



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 25, 2026 – 02:05 PM EDT

PDB ID : 3AIC / pdb_00003aic
Title : Crystal Structure of Glucansucrase from Streptococcus mutans
Authors : Ito, K.; Ito, S.; Shimamura, T.; Iwata, S.
Deposited on : 2010-05-12
Resolution : 3.11 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

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>.

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

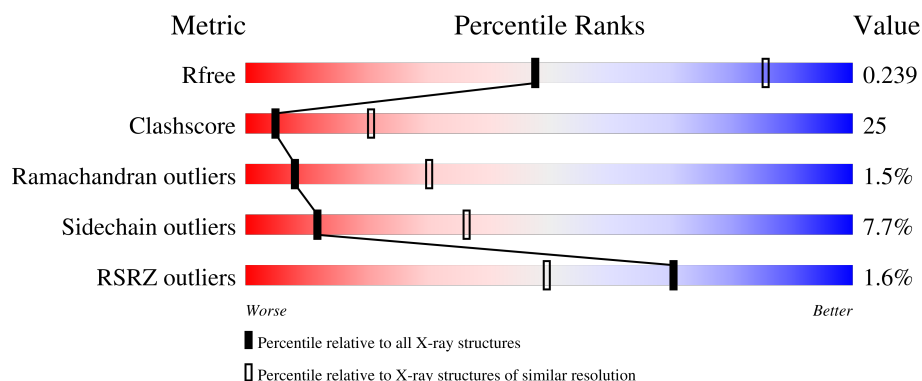
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.11 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.



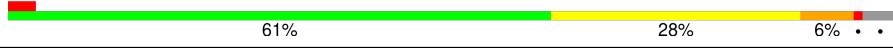
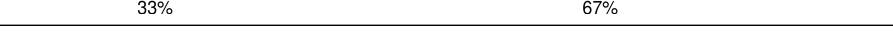
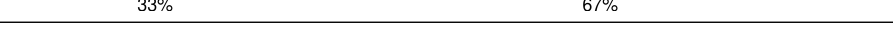
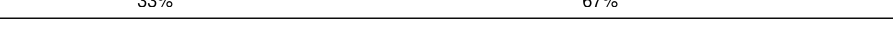
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1816 (3.14-3.10)
Clashscore	190562	1906 (3.14-3.10)
Ramachandran outliers	187476	1802 (3.14-3.10)
Sidechain outliers	187428	1802 (3.14-3.10)
RSRZ outliers	180081	1816 (3.14-3.10)

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 $\leq 5\%$. 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	844	2% 61% 33% 6%
1	B	844	% 54% 30% 11%
1	C	844	% 63% 32% 5%
1	D	844	2% 59% 34% 6%
1	E	844	3% 62% 30% 7%

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Mol	Chain	Length	Quality of chain
1	F	844	% 
1	G	844	% 
1	H	844	3% 
2	I	3	
2	J	3	
2	K	3	
2	L	3	
2	M	3	
2	N	3	
2	O	3	
2	P	3	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	AC1	I	3	-	-	X	-
2	AC1	K	3	-	-	X	-
2	AC1	M	3	-	-	X	-
4	MES	B	5001	-	X	-	-
4	MES	F	5001	-	X	-	-
4	MES	G	5001	-	X	-	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 52865 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 Glucosyltransferase-SI.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	842	Total	C	N	O	S	0	0	0
			6643	4184	1141	1302	16			
1	B	747	Total	C	N	O	S	0	0	0
			5854	3684	1005	1151	14			
1	C	844	Total	C	N	O	S	0	0	0
			6660	4196	1143	1305	16			
1	D	844	Total	C	N	O	S	0	0	0
			6660	4196	1143	1305	16			
1	E	843	Total	C	N	O	S	0	0	0
			6654	4193	1142	1303	16			
1	F	844	Total	C	N	O	S	0	0	0
			6660	4196	1143	1305	16			
1	G	844	Total	C	N	O	S	0	0	0
			6660	4196	1143	1305	16			
1	H	807	Total	C	N	O	S	0	0	0
			6372	4019	1093	1244	16			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	597	ASP	ASN	SEE REMARK 999	UNP P13470
A	600	LYS	ARG	SEE REMARK 999	UNP P13470
A	727	ILE	THR	SEE REMARK 999	UNP P13470
A	734	VAL	ALA	SEE REMARK 999	UNP P13470
B	597	ASP	ASN	SEE REMARK 999	UNP P13470
B	600	LYS	ARG	SEE REMARK 999	UNP P13470
B	727	ILE	THR	SEE REMARK 999	UNP P13470
B	734	VAL	ALA	SEE REMARK 999	UNP P13470
C	597	ASP	ASN	SEE REMARK 999	UNP P13470
C	600	LYS	ARG	SEE REMARK 999	UNP P13470
C	727	ILE	THR	SEE REMARK 999	UNP P13470
C	734	VAL	ALA	SEE REMARK 999	UNP P13470
D	597	ASP	ASN	SEE REMARK 999	UNP P13470

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Chain	Residue	Modelled	Actual	Comment	Reference
D	600	LYS	ARG	SEE REMARK 999	UNP P13470
D	727	ILE	THR	SEE REMARK 999	UNP P13470
D	734	VAL	ALA	SEE REMARK 999	UNP P13470
E	597	ASP	ASN	SEE REMARK 999	UNP P13470
E	600	LYS	ARG	SEE REMARK 999	UNP P13470
E	727	ILE	THR	SEE REMARK 999	UNP P13470
E	734	VAL	ALA	SEE REMARK 999	UNP P13470
F	597	ASP	ASN	SEE REMARK 999	UNP P13470
F	600	LYS	ARG	SEE REMARK 999	UNP P13470
F	727	ILE	THR	SEE REMARK 999	UNP P13470
F	734	VAL	ALA	SEE REMARK 999	UNP P13470
G	597	ASP	ASN	SEE REMARK 999	UNP P13470
G	600	LYS	ARG	SEE REMARK 999	UNP P13470
G	727	ILE	THR	SEE REMARK 999	UNP P13470
G	734	VAL	ALA	SEE REMARK 999	UNP P13470
H	597	ASP	ASN	SEE REMARK 999	UNP P13470
H	600	LYS	ARG	SEE REMARK 999	UNP P13470
H	727	ILE	THR	SEE REMARK 999	UNP P13470
H	734	VAL	ALA	SEE REMARK 999	UNP P13470

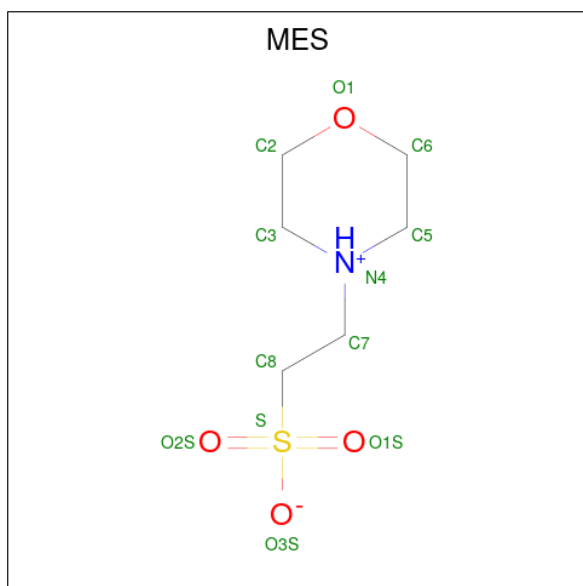
- Molecule 2 is an oligosaccharide called 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	I	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	J	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	K	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	L	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	M	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	N	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	O	3	Total	C	N	O	0	0	0
			44	25	1	18			
2	P	3	Total	C	N	O	0	0	0
			44	25	1	18			

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Ca 1 1	0	0
3	B	1	Total Ca 1 1	0	0
3	C	1	Total Ca 1 1	0	0
3	D	1	Total Ca 1 1	0	0
3	E	1	Total Ca 1 1	0	0
3	F	1	Total Ca 1 1	0	0
3	G	1	Total Ca 1 1	0	0
3	H	1	Total Ca 1 1	0	0

- Molecule 4 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: $C_6H_{13}NO_4S$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O S 12 6 1 4 1	0	0
4	B	1	Total C N O S 12 6 1 4 1	0	0
4	C	1	Total C N O S 12 6 1 4 1	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	D	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	E	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	F	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	G	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
4	H	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

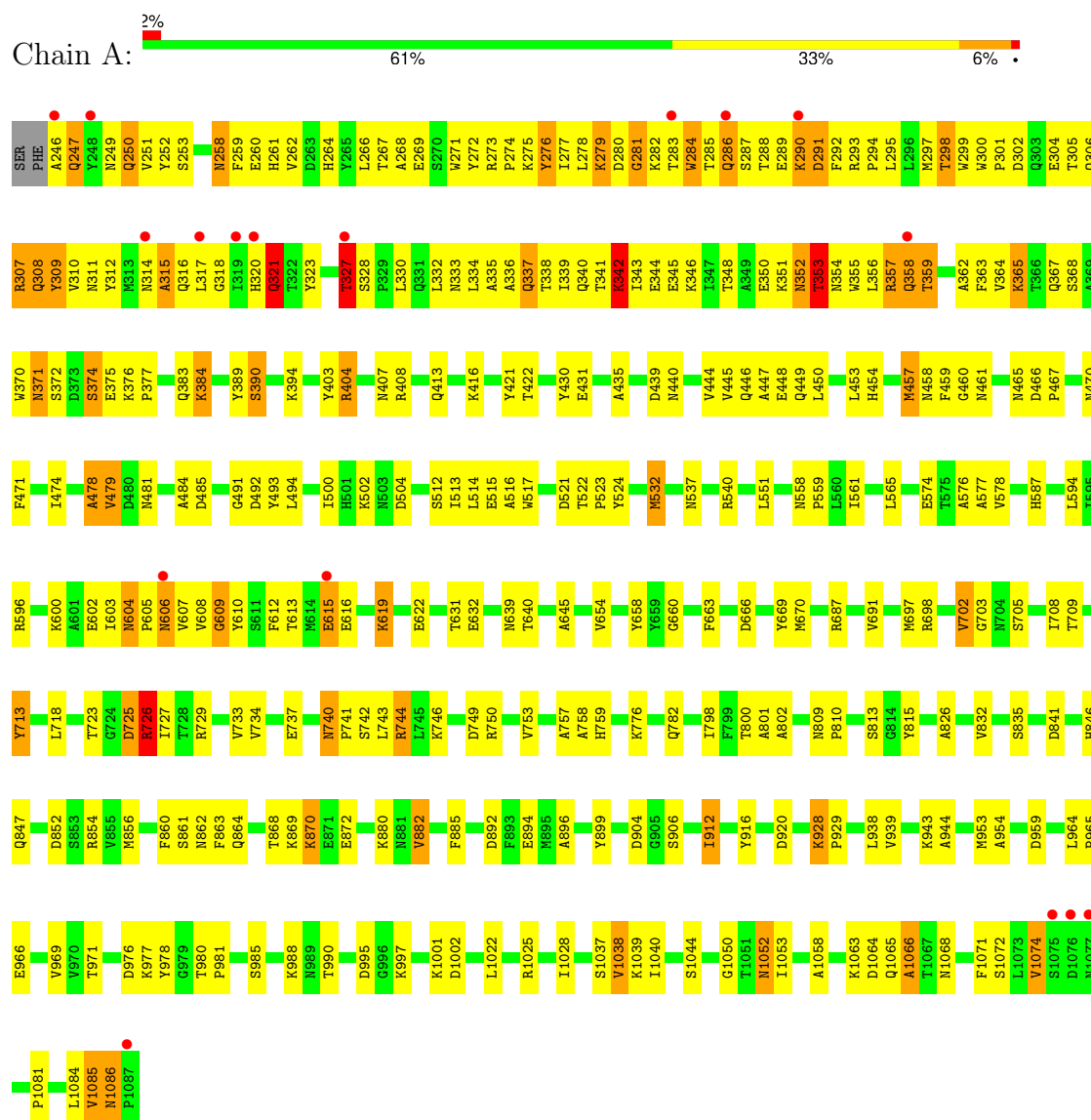
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	33	Total	O	0	0
			33	33		
5	B	20	Total	O	0	0
			20	20		
5	C	32	Total	O	0	0
			32	32		
5	D	40	Total	O	0	0
			40	40		
5	E	48	Total	O	0	0
			48	48		
5	F	15	Total	O	0	0
			15	15		
5	G	34	Total	O	0	0
			34	34		
5	H	24	Total	O	0	0
			24	24		

3 Residue-property plots [i](#)

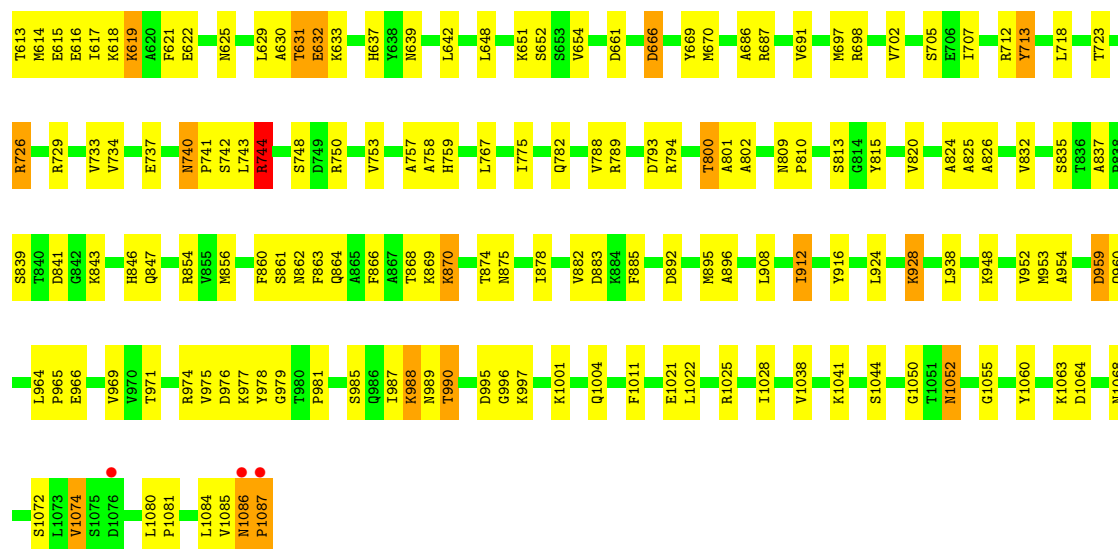
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Glucosyltransferase-SI

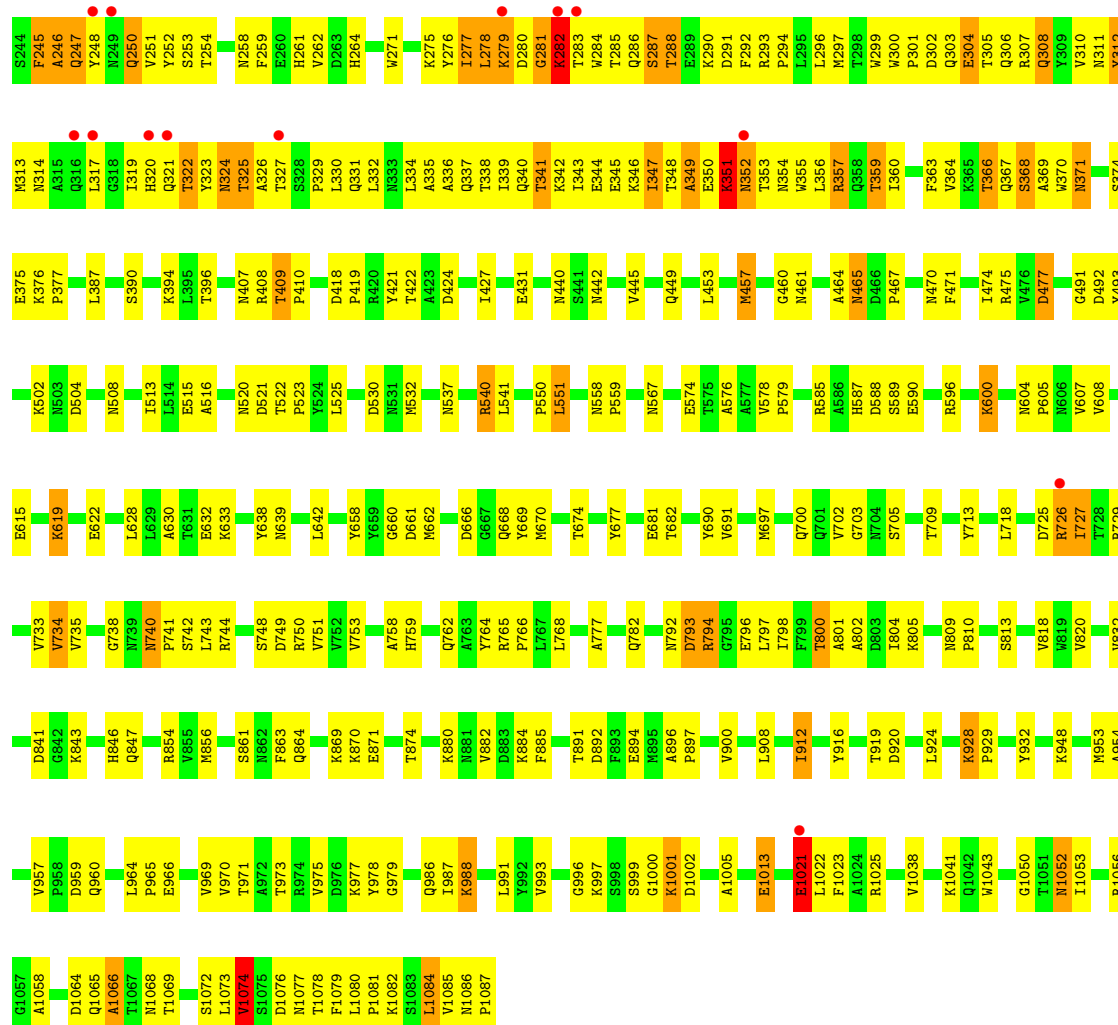


• Molecule 1: Glucosyltransferase-SI

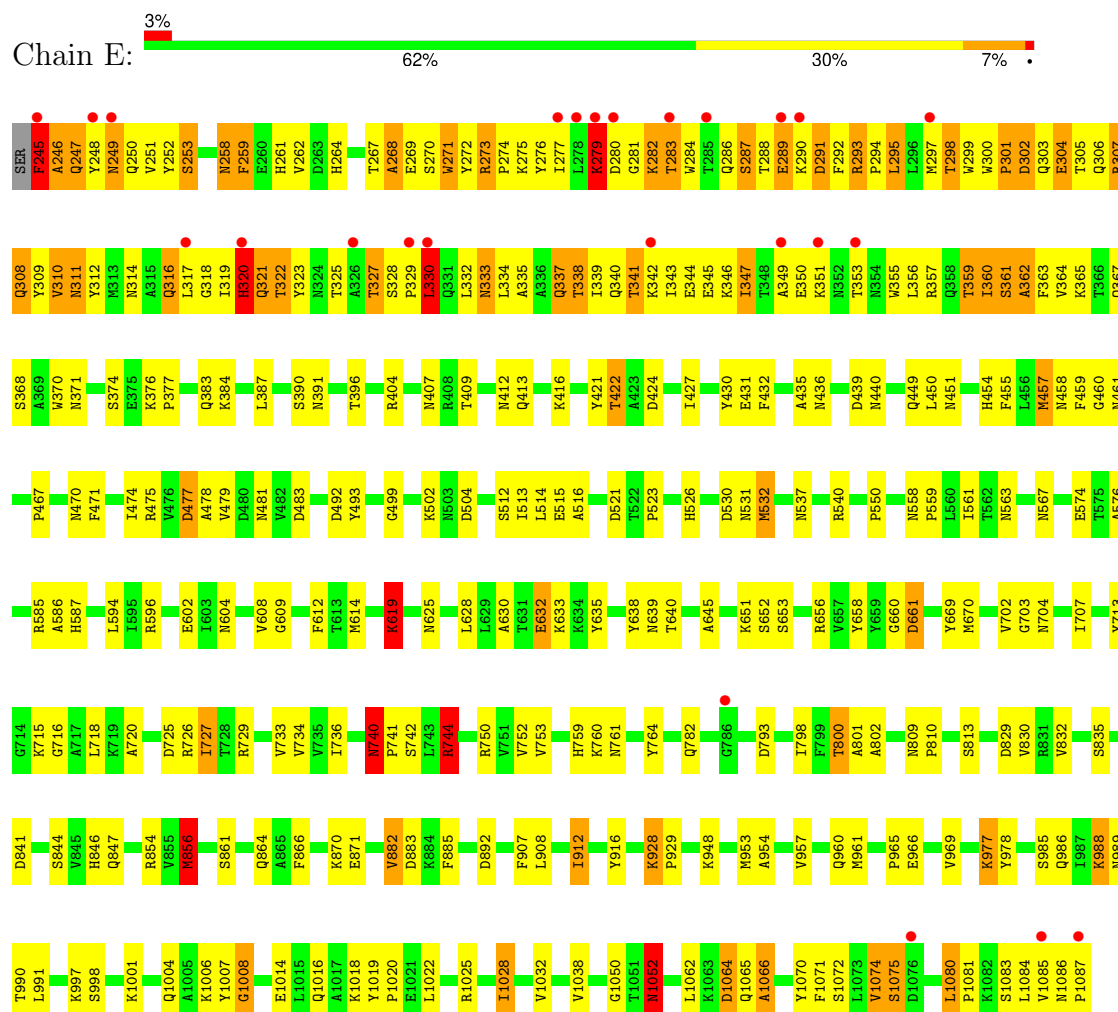




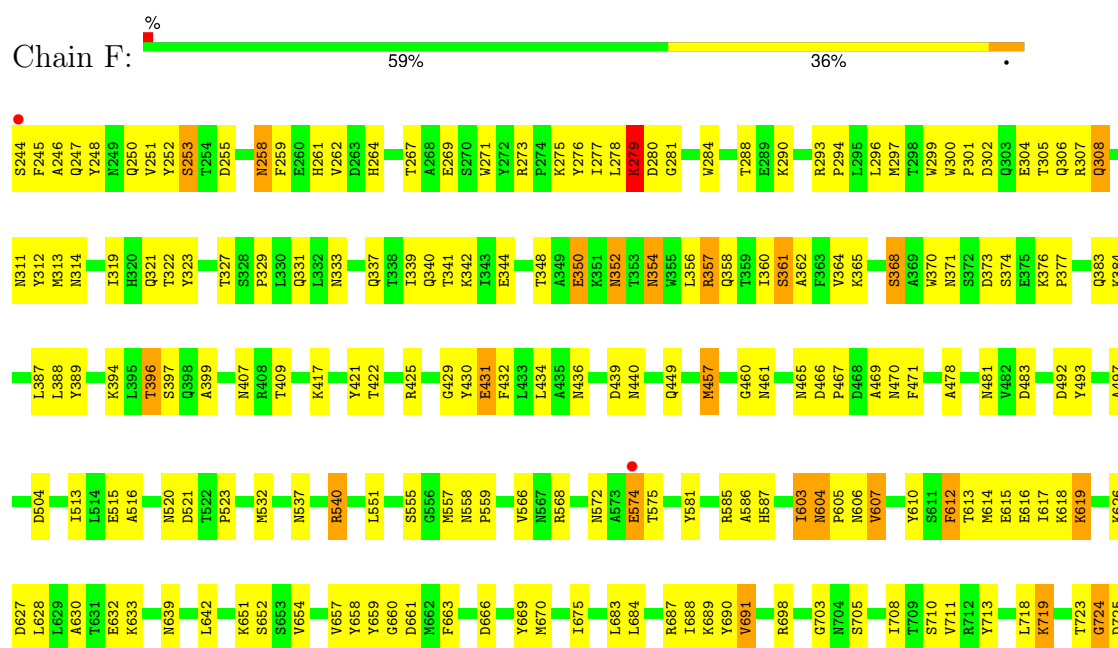
● Molecule 1: Glucosyltransferase-SI

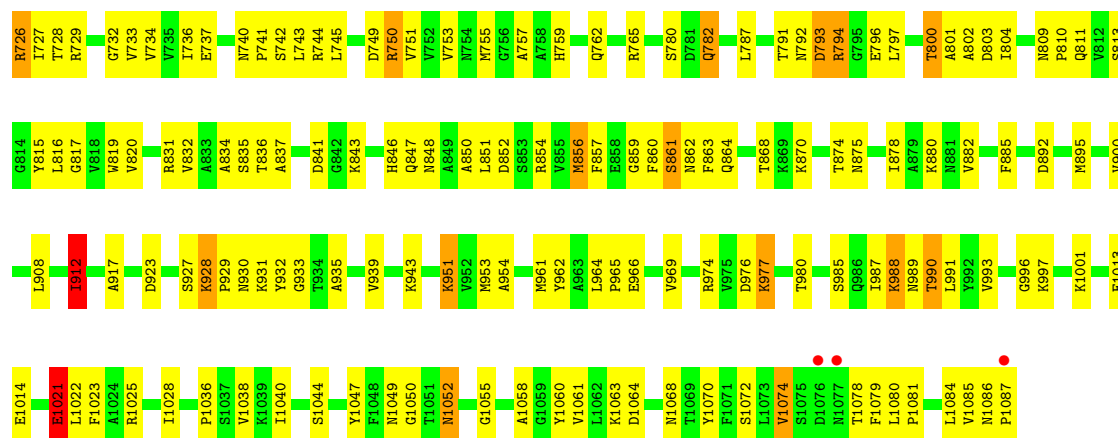


• Molecule 1: Glucosyltransferase-SI

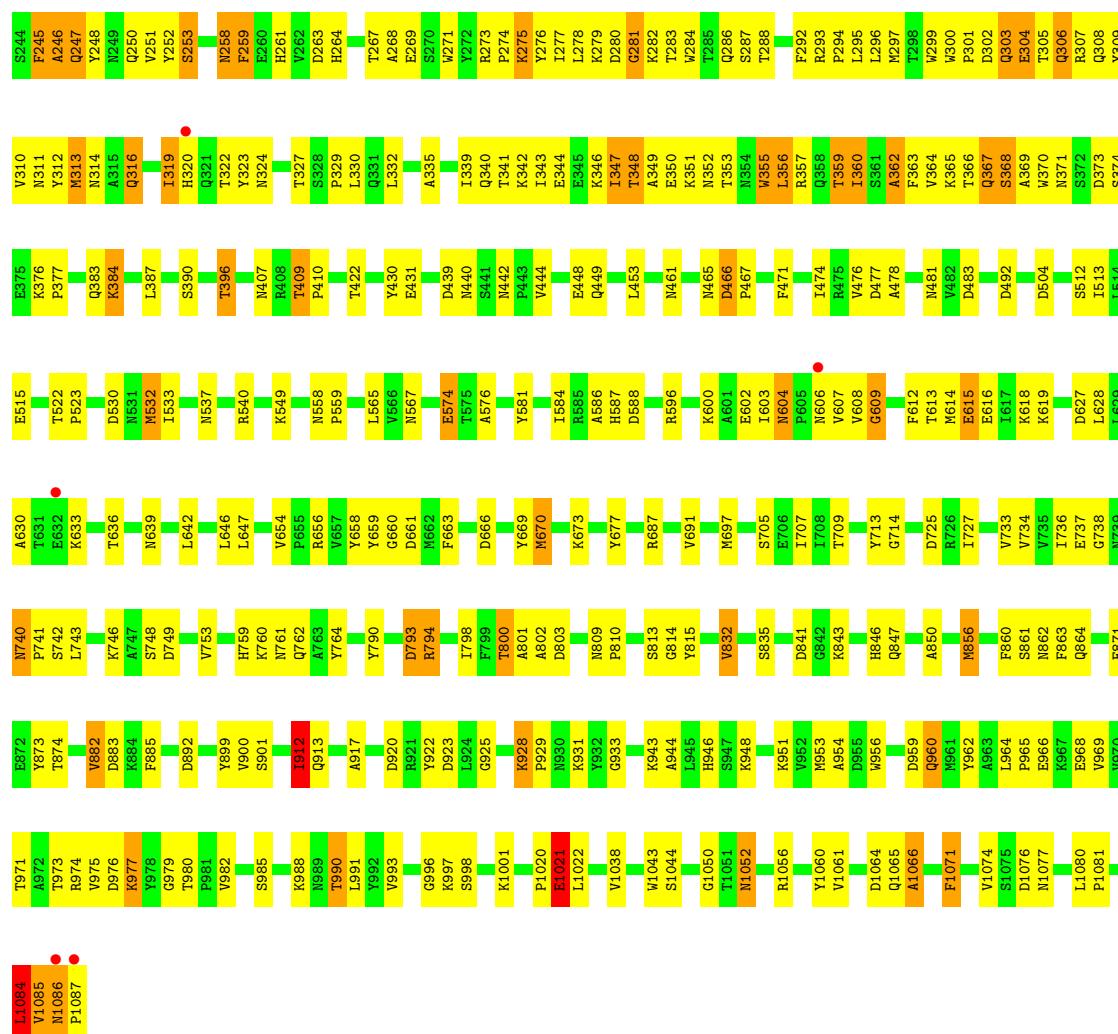


• Molecule 1: Glucosyltransferase-SI

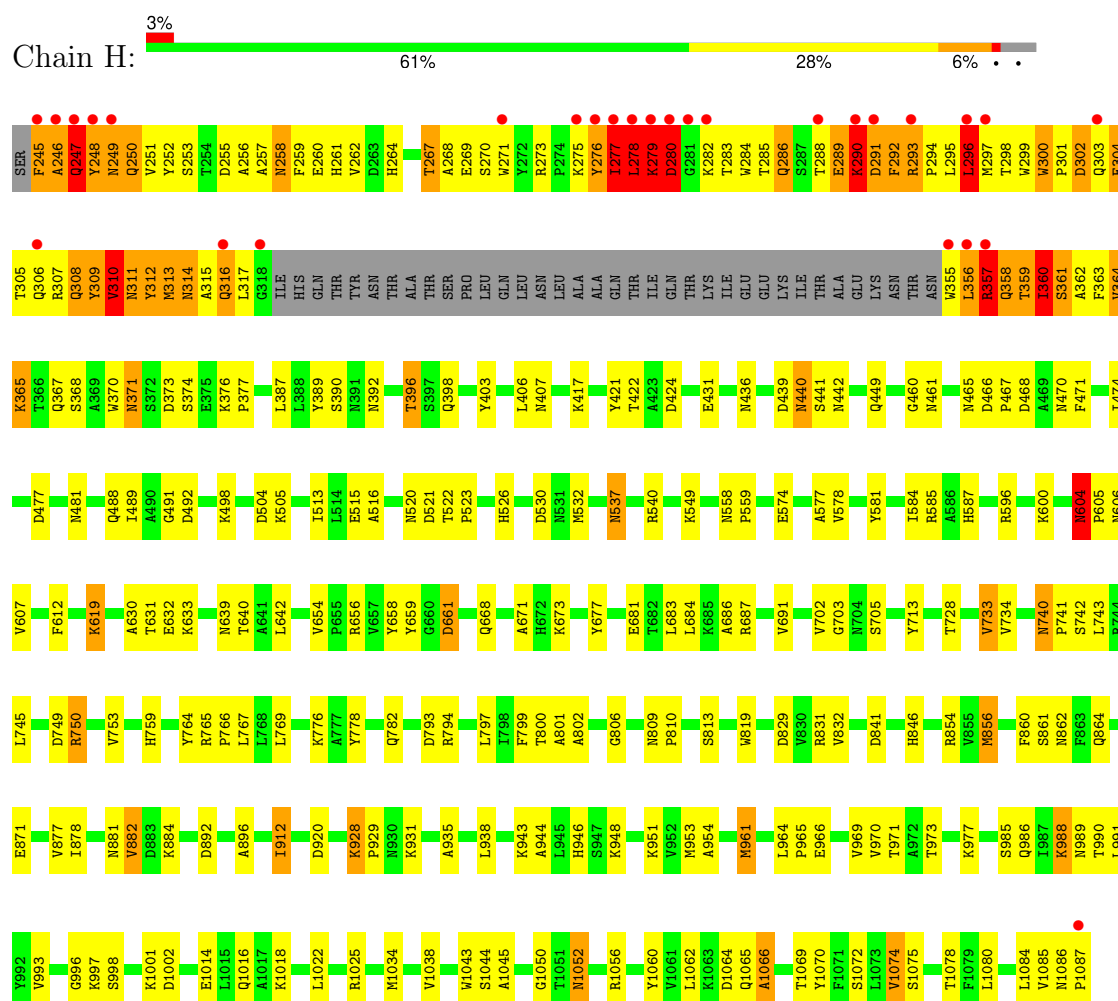




• Molecule 1: Glucosyltransferase-SI



• Molecule 1: Glucosyltransferase-SI



- Molecule 2: 4,6-dideoxy-4-([(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose



- Molecule 2: 4,6-dideoxy-4-([(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose



- Molecule 2: 4,6-dideoxy-4-([(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose





- Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain L:



- Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain M:



- Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain N:



- Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain O:



- Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose

Chain P:



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	295.52Å 214.41Å 220.66Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	61.77 – 3.11 61.77 – 3.11	Depositor EDS
% Data completeness (in resolution range)	100.0 (61.77-3.11) 95.2 (61.77-3.11)	Depositor EDS
R_{merge}	0.37	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.52 (at 3.13Å)	Xtriage
Refinement program	REFMAC 5.5.0066	Depositor
R, R_{free}	0.211 , 0.244 0.208 , 0.239	Depositor DCC
R_{free} test set	12026 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	65.5	Xtriage
Anisotropy	0.020	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 31.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.000 for -h,l,k	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	52865	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 32.08 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.9554e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GLC, CA, AC1, MES

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	1.28	17/6784 (0.3%)	1.26	29/9213 (0.3%)
1	B	1.07	13/5976 (0.2%)	1.22	37/8113 (0.5%)
1	C	1.18	7/6802 (0.1%)	1.24	27/9237 (0.3%)
1	D	1.17	7/6802 (0.1%)	1.23	24/9237 (0.3%)
1	E	1.26	21/6796 (0.3%)	1.26	37/9229 (0.4%)
1	F	1.00	5/6802 (0.1%)	1.16	17/9237 (0.2%)
1	G	1.19	5/6802 (0.1%)	1.27	32/9237 (0.3%)
1	H	1.12	9/6510 (0.1%)	1.20	24/8837 (0.3%)
All	All	1.16	84/53274 (0.2%)	1.23	227/72340 (0.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	H	0	1
All	All	0	2

The worst 5 of 84 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	320	HIS	CE1-NE2	33.41	1.66	1.32
1	E	245	PHE	N-CA	12.75	1.70	1.46
1	H	249	ASN	CG-OD1	11.93	1.46	1.23
1	A	320	HIS	CG-CD2	11.82	1.48	1.35
1	B	250	GLN	CD-NE2	11.48	1.57	1.33

The worst 5 of 227 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	250	GLN	OE1-CD-NE2	15.61	138.21	122.60
1	E	744	ARG	CB-CA-C	-9.96	95.71	110.24
1	C	744	ARG	CB-CA-C	-9.54	96.31	110.24
1	B	250	GLN	CG-CD-NE2	-9.51	102.14	116.40
1	D	283	THR	N-CA-C	8.85	124.02	109.24

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	370	TRP	Peptide
1	H	245	PHE	Sidechain

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	6643	0	6475	357	0
1	B	5854	0	5691	262	0
1	C	6660	0	6489	270	0
1	D	6660	0	6489	342	0
1	E	6654	0	6484	370	0
1	F	6660	0	6489	338	0
1	G	6660	0	6489	299	0
1	H	6372	0	6196	349	0
2	I	44	0	30	10	0
2	J	44	0	30	8	0
2	K	44	0	30	9	0
2	L	44	0	30	6	0
2	M	44	0	30	10	0
2	N	44	0	30	6	0
2	O	44	0	30	7	0
2	P	44	0	30	6	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
4	A	12	0	12	2	0
4	B	12	0	12	0	0
4	C	12	0	12	2	0
4	D	12	0	12	2	0
4	E	12	0	12	1	0
4	F	12	0	12	0	0
4	G	12	0	12	1	0
4	H	12	0	12	0	0
5	A	33	0	0	5	0
5	B	20	0	0	6	0
5	C	32	0	0	2	0
5	D	40	0	0	2	0
5	E	48	0	0	2	0
5	F	15	0	0	10	0
5	G	34	0	0	2	0
5	H	24	0	0	4	0
All	All	52865	0	51138	2618	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 25.

The worst 5 of 2618 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:E:245:PHE:N	1:E:245:PHE:CA	1.70	1.54
1:E:277:ILE:CD1	1:E:291:ASP:HB3	1.38	1.54
1:A:290:LYS:NZ	1:A:290:LYS:CE	1.71	1.53
1:E:279:LYS:NZ	1:E:279:LYS:CE	1.73	1.51
1:E:273:ARG:CD	1:E:287:SER:HB2	1.40	1.49

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	840/844 (100%)	772 (92%)	57 (7%)	11 (1%)	9	33
1	B	743/844 (88%)	678 (91%)	53 (7%)	12 (2%)	7	29
1	C	842/844 (100%)	777 (92%)	57 (7%)	8 (1%)	12	39
1	D	842/844 (100%)	763 (91%)	66 (8%)	13 (2%)	8	30
1	E	841/844 (100%)	758 (90%)	70 (8%)	13 (2%)	8	30
1	F	842/844 (100%)	771 (92%)	65 (8%)	6 (1%)	18	47
1	G	842/844 (100%)	776 (92%)	56 (7%)	10 (1%)	10	34
1	H	803/844 (95%)	717 (89%)	62 (8%)	24 (3%)	3	17
All	All	6595/6752 (98%)	6012 (91%)	486 (7%)	97 (2%)	8	30

5 of 97 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	250	GLN
1	C	321	GLN
1	C	327	THR
1	C	351	LYS
1	D	278	LEU

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	713/715 (100%)	661 (93%)	52 (7%)	13	38

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	627/715 (88%)	588 (94%)	39 (6%)	16	44
1	C	715/715 (100%)	662 (93%)	53 (7%)	13	38
1	D	715/715 (100%)	658 (92%)	57 (8%)	11	35
1	E	714/715 (100%)	651 (91%)	63 (9%)	9	31
1	F	715/715 (100%)	653 (91%)	62 (9%)	9	32
1	G	715/715 (100%)	660 (92%)	55 (8%)	12	36
1	H	682/715 (95%)	631 (92%)	51 (8%)	12	38
All	All	5596/5720 (98%)	5164 (92%)	432 (8%)	12	36

5 of 432 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	368	SER
1	F	465	ASN
1	H	365	LYS
1	E	574	GLU
1	E	1052	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 218 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	354	ASN
1	F	407	ASN
1	H	407	ASN
1	E	440	ASN
1	E	782	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

24 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	GLC	I	1	2	12,12,12	0.68	0	17,17,17	2.03	6 (35%)
2	GLC	I	2	2	11,11,12	1.15	0	15,15,17	2.59	5 (33%)
2	AC1	I	3	2	21,22,23	1.46	4 (19%)	22,32,34	2.15	4 (18%)
2	GLC	J	1	2	12,12,12	0.77	0	17,17,17	1.91	5 (29%)
2	GLC	J	2	2	11,11,12	1.11	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	J	3	2	21,22,23	1.33	2 (9%)	22,32,34	1.52	3 (13%)
2	GLC	K	1	2	12,12,12	0.77	0	17,17,17	1.91	5 (29%)
2	GLC	K	2	2	11,11,12	1.10	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	K	3	2	21,22,23	1.32	2 (9%)	22,32,34	1.52	3 (13%)
2	GLC	L	1	2	12,12,12	0.78	0	17,17,17	1.92	5 (29%)
2	GLC	L	2	2	11,11,12	1.11	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	L	3	2	21,22,23	1.33	2 (9%)	22,32,34	1.51	3 (13%)
2	GLC	M	1	2	12,12,12	0.78	0	17,17,17	1.91	5 (29%)
2	GLC	M	2	2	11,11,12	1.12	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	M	3	2	21,22,23	1.34	2 (9%)	22,32,34	1.52	3 (13%)
2	GLC	N	1	2	12,12,12	0.77	0	17,17,17	1.92	5 (29%)
2	GLC	N	2	2	11,11,12	1.11	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	N	3	2	21,22,23	1.32	2 (9%)	22,32,34	1.52	3 (13%)
2	GLC	O	1	2	12,12,12	0.77	0	17,17,17	1.91	5 (29%)
2	GLC	O	2	2	11,11,12	1.10	1 (9%)	15,15,17	2.17	4 (26%)
2	AC1	O	3	2	21,22,23	1.33	2 (9%)	22,32,34	1.52	3 (13%)
2	GLC	P	1	2	12,12,12	0.78	0	17,17,17	1.91	5 (29%)
2	GLC	P	2	2	11,11,12	1.11	1 (9%)	15,15,17	2.16	4 (26%)
2	AC1	P	3	2	21,22,23	1.33	2 (9%)	22,32,34	1.52	3 (13%)

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	GLC	I	1	2	-	2/2/22/22	0/1/1/1
2	GLC	I	2	2	-	2/2/19/22	0/1/1/1
2	AC1	I	3	2	-	3/6/43/46	0/2/2/2
2	GLC	J	1	2	-	2/2/22/22	0/1/1/1
2	GLC	J	2	2	-	2/2/19/22	0/1/1/1
2	AC1	J	3	2	-	3/6/43/46	0/2/2/2
2	GLC	K	1	2	-	2/2/22/22	0/1/1/1
2	GLC	K	2	2	-	2/2/19/22	0/1/1/1
2	AC1	K	3	2	-	3/6/43/46	0/2/2/2
2	GLC	L	1	2	-	2/2/22/22	0/1/1/1
2	GLC	L	2	2	-	2/2/19/22	0/1/1/1
2	AC1	L	3	2	-	3/6/43/46	0/2/2/2
2	GLC	M	1	2	-	2/2/22/22	0/1/1/1
2	GLC	M	2	2	-	2/2/19/22	0/1/1/1
2	AC1	M	3	2	-	3/6/43/46	0/2/2/2
2	GLC	N	1	2	-	2/2/22/22	0/1/1/1
2	GLC	N	2	2	-	2/2/19/22	0/1/1/1
2	AC1	N	3	2	-	3/6/43/46	0/2/2/2
2	GLC	O	1	2	-	2/2/22/22	0/1/1/1
2	GLC	O	2	2	-	2/2/19/22	0/1/1/1
2	AC1	O	3	2	-	3/6/43/46	0/2/2/2
2	GLC	P	1	2	-	2/2/22/22	0/1/1/1
2	GLC	P	2	2	-	2/2/19/22	0/1/1/1
2	AC1	P	3	2	-	3/6/43/46	0/2/2/2

The worst 5 of 25 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	3	AC1	C4A-C5B	-3.27	1.48	1.51
2	L	3	AC1	C4A-C5B	-2.83	1.49	1.51
2	J	3	AC1	C4A-C5B	-2.81	1.49	1.51
2	M	3	AC1	C4A-C5B	-2.80	1.49	1.51
2	P	3	AC1	C4A-C5B	-2.80	1.49	1.51

The worst 5 of 99 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	I	3	AC1	C1-C2-C3	6.91	119.71	109.64
2	I	2	GLC	C1-O5-C5	6.08	120.34	112.19
2	I	2	GLC	O2-C2-C1	-5.12	97.49	109.22
2	I	1	GLC	C3-C4-C5	-4.62	101.85	110.23
2	J	2	GLC	C6-C5-C4	-4.32	102.42	113.02

There are no chirality outliers.

5 of 56 torsion outliers are listed below:

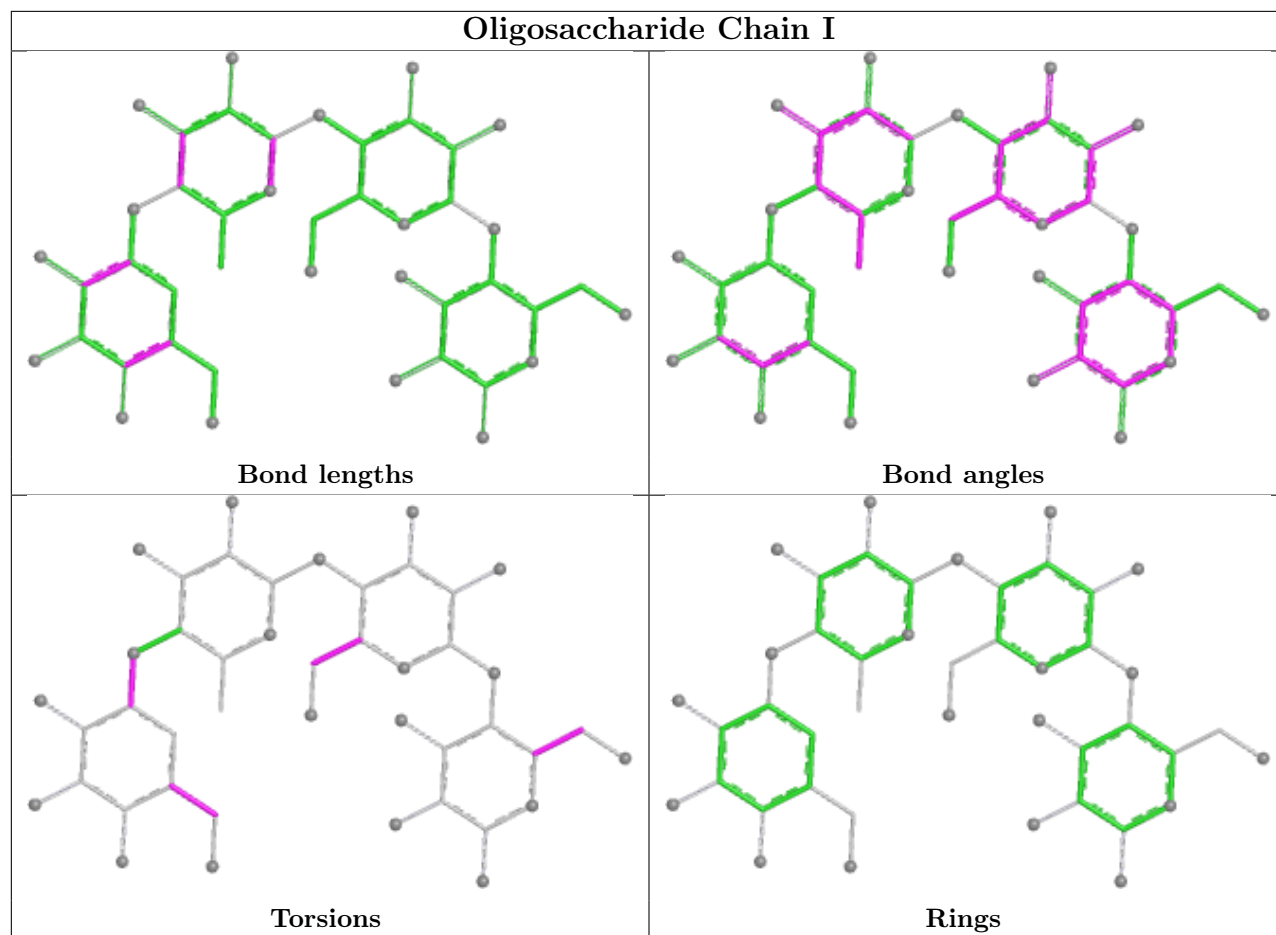
Mol	Chain	Res	Type	Atoms
2	I	3	AC1	C7B-C1B-N4A-C4
2	I	3	AC1	C4A-C5B-C6B-O6B
2	I	3	AC1	C7B-C5B-C6B-O6B
2	J	3	AC1	C7B-C1B-N4A-C4
2	J	3	AC1	C4A-C5B-C6B-O6B

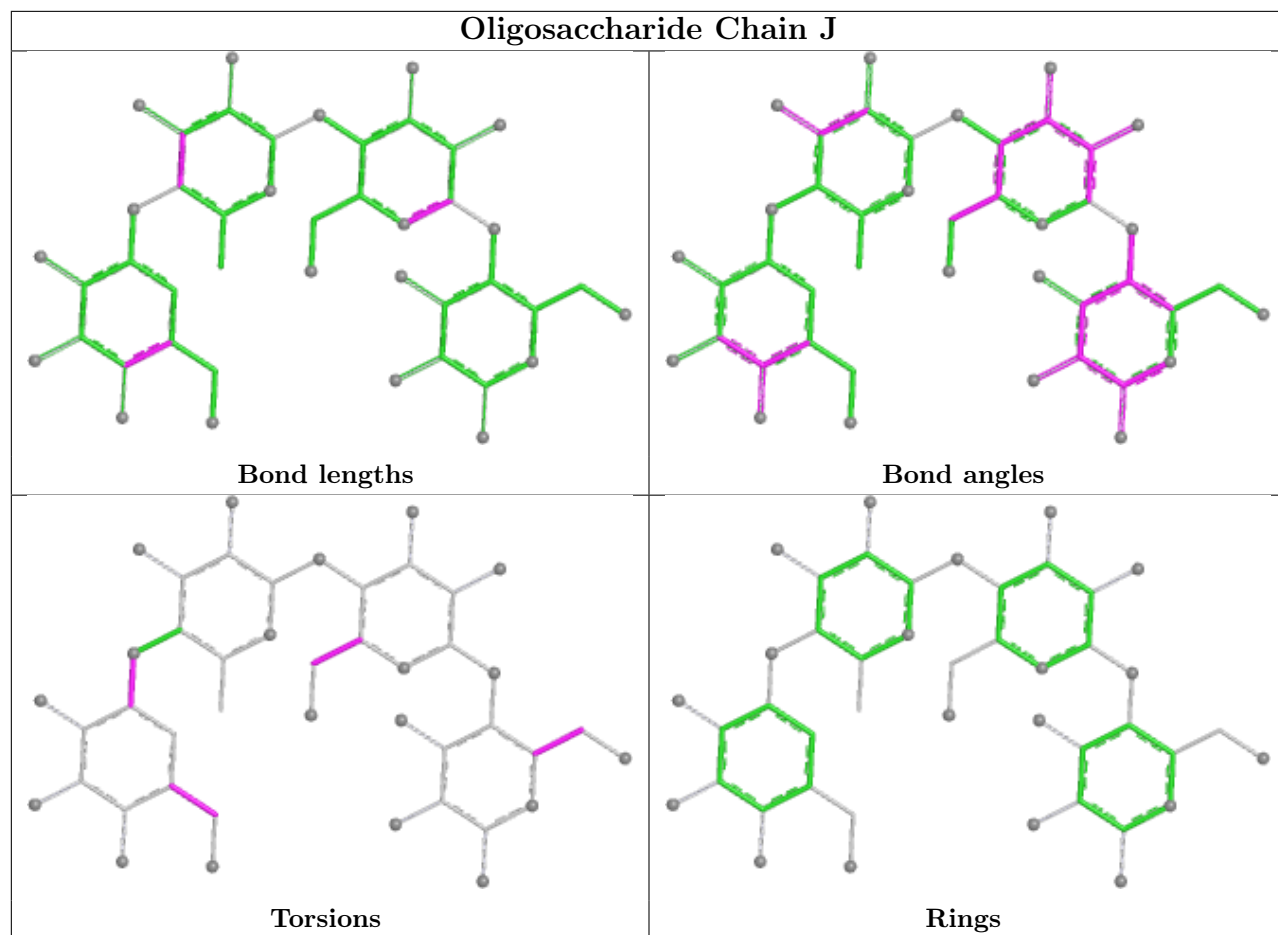
There are no ring outliers.

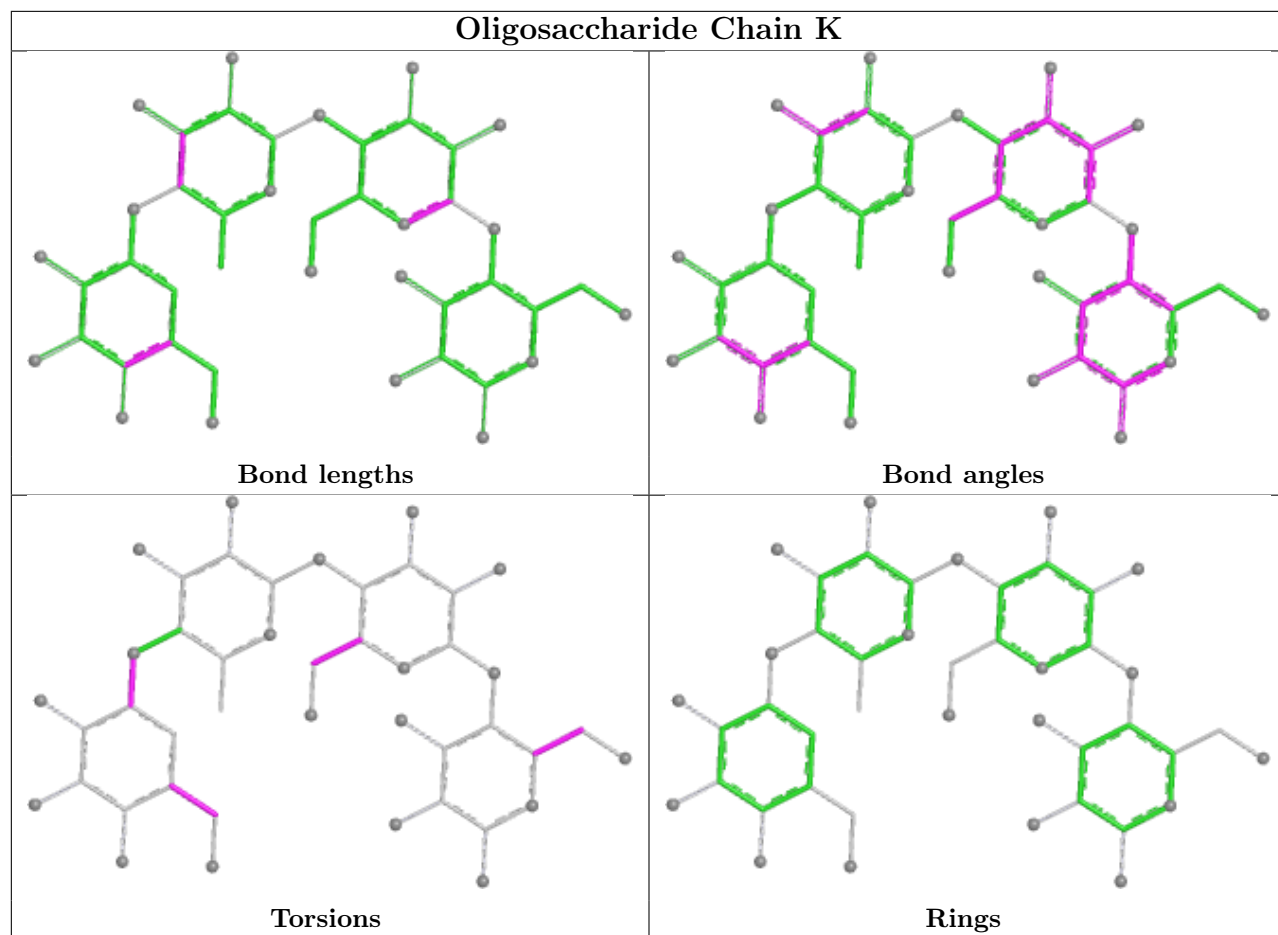
16 monomers are involved in 62 short contacts:

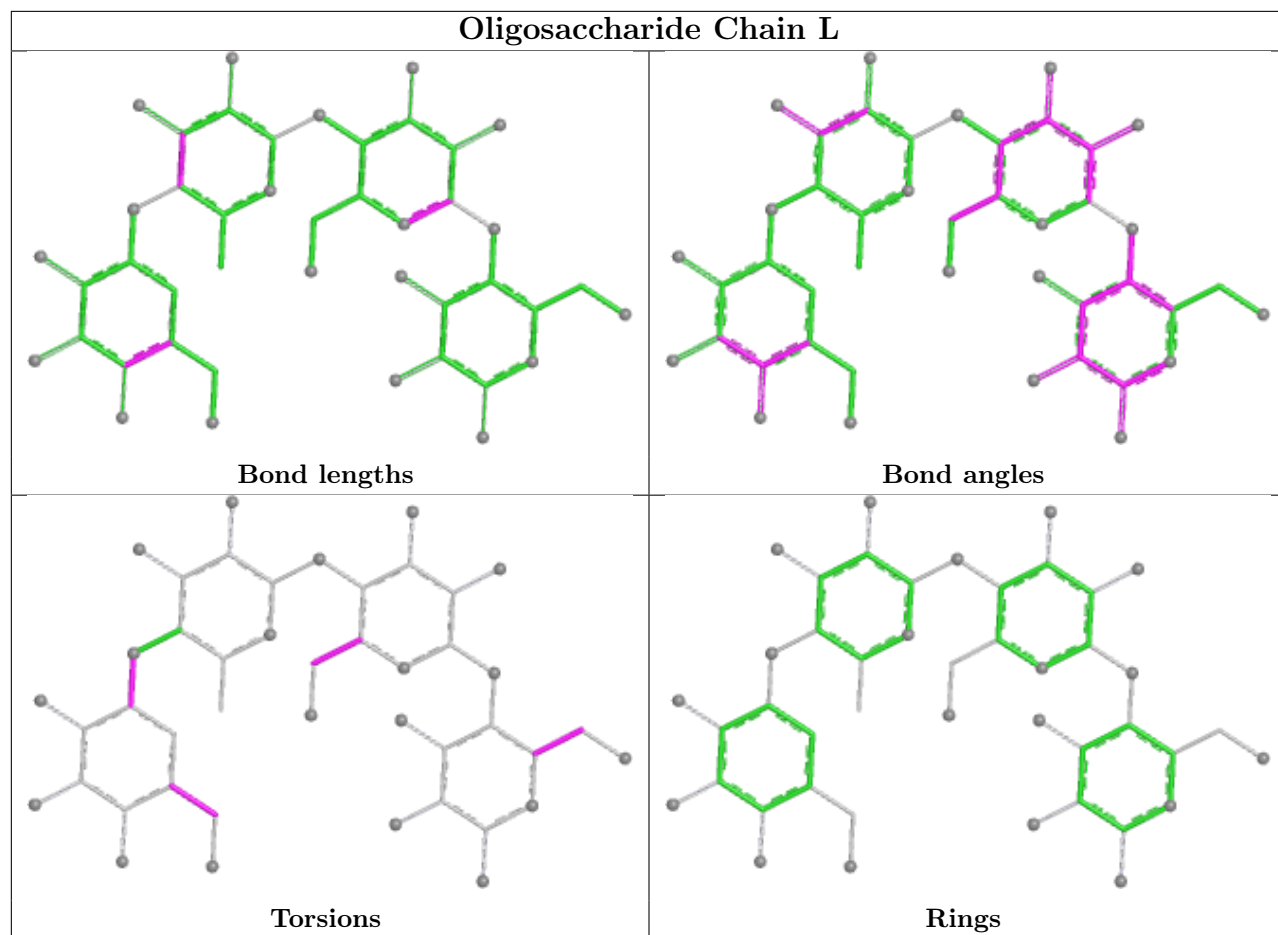
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	M	3	AC1	10	0
2	K	3	AC1	9	0
2	I	3	AC1	10	0
2	K	2	GLC	4	0
2	P	2	GLC	3	0
2	O	3	AC1	7	0
2	J	3	AC1	8	0
2	L	2	GLC	4	0
2	N	3	AC1	6	0
2	I	2	GLC	4	0
2	J	2	GLC	4	0
2	L	3	AC1	6	0
2	N	2	GLC	4	0
2	P	3	AC1	6	0
2	O	2	GLC	4	0
2	M	2	GLC	4	0

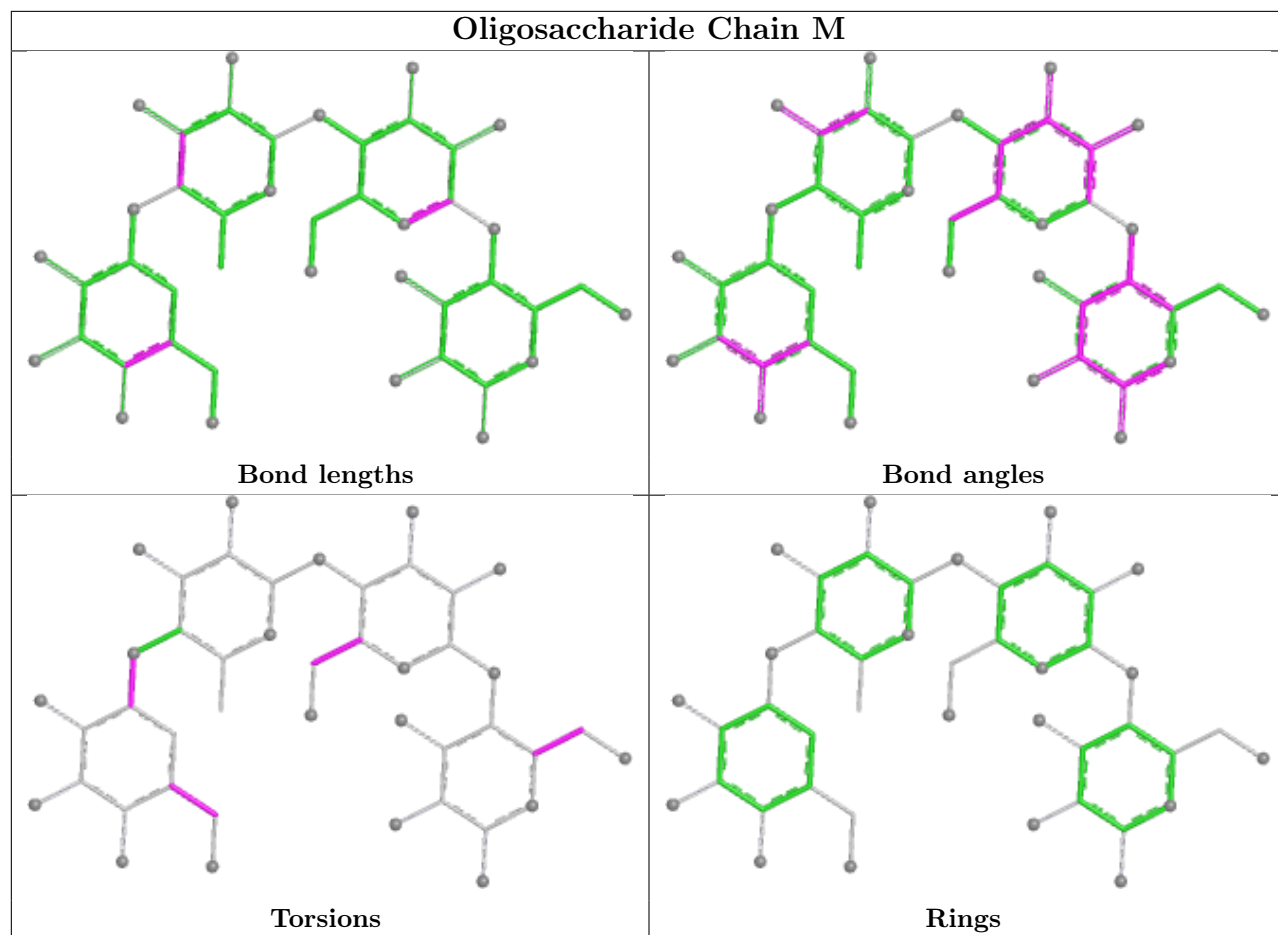
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

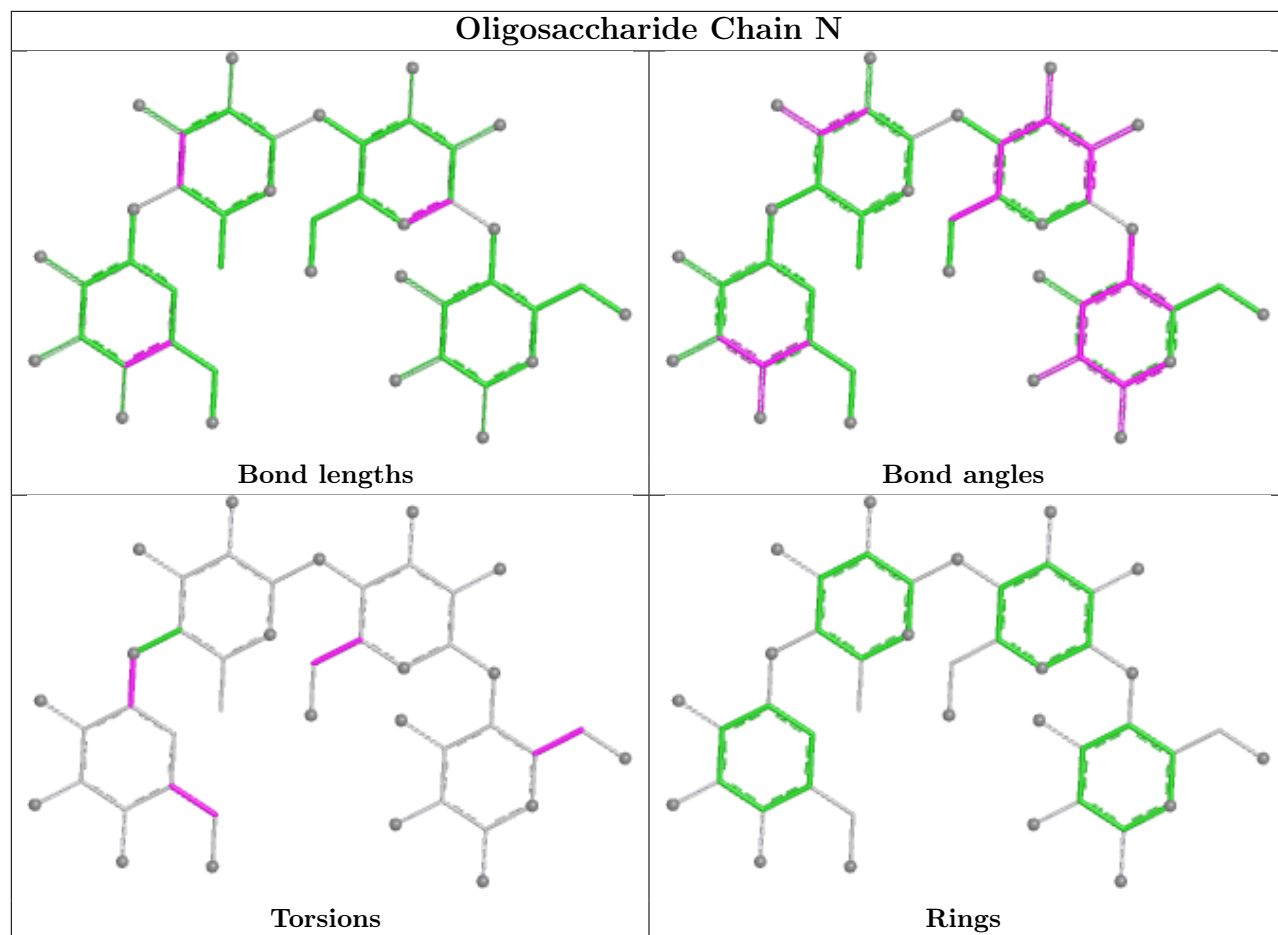


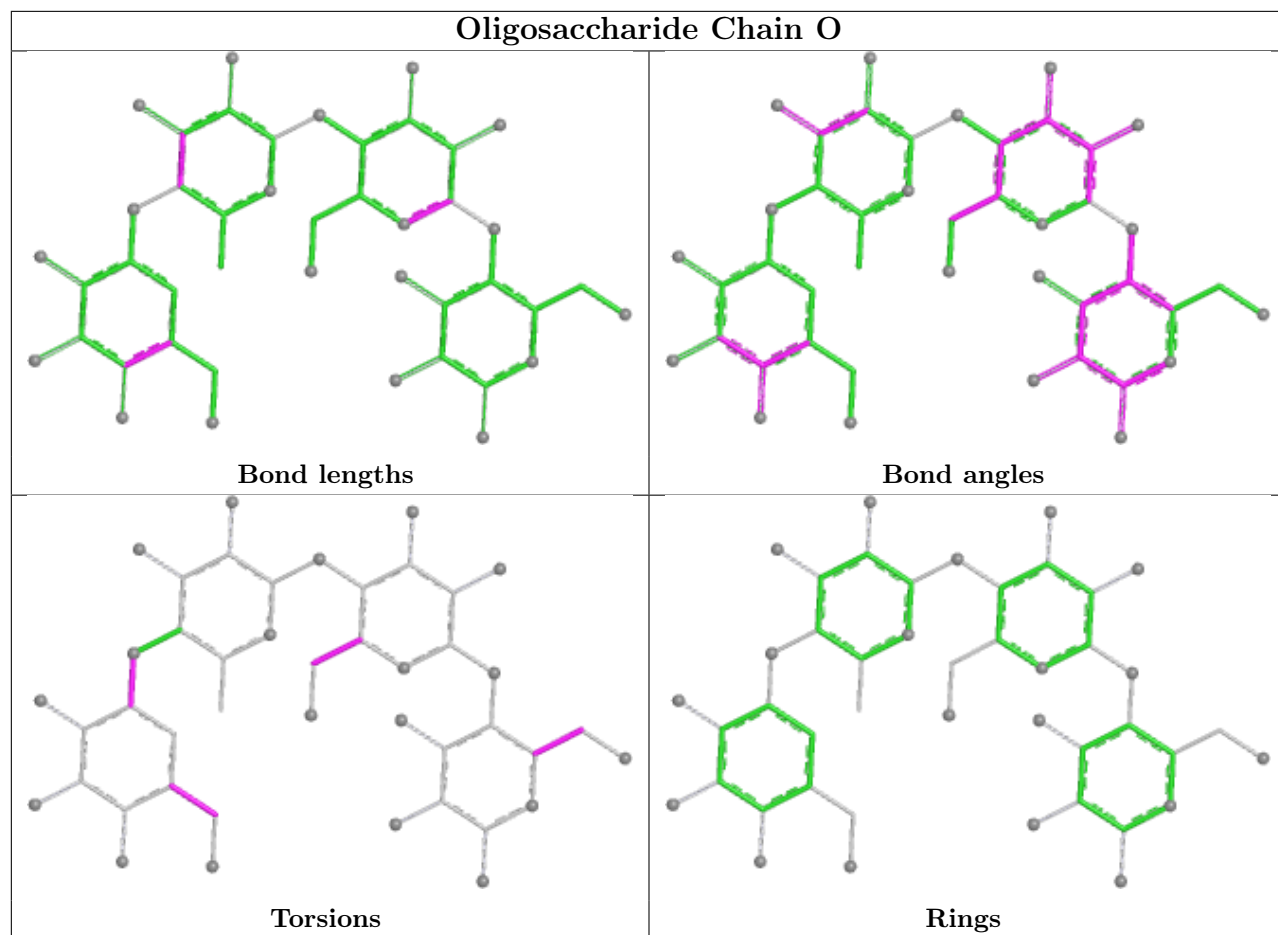


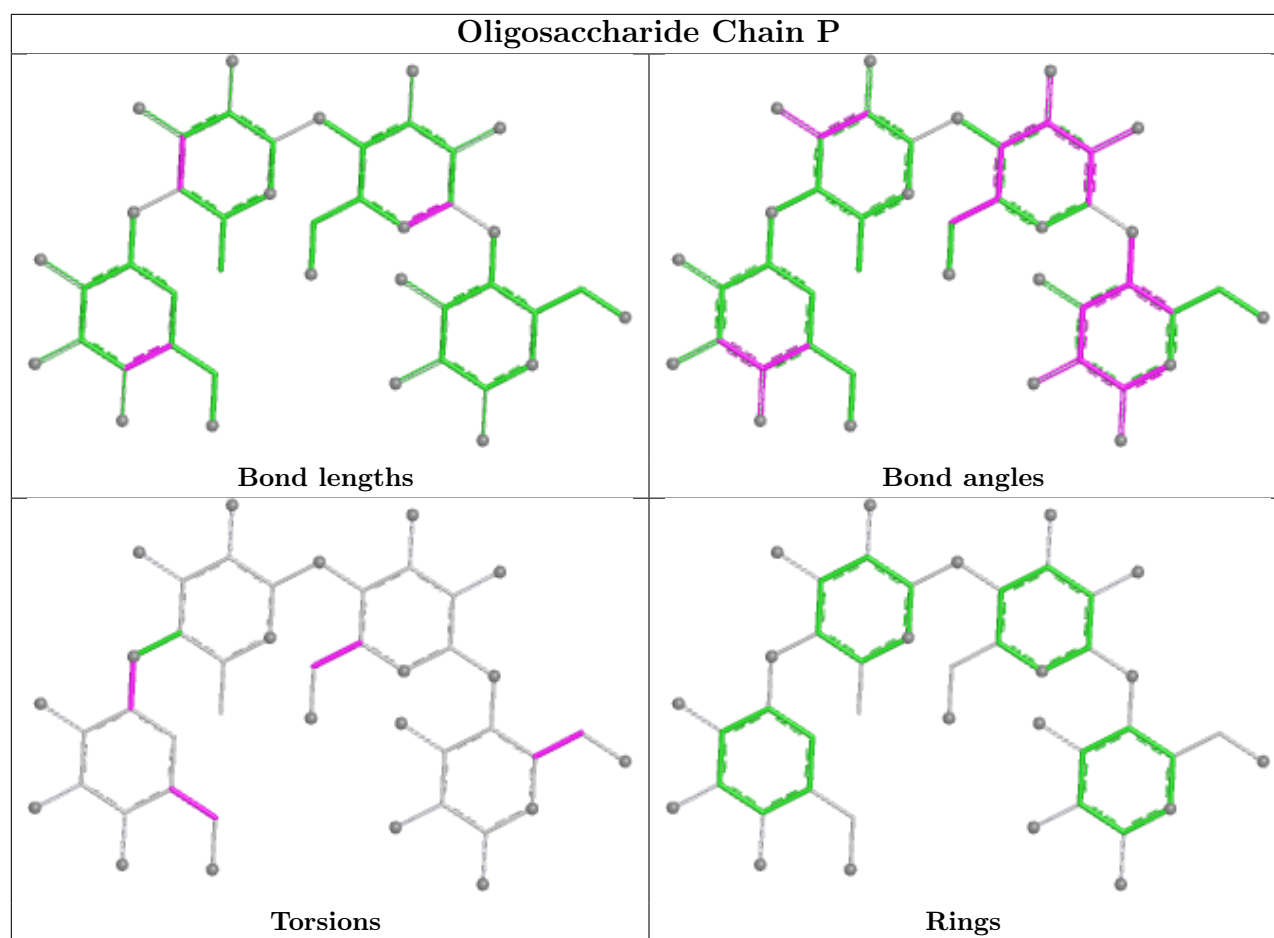












5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 8 are monoatomic - leaving 8 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
4	MES	G	5001	-	12,12,12	1.49	2 (16%)	15,16,16	5.94	11 (73%)
4	MES	C	5001	-	12,12,12	1.52	3 (25%)	15,16,16	5.54	9 (60%)
4	MES	D	5001	-	12,12,12	1.45	2 (16%)	15,16,16	5.29	9 (60%)
4	MES	F	5001	-	12,12,12	1.90	3 (25%)	15,16,16	6.27	12 (80%)
4	MES	A	5001	-	12,12,12	1.55	3 (25%)	15,16,16	6.65	10 (66%)
4	MES	E	5001	-	12,12,12	1.42	4 (33%)	15,16,16	6.07	11 (73%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	MES	H	5001	-	12,12,12	1.09	1 (8%)	15,16,16	5.93	11 (73%)
4	MES	B	5001	-	12,12,12	1.73	4 (33%)	15,16,16	6.46	12 (80%)

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	MES	G	5001	-	-	5/6/14/14	0/1/1/1
4	MES	C	5001	-	-	4/6/14/14	0/1/1/1
4	MES	D	5001	-	-	5/6/14/14	0/1/1/1
4	MES	F	5001	-	-	4/6/14/14	0/1/1/1
4	MES	A	5001	-	-	2/6/14/14	0/1/1/1
4	MES	E	5001	-	-	1/6/14/14	0/1/1/1
4	MES	H	5001	-	-	1/6/14/14	0/1/1/1
4	MES	B	5001	-	-	2/6/14/14	0/1/1/1

The worst 5 of 22 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	5001	MES	C8-S	-4.11	1.71	1.77
4	A	5001	MES	O2S-S	3.81	1.55	1.45
4	B	5001	MES	C8-S	-3.37	1.72	1.77
4	B	5001	MES	O2S-S	3.15	1.54	1.45
4	F	5001	MES	O1S-S	2.90	1.53	1.45

The worst 5 of 85 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	5001	MES	O2S-S-C8	-20.68	75.47	106.73
4	B	5001	MES	O1S-S-C8	-17.23	80.69	106.73
4	F	5001	MES	O2S-S-C8	-14.63	84.62	106.73
4	C	5001	MES	O1S-S-C8	-14.59	84.69	106.73
4	E	5001	MES	O2S-S-C8	-14.43	84.93	106.73

There are no chirality outliers.

5 of 24 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	5001	MES	C8-C7-N4-C5
4	A	5001	MES	N4-C7-C8-S
4	B	5001	MES	C8-C7-N4-C5
4	C	5001	MES	C8-C7-N4-C5
4	C	5001	MES	C7-C8-S-O2S

There are no ring outliers.

5 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	G	5001	MES	1	0
4	C	5001	MES	2	0
4	D	5001	MES	2	0
4	A	5001	MES	2	0
4	E	5001	MES	1	0

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, 95th 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	842/844 (99%)	-0.33	17 (2%) 65 44	23, 38, 90, 113	0
1	B	747/844 (88%)	-0.21	8 (1%) 78 59	31, 50, 88, 136	0
1	C	844/844 (100%)	-0.51	5 (0%) 85 70	24, 35, 60, 70	0
1	D	844/844 (100%)	-0.33	13 (1%) 72 52	26, 39, 83, 101	0
1	E	843/844 (99%)	-0.29	25 (2%) 52 32	22, 36, 101, 126	0
1	F	844/844 (100%)	-0.22	5 (0%) 85 70	37, 53, 73, 89	0
1	G	844/844 (100%)	-0.43	5 (0%) 85 70	24, 35, 68, 79	0
1	H	807/844 (95%)	-0.30	28 (3%) 47 27	24, 42, 95, 139	0
All	All	6615/6752 (97%)	-0.33	106 (1%) 70 49	22, 40, 83, 139	0

The worst 5 of 106 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	277	ILE	7.3
1	B	248	TYR	6.4
1	B	249	ASN	5.8
1	H	282	LYS	5.7
1	H	288	THR	5.4

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,

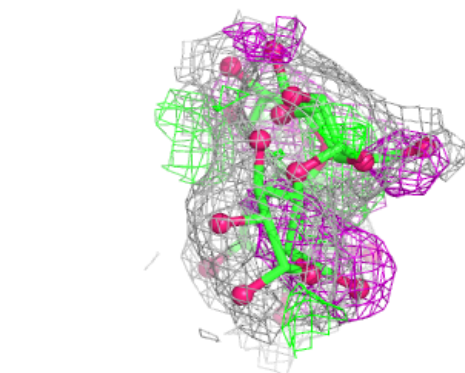
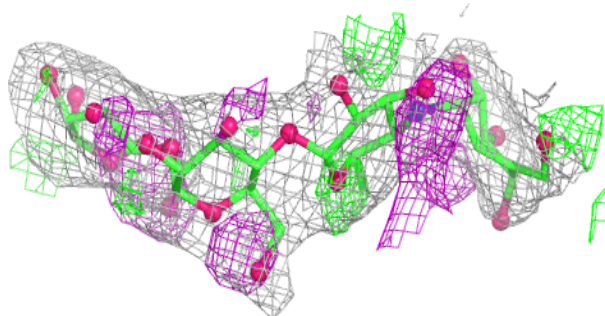
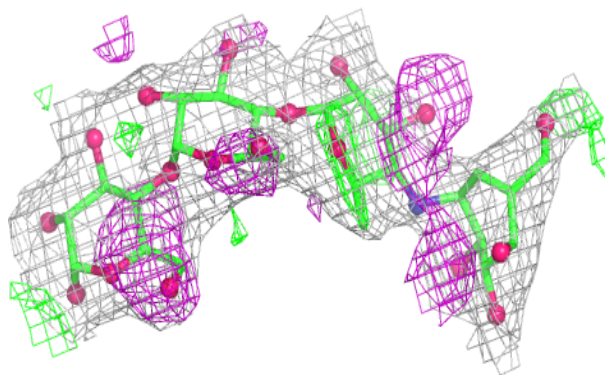
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	GLC	M	1	12/12	0.73	0.19	48,49,49,50	0
2	GLC	N	1	12/12	0.73	0.19	48,49,49,50	0
2	GLC	N	2	11/12	0.74	0.17	46,47,47,47	0
2	GLC	L	1	12/12	0.77	0.20	48,49,49,50	0
2	GLC	O	1	12/12	0.77	0.20	48,49,49,50	0
2	GLC	J	2	11/12	0.79	0.16	46,47,47,47	0
2	GLC	O	2	11/12	0.79	0.16	46,47,47,47	0
2	GLC	L	2	11/12	0.80	0.16	46,47,47,47	0
2	GLC	I	2	11/12	0.81	0.13	46,47,47,47	0
2	AC1	M	3	21/22	0.81	0.20	35,50,53,53	0
2	AC1	N	3	21/22	0.82	0.18	35,50,53,53	0
2	GLC	M	2	11/12	0.82	0.15	46,47,47,47	0
2	GLC	K	1	12/12	0.82	0.18	48,49,49,50	0
2	GLC	I	1	12/12	0.83	0.16	48,49,49,50	0
2	GLC	J	1	12/12	0.84	0.13	48,49,49,50	0
2	AC1	I	3	21/22	0.85	0.18	35,50,53,53	0
2	GLC	P	1	12/12	0.85	0.16	48,49,49,50	0
2	GLC	P	2	11/12	0.85	0.13	46,47,47,47	0
2	GLC	K	2	11/12	0.86	0.13	46,47,47,47	0
2	AC1	P	3	21/22	0.86	0.16	35,50,53,53	0
2	AC1	L	3	21/22	0.89	0.15	35,50,53,53	0
2	AC1	K	3	21/22	0.89	0.18	35,50,53,53	0
2	AC1	O	3	21/22	0.91	0.16	35,50,53,53	0
2	AC1	J	3	21/22	0.91	0.16	35,50,53,53	0

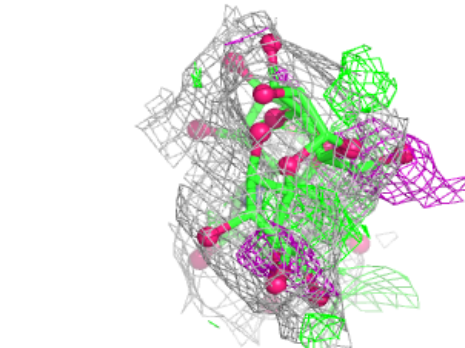
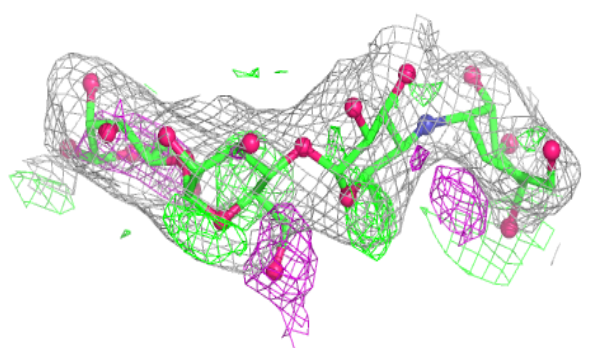
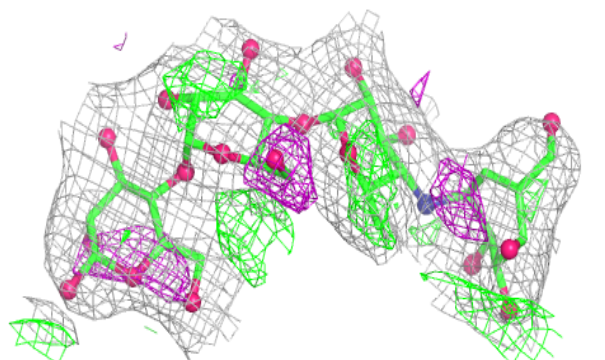
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around Chain I:

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

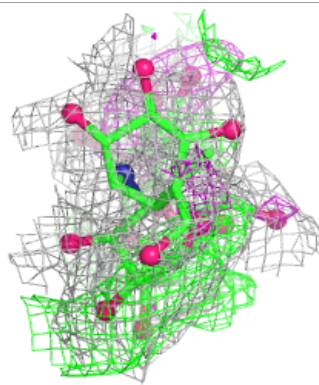
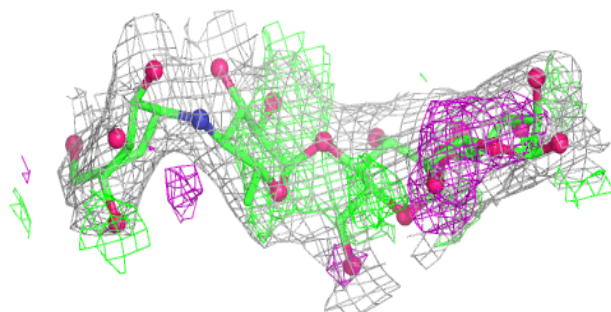
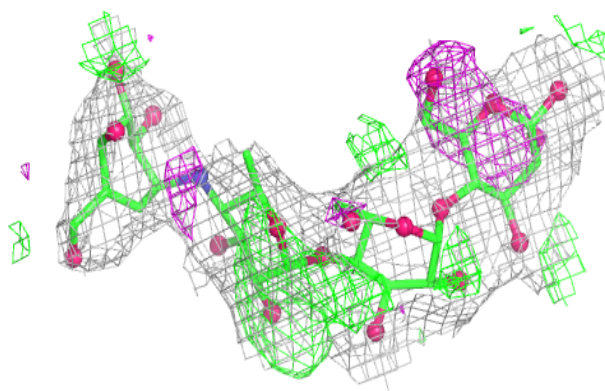
**Electron density around Chain J:**

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

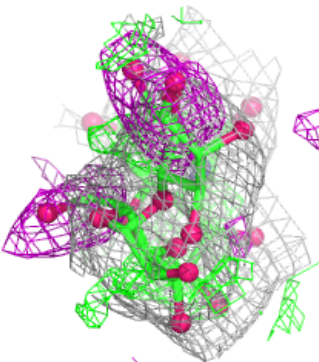
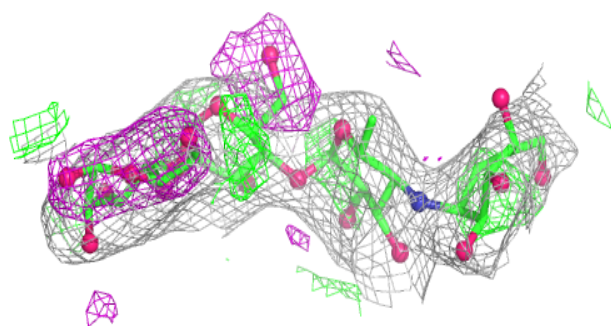
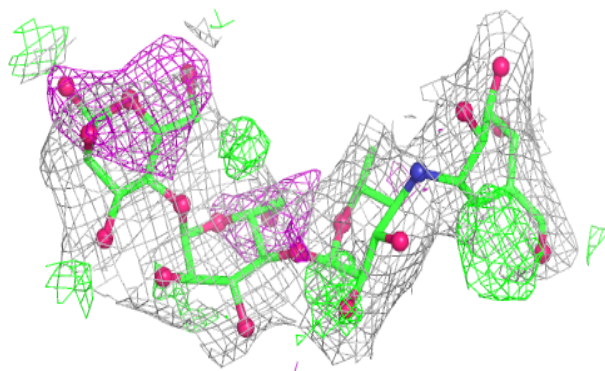


Electron density around Chain K:

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

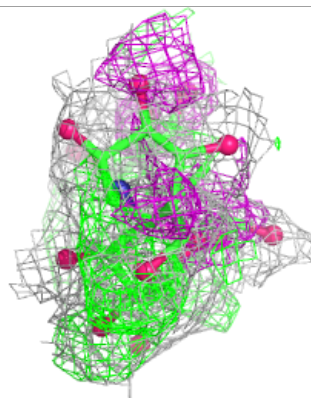
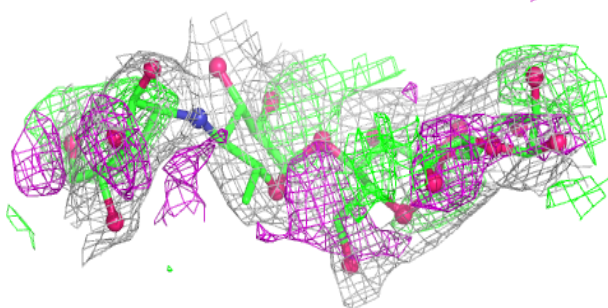
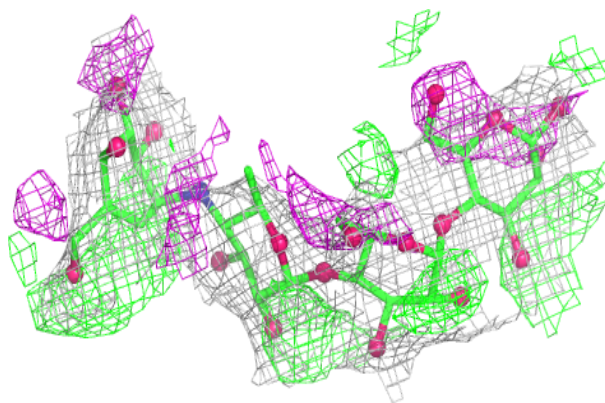
**Electron density around Chain L:**

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

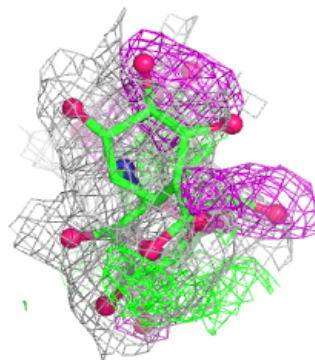
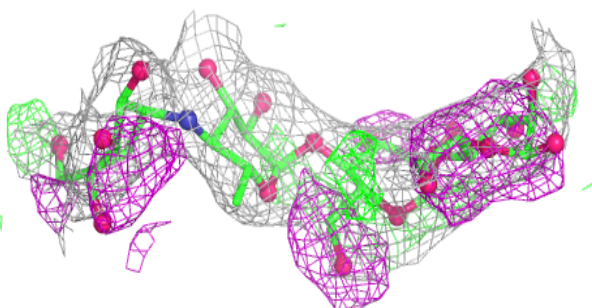
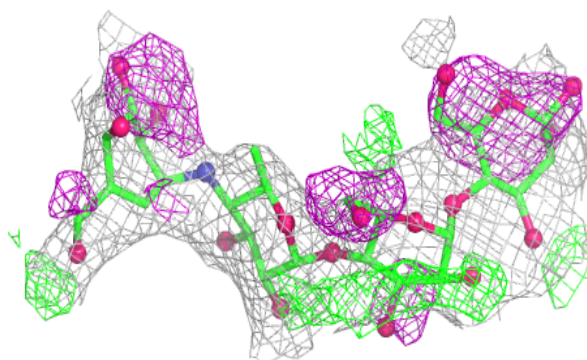


Electron density around Chain M:

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

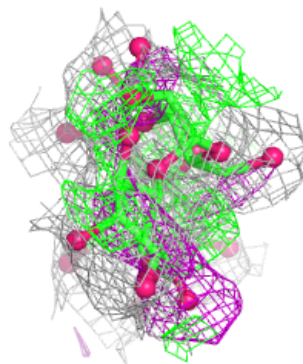
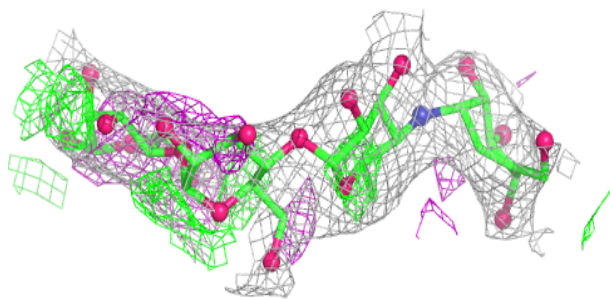
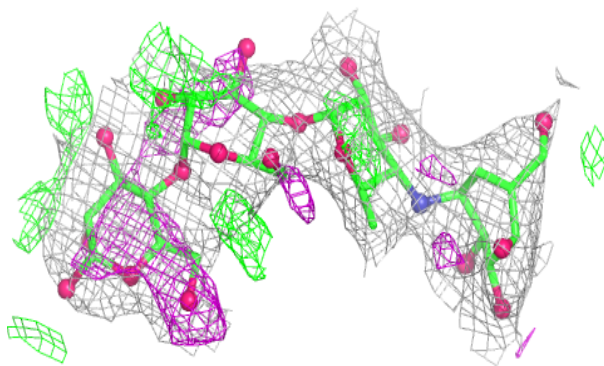
**Electron density around Chain N:**

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

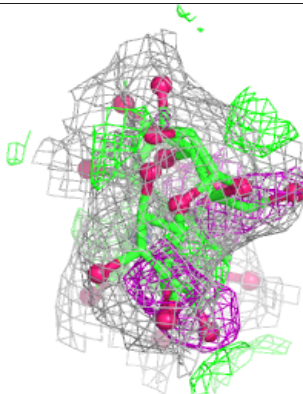
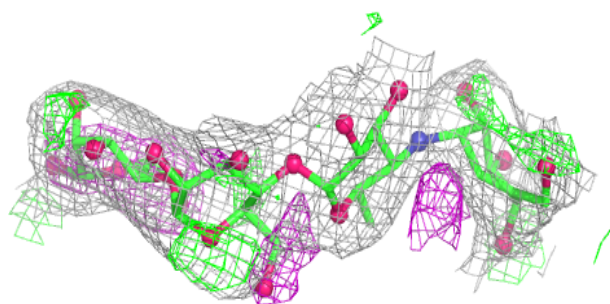
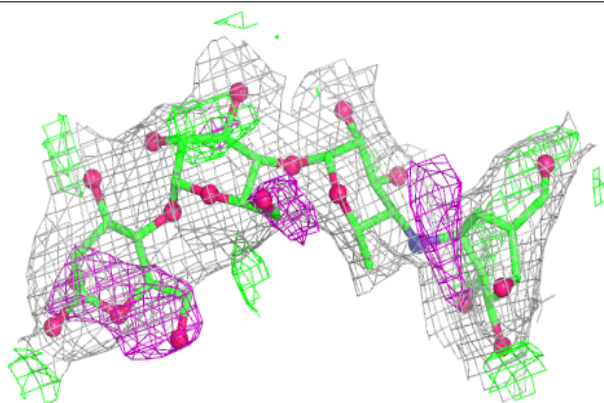


Electron density around Chain O:

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

**Electron density around Chain P:**

$2mF_o-DF_c$ (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, 95th 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	MES	C	5001	12/12	0.92	0.14	29,31,32,32	0
4	MES	A	5001	12/12	0.93	0.14	29,31,33,33	0
4	MES	B	5001	12/12	0.94	0.18	39,41,43,44	0
3	CA	A	4001	1/1	0.94	0.07	28,28,28,28	0
4	MES	E	5001	12/12	0.94	0.13	30,33,35,36	0
4	MES	G	5001	12/12	0.94	0.12	30,31,33,33	0
4	MES	H	5001	12/12	0.94	0.13	28,30,32,32	0
4	MES	F	5001	12/12	0.96	0.13	36,37,37,37	0
3	CA	B	4001	1/1	0.96	0.04	33,33,33,33	0
3	CA	G	4001	1/1	0.96	0.05	28,28,28,28	0
3	CA	F	4001	1/1	0.97	0.05	38,38,38,38	0
4	MES	D	5001	12/12	0.97	0.12	31,33,35,35	0
3	CA	D	4001	1/1	0.97	0.05	32,32,32,32	0
3	CA	C	4001	1/1	0.98	0.03	29,29,29,29	0
3	CA	E	4001	1/1	0.98	0.08	32,32,32,32	0
3	CA	H	4001	1/1	0.99	0.05	32,32,32,32	0

6.5 Other polymers [i](#)

There are no such residues in this entry.