



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2026 – 12:16 AM UTC

PDB ID : 5MGD / pdb_00005mgd
Title : STRUCTURE OF E298Q-BETA-GALACTOSIDASE FROM AS-
PERGILLUS NIGER IN COMPLEX WITH 6-Galactosyl-lactose
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cerra, M.; Sanz-Aparicio, J.
Deposited on : 2016-11-21
Resolution : 2.15 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 ⓘ 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

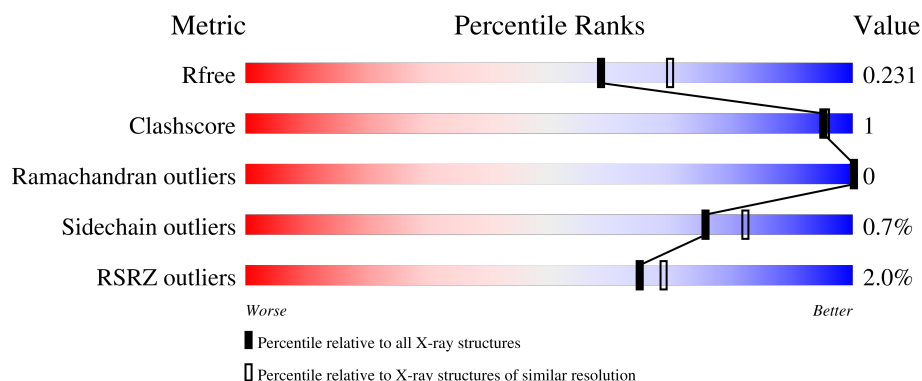
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.15 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	2057 (2.16-2.16)
Clashscore	190562	2159 (2.16-2.16)
Ramachandran outliers	187476	2134 (2.16-2.16)
Sidechain outliers	187428	2133 (2.16-2.16)
RSRZ outliers	180081	2059 (2.16-2.16)

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	1013	2% 92% • •
2	B	8	25% 62% 12%
3	C	10	20% 70% 10%
4	D	6	17% 67% 17%
5	E	3	33% 67%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 8088 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.

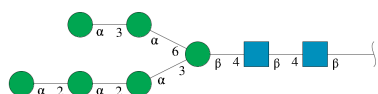
- Molecule 1 is a protein called Probable beta-galactosidase A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	968	7482	4780	1220	1471	11	0	0	0

There are 7 discrepancies between the modelled and reference sequences:

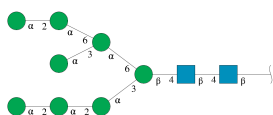
Chain	Residue	Modelled	Actual	Comment	Reference
A	298	GLN	GLU	engineered mutation	UNP A2QAN3
A	1008	HIS	-	expression tag	UNP A2QAN3
A	1009	HIS	-	expression tag	UNP A2QAN3
A	1010	HIS	-	expression tag	UNP A2QAN3
A	1011	HIS	-	expression tag	UNP A2QAN3
A	1012	HIS	-	expression tag	UNP A2QAN3
A	1013	HIS	-	expression tag	UNP A2QAN3

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



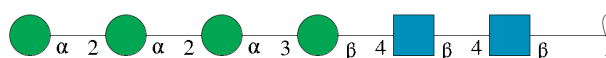
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	8	94	52	2	40	0	0	0

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-6)]-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-3)]alpha-D-mannopyranose-(1-6)]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
3	C	10	Total	C	N	O	0	0	0
			116	64	2	50			

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	D	6	Total	C	N	O	0	0	0
			72	40	2	30			

- Molecule 5 is an oligosaccharide called beta-D-galactopyranose-(1-6)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
5	E	3	Total	C	O	0	0	0
			34	18	16			

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 7 is DIMETHYL SULFOXIDE (CCD ID: DMS) (formula: C₂H₆OS).

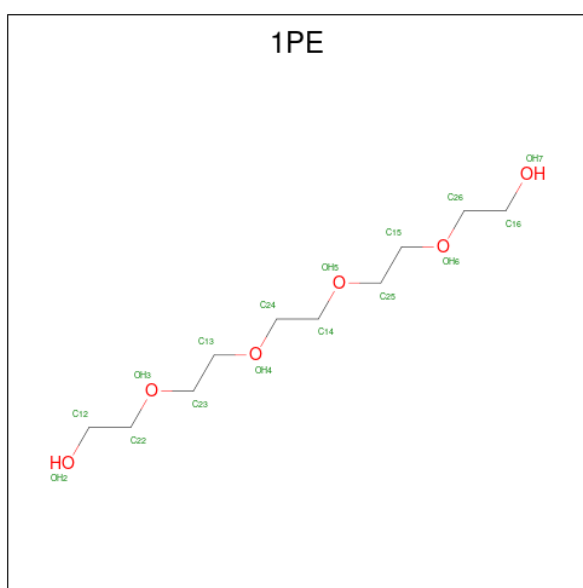


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 8 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	1	Total	Cl	0	0
			1	1		

- Molecule 9 is PENTAETHYLENE GLYCOL (CCD ID: 1PE) (formula: C₁₀H₂₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	A	1	Total	C	O	0	0
			16	10	6		

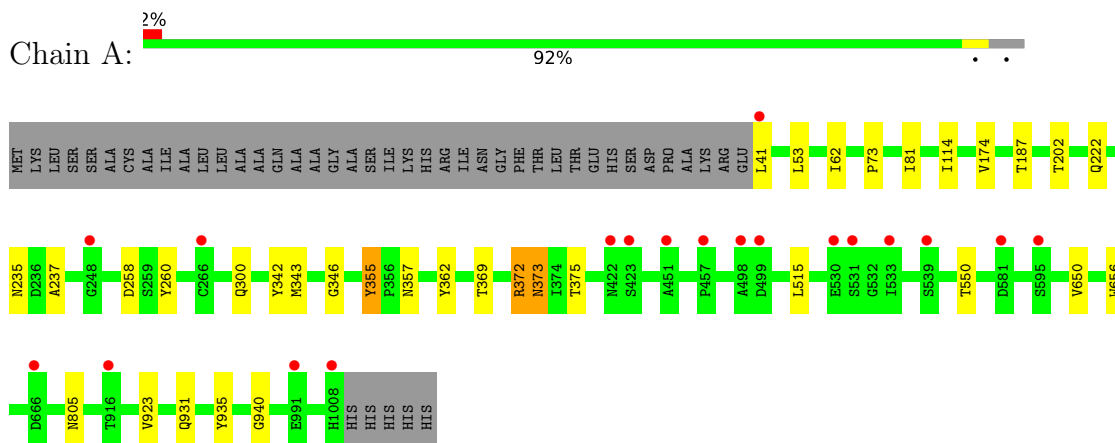
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	185	Total	O	0	0
			185	185		

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: Probable beta-galactosidase A



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



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



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

Chain D:  17% 67% 17%



- Molecule 5: beta-D-galactopyranose-(1-6)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose

Chain E:  33% 67%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	58.28Å 105.87Å 83.72Å 90.00° 99.24° 90.00°	Depositor
Resolution (Å)	82.63 – 2.15 82.63 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.9 (82.63-2.15) 99.9 (82.63-2.15)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.06 (at 2.16Å)	Xtriage
Refinement program	REFMAC 5.8.0155	Depositor
R, R_{free}	0.191 , 0.227 0.201 , 0.231	Depositor DCC
R_{free} test set	2769 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	18.9	Xtriage
Anisotropy	1.137	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 33.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	8088	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.71% of the height of the origin peak. No significant pseudotranslation is detected.*

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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, GAL, NAG, GLC, BMA, DMS, 1PE, MAN

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.65	2/7685 (0.0%)	0.76	1/10488 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	372	ARG	C-N	-15.98	1.10	1.33
1	A	373	ASN	C-O	-6.29	1.16	1.23

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	372	ARG	O-C-N	-5.99	114.52	122.00

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	7482	0	7179	17	0
2	B	94	0	79	2	0
3	C	116	0	97	1	0
4	D	72	0	61	1	0
5	E	34	0	30	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	84	0	78	0	0
7	A	4	0	6	0	0
8	A	1	0	0	0	0
9	A	16	0	22	0	0
10	A	185	0	0	0	0
All	All	8088	0	7552	19	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 1.

All (19) 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)
5:E:1:GLC:H62	5:E:2:GAL:C1	2.00	0.92
1:A:375:THR:HG21	2:B:1:NAG:H82	1.85	0.56
1:A:940:GLY:HA2	4:D:1:NAG:H83	1.93	0.51
1:A:202:THR:HG21	1:A:237:ALA:HB3	1.93	0.50
1:A:53:LEU:HD12	1:A:62:ILE:HG13	1.94	0.49
1:A:550:THR:HG21	3:C:9:MAN:H62	1.95	0.48
1:A:174:VAL:HG11	1:A:222:GLN:HB3	1.97	0.46
1:A:346:GLY:HA3	1:A:362:TYR:O	2.15	0.46
1:A:650:VAL:HG22	1:A:656:TRP:CD1	2.50	0.46
1:A:260:TYR:HA	1:A:300:GLN:HB2	1.99	0.45
1:A:369:THR:HB	2:B:1:NAG:H62	1.98	0.45
1:A:73:PRO:HB2	1:A:114:ILE:HB	1.98	0.44
1:A:515:LEU:C	1:A:515:LEU:HD12	2.44	0.42
1:A:81:ILE:HD11	1:A:372:ARG:HG2	2.01	0.42
1:A:355:TYR:CZ	1:A:357:ASN:HB2	2.55	0.42
1:A:923:VAL:HB	1:A:935:TYR:HB3	2.02	0.41
5:E:1:GLC:C6	5:E:2:GAL:C1	2.78	0.40
1:A:235:ASN:HB2	1:A:258:ASP:OD1	2.21	0.40
1:A:342:TYR:HA	1:A:343:MET:HA	1.95	0.40

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	966/1013 (95%)	934 (97%)	32 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	808/842 (96%)	802 (99%)	6 (1%)	76	82

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	LEU
1	A	187	THR
1	A	355	TYR
1	A	373	ASN
1	A	805	ASN
1	A	931	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	140	ASN
1	A	268	ASN

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Mol	Chain	Res	Type
1	A	458	GLN
1	A	568	ASN
1	A	839	ASN
1	A	924	GLN
1	A	953	ASN
1	A	997	GLN
1	A	1008	HIS

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 ⓘ

27 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	NAG	B	1	1,2	14,14,15	2.27	8 (57%)	17,19,21	1.59	3 (17%)
2	NAG	B	2	2	14,14,15	0.32	0	17,19,21	0.88	0
2	BMA	B	3	2	11,11,12	0.25	0	15,15,17	1.36	2 (13%)
2	MAN	B	4	2	11,11,12	0.27	0	15,15,17	1.24	1 (6%)
2	MAN	B	5	2	11,11,12	0.27	0	15,15,17	1.14	1 (6%)
2	MAN	B	6	2	11,11,12	0.46	0	15,15,17	0.64	0
2	MAN	B	7	2	11,11,12	0.56	0	15,15,17	2.42	3 (20%)
2	MAN	B	8	2	11,11,12	0.33	0	15,15,17	1.55	1 (6%)
3	NAG	C	1	1,3	14,14,15	0.34	0	17,19,21	1.26	3 (17%)
3	MAN	C	10	3	11,11,12	0.39	0	15,15,17	0.60	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	NAG	C	2	3	14,14,15	0.46	0	17,19,21	0.90	1 (5%)
3	BMA	C	3	3	11,11,12	0.30	0	15,15,17	0.92	0
3	MAN	C	4	3	11,11,12	0.23	0	15,15,17	1.42	1 (6%)
3	MAN	C	5	3	11,11,12	0.27	0	15,15,17	0.82	1 (6%)
3	MAN	C	6	3	11,11,12	0.38	0	15,15,17	1.28	1 (6%)
3	MAN	C	7	3	11,11,12	0.38	0	15,15,17	0.86	1 (6%)
3	MAN	C	8	3	11,11,12	0.39	0	15,15,17	0.79	1 (6%)
3	MAN	C	9	3	11,11,12	0.51	0	15,15,17	0.89	1 (6%)
4	NAG	D	1	1,4	14,14,15	0.38	0	17,19,21	0.96	1 (5%)
4	NAG	D	2	4	14,14,15	0.35	0	17,19,21	1.01	2 (11%)
4	BMA	D	3	4	11,11,12	0.51	0	15,15,17	1.10	0
4	MAN	D	4	4	11,11,12	0.46	0	15,15,17	1.24	2 (13%)
4	MAN	D	5	4	11,11,12	0.35	0	15,15,17	0.92	1 (6%)
4	MAN	D	6	4	11,11,12	0.32	0	15,15,17	0.87	1 (6%)
5	GLC	E	1	5	12,12,12	0.97	1 (8%)	17,17,17	0.89	1 (5%)
5	GAL	E	2	5	11,11,12	1.61	1 (9%)	15,15,17	2.25	7 (46%)
5	GAL	E	3	5	11,11,12	1.15	2 (18%)	15,15,17	1.87	4 (26%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '–' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	B	1	1,2	–	0/6/23/26	0/1/1/1
2	NAG	B	2	2	–	0/6/23/26	0/1/1/1
2	BMA	B	3	2	–	0/2/19/22	0/1/1/1
2	MAN	B	4	2	–	0/2/19/22	0/1/1/1
2	MAN	B	5	2	–	0/2/19/22	0/1/1/1
2	MAN	B	6	2	–	2/2/19/22	0/1/1/1
2	MAN	B	7	2	–	0/2/19/22	0/1/1/1
2	MAN	B	8	2	–	1/2/19/22	0/1/1/1
3	NAG	C	1	1,3	–	1/6/23/26	0/1/1/1
3	MAN	C	10	3	–	2/2/19/22	0/1/1/1
3	NAG	C	2	3	–	0/6/23/26	0/1/1/1
3	BMA	C	3	3	–	0/2/19/22	0/1/1/1
3	MAN	C	4	3	–	0/2/19/22	0/1/1/1
3	MAN	C	5	3	–	1/2/19/22	0/1/1/1
3	MAN	C	6	3	–	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	MAN	C	7	3	-	2/2/19/22	0/1/1/1
3	MAN	C	8	3	-	2/2/19/22	0/1/1/1
3	MAN	C	9	3	-	1/2/19/22	0/1/1/1
4	NAG	D	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	D	2	4	-	0/6/23/26	0/1/1/1
4	BMA	D	3	4	-	0/2/19/22	0/1/1/1
4	MAN	D	4	4	-	0/2/19/22	0/1/1/1
4	MAN	D	5	4	-	2/2/19/22	0/1/1/1
4	MAN	D	6	4	-	0/2/19/22	0/1/1/1
5	GLC	E	1	5	-	0/2/22/22	0/1/1/1
5	GAL	E	2	5	-	0/2/19/22	0/1/1/1
5	GAL	E	3	5	-	1/2/19/22	0/1/1/1

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	E	2	GAL	O6-C6	-5.08	1.21	1.42
2	B	1	NAG	C1-C2	4.79	1.58	1.52
2	B	1	NAG	O5-C1	-3.09	1.38	1.43
5	E	1	GLC	O4-C4	-2.96	1.35	1.43
2	B	1	NAG	C3-C2	-2.77	1.46	1.52
2	B	1	NAG	O7-C7	-2.69	1.17	1.23
2	B	1	NAG	O3-C3	-2.40	1.37	1.43
5	E	3	GAL	O5-C1	-2.35	1.39	1.43
5	E	3	GAL	O2-C2	-2.31	1.38	1.43
2	B	1	NAG	O4-C4	-2.28	1.37	1.43
2	B	1	NAG	C2-N2	-2.13	1.42	1.46
2	B	1	NAG	O5-C5	-2.07	1.39	1.43

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	7	MAN	C1-O5-C5	7.98	122.89	112.19
2	B	8	MAN	C1-O5-C5	5.32	119.32	112.19
5	E	2	GAL	O6-C6-C5	4.80	127.69	111.33
3	C	6	MAN	C1-O5-C5	4.70	118.49	112.19
5	E	3	GAL	O2-C2-C1	-4.55	98.80	109.22
3	C	4	MAN	C1-O5-C5	4.52	118.25	112.19
2	B	4	MAN	C1-O5-C5	4.20	117.82	112.19
2	B	3	BMA	C1-O5-C5	4.03	117.58	112.19
2	B	5	MAN	C1-O5-C5	3.73	117.19	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	E	2	GAL	O4-C4-C3	-3.68	101.70	110.38
2	B	1	NAG	O3-C3-C2	-3.27	102.61	109.40
4	D	4	MAN	C1-O5-C5	3.14	116.39	112.19
2	B	7	MAN	C1-C2-C3	3.14	114.21	109.64
5	E	3	GAL	O2-C2-C3	3.02	116.40	110.15
5	E	1	GLC	O4-C4-C3	-2.99	103.32	110.38
2	B	7	MAN	O5-C1-C2	2.98	117.90	110.79
5	E	2	GAL	O5-C5-C6	2.90	113.31	107.66
2	B	1	NAG	C2-N2-C7	2.81	126.66	122.90
4	D	5	MAN	C1-O5-C5	2.72	115.83	112.19
2	B	1	NAG	O5-C1-C2	-2.64	107.21	111.29
5	E	2	GAL	O5-C1-C2	-2.62	104.53	110.79
3	C	5	MAN	C1-O5-C5	2.54	115.60	112.19
3	C	7	MAN	O6-C6-C5	-2.53	102.70	111.33
4	D	6	MAN	C1-O5-C5	2.52	115.56	112.19
2	B	3	BMA	C6-C5-C4	-2.49	106.90	113.02
3	C	8	MAN	C1-O5-C5	2.41	115.42	112.19
4	D	4	MAN	O2-C2-C3	-2.38	105.23	110.15
3	C	1	NAG	O5-C1-C2	-2.34	107.67	111.29
5	E	3	GAL	C1-C2-C3	-2.34	106.24	109.64
3	C	1	NAG	C1-C2-N2	2.32	114.09	110.43
5	E	2	GAL	C2-C3-C4	-2.23	106.93	110.86
5	E	3	GAL	O5-C1-C2	-2.19	105.56	110.79
3	C	2	NAG	C1-C2-N2	-2.17	107.01	110.43
5	E	2	GAL	O2-C2-C1	2.16	114.18	109.22
3	C	1	NAG	C1-O5-C5	2.13	115.05	112.19
4	D	1	NAG	O5-C1-C2	-2.12	108.02	111.29
3	C	9	MAN	O5-C5-C6	2.11	111.77	107.66
4	D	2	NAG	C1-O5-C5	2.09	114.99	112.19
4	D	2	NAG	C2-N2-C7	2.04	125.64	122.90
5	E	2	GAL	C3-C4-C5	2.04	113.92	110.23

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	5	MAN	C4-C5-C6-O6
4	D	5	MAN	O5-C5-C6-O6
2	B	6	MAN	O5-C5-C6-O6
2	B	6	MAN	C4-C5-C6-O6
3	C	9	MAN	O5-C5-C6-O6
3	C	7	MAN	C4-C5-C6-O6

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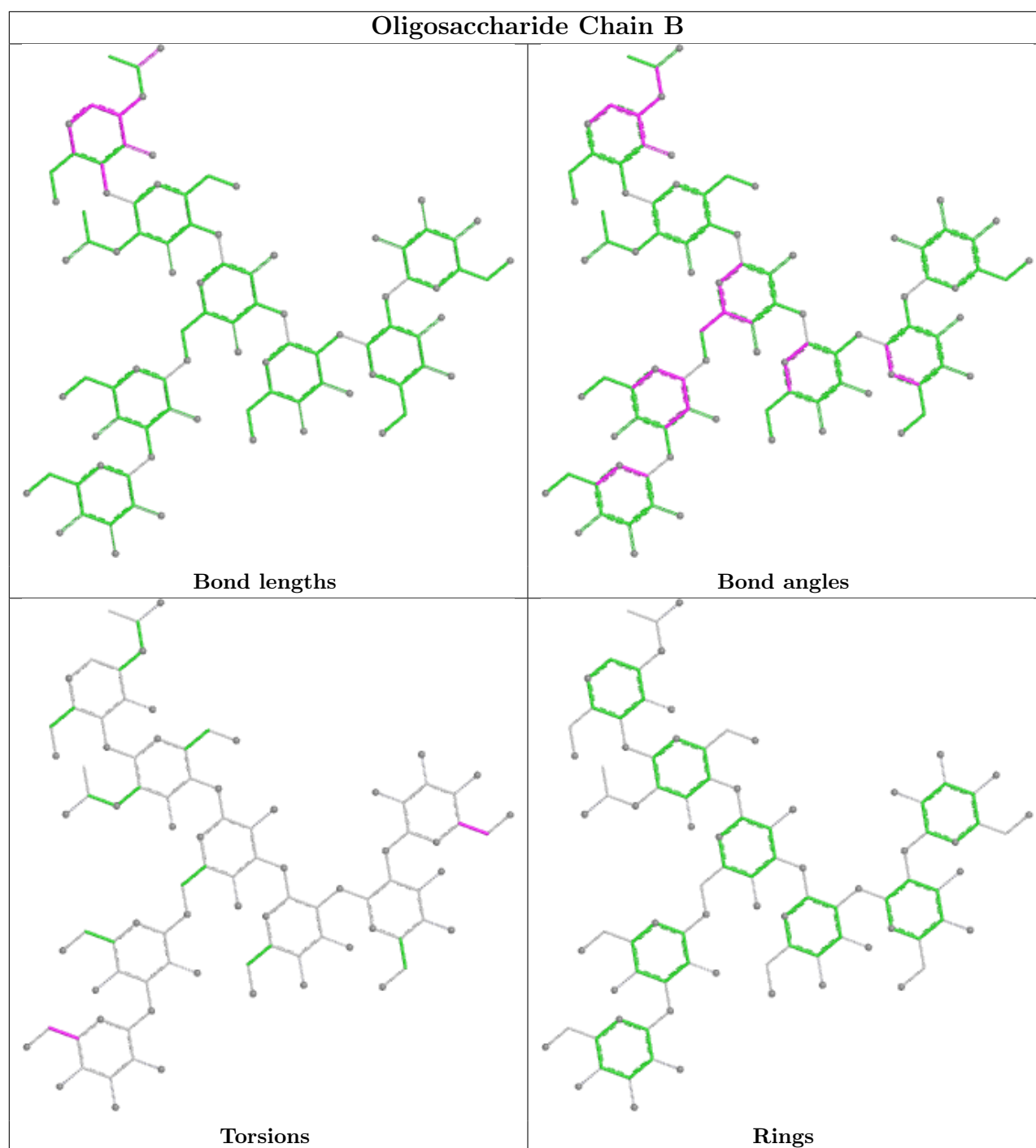
Mol	Chain	Res	Type	Atoms
5	E	3	GAL	O5-C5-C6-O6
2	B	8	MAN	O5-C5-C6-O6
3	C	10	MAN	C4-C5-C6-O6
3	C	7	MAN	O5-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
3	C	5	MAN	C4-C5-C6-O6
3	C	8	MAN	C4-C5-C6-O6
3	C	8	MAN	O5-C5-C6-O6
3	C	10	MAN	O5-C5-C6-O6

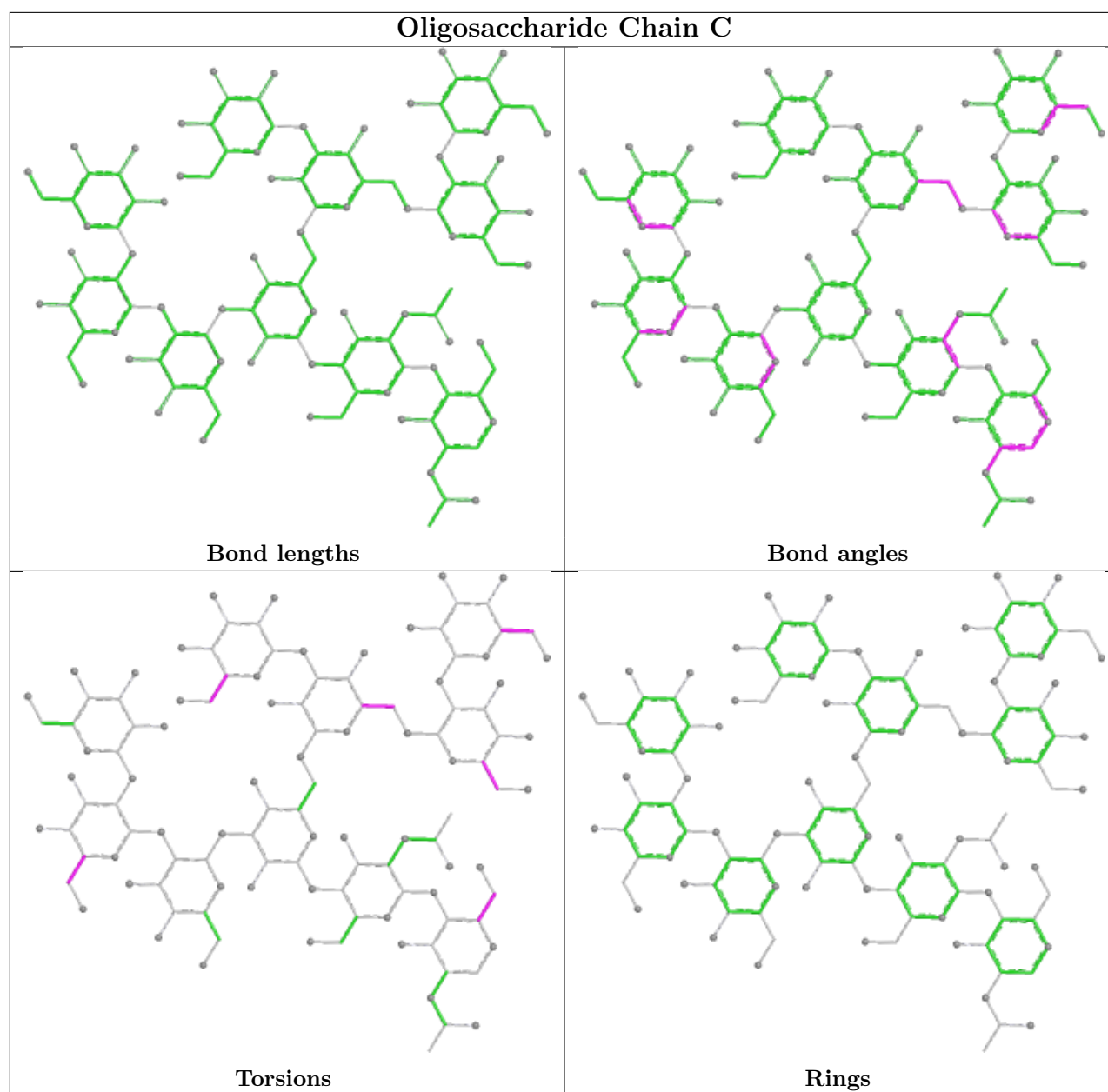
There are no ring outliers.

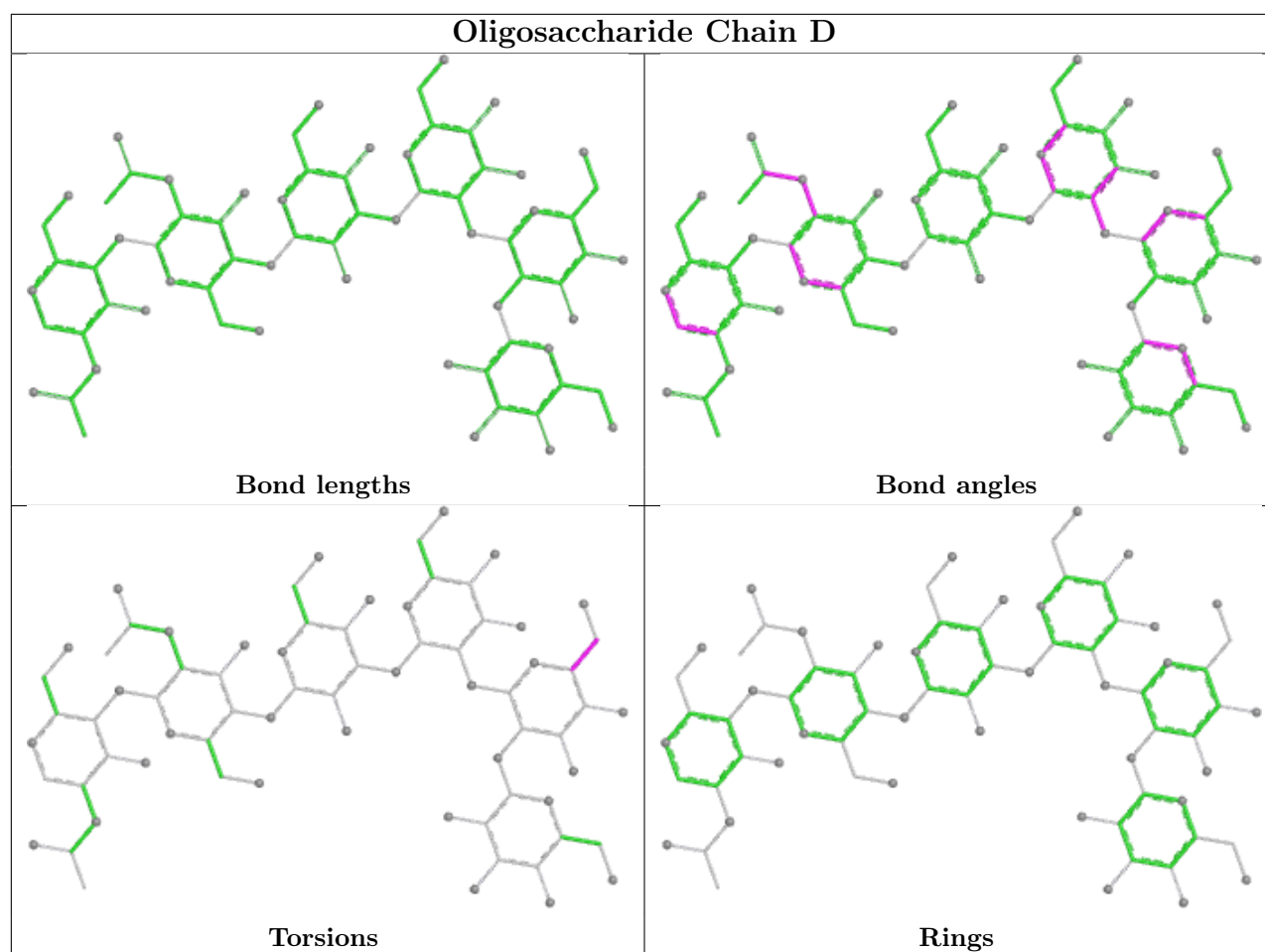
5 monomers are involved in 6 short contacts:

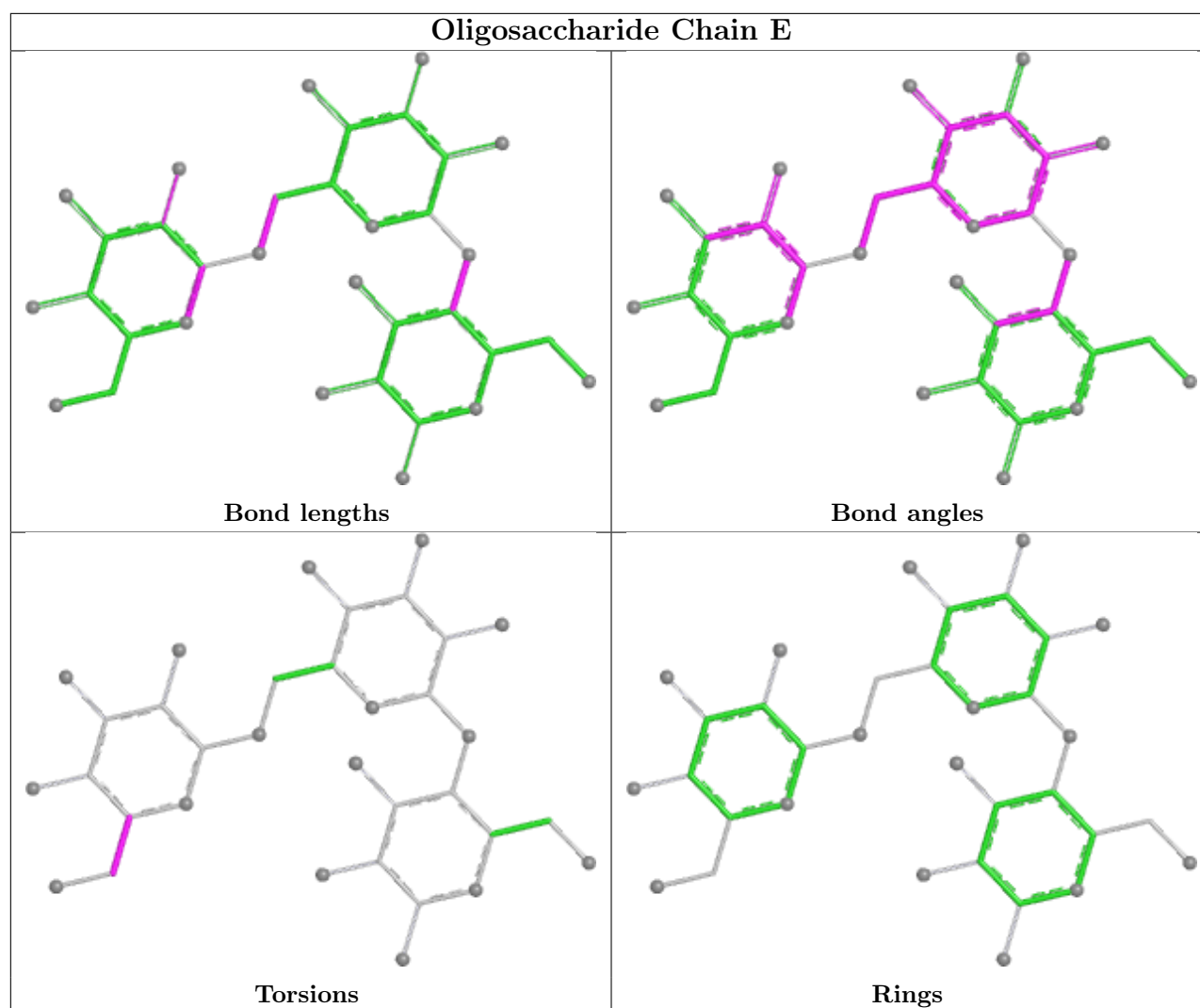
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	NAG	2	0
5	E	2	GAL	2	0
3	C	9	MAN	1	0
5	E	1	GLC	2	0
4	D	1	NAG	1	0

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









5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 1 is 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	$\# Z > 2$
6	NAG	A	1739	1	14,14,15	0.49	0	17,19,21	2.06	4 (23%)
9	1PE	A	3003	-	15,15,15	0.51	0	14,14,14	0.55	0
7	DMS	A	3001	-	3,3,3	0.54	0	3,3,3	0.64	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
6	NAG	A	1760	1	14,14,15	0.34	0	17,19,21	1.23	1 (5%)
6	NAG	A	1478	1	14,14,15	0.47	0	17,19,21	0.98	1 (5%)
6	NAG	A	1402	1	14,14,15	0.69	0	17,19,21	1.41	1 (5%)
6	NAG	A	1156	1	14,14,15	0.71	0	17,19,21	1.58	4 (23%)
6	NAG	A	1777	1	14,14,15	0.36	0	17,19,21	0.87	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
6	NAG	A	1739	1	-	3/6/23/26	0/1/1/1
9	1PE	A	3003	-	-	8/13/13/13	-
6	NAG	A	1760	1	-	2/6/23/26	0/1/1/1
6	NAG	A	1478	1	-	0/6/23/26	0/1/1/1
6	NAG	A	1402	1	-	0/6/23/26	0/1/1/1
6	NAG	A	1156	1	-	1/6/23/26	0/1/1/1
6	NAG	A	1777	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1739	NAG	C2-N2-C7	5.72	130.56	122.90
6	A	1402	NAG	C1-O5-C5	4.77	118.58	112.19
6	A	1760	NAG	C1-O5-C5	4.38	118.06	112.19
6	A	1156	NAG	C4-C3-C2	3.92	116.76	111.02
6	A	1739	NAG	C8-C7-N2	3.64	122.15	116.12
6	A	1739	NAG	C1-C2-N2	2.91	115.02	110.43
6	A	1739	NAG	O5-C1-C2	-2.52	107.39	111.29
6	A	1156	NAG	O5-C1-C2	2.50	115.16	111.29
6	A	1478	NAG	C1-O5-C5	2.33	115.31	112.19
6	A	1156	NAG	O5-C5-C4	-2.24	105.37	110.83
6	A	1156	NAG	C2-N2-C7	2.14	125.76	122.90

There are no chirality outliers.

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	1760	NAG	O5-C5-C6-O6
6	A	1739	NAG	C8-C7-N2-C2
6	A	1739	NAG	O7-C7-N2-C2
9	A	3003	1PE	C24-C14-OH5-C25
9	A	3003	1PE	C15-C25-OH5-C14
6	A	1156	NAG	O5-C5-C6-O6
6	A	1760	NAG	C4-C5-C6-O6
9	A	3003	1PE	OH7-C16-C26-OH6
9	A	3003	1PE	C16-C26-OH6-C15
9	A	3003	1PE	C14-C24-OH4-C13
9	A	3003	1PE	C23-C13-OH4-C24
6	A	1739	NAG	C3-C2-N2-C7
9	A	3003	1PE	OH2-C12-C22-OH3
9	A	3003	1PE	C12-C22-OH3-C23

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	372:ARG	C	373:ASN	N	1.10

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	968/1013 (95%)	0.32	19 (1%) 65 69	16, 27, 43, 68	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	41	LEU	4.1
1	A	1008	HIS	3.7
1	A	422	ASN	3.0
1	A	916	THR	3.0
1	A	423	SER	2.6
1	A	533	ILE	2.6
1	A	499	ASP	2.5
1	A	595	SER	2.5
1	A	539	SER	2.4
1	A	266	CYS	2.4
1	A	531	SER	2.2
1	A	530	GLU	2.2
1	A	457	PRO	2.2
1	A	498	ALA	2.1
1	A	248	GLY	2.1
1	A	451	ALA	2.1
1	A	991	GLU	2.0
1	A	581	ASP	2.0
1	A	666	ASP	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 ⓘ

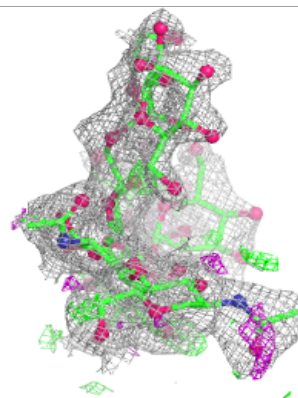
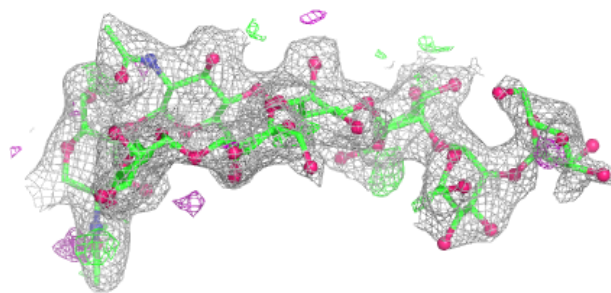
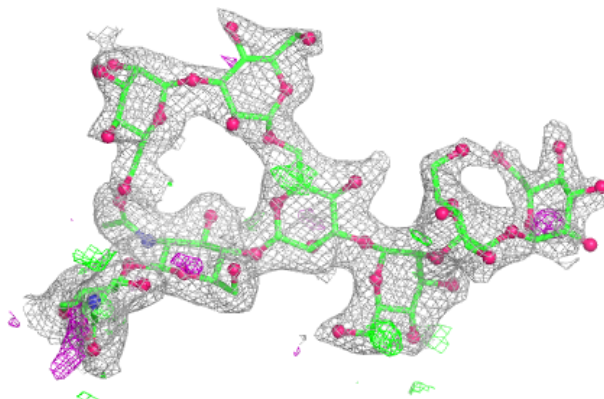
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	GLC	E	1	12/12	0.57	0.17	20,20,20,20	0
4	MAN	D	6	11/12	0.58	0.19	72,74,76,77	0
2	MAN	B	6	11/12	0.61	0.15	65,67,68,69	0
5	GAL	E	2	11/12	0.62	0.15	20,20,20,20	0
3	MAN	C	6	11/12	0.69	0.17	62,67,69,70	0
3	MAN	C	9	11/12	0.74	0.16	47,49,51,53	0
2	MAN	B	7	11/12	0.76	0.13	56,62,64,65	0
5	GAL	E	3	11/12	0.76	0.14	20,20,20,20	0
3	MAN	C	5	11/12	0.79	0.13	51,53,56,58	0
4	MAN	D	5	11/12	0.79	0.13	56,57,60,67	0
2	MAN	B	8	11/12	0.80	0.14	59,61,62,62	0
2	MAN	B	5	11/12	0.81	0.11	50,54,57,59	0
4	BMA	D	3	11/12	0.83	0.12	43,45,47,49	0
2	MAN	B	4	11/12	0.83	0.11	35,36,39,43	0
4	MAN	D	4	11/12	0.84	0.12	43,46,51,54	0
2	NAG	B	1	14/15	0.84	0.12	23,24,26,27	0
3	NAG	C	1	14/15	0.84	0.12	27,29,34,34	0
3	MAN	C	8	11/12	0.85	0.11	40,42,44,44	0
3	MAN	C	10	11/12	0.86	0.10	39,41,42,42	0
2	BMA	B	3	11/12	0.88	0.10	28,34,41,48	0
3	NAG	C	2	14/15	0.89	0.09	24,27,29,31	0
4	NAG	D	1	14/15	0.90	0.09	22,26,28,29	0
4	NAG	D	2	14/15	0.90	0.09	30,32,38,38	0
3	MAN	C	4	11/12	0.90	0.10	39,42,42,47	0
3	BMA	C	3	11/12	0.93	0.08	27,30,31,35	0
2	NAG	B	2	14/15	0.93	0.07	23,26,27,29	0
3	MAN	C	7	11/12	0.93	0.08	30,33,36,38	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.

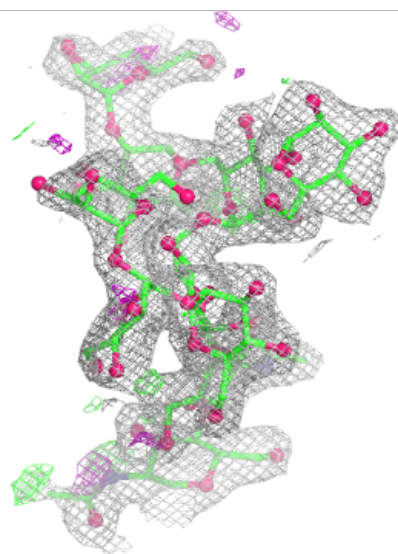
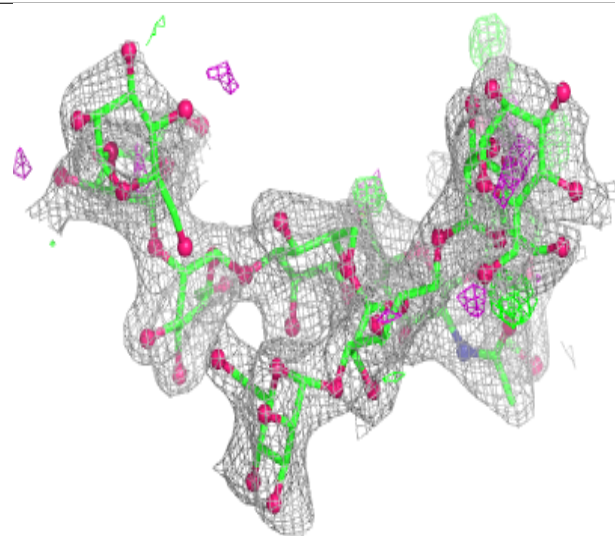
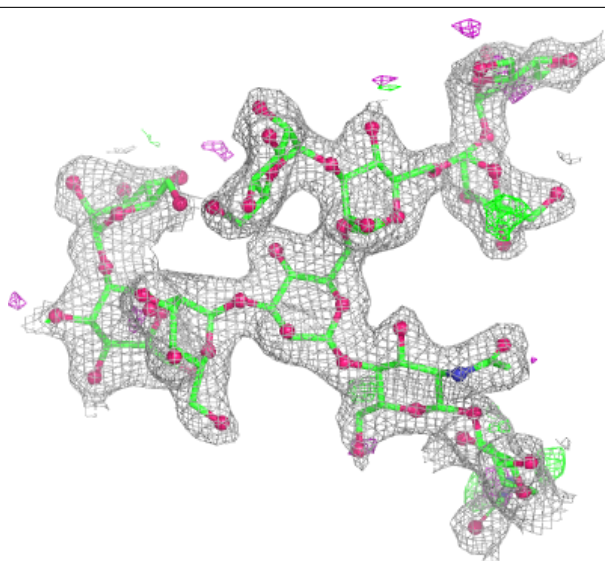
Electron density around Chain B:

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



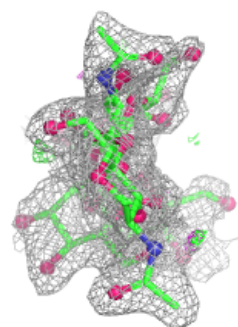
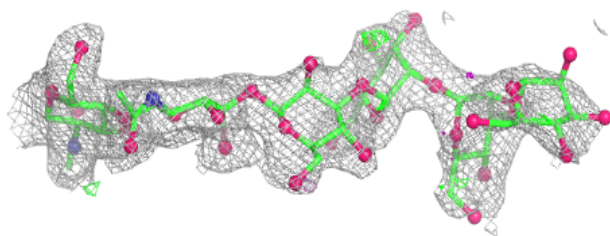
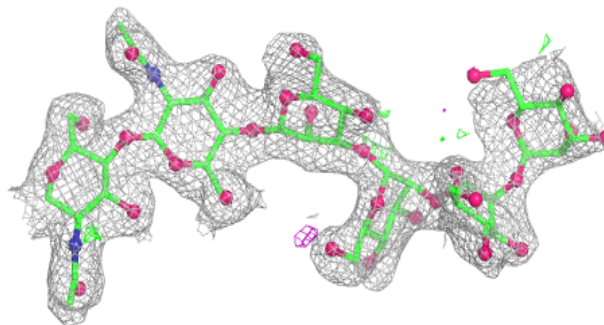
Electron density around Chain C:

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

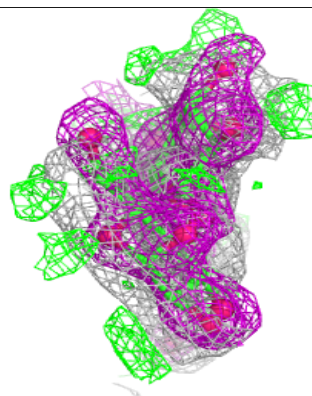
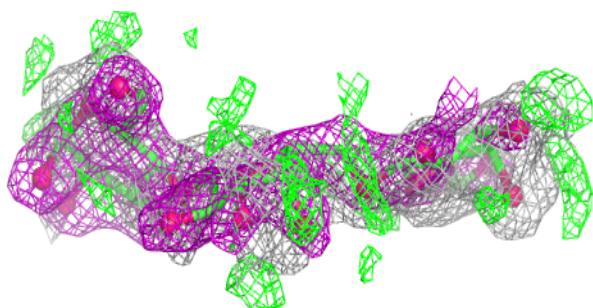
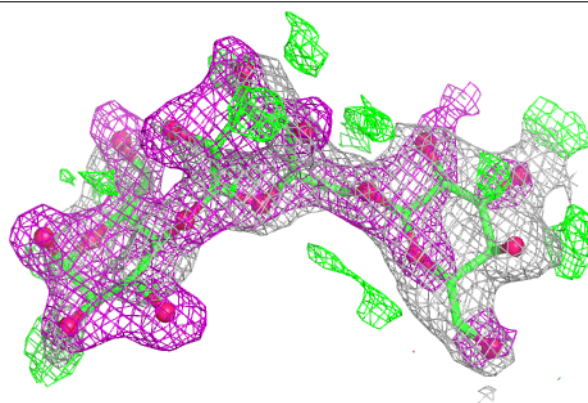


Electron density around Chain D:

$2mF_o-DF_c$ (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)



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($\text{\AA}^2$)	Q<0.9
6	NAG	A	1402	14/15	0.31	0.22	72,76,88,89	0
6	NAG	A	1156	14/15	0.42	0.20	69,74,79,79	0
7	DMS	A	3001	4/4	0.61	0.29	77,77,78,80	0
6	NAG	A	1739	14/15	0.65	0.17	60,65,67,69	0
9	1PE	A	3003	16/16	0.66	0.25	66,75,77,77	0
6	NAG	A	1478	14/15	0.73	0.13	50,55,58,58	0
6	NAG	A	1760	14/15	0.89	0.11	33,35,40,42	0
6	NAG	A	1777	14/15	0.89	0.09	31,34,38,39	0
8	CL	A	3002	1/1	0.99	0.04	26,26,26,26	0

6.5 Other polymers [i](#)

There are no such residues in this entry.