



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 10, 2022 – 10:08 PM EST

PDB ID : 4KXD  
Title : Crystal structure of human aminopeptidase A complexed with glutamate and calcium  
Authors : Yang, Y.; Liu, C.; Lin, Y.Y.; Li, F.  
Deposited on : 2013-05-25  
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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.31.2  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.31.2

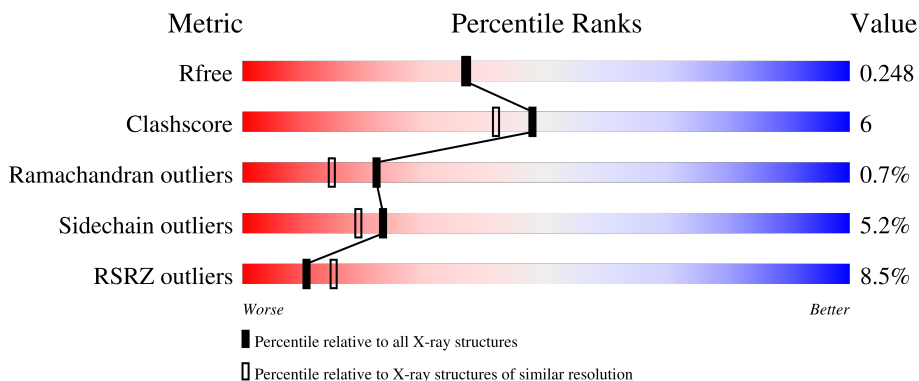
# 1 Overall quality at a glance i

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.




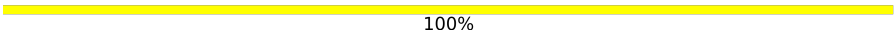
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1479 (2.16-2.16)
Clashscore	141614	1585 (2.16-2.16)
Ramachandran outliers	138981	1560 (2.16-2.16)
Sidechain outliers	138945	1559 (2.16-2.16)
RSRZ outliers	127900	1456 (2.16-2.16)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	888	<div style="display: flex; align-items: center;"> <div style="width: 8%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 82%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 15%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 2%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">8%      82%      15%      ..</p>
2	B	2	<div style="display: flex; align-items: center;"> <div style="width: 50%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 50%; height: 10px; background-color: yellow; margin-right: 5px;"></div> </div> <p style="text-align: center;">50%      50%</p>
2	C	2	<div style="display: flex; align-items: center;"> <div style="width: 100%; height: 10px; background-color: yellow; margin-right: 5px;"></div> </div> <p style="text-align: center;">100%</p>
2	F	2	<div style="display: flex; align-items: center;"> <div style="width: 100%; height: 10px; background-color: yellow; margin-right: 5px;"></div> </div> <p style="text-align: center;">100%</p>
2	G	2	<div style="display: flex; align-items: center;"> <div style="width: 50%; height: 10px; background-color: yellow; margin-right: 5px;"></div> <div style="width: 50%; height: 10px; background-color: orange; margin-right: 5px;"></div> </div> <p style="text-align: center;">50%      50%</p>

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Mol	Chain	Length	Quality of chain
3	D	3	 67% 33%
3	E	3	 100%

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	NAG	F	2	-	-	-	X
6	NAG	A	1007	-	-	-	X
6	NAG	A	1018	-	-	-	X

## 2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 7945 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 Glutamyl aminopeptidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	875	7159	4584	1192	1358	25	0	2	0

There are 8 discrepancies between the modelled and reference sequences:

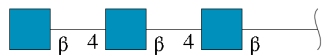
Chain	Residue	Modelled	Actual	Comment	Reference
A	213	ARG	GLN	variant	UNP Q07075
A	218	ALA	VAL	variant	UNP Q07075
A	958	HIS	-	expression tag	UNP Q07075
A	959	HIS	-	expression tag	UNP Q07075
A	960	HIS	-	expression tag	UNP Q07075
A	961	HIS	-	expression tag	UNP Q07075
A	962	HIS	-	expression tag	UNP Q07075
A	963	HIS	-	expression tag	UNP Q07075

- 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
			Total	C	N	O			
2	B	2	28	16	2	10	0	0	0
2	C	2	28	16	2	10	0	0	0
2	F	2	28	16	2	10	0	0	0
2	G	2	28	16	2	10	0	0	0

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(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
3	D	3	42	24	3	15	0	0	0
3	E	3	42	24	3	15	0	0	0

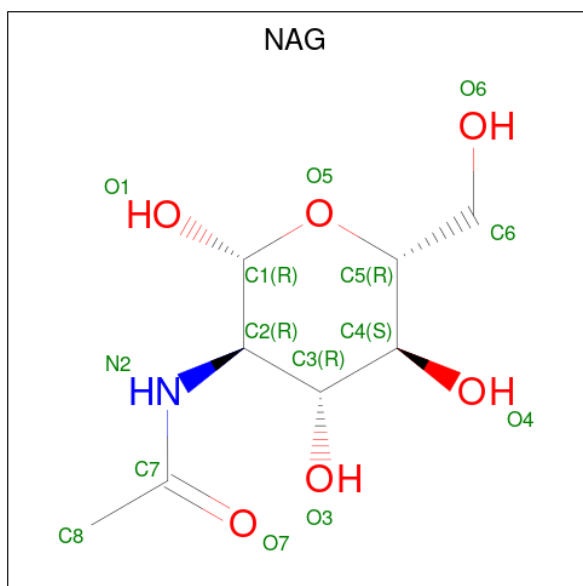
- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Ca	0	0
			1	1		

- Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

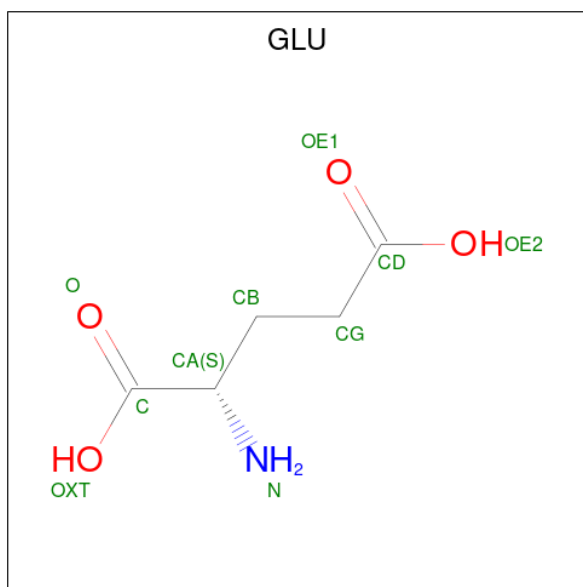
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Zn	0	0
			1	1		

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



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		

- Molecule 7 is GLUTAMIC ACID (three-letter code: GLU) (formula: C<sub>5</sub>H<sub>9</sub>NO<sub>4</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	N	O	0	0
			10	5	1	4		

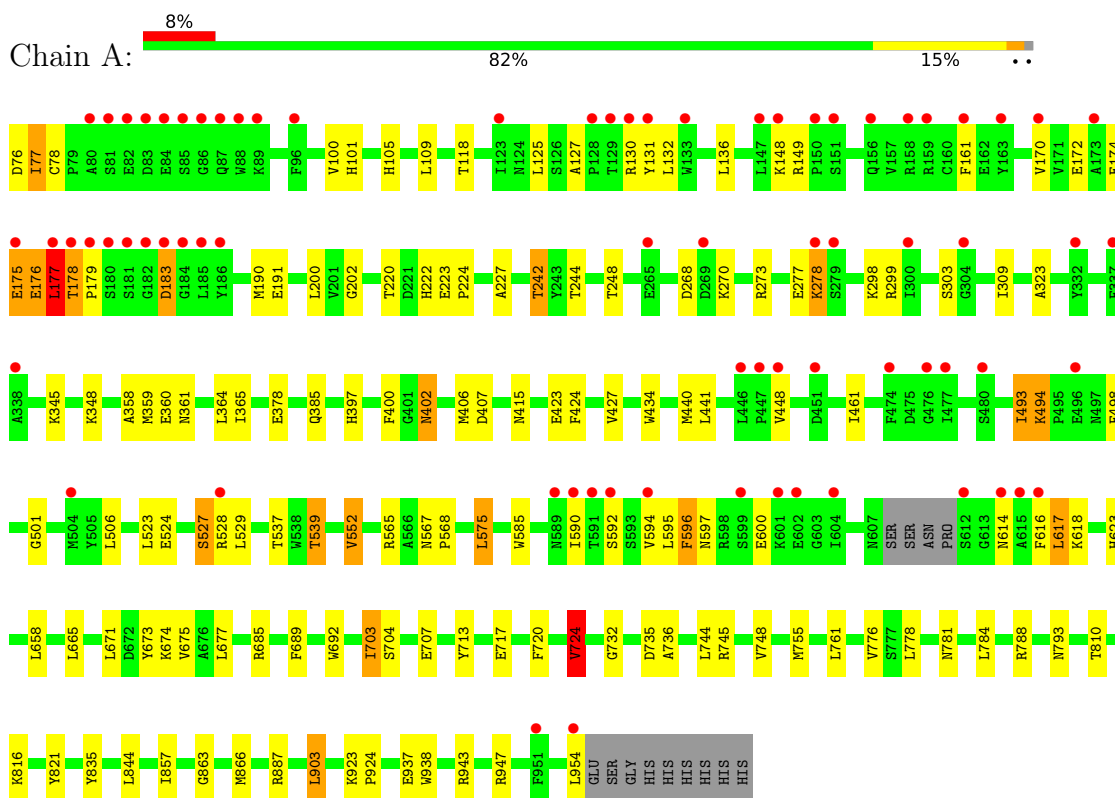
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	550	Total	O	0	0
			550	550		

### 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: Glutamyl aminopeptidase



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




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



MAG1  
MAG2

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

Chain F:  100%MAG1  
MAG2

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

Chain G:  50% 50%MAG1  
MAG2

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

Chain D:  67% 33%MAG1  
MAG2  
MAG3

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

Chain E:  100%MAG1  
MAG2  
MAG3



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	142.23Å 142.23Å 237.08Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.53 – 2.15 45.53 – 2.15	Depositor EDS
% Data completeness (in resolution range)	96.0 (45.53-2.15) 96.1 (45.53-2.15)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.81 (at 2.16Å)	Xtrriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.183 , 0.248 0.192 , 0.248	Depositor DCC
$R_{free}$ test set	3742 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.3	Xtrriage
Anisotropy	0.687	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 55.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7945	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	56.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.05% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, CA, NAG

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	0.42	1/7344 (0.0%)	0.58	2/9985 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	149	ARG	CZ-NH1	8.84	1.44	1.33

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	724	VAL	CB-CA-C	-5.47	101.00	111.40
1	A	903	LEU	CA-CB-CG	5.22	127.31	115.30

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	7159	0	6949	87	0
2	B	28	0	25	0	0
2	C	28	0	25	0	0
2	F	28	0	25	0	0
2	G	28	0	25	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	42	0	37	1	0
3	E	42	0	37	0	0
4	A	1	0	0	0	0
5	A	1	0	0	0	0
6	A	28	0	26	1	0
7	A	10	0	5	1	0
8	A	550	0	0	15	0
All	All	7945	0	7154	88	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 6.

All (88) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:378:GLU:HG3	8:A:1549:HOH:O	1.56	1.06
1:A:761:LEU:HD22	1:A:793:ASN:HD21	1.37	0.88
1:A:190:MET:HA	8:A:1617:HOH:O	1.77	0.83
1:A:736:ALA:O	1:A:745:ARG:NH1	2.20	0.74
1:A:793:ASN:HB3	8:A:1600:HOH:O	1.85	0.74
1:A:703:ILE:HD12	1:A:713:TYR:CE2	2.24	0.72
1:A:177:LEU:HD13	1:A:178:THR:H	1.56	0.69
1:A:131:TYR:CE2	1:A:172:GLU:HB3	2.27	0.69
1:A:423:GLU:O	1:A:427:VAL:HG12	1.93	0.69
1:A:273:ARG:HD2	8:A:1612:HOH:O	1.94	0.67
1:A:501:GLY:HA3	1:A:523:LEU:HD23	1.79	0.65
1:A:175:GLU:O	1:A:176:GLU:HB2	1.97	0.65
1:A:674:LYS:HD3	3:D:1:NAG:H62	1.79	0.64
1:A:552:VAL:HG12	1:A:617:LEU:HD12	1.81	0.61
1:A:277:GLU:HA	8:A:1374:HOH:O	2.03	0.59
1:A:565:ARG:CZ	1:A:937:GLU:HG3	2.32	0.59
1:A:101:HIS:CD2	1:A:242:THR:HG23	2.39	0.58
1:A:498:PHE:HD2	8:A:1469:HOH:O	1.86	0.58
1:A:717:GLU:HG2	1:A:755:MET:O	2.04	0.57
1:A:348:LYS:HZ3	1:A:365:ILE:HD13	1.68	0.57
1:A:943:ARG:HH12	1:A:947:ARG:HH11	1.53	0.55
1:A:361:ASN:HB2	1:A:364:LEU:O	2.06	0.55
1:A:125:LEU:HD22	1:A:178:THR:HA	1.89	0.55
1:A:784:LEU:O	1:A:788:ARG:HG3	2.07	0.54
1:A:597:ASN:HB3	1:A:600:GLU:HG2	1.88	0.54
1:A:537:THR:HA	1:A:575:LEU:HD23	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:585:TRP:CD1	1:A:617:LEU:HD23	2.42	0.53
1:A:441:LEU:HD21	1:A:623:HIS:HB3	1.91	0.53
1:A:493:ILE:O	1:A:494:LYS:HB2	2.10	0.52
1:A:735:ASP:OD1	1:A:781:ASN:HB2	2.09	0.52
1:A:244:THR:HG22	1:A:278:LYS:HA	1.92	0.52
1:A:222:HIS:CD2	1:A:227:ALA:HA	2.45	0.51
1:A:671:LEU:HD11	1:A:675:VAL:HG11	1.92	0.51
1:A:937:GLU:HG2	8:A:1540:HOH:O	2.10	0.51
1:A:863:GLY:HA2	1:A:866:MET:HB2	1.92	0.51
1:A:118:THR:HG22	1:A:191:GLU:HG2	1.92	0.51
1:A:887:ARG:HD2	8:A:1279:HOH:O	2.10	0.51
1:A:732:GLY:O	1:A:745:ARG:HD2	2.12	0.50
1:A:402:ASN:N	1:A:402:ASN:HD22	2.10	0.50
1:A:673:TYR:HH	1:A:938:TRP:HE1	1.58	0.50
1:A:161:PHE:CZ	1:A:170:VAL:HB	2.47	0.50
1:A:704:SER:HA	1:A:707:GLU:HG3	1.94	0.49
1:A:223:GLU:HB2	1:A:359:MET:CE	2.43	0.49
1:A:810:THR:O	1:A:816:LYS:NZ	2.45	0.48
1:A:720:PHE:O	1:A:724:VAL:HG22	2.15	0.47
1:A:461:ILE:HD12	1:A:539:THR:HG23	1.96	0.46
1:A:348:LYS:NZ	1:A:365:ILE:HD13	2.30	0.46
1:A:358:ALA:O	7:A:1019:GLU:HA	2.15	0.46
1:A:524:GLU:HB3	8:A:1584:HOH:O	2.16	0.46
1:A:776:VAL:HG23	8:A:1414:HOH:O	2.16	0.45
1:A:793:ASN:CB	8:A:1600:HOH:O	2.57	0.45
1:A:585:TRP:CD1	1:A:617:LEU:CD2	2.99	0.45
1:A:857:ILE:O	1:A:863:GLY:HA3	2.17	0.45
8:A:1230:HOH:O	2:G:1:NAG:H83	2.16	0.45
1:A:178:THR:N	1:A:179:PRO:HD3	2.31	0.45
1:A:268:ASP:HB3	1:A:270:LYS:H	1.82	0.45
1:A:923:LYS:HB2	1:A:924:PRO:HD3	1.99	0.44
1:A:585:TRP:CZ3	1:A:594:VAL:HG23	2.53	0.44
1:A:595:LEU:HD23	6:A:1018:NAG:O7	2.18	0.44
1:A:100:VAL:O	1:A:242:THR:HG22	2.17	0.44
1:A:125:LEU:HD21	1:A:127:ALA:O	2.17	0.44
1:A:397:HIS:HA	1:A:400:PHE:O	2.18	0.43
1:A:527:SER:C	1:A:529:LEU:H	2.21	0.43
1:A:736:ALA:H	1:A:745:ARG:NH1	2.16	0.43
1:A:202:GLY:O	1:A:220:THR:HA	2.18	0.43
1:A:223:GLU:HA	1:A:224:PRO:HA	1.75	0.43
1:A:689:PHE:HA	1:A:744:LEU:HD13	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:309:ILE:CD1	1:A:323:ALA:HA	2.49	0.43
1:A:567:ASN:HA	1:A:568:PRO:HD3	1.89	0.43
1:A:175:GLU:O	1:A:176:GLU:CB	2.66	0.43
1:A:359:MET:O	1:A:365:ILE:HG23	2.19	0.43
1:A:407:ASP:HB3	8:A:1460:HOH:O	2.18	0.42
1:A:596:PHE:C	1:A:596:PHE:CD1	2.93	0.42
1:A:77:ILE:HG12	1:A:78:CYS:N	2.33	0.42
1:A:616:PHE:HE2	1:A:618:LYS:HG3	1.85	0.42
1:A:692:TRP:CZ3	1:A:724:VAL:HG13	2.55	0.42
1:A:943:ARG:HH22	1:A:947:ARG:NH1	2.18	0.42
1:A:105:HIS:HE1	1:A:248:THR:OG1	2.03	0.41
1:A:385:GLN:HA	1:A:434:TRP:CZ3	2.55	0.41
1:A:424:PHE:CG	1:A:440:MET:HG2	2.55	0.41
1:A:360:GLU:O	1:A:361:ASN:C	2.56	0.41
1:A:130:ARG:HG3	1:A:175:GLU:O	2.21	0.41
1:A:131:TYR:CD2	1:A:172:GLU:HB3	2.56	0.41
1:A:174:GLU:OE2	1:A:174:GLU:HA	2.21	0.41
1:A:685:ARG:NH1	8:A:1308:HOH:O	2.53	0.40
1:A:76:ASP:HB3	8:A:1581:HOH:O	2.21	0.40
1:A:493:ILE:HG12	1:A:527:SER:OG	2.21	0.40
1:A:183:ASP:OD1	1:A:183:ASP:N	2.54	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	873/888 (98%)	839 (96%)	28 (3%)	6 (1%)	22 15

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	176	GLU
1	A	175	GLU
1	A	177	LEU
1	A	552	VAL
1	A	494	LYS
1	A	178	THR

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	787/797 (99%)	746 (95%)	41 (5%)	23 19

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	ILE
1	A	109	LEU
1	A	132	LEU
1	A	136	LEU
1	A	148	LYS
1	A	177	LEU
1	A	183	ASP
1	A	200	LEU
1	A	242	THR
1	A	278	LYS
1	A	298	LYS
1	A	299	ARG
1	A	303	SER
1	A	345	LYS
1	A	402	ASN
1	A	406	MET
1	A	415	ASN
1	A	448	VAL
1	A	493	ILE
1	A	506	LEU
1	A	527	SER

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Mol	Chain	Res	Type
1	A	528	ARG
1	A	539	THR
1	A	575	LEU
1	A	590	ILE
1	A	592	SER
1	A	596	PHE
1	A	614	ASN
1	A	617	LEU
1	A	658	LEU
1	A	665	LEU
1	A	677	LEU
1	A	703	ILE
1	A	724	VAL
1	A	748	VAL
1	A	778	LEU
1	A	821	TYR
1	A	835	TYR
1	A	844	LEU
1	A	903	LEU
1	A	954	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	101	HIS
1	A	105	HIS
1	A	154	GLN
1	A	317	HIS
1	A	402	ASN
1	A	415	ASN
1	A	570	GLN
1	A	734	ASN
1	A	792	GLN
1	A	793	ASN
1	A	806	GLN
1	A	843	ASN
1	A	874	ASN

### 5.3.3 RNA

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 5.5 Carbohydrates [i](#)

14 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	2,1	14,14,15	0.46	0	17,19,21	0.82	0
2	NAG	B	2	2	14,14,15	0.50	0	17,19,21	1.19	1 (5%)
2	NAG	C	1	2,1	14,14,15	0.57	0	17,19,21	2.04	5 (29%)
2	NAG	C	2	2	14,14,15	0.62	0	17,19,21	2.38	4 (23%)
3	NAG	D	1	3,1	14,14,15	0.59	0	17,19,21	1.19	3 (17%)
3	NAG	D	2	3	14,14,15	0.54	0	17,19,21	1.14	1 (5%)
3	NAG	D	3	3	14,14,15	0.56	0	17,19,21	1.97	2 (11%)
3	NAG	E	1	3,1	14,14,15	0.51	0	17,19,21	1.17	2 (11%)
3	NAG	E	2	3	14,14,15	0.63	0	17,19,21	1.64	2 (11%)
3	NAG	E	3	3	14,14,15	1.19	1 (7%)	17,19,21	1.31	2 (11%)
2	NAG	F	1	2,1	14,14,15	0.57	0	17,19,21	1.97	4 (23%)
2	NAG	F	2	2	14,14,15	0.46	0	17,19,21	1.26	1 (5%)
2	NAG	G	1	2,1	14,14,15	0.59	0	17,19,21	1.31	2 (11%)
2	NAG	G	2	2	14,14,15	0.59	0	17,19,21	1.00	1 (5%)

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	2,1	-	2/6/23/26	0/1/1/1
2	NAG	B	2	2	-	2/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	C	1	2,1	-	2/6/23/26	0/1/1/1
2	NAG	C	2	2	-	2/6/23/26	0/1/1/1
3	NAG	D	1	3,1	-	2/6/23/26	0/1/1/1
3	NAG	D	2	3	-	1/6/23/26	0/1/1/1
3	NAG	D	3	3	-	2/6/23/26	0/1/1/1
3	NAG	E	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	E	2	3	-	3/6/23/26	0/1/1/1
3	NAG	E	3	3	-	1/6/23/26	0/1/1/1
2	NAG	F	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	F	2	2	-	2/6/23/26	0/1/1/1
2	NAG	G	1	2,1	-	2/6/23/26	0/1/1/1
2	NAG	G	2	2	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	3	NAG	O7-C7	3.51	1.31	1.23

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	3	NAG	C1-O5-C5	6.54	121.05	112.19
2	C	2	NAG	C1-O5-C5	5.73	119.96	112.19
2	C	2	NAG	C2-N2-C7	5.71	131.03	122.90
2	F	1	NAG	C1-O5-C5	5.31	119.39	112.19
2	C	1	NAG	O4-C4-C3	4.48	120.71	110.35
2	F	2	NAG	C1-O5-C5	3.86	117.42	112.19
2	C	1	NAG	C2-N2-C7	3.78	128.29	122.90
2	F	1	NAG	O4-C4-C3	3.69	118.87	110.35
2	G	1	NAG	C1-C2-N2	-3.65	104.26	110.49
3	E	2	NAG	O5-C1-C2	-3.56	105.66	111.29
3	D	2	NAG	C4-C3-C2	3.35	115.93	111.02
2	C	1	NAG	C1-O5-C5	3.31	116.68	112.19
3	D	3	NAG	O5-C5-C6	3.30	112.37	107.20
2	C	1	NAG	C8-C7-N2	3.10	121.35	116.10
3	E	2	NAG	C2-N2-C7	3.02	127.20	122.90
3	E	3	NAG	C4-C3-C2	2.99	115.41	111.02
2	C	2	NAG	C1-C2-N2	2.97	115.57	110.49
2	F	1	NAG	C4-C3-C2	-2.95	106.70	111.02
2	F	1	NAG	O4-C4-C5	2.94	116.61	109.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	3	NAG	O7-C7-N2	2.81	127.12	121.95
2	B	2	NAG	C1-O5-C5	2.59	115.70	112.19
2	C	1	NAG	O7-C7-C8	-2.51	117.40	122.06
3	E	1	NAG	C1-O5-C5	2.42	115.47	112.19
2	G	2	NAG	C4-C3-C2	2.41	114.55	111.02
2	G	1	NAG	C8-C7-N2	2.33	120.05	116.10
3	E	1	NAG	C4-C3-C2	2.27	114.34	111.02
3	D	1	NAG	O5-C5-C6	2.16	110.58	107.20
3	D	1	NAG	O4-C4-C5	2.14	114.61	109.30
2	C	2	NAG	O7-C7-N2	2.04	125.71	121.95
3	D	1	NAG	O7-C7-C8	-2.03	118.28	122.06

There are no chirality outliers.

All (23) torsion outliers are listed below:

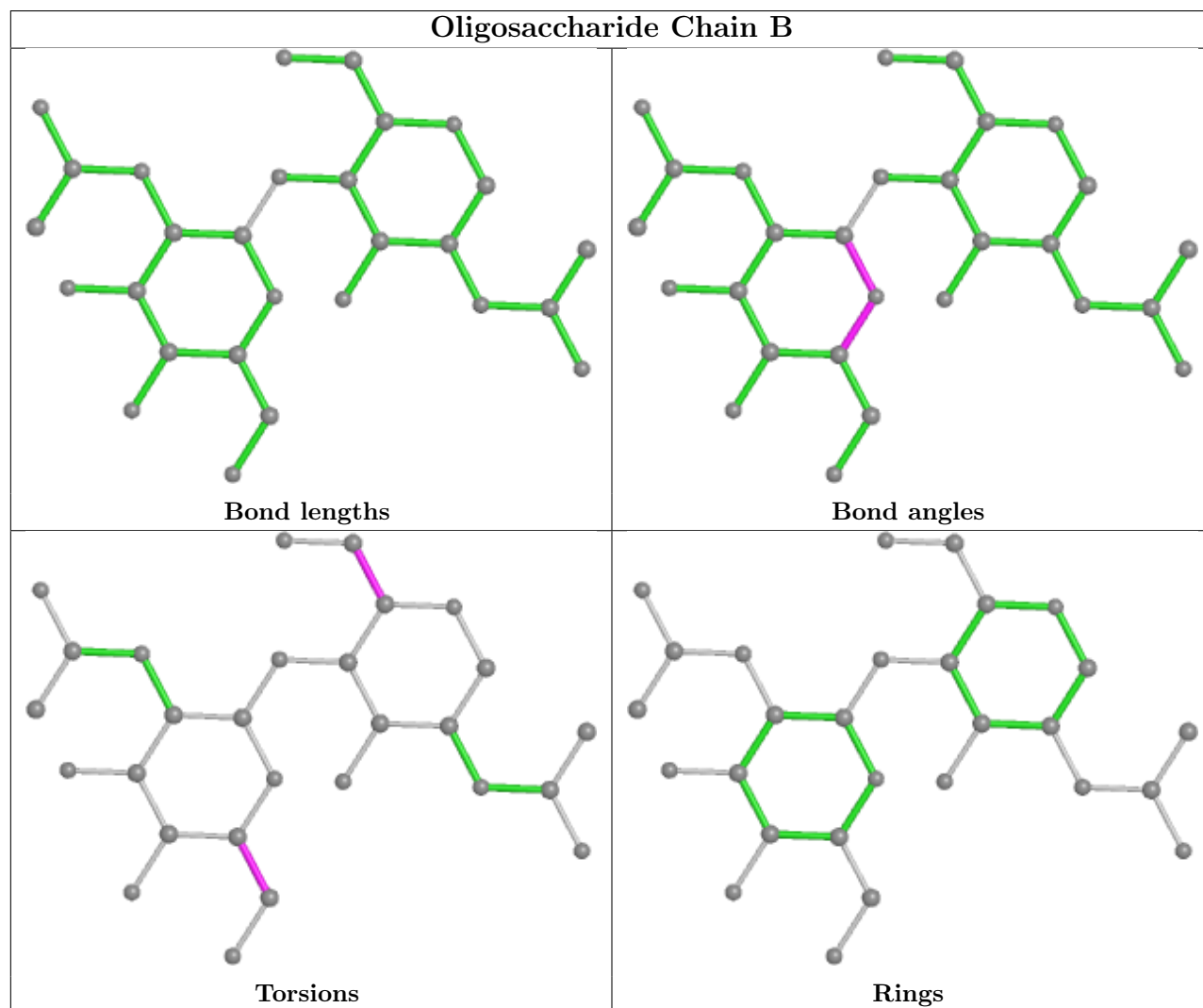
Mol	Chain	Res	Type	Atoms
3	E	2	NAG	O5-C5-C6-O6
3	D	3	NAG	O5-C5-C6-O6
3	E	2	NAG	C4-C5-C6-O6
2	C	2	NAG	C1-C2-N2-C7
2	C	1	NAG	C8-C7-N2-C2
2	C	1	NAG	O7-C7-N2-C2
2	F	2	NAG	C8-C7-N2-C2
2	F	2	NAG	O7-C7-N2-C2
2	G	1	NAG	C8-C7-N2-C2
2	G	1	NAG	O7-C7-N2-C2
3	D	1	NAG	C8-C7-N2-C2
3	D	1	NAG	O7-C7-N2-C2
2	G	2	NAG	O5-C5-C6-O6
2	G	2	NAG	C4-C5-C6-O6
3	D	3	NAG	C4-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6
3	E	3	NAG	O5-C5-C6-O6
2	B	1	NAG	C4-C5-C6-O6
2	B	1	NAG	O5-C5-C6-O6
3	D	2	NAG	C4-C5-C6-O6
2	B	2	NAG	O5-C5-C6-O6
2	C	2	NAG	C4-C5-C6-O6
3	E	2	NAG	C3-C2-N2-C7

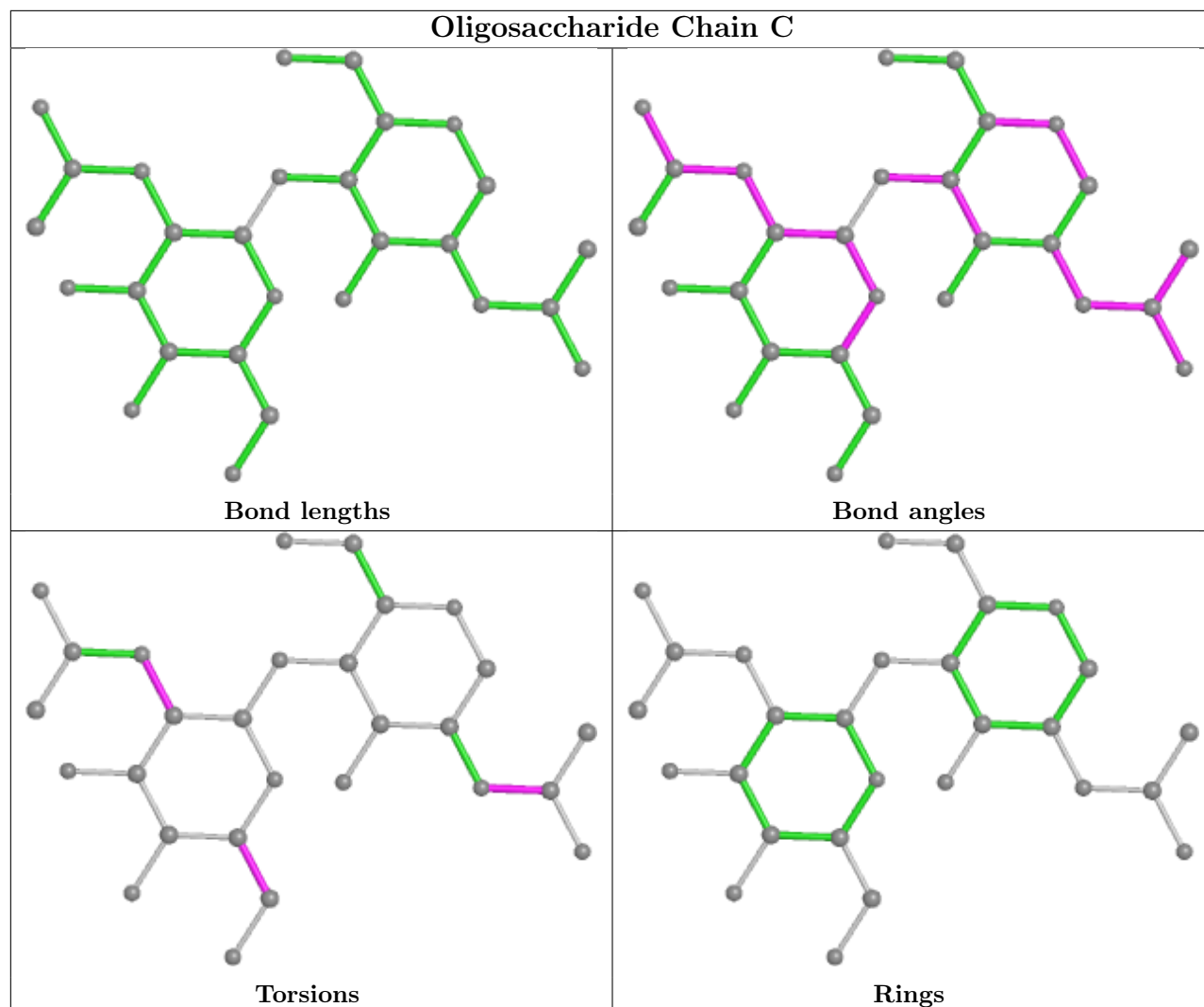
There are no ring outliers.

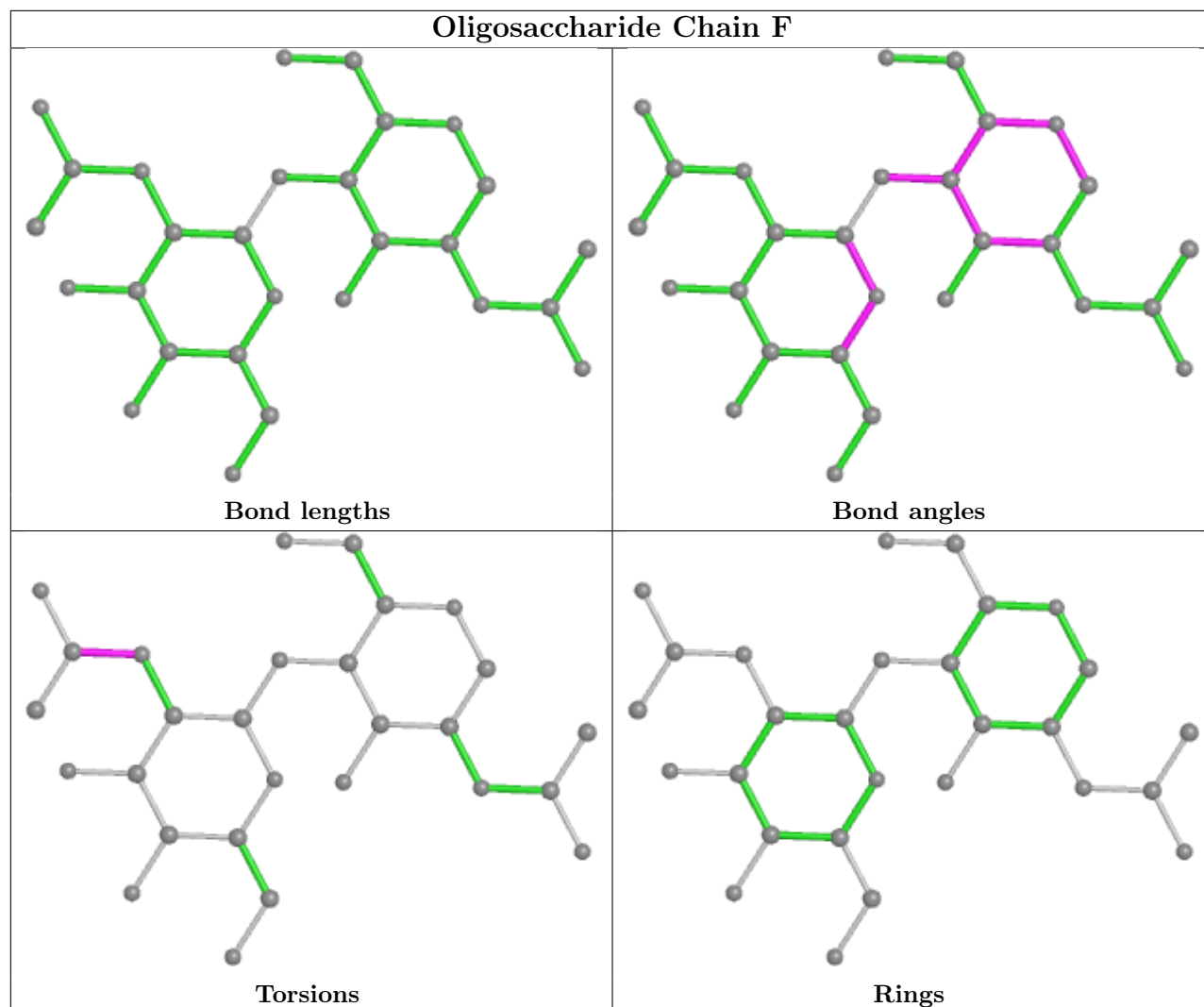
2 monomers are involved in 2 short contacts:

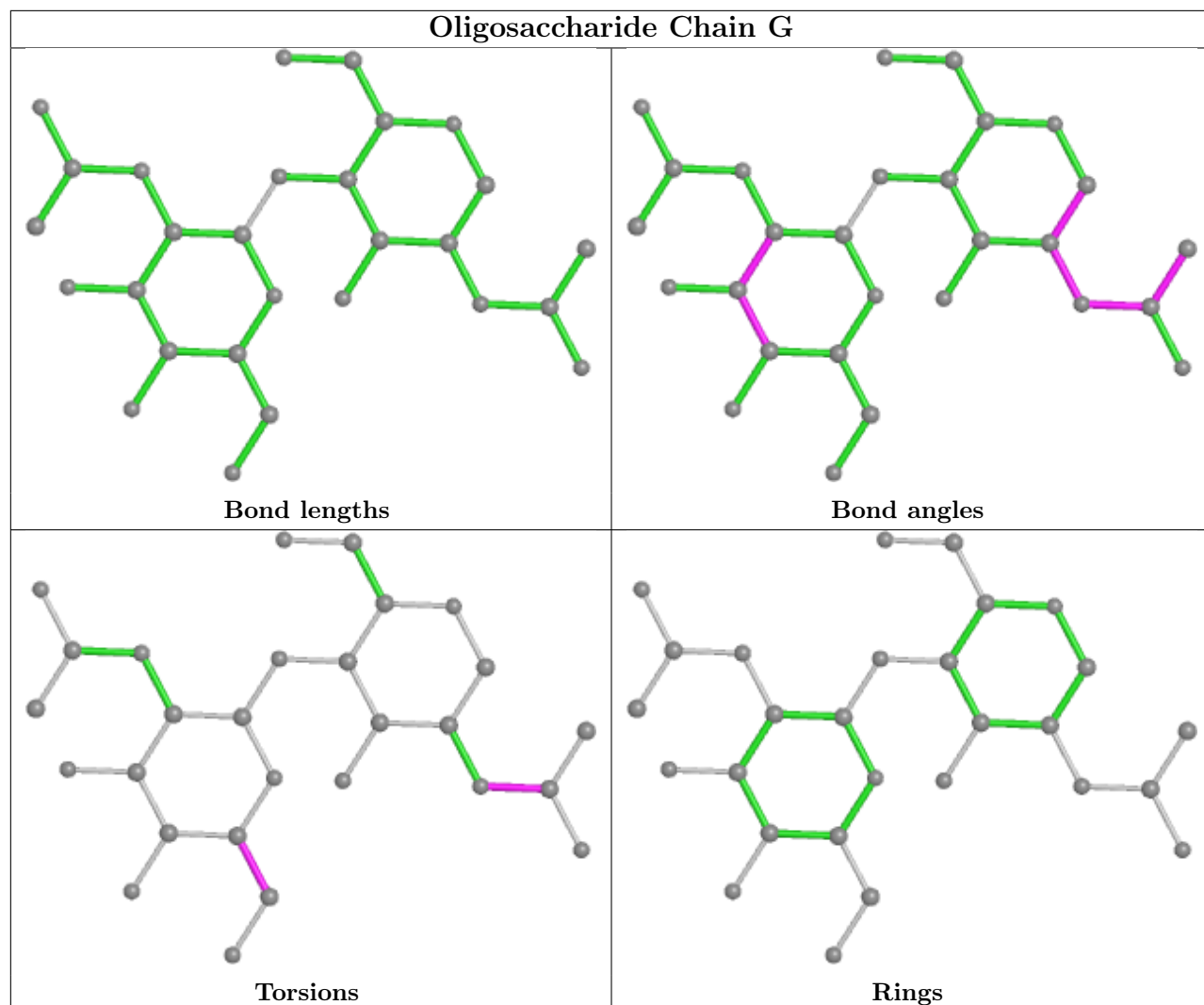
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	1	NAG	1	0
2	G	1	NAG	1	0

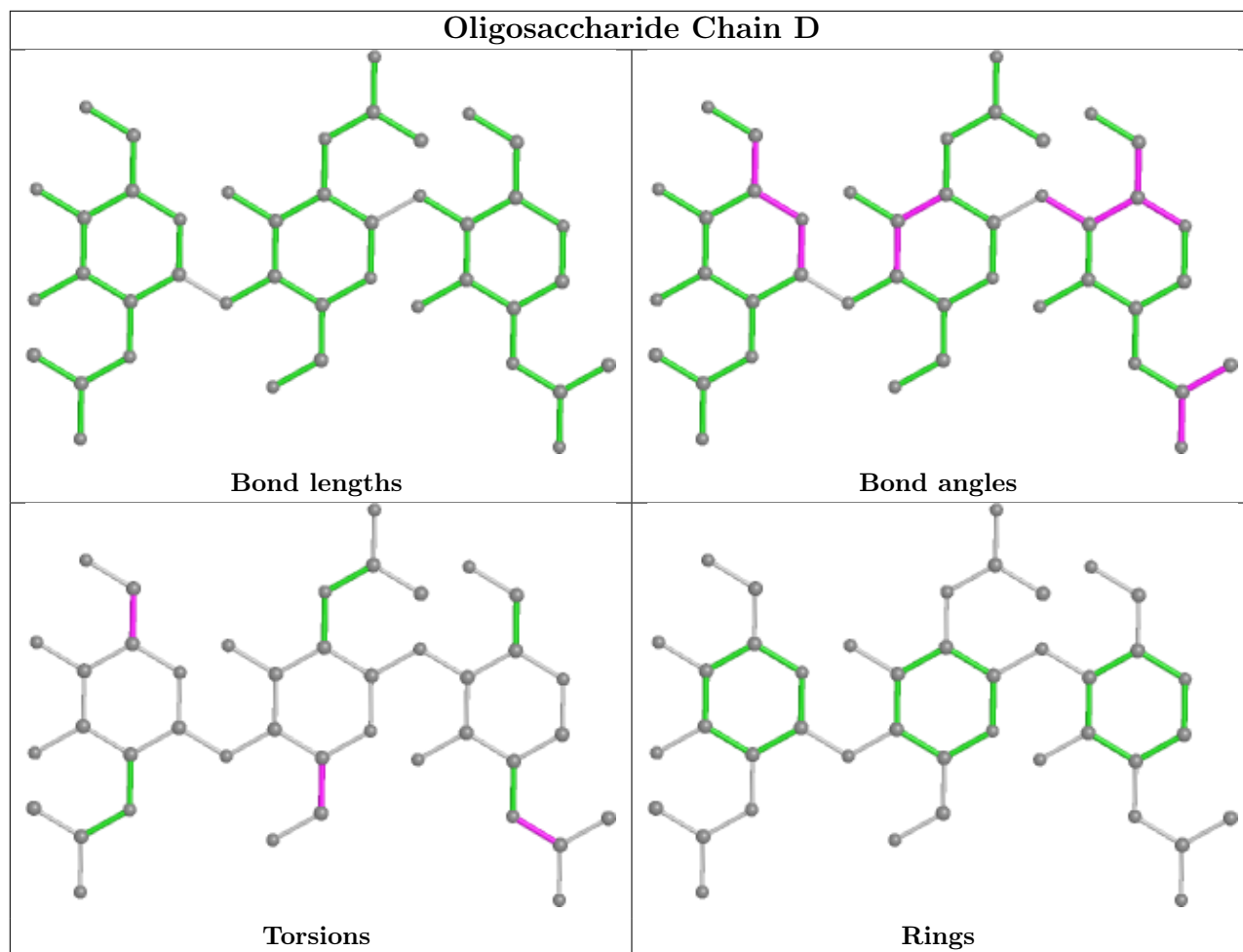
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

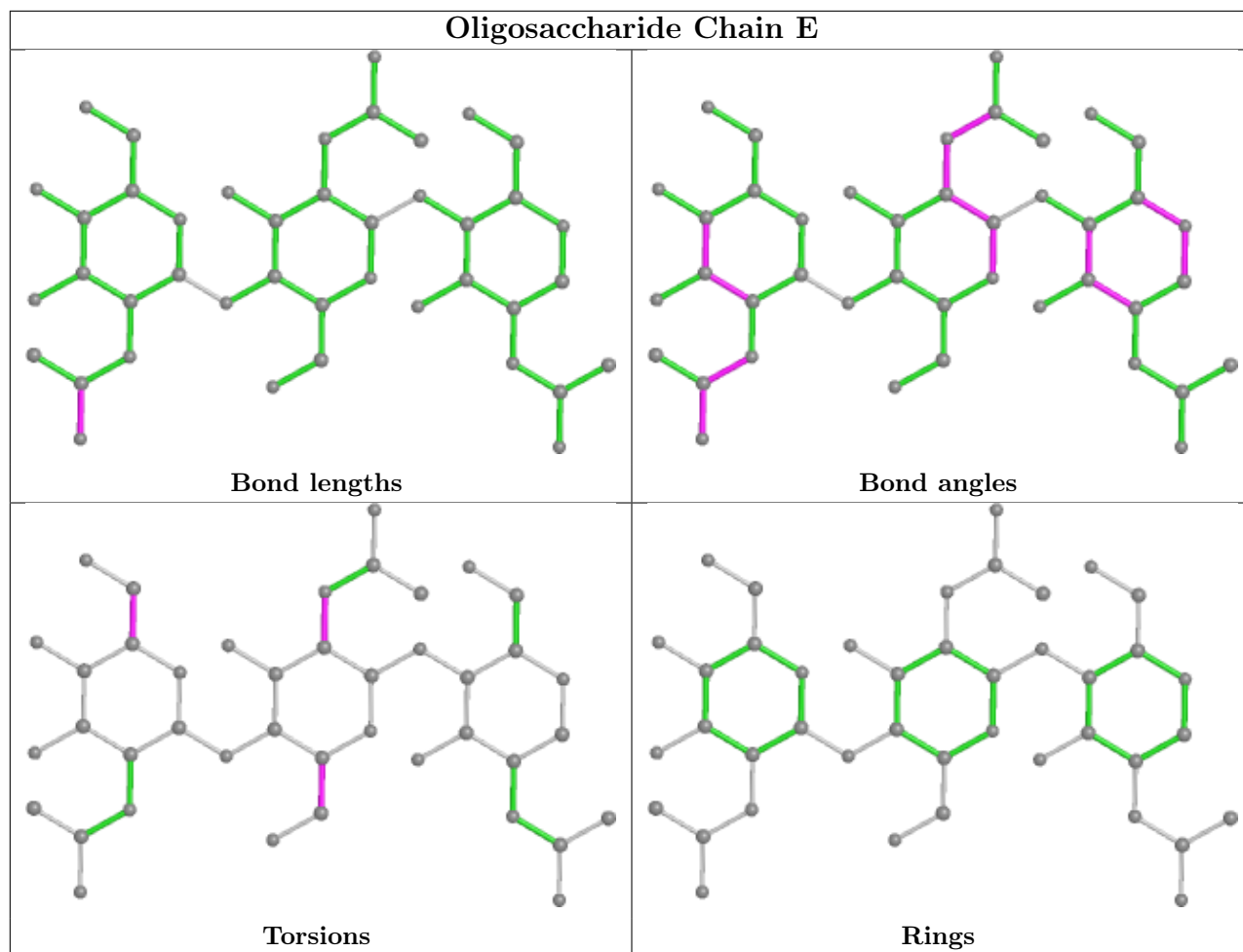












## 5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 2 are monoatomic - leaving 3 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	1007	1	14,14,15	0.57	0	17,19,21	1.40	3 (17%)
7	GLU	A	1019	4	8,9,9	1.09	1 (12%)	10,11,11	1.34	2 (20%)
6	NAG	A	1018	1	14,14,15	0.42	0	17,19,21	1.51	4 (23%)

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	1007	1	-	1/6/23/26	0/1/1/1
7	GLU	A	1019	4	-	2/9/9/9	-
6	NAG	A	1018	1	-	4/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	1019	GLU	OXT-C	-2.21	1.23	1.30

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	1007	NAG	C2-N2-C7	4.10	128.74	122.90
6	A	1018	NAG	C1-C2-N2	3.03	115.66	110.49
6	A	1018	NAG	C4-C3-C2	-2.92	106.74	111.02
7	A	1019	GLU	OXT-C-O	-2.72	117.90	124.09
6	A	1018	NAG	O5-C1-C2	-2.70	107.02	111.29
6	A	1018	NAG	C1-O5-C5	2.55	115.65	112.19
7	A	1019	GLU	OXT-C-CA	2.38	121.50	113.38
6	A	1007	NAG	C1-C2-N2	2.05	113.99	110.49
6	A	1007	NAG	O5-C5-C6	2.02	110.37	107.20

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	A	1019	GLU	O-C-CA-N
6	A	1018	NAG	O5-C5-C6-O6
6	A	1018	NAG	C8-C7-N2-C2
6	A	1018	NAG	O7-C7-N2-C2
7	A	1019	GLU	OXT-C-CA-N
6	A	1007	NAG	C1-C2-N2-C7
6	A	1018	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	1019	GLU	1	0
6	A	1018	NAG	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

### 6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	875/888 (98%)	0.31	74 (8%) <b>10</b> <b>15</b>	20, 52, 96, 133	0

All (74) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	184	GLY	6.7
1	A	182	GLY	5.1
1	A	615	ALA	4.9
1	A	84	GLU	4.8
1	A	173	ALA	4.8
1	A	183	ASP	4.7
1	A	179	PRO	4.5
1	A	185	LEU	4.4
1	A	177	LEU	4.4
1	A	951	PHE	4.4
1	A	528	ARG	4.3
1	A	954	LEU	4.2
1	A	175	GLU	4.2
1	A	599	SER	3.9
1	A	128	PRO	3.7
1	A	496	GLU	3.5
1	A	181	SER	3.5
1	A	85	SER	3.4
1	A	602	GLU	3.2
1	A	589	ASN	3.1
1	A	601	LYS	3.1
1	A	150	PRO	3.0
1	A	89	LYS	3.0
1	A	148	LYS	3.0
1	A	304	GLY	2.9
1	A	332	TYR	2.9
1	A	129	THR	2.9

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	614	ASN	2.9
1	A	88	TRP	2.9
1	A	170	VAL	2.9
1	A	186	TYR	2.8
1	A	82	GLU	2.8
1	A	159	ARG	2.8
1	A	81	SER	2.8
1	A	151	SER	2.8
1	A	130	ARG	2.7
1	A	612	SER	2.7
1	A	338	ALA	2.6
1	A	161	PHE	2.6
1	A	616	PHE	2.6
1	A	83	ASP	2.6
1	A	158	ARG	2.5
1	A	278	LYS	2.5
1	A	504	MET	2.5
1	A	265	GLU	2.5
1	A	446	LEU	2.4
1	A	87	GLN	2.4
1	A	594	VAL	2.4
1	A	591	THR	2.4
1	A	476	GLY	2.4
1	A	480	SER	2.4
1	A	96	PHE	2.4
1	A	448	VAL	2.4
1	A	178	THR	2.4
1	A	163	TYR	2.4
1	A	80	ALA	2.3
1	A	590	ILE	2.3
1	A	604	ILE	2.3
1	A	477	ILE	2.3
1	A	337	PHE	2.2
1	A	300	ILE	2.2
1	A	123	ILE	2.2
1	A	133	TRP	2.1
1	A	180	SER	2.1
1	A	592	SER	2.1
1	A	131	TYR	2.1
1	A	474	PHE	2.1
1	A	269	ASP	2.1
1	A	451	ASP	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	279	SER	2.1
1	A	86	GLY	2.1
1	A	156	GLN	2.1
1	A	447	PRO	2.0
1	A	147	LEU	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 6.3 Carbohydrates [i](#)

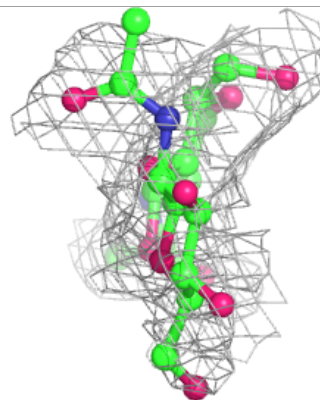
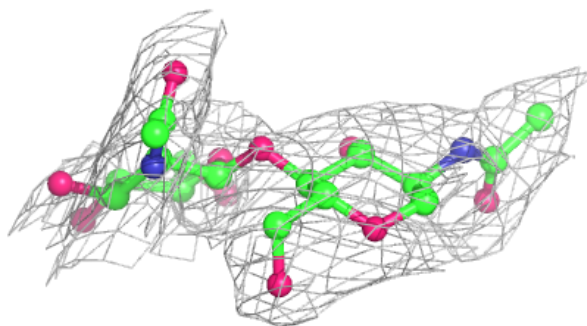
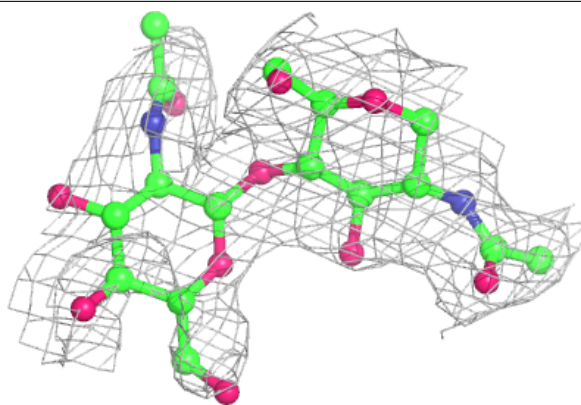
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	NAG	F	2	14/15	0.75	0.44	106,111,137,138	0
3	NAG	D	3	14/15	0.77	0.28	114,144,151,155	0
2	NAG	C	2	14/15	0.78	0.24	81,135,143,145	0
2	NAG	G	2	14/15	0.86	0.29	84,111,126,132	0
2	NAG	B	2	14/15	0.86	0.27	101,122,141,142	0
3	NAG	E	3	14/15	0.87	0.21	97,129,155,161	0
2	NAG	B	1	14/15	0.91	0.11	59,76,99,119	0
2	NAG	F	1	14/15	0.92	0.25	50,70,86,96	0
3	NAG	D	2	14/15	0.92	0.23	103,127,135,139	0
3	NAG	E	2	14/15	0.93	0.21	86,99,117,126	0
3	NAG	D	1	14/15	0.93	0.11	58,85,107,108	0
2	NAG	C	1	14/15	0.94	0.16	63,90,105,110	0
3	NAG	E	1	14/15	0.94	0.15	58,69,84,90	0
2	NAG	G	1	14/15	0.95	0.11	42,67,83,93	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.

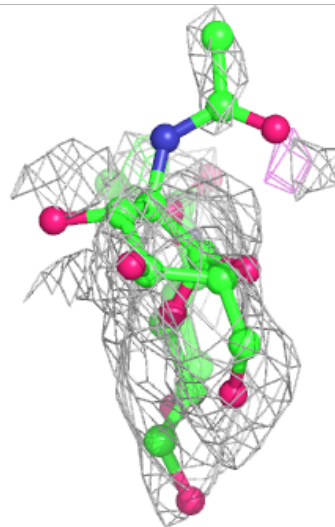
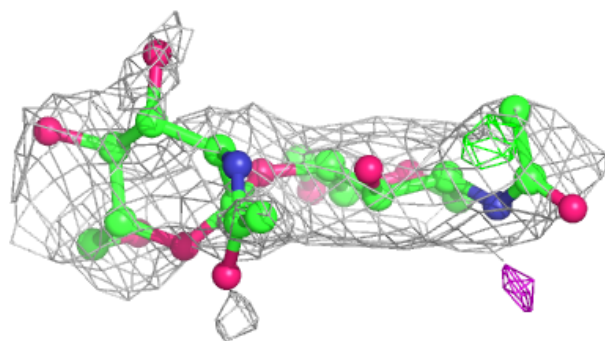
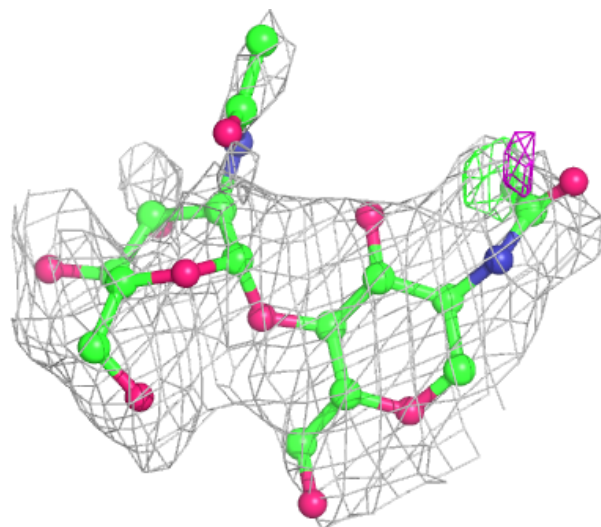
**Electron density around Chain B:**

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



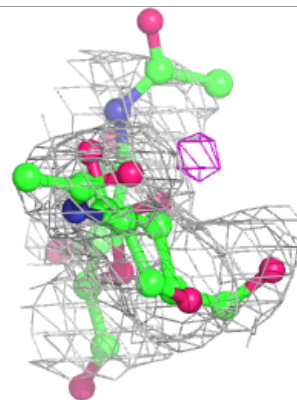
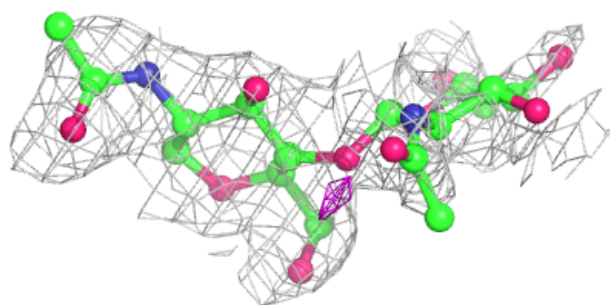
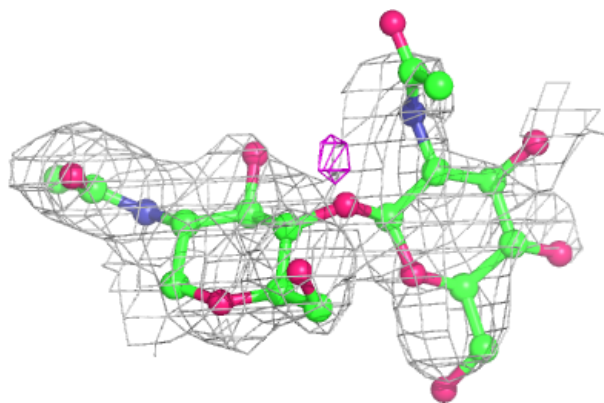
**Electron density around Chain C:**

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

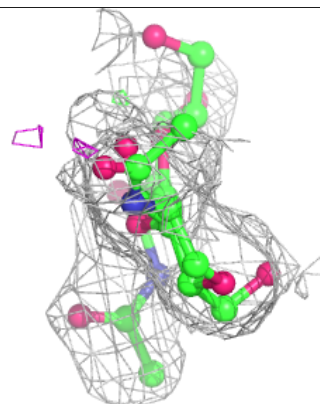
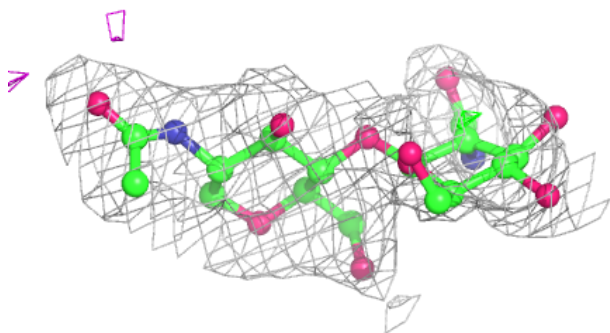
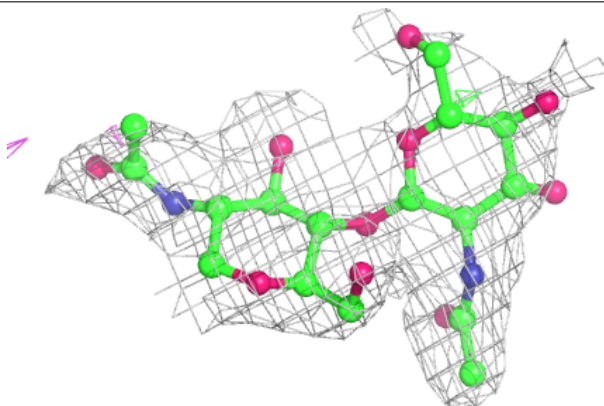


**Electron density around Chain F:**

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

**Electron density around Chain G:**

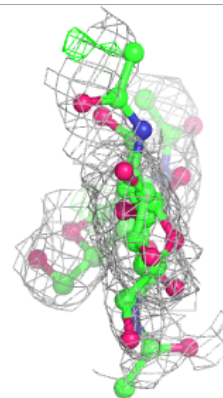
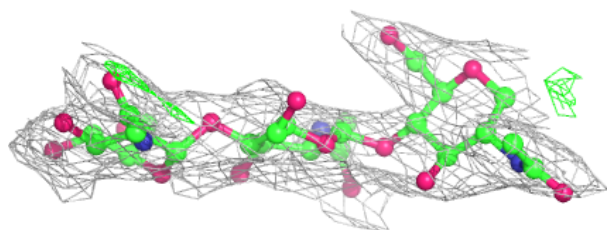
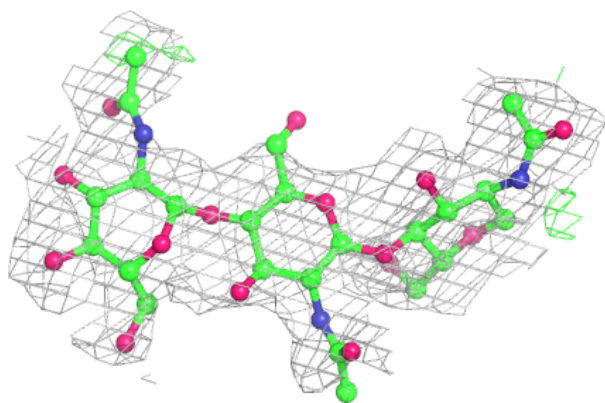
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



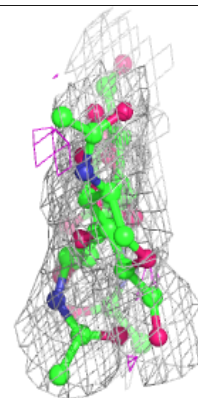
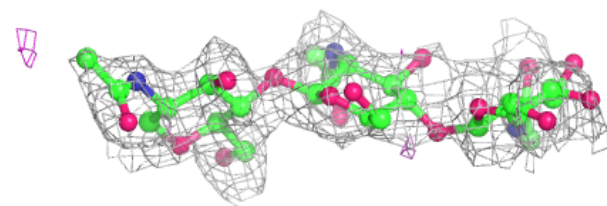
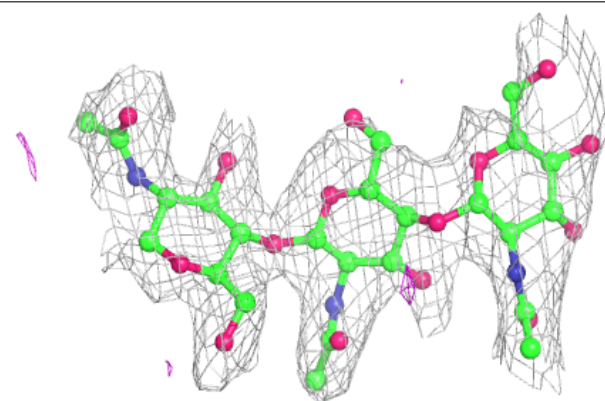


**Electron density around Chain D:**

$2mF_o-DF_c$  (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, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
6	NAG	A	1007	14/15	0.76	0.43	114,138,155,160	0
6	NAG	A	1018	14/15	0.77	0.49	89,107,118,130	0
7	GLU	A	1019	10/10	0.88	0.19	46,64,81,92	0
5	ZN	A	1002	1/1	0.99	0.09	79,79,79,79	0
4	CA	A	1001	1/1	0.99	0.20	38,38,38,38	1

## 6.5 Other polymers [i](#)

There are no such residues in this entry.