



wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 12, 2024 – 05:07 PM EST

PDB ID : 3SE6
Title : Crystal structure of the human Endoplasmic Reticulum Aminopeptidase 2
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Deposited on : 2011-06-10
Resolution : 3.08 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

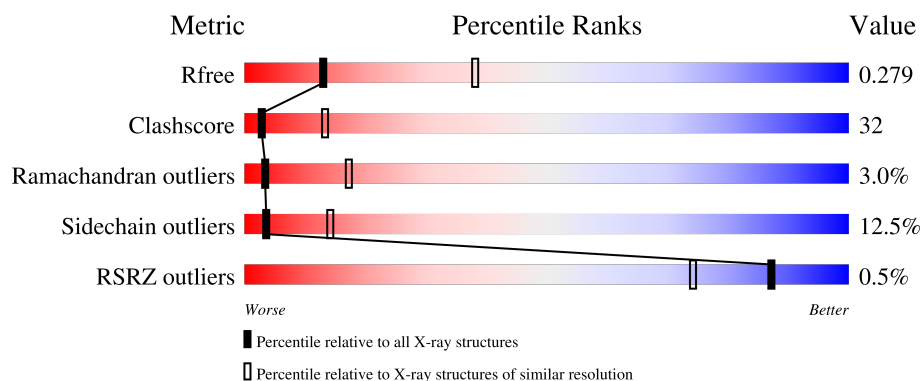
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.08 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	1842 (3.10-3.06)
Clashscore	180529	1965 (3.10-3.06)
Ramachandran outliers	177936	1859 (3.10-3.06)
Sidechain outliers	177891	1858 (3.10-3.06)
RSRZ outliers	164620	1842 (3.10-3.06)

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	967	<div> <div></div> <div>43%</div> <div>39%</div> <div>8%</div> <div>10%</div> </div>
1	B	967	<div> <div>39%</div> <div>41%</div> <div>8%</div> <div>11%</div> </div>
2	C	2	<div> <div>100%</div> </div>
2	D	2	<div> <div>50%</div> <div>50%</div> </div>
3	E	4	<div> <div>25%</div> <div>75%</div> </div>

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
3	MAN	E	3	X	-	-	-
3	MAN	E	4	X	-	-	-

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 14348 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 Endoplasmic reticulum aminopeptidase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	869	Total	C	N	O	S	2	2	0
			7050	4548	1173	1302	27			
1	B	859	Total	C	N	O	S	0	0	0
			6978	4504	1160	1287	27			

There are 18 discrepancies between the modelled and reference sequences:

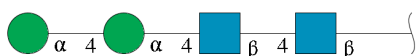
Chain	Residue	Modelled	Actual	Comment	Reference
A	2	VAL	PHE	engineered mutation	UNP Q6P179
A	392	ASN	LYS	SEE REMARK 999	UNP Q6P179
A	961	ARG	-	expression tag	UNP Q6P179
A	962	HIS	-	expression tag	UNP Q6P179
A	963	HIS	-	expression tag	UNP Q6P179
A	964	HIS	-	expression tag	UNP Q6P179
A	965	HIS	-	expression tag	UNP Q6P179
A	966	HIS	-	expression tag	UNP Q6P179
A	967	HIS	-	expression tag	UNP Q6P179
B	2	VAL	PHE	engineered mutation	UNP Q6P179
B	392	ASN	LYS	SEE REMARK 999	UNP Q6P179
B	961	ARG	-	expression tag	UNP Q6P179
B	962	HIS	-	expression tag	UNP Q6P179
B	963	HIS	-	expression tag	UNP Q6P179
B	964	HIS	-	expression tag	UNP Q6P179
B	965	HIS	-	expression tag	UNP Q6P179
B	966	HIS	-	expression tag	UNP Q6P179
B	967	HIS	-	expression tag	UNP Q6P179

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	2	Total	C	N	O	0	0	0
			28	16	2	10			
2	D	2	Total	C	N	O	0	0	0
			28	16	2	10			

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

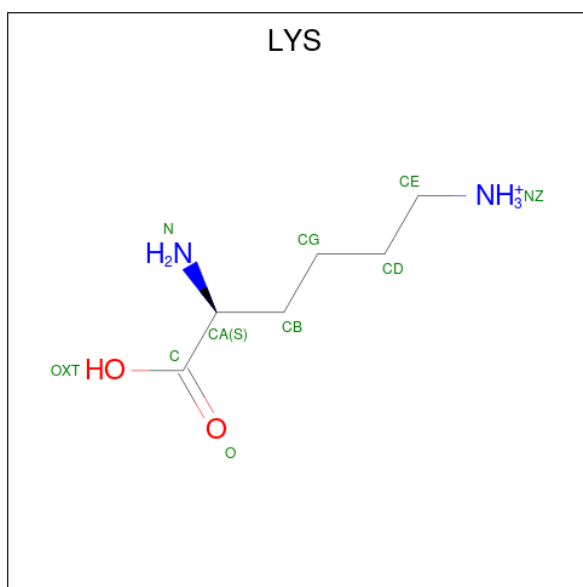


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	4	Total	C	N	O	0	0	0
			50	28	2	20			

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

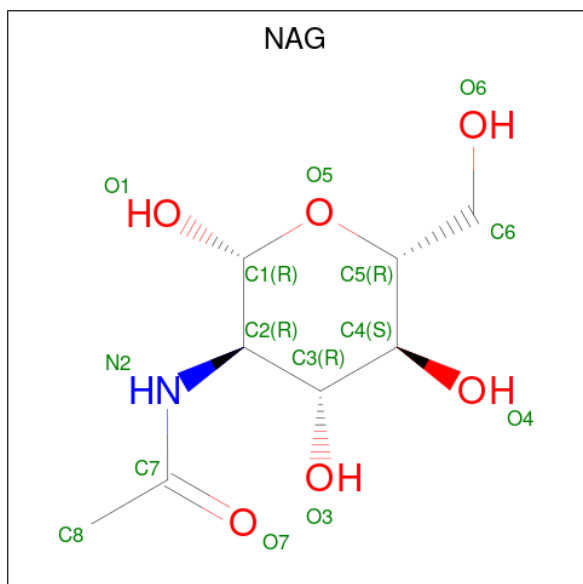
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		
4	B	1	Total	Zn	0	0
			1	1		

- Molecule 5 is LYSINE (three-letter code: LYS) (formula: C₆H₁₅N₂O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			10	6	2	2		
5	B	1	Total	C	N	O	0	0
			10	6	2	2		

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



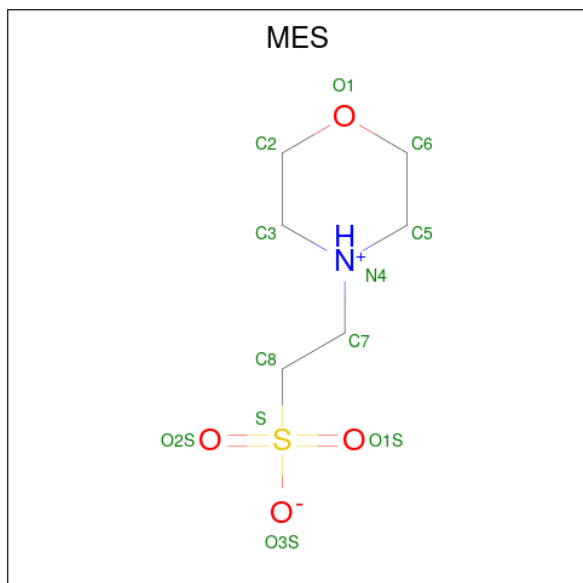
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

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

- Molecule 7 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: $C_6H_{13}NO_4S$).



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

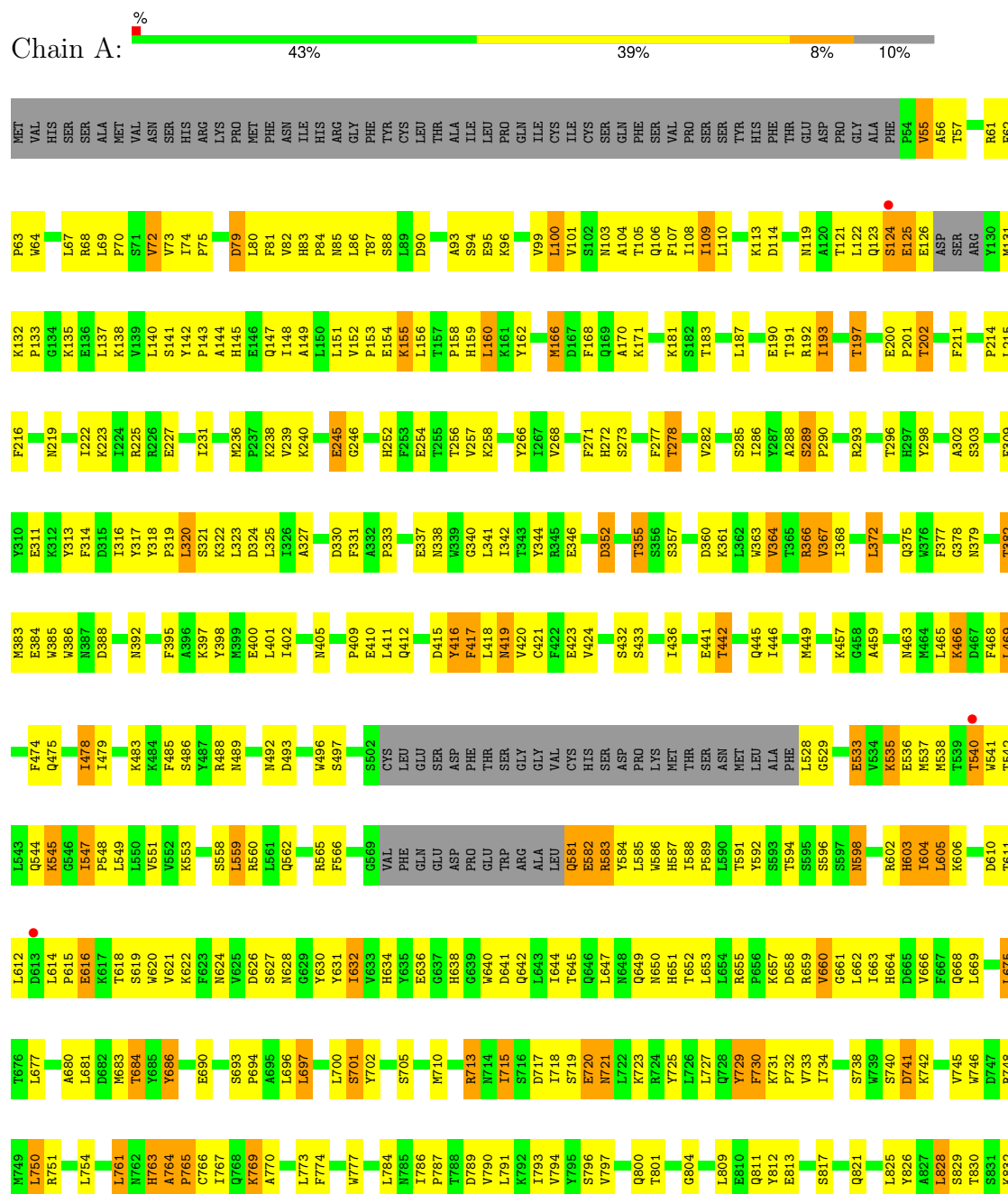
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	73	Total	O	0	0
			73	73		
8	B	53	Total	O	0	0
			53	53		

3 Residue-property plots

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.

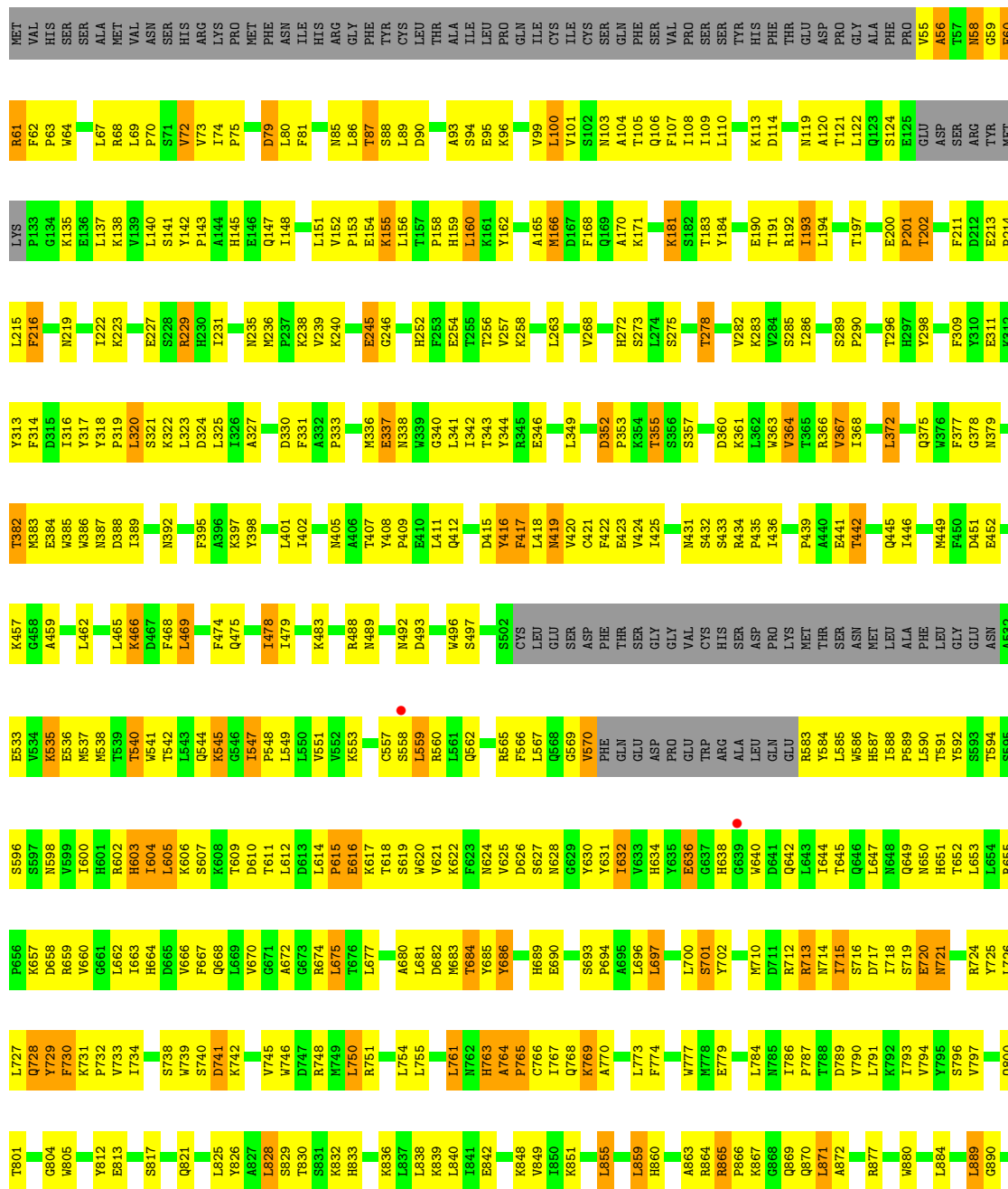
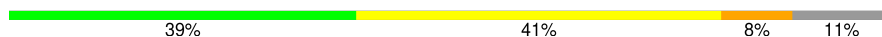
• Molecule 1: Endoplasmic reticulum aminopeptidase 2





• Molecule 1: Endoplasmic reticulum aminopeptidase 2

Chain B:





- NAG1
NAG2

- | | NAG1 | NAG2 |
|-----|--------|--------|
| 1 | 0.0000 | 0.0000 |
| 2 | 0.0000 | 0.0000 |
| 3 | 0.0000 | 0.0000 |
| 4 | 0.0000 | 0.0000 |
| 5 | 0.0000 | 0.0000 |
| 6 | 0.0000 | 0.0000 |
| 7 | 0.0000 | 0.0000 |
| 8 | 0.0000 | 0.0000 |
| 9 | 0.0000 | 0.0000 |
| 10 | 0.0000 | 0.0000 |
| 11 | 0.0000 | 0.0000 |
| 12 | 0.0000 | 0.0000 |
| 13 | 0.0000 | 0.0000 |
| 14 | 0.0000 | 0.0000 |
| 15 | 0.0000 | 0.0000 |
| 16 | 0.0000 | 0.0000 |
| 17 | 0.0000 | 0.0000 |
| 18 | 0.0000 | 0.0000 |
| 19 | 0.0000 | 0.0000 |
| 20 | 0.0000 | 0.0000 |
| 21 | 0.0000 | 0.0000 |
| 22 | 0.0000 | 0.0000 |
| 23 | 0.0000 | 0.0000 |
| 24 | 0.0000 | 0.0000 |
| 25 | 0.0000 | 0.0000 |
| 26 | 0.0000 | 0.0000 |
| 27 | 0.0000 | 0.0000 |
| 28 | 0.0000 | 0.0000 |
| 29 | 0.0000 | 0.0000 |
| 30 | 0.0000 | 0.0000 |
| 31 | 0.0000 | 0.0000 |
| 32 | 0.0000 | 0.0000 |
| 33 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0000 |
| 35 | 0.0000 | 0.0000 |
| 36 | 0.0000 | 0.0000 |
| 37 | 0.0000 | 0.0000 |
| 38 | 0.0000 | 0.0000 |
| 39 | 0.0000 | 0.0000 |
| 40 | 0.0000 | 0.0000 |
| 41 | 0.0000 | 0.0000 |
| 42 | 0.0000 | 0.0000 |
| 43 | 0.0000 | 0.0000 |
| 44 | 0.0000 | 0.0000 |
| 45 | 0.0000 | 0.0000 |
| 46 | 0.0000 | 0.0000 |
| 47 | 0.0000 | 0.0000 |
| 48 | 0.0000 | 0.0000 |
| 49 | 0.0000 | 0.0000 |
| 50 | 0.0000 | 0.0000 |
| 51 | 0.0000 | 0.0000 |
| 52 | 0.0000 | 0.0000 |
| 53 | 0.0000 | 0.0000 |
| 54 | 0.0000 | 0.0000 |
| 55 | 0.0000 | 0.0000 |
| 56 | 0.0000 | 0.0000 |
| 57 | 0.0000 | 0.0000 |
| 58 | 0.0000 | 0.0000 |
| 59 | 0.0000 | 0.0000 |
| 60 | 0.0000 | 0.0000 |
| 61 | 0.0000 | 0.0000 |
| 62 | 0.0000 | 0.0000 |
| 63 | 0.0000 | 0.0000 |
| 64 | 0.0000 | 0.0000 |
| 65 | 0.0000 | 0.0000 |
| 66 | 0.0000 | 0.0000 |
| 67 | 0.0000 | 0.0000 |
| 68 | 0.0000 | 0.0000 |
| 69 | 0.0000 | 0.0000 |
| 70 | 0.0000 | 0.0000 |
| 71 | 0.0000 | 0.0000 |
| 72 | 0.0000 | 0.0000 |
| 73 | 0.0000 | 0.0000 |
| 74 | 0.0000 | 0.0000 |
| 75 | 0.0000 | 0.0000 |
| 76 | 0.0000 | 0.0000 |
| 77 | 0.0000 | 0.0000 |
| 78 | 0.0000 | 0.0000 |
| 79 | 0.0000 | 0.0000 |
| 80 | 0.0000 | 0.0000 |
| 81 | 0.0000 | 0.0000 |
| 82 | 0.0000 | 0.0000 |
| 83 | 0.0000 | 0.0000 |
| 84 | 0.0000 | 0.0000 |
| 85 | 0.0000 | 0.0000 |
| 86 | 0.0000 | 0.0000 |
| 87 | 0.0000 | 0.0000 |
| 88 | 0.0000 | 0.0000 |
| 89 | 0.0000 | 0.0000 |
| 90 | 0.0000 | 0.0000 |
| 91 | 0.0000 | 0.0000 |
| 92 | 0.0000 | 0.0000 |
| 93 | 0.0000 | 0.0000 |
| 94 | 0.0000 | 0.0000 |
| 95 | 0.0000 | 0.0000 |
| 96 | 0.0000 | 0.0000 |
| 97 | 0.0000 | 0.0000 |
| 98 | 0.0000 | 0.0000 |
| 99 | 0.0000 | 0.0000 |
| 100 | 0.0000 | 0.0000 |

- | | |
|------|--|
| NAG1 | |
| NAG2 | |
| MAN3 | |
| MAN4 | |

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	74.58Å 134.36Å 128.01Å 90.00° 90.71° 90.00°	Depositor
Resolution (Å)	11.00 – 3.08 11.00 – 3.08	Depositor EDS
% Data completeness (in resolution range)	94.3 (11.00-3.08) 92.1 (11.00-3.08)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.21 (at 3.09Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, R_{free}	0.212 , 0.277 0.213 , 0.279	Depositor DCC
R_{free} test set	2293 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	60.6	Xtriage
Anisotropy	0.260	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 64.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.018 for -h,-l,-k 0.005 for -h,l,k 0.034 for h,-k,-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	14348	wwPDB-VP
Average B, all atoms (Å ²)	65.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.00% 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: ZN, MES, NAG, 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	0.40	0/7227	0.58	1/9794 (0.0%)
1	B	0.41	0/7148	0.58	0/9686
All	All	0.41	0/14375	0.58	1/19480 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	923	ALA	N-CA-C	-5.60	95.88	111.00

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	7050	0	6987	431	0
1	B	6978	0	6946	474	0
2	C	28	0	25	3	0
2	D	28	0	25	2	0
3	E	50	0	43	1	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	10	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	10	0	12	2	0
6	A	28	0	26	0	0
6	B	14	0	13	3	0
7	A	12	0	12	2	0
7	B	12	0	12	4	0
8	A	73	0	0	4	0
8	B	53	0	0	12	0
All	All	14348	0	14113	904	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 32.

The worst 5 of 904 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:56:ALA:HB1	1:B:61:ARG:HA	1.23	1.09
1:A:56:ALA:HB1	1:A:57:THR:HA	1.34	1.06
1:B:245:GLU:HG2	1:B:246:GLY:H	1.27	0.98
1:A:245:GLU:HG2	1:A:246:GLY:H	1.23	0.98
1:A:544:GLN:HE21	1:A:584:TYR:HD1	1.16	0.93

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	863/967 (89%)	746 (86%)	95 (11%)	22 (2%)	4	20
1	B	851/967 (88%)	732 (86%)	89 (10%)	30 (4%)	3	15
All	All	1714/1934 (89%)	1478 (86%)	184 (11%)	52 (3%)	3	17

5 of 52 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	55	VAL
1	A	245	GLU
1	A	417	PHE
1	A	596	SER
1	A	616	GLU

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	773/870 (89%)	677 (88%)	96 (12%)	4	14
1	B	770/870 (88%)	672 (87%)	98 (13%)	3	14
All	All	1543/1740 (89%)	1349 (87%)	194 (13%)	3	14

5 of 194 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	231	ILE
1	B	570	VAL
1	B	320	LEU
1	B	416	TYR
1	B	609	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 53 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	959	ASN
1	B	272	HIS
1	B	882	HIS
1	B	58	ASN
1	B	147	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 ⓘ

8 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
2	NAG	C	1	1,2	14,14,15	0.68	0	17,19,21	1.18	3 (17%)
2	NAG	C	2	2	14,14,15	0.48	0	17,19,21	1.48	2 (11%)
2	NAG	D	1	1,2	14,14,15	0.62	0	17,19,21	1.80	2 (11%)
2	NAG	D	2	2	14,14,15	0.53	0	17,19,21	0.65	0
3	NAG	E	1	1,3	14,14,15	0.46	0	17,19,21	1.45	2 (11%)
3	NAG	E	2	3	14,14,15	0.56	0	17,19,21	1.35	2 (11%)
3	MAN	E	3	3	11,11,12	0.70	0	15,15,17	0.88	0
3	MAN	E	4	3	11,11,12	0.59	0	15,15,17	0.57	0

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

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

There are no bond length outliers.

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	NAG	C1-O5-C5	6.26	120.58	112.19
2	C	2	NAG	C1-O5-C5	4.50	118.22	112.19
3	E	2	NAG	C1-O5-C5	3.95	117.48	112.19
3	E	1	NAG	C1-O5-C5	3.55	116.95	112.19
3	E	1	NAG	C4-C3-C2	-2.93	106.72	111.02

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	E	3	MAN	C1
3	E	4	MAN	C1

5 of 15 torsion outliers are listed below:

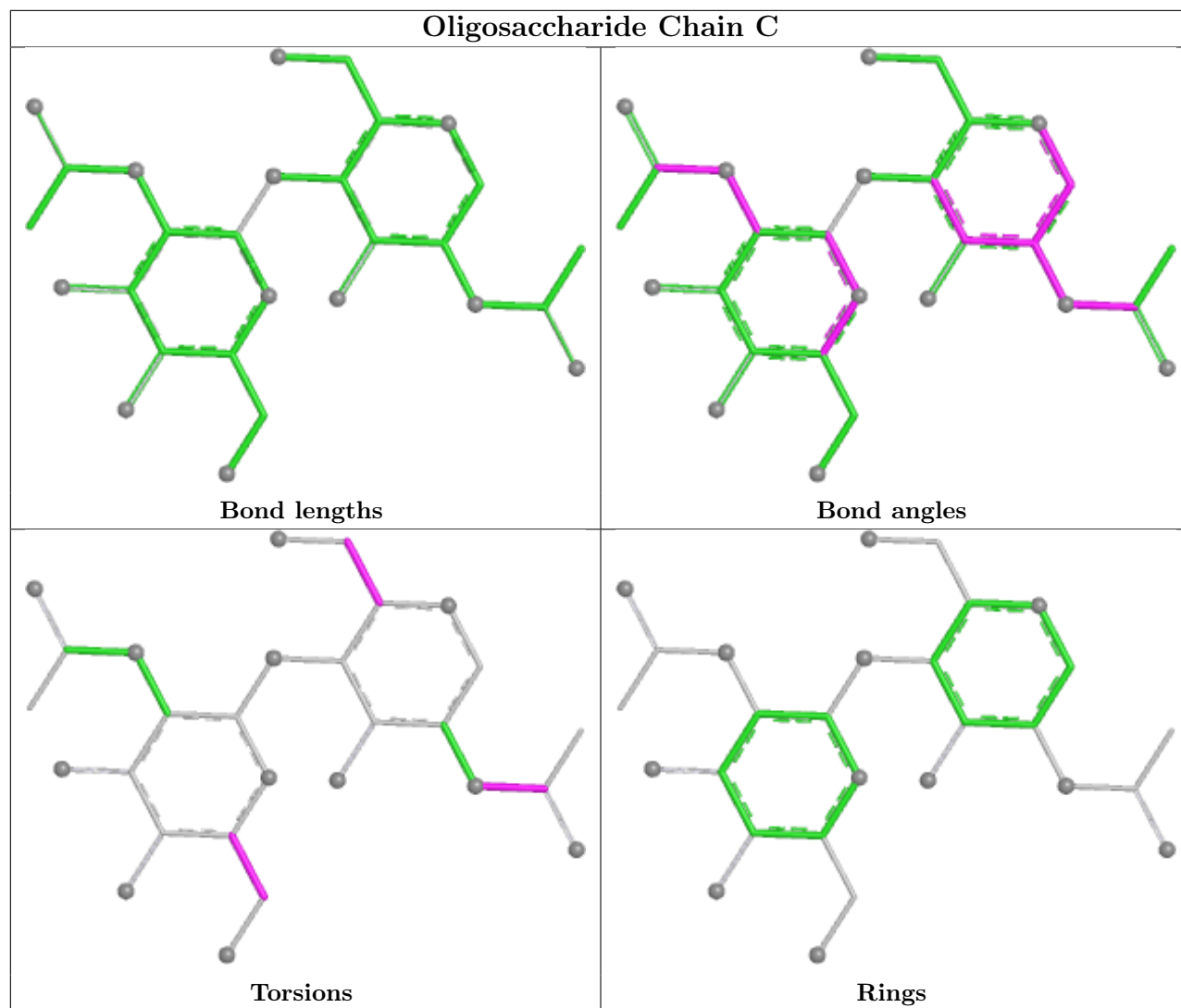
Mol	Chain	Res	Type	Atoms
2	D	1	NAG	C8-C7-N2-C2
2	D	1	NAG	O7-C7-N2-C2
2	C	1	NAG	C8-C7-N2-C2
2	C	1	NAG	O7-C7-N2-C2
2	C	1	NAG	O5-C5-C6-O6

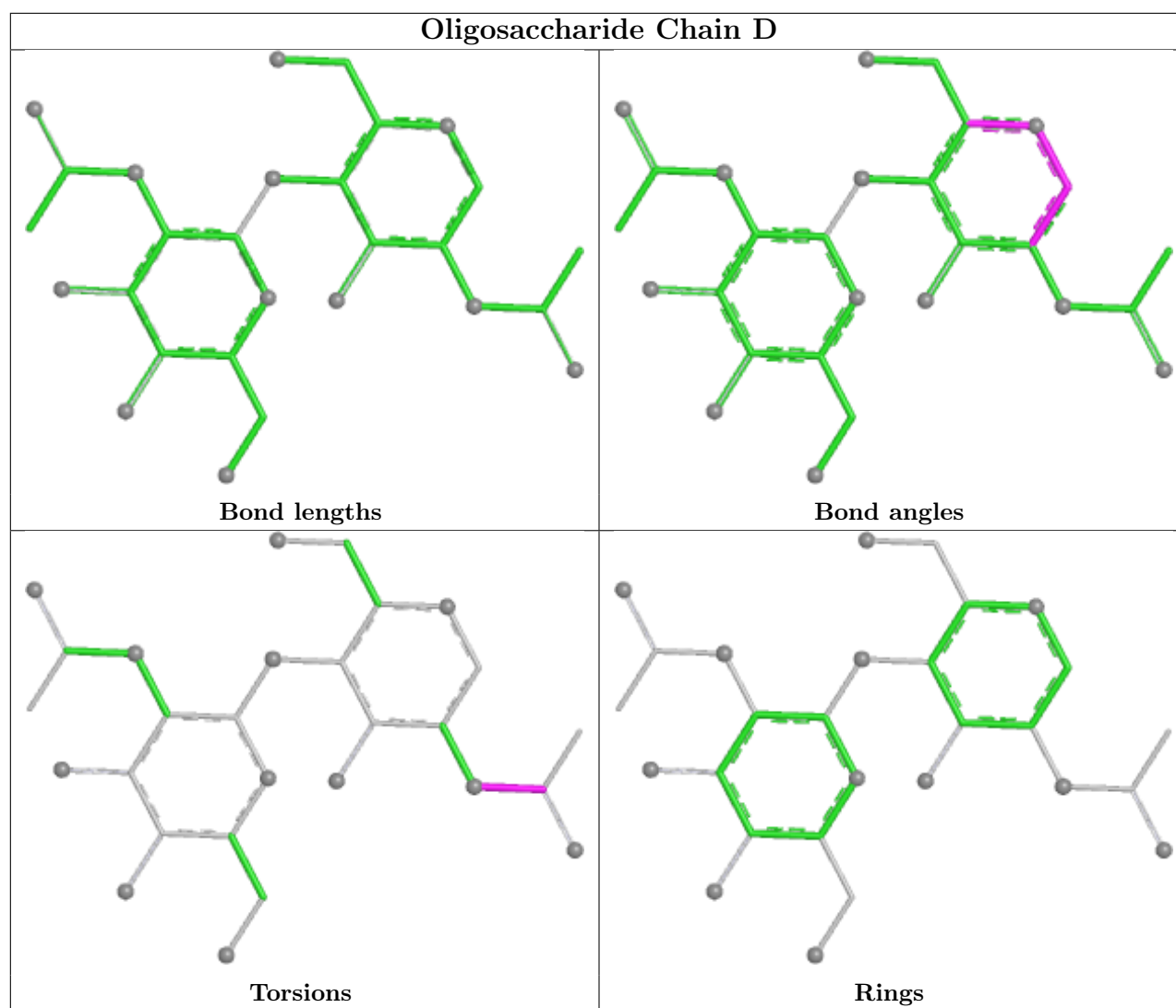
There are no ring outliers.

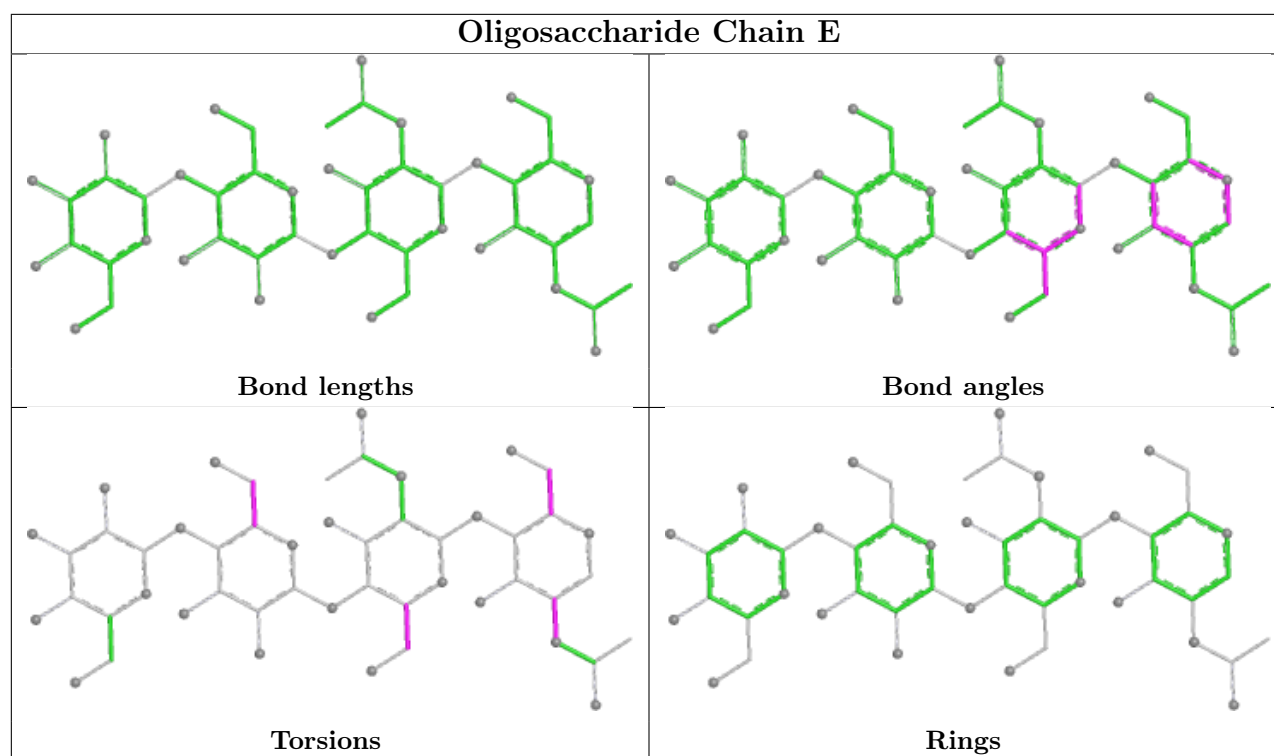
5 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	1	NAG	2	0
2	C	2	NAG	1	0
3	E	3	MAN	1	0
2	C	1	NAG	3	0
2	D	2	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, 2 are monoatomic - leaving 7 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	B	1081	1	14,14,15	0.71	0	17,19,21	0.95	0
7	MES	A	1083	-	12,12,12	2.35	2 (16%)	15,16,16	2.42	6 (40%)
7	MES	B	1084	-	12,12,12	2.15	1 (8%)	15,16,16	2.54	7 (46%)
5	LYS	A	968	4	8,9,9	0.71	0	7,10,10	0.88	1 (14%)
5	LYS	B	968	4	8,9,9	0.81	0	7,10,10	0.69	0
6	NAG	A	1075	1	14,14,15	0.51	0	17,19,21	1.02	1 (5%)
6	NAG	A	1076	1	14,14,15	0.72	0	17,19,21	1.66	3 (17%)

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	B	1081	1	-	0/6/23/26	0/1/1/1
7	MES	A	1083	-	-	4/6/14/14	0/1/1/1
7	MES	B	1084	-	-	4/6/14/14	0/1/1/1
5	LYS	A	968	4	-	4/9/9/9	-
5	LYS	B	968	4	-	3/9/9/9	-
6	NAG	A	1075	1	-	2/6/23/26	0/1/1/1
6	NAG	A	1076	1	-	2/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	1083	MES	C8-S	-7.60	1.66	1.77
7	B	1084	MES	C8-S	-7.05	1.67	1.77
7	A	1083	MES	O2S-S	2.07	1.51	1.45

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	A	1083	MES	C5-N4-C3	4.96	119.53	108.84
7	B	1084	MES	C5-N4-C3	4.74	119.04	108.84
7	B	1084	MES	C6-C5-N4	-4.43	103.39	110.12
6	A	1076	NAG	C2-N2-C7	-3.77	117.85	122.90
7	A	1083	MES	C6-C5-N4	-3.74	104.43	110.12

There are no chirality outliers.

5 of 19 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	968	LYS	C-CA-CB-CG
6	A	1076	NAG	C8-C7-N2-C2
6	A	1076	NAG	O7-C7-N2-C2
7	A	1083	MES	C8-C7-N4-C3
7	B	1084	MES	C8-C7-N4-C3

There are no ring outliers.

5 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	1081	NAG	3	0
7	A	1083	MES	2	0
7	B	1084	MES	4	0
5	A	968	LYS	1	0
5	B	968	LYS	2	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	869/967 (89%)	-0.40	5 (0%) 85 72	23, 61, 108, 138	4 (0%)
1	B	859/967 (88%)	-0.39	3 (0%) 90 81	27, 63, 111, 139	0
All	All	1728/1934 (89%)	-0.40	8 (0%) 87 74	23, 62, 109, 139	4 (0%)

The worst 5 of 8 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	540	THR	5.1
1	A	926	SER	3.7
1	B	558	SER	3.7
1	A	124	SER	3.2
1	A	922	GLU	2.8

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.

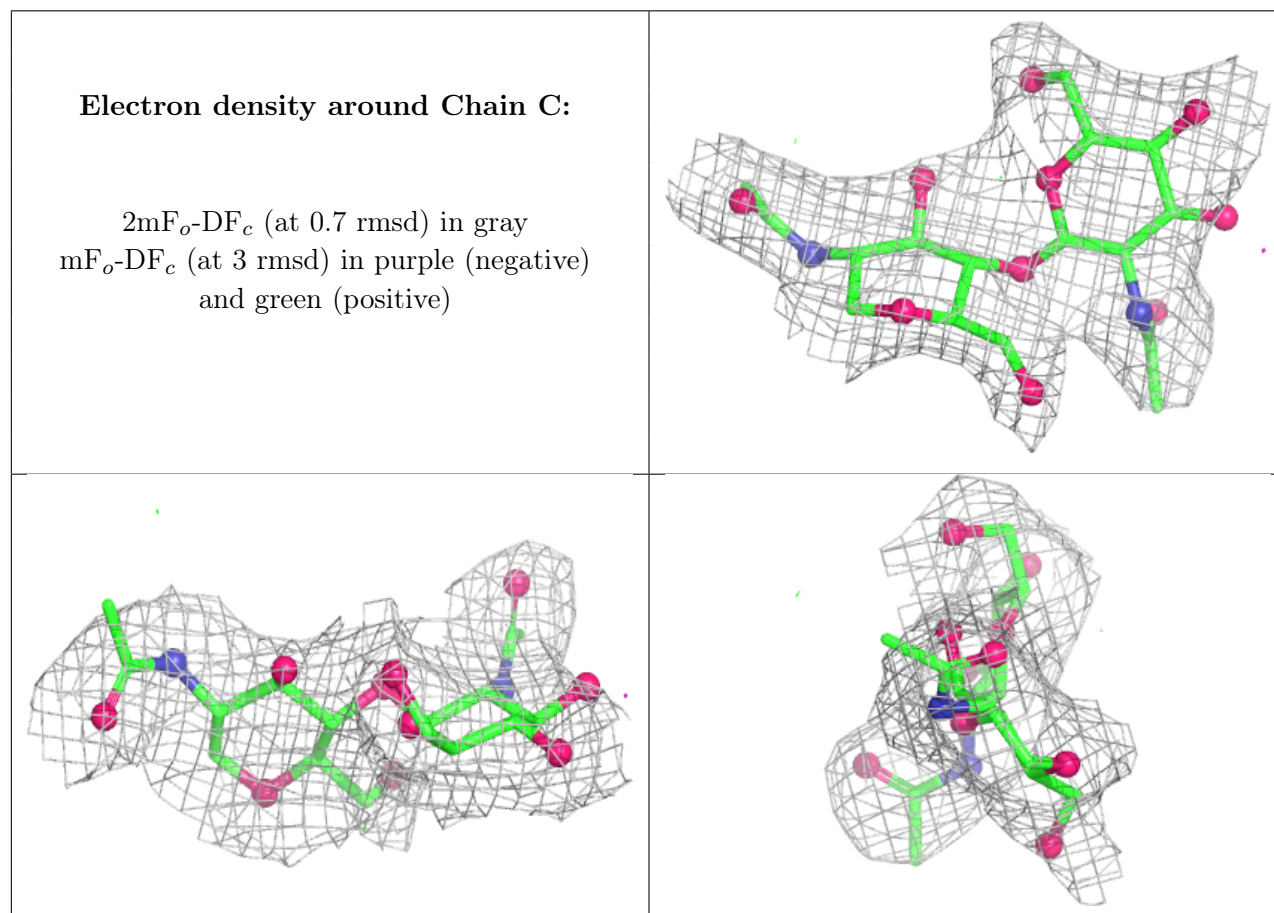
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	D	2	14/15	0.66	0.18	78,88,106,128	0
3	MAN	E	4	11/12	0.67	0.10	98,112,120,124	0
3	MAN	E	3	11/12	0.68	0.12	94,102,111,115	0
2	NAG	C	2	14/15	0.77	0.09	62,77,82,90	0
3	NAG	E	2	14/15	0.84	0.11	57,74,91,95	0

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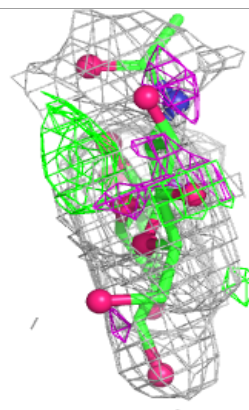
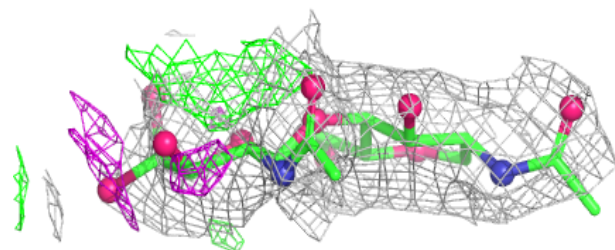
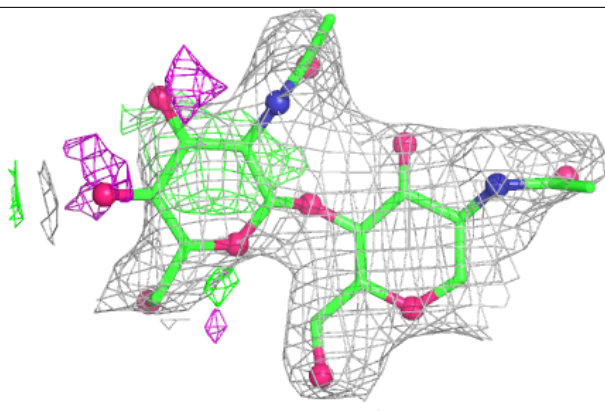
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	NAG	E	1	14/15	0.87	0.09	45,65,74,75	0
2	NAG	D	1	14/15	0.89	0.09	44,63,69,71	0
2	NAG	C	1	14/15	0.93	0.08	43,58,70,72	0

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.

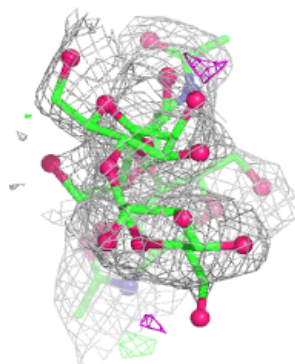
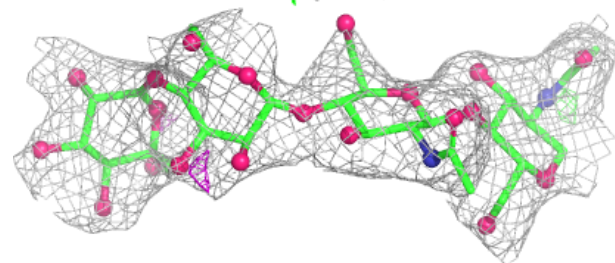
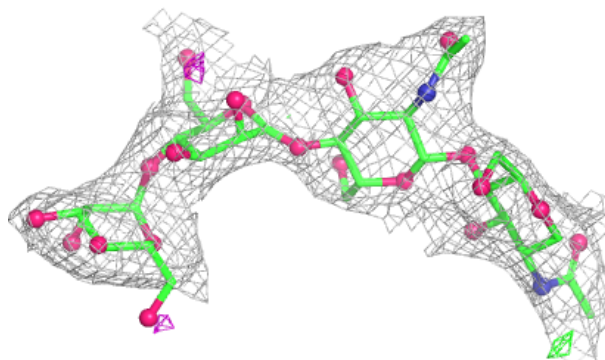


Electron density around Chain D:

$2mF_o-DF_c$ (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(Å ²)	Q<0.9
6	NAG	A	1076	14/15	0.64	0.11	59,91,103,108	0
6	NAG	B	1081	14/15	0.84	0.12	53,72,97,99	0
7	MES	B	1084	12/12	0.85	0.14	53,71,88,100	0
6	NAG	A	1075	14/15	0.88	0.07	58,81,86,93	0
7	MES	A	1083	12/12	0.90	0.12	46,68,81,96	0
5	LYS	B	968	10/10	0.92	0.12	36,51,71,71	0
5	LYS	A	968	10/10	0.95	0.07	32,39,51,51	0
4	ZN	B	6000	1/1	0.99	0.02	36,36,36,36	0
4	ZN	A	5000	1/1	1.00	0.04	31,31,31,31	0

6.5 Other polymers [i](#)

There are no such residues in this entry.