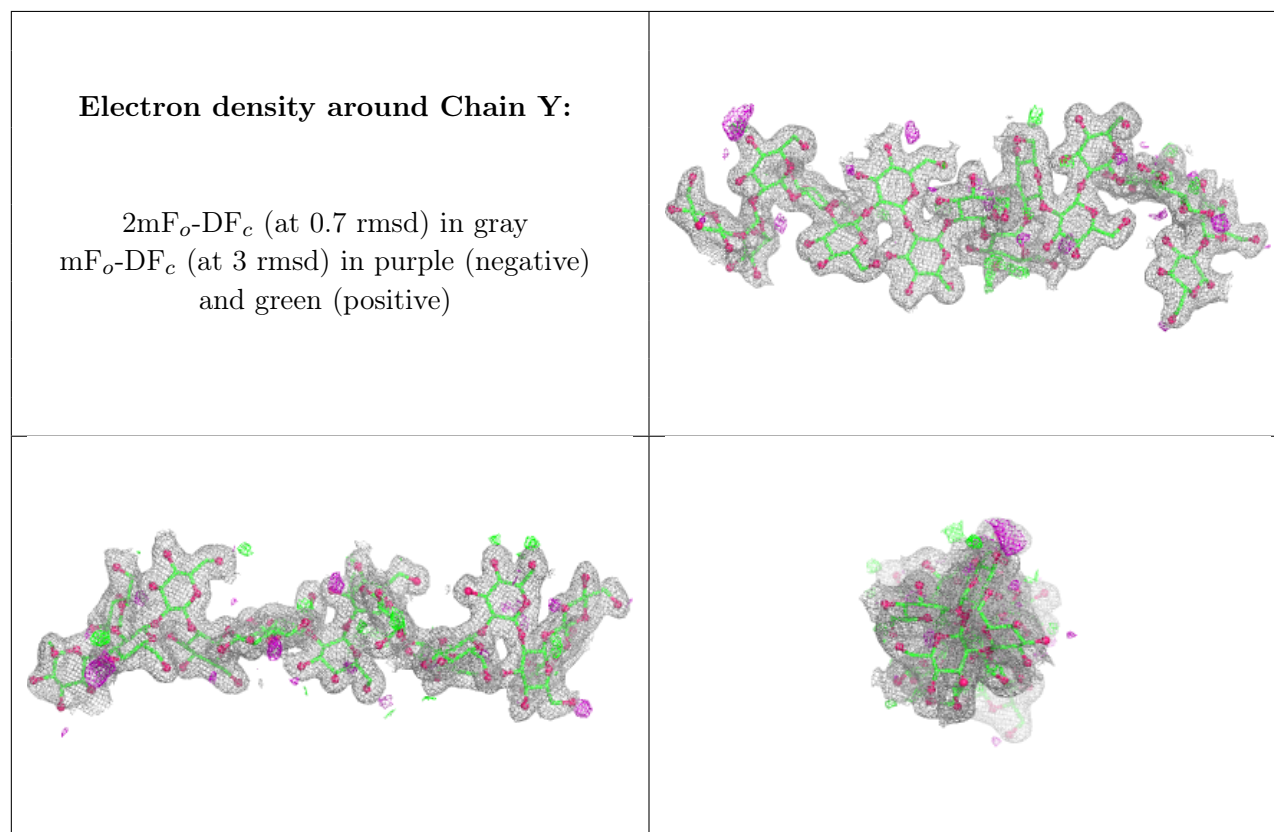
### 6.3 Carbohydrates [i](#)

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
2	BGC	Y	1	12/12	-	-	36,43,50,52	0
2	BGC	Y	2	11/12	-	-	27,32,38,42	0
2	BGC	Y	3	11/12	-	-	28,38,46,53	0
2	BGC	Y	4	11/12	-	-	23,25,27,27	0
2	BGC	Y	5	11/12	-	-	22,25,29,29	0
2	BGC	Y	6	11/12	-	-	25,29,37,38	0
2	BGC	Y	7	11/12	-	-	23,24,26,27	0
2	BGC	Y	8	11/12	-	-	19,23,25,25	0
2	BGC	Y	9	11/12	-	-	21,24,26,26	0
2	BGC	Y	10	11/12	-	-	22,26,27,28	0
2	BGC	Y	11	11/12	-	-	19,24,27,30	0
2	BGC	Y	12	11/12	-	-	25,35,40,47	0
2	BGC	Y	13	11/12	-	-	23,27,29,30	0
2	BGC	Y	14	11/12	-	-	33,37,41,47	0
2	BGC	Y	15	11/12	-	-	46,51,66,69	0
2	BGC	Y	16	11/12	-	-	64,68,73,77	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.



## 6.4 Ligands

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.