



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 4, 2024 – 09:59 pm GMT

PDB ID : 5AB2  
Title : Crystal structure of aminopeptidase ERAP2 with ligand  
Authors : Mpakali, A.; Giastas, P.; Saridakis, E.; Mavridis, I.M.; Stratikos, E.  
Deposited on : 2015-07-31  
Resolution : 2.73 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](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 : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

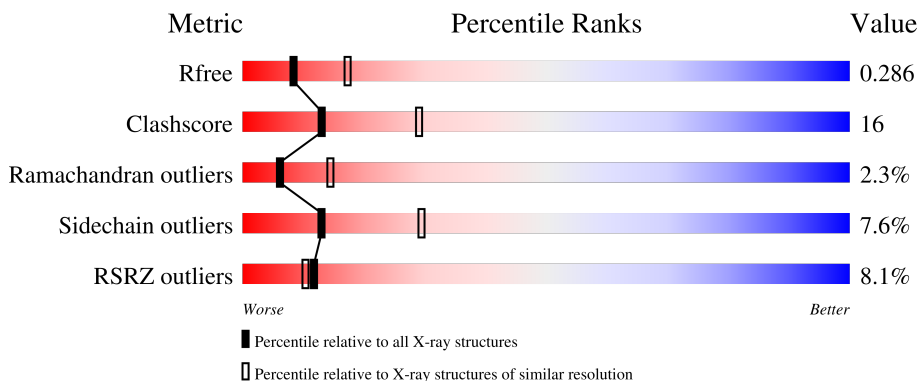
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.73 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.




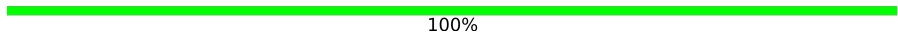
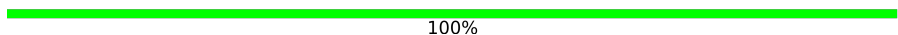
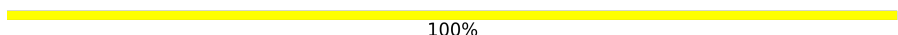


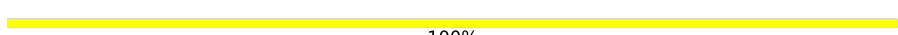


Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	3359 (2.74-2.70)
Clashscore	141614	3686 (2.74-2.70)
Ramachandran outliers	138981	3622 (2.74-2.70)
Sidechain outliers	138945	3623 (2.74-2.70)
RSRZ outliers	127900	3276 (2.74-2.70)

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	967	 2% 69% 22% 7%
1	B	967	 12% 52% 33% 6% 9%
2	C	6	 33% 50% 33% 17%
2	D	6	 33% 83% 50% 17%
3	E	3	 33% 67%

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Mol	Chain	Length	Quality of chain
3	G	3	 33% 67%
4	F	2	 100%
4	H	2	 100%
4	I	2	 100%
4	J	2	 50% 50%
4	K	2	 50% 50%
4	M	2	 100%
4	N	2	 50% 50%
5	L	4	 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
6	NAG	B	1010	-	-	-	X

## 2 Entry composition i

There are 9 unique types of molecules in this entry. The entry contains 15144 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
			Total	C	N	O	S			
1	A	897	Total	C	N	O	S	0	8	1
			7344	4737	1217	1361	29			
1	B	879	Total	C	N	O	S	0	0	1
			7156	4617	1188	1323	28			

There are 14 discrepancies between the modelled and reference sequences:

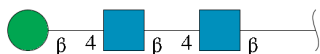
Chain	Residue	Modelled	Actual	Comment	Reference
A	961	ARG	-	cloning artifact	UNP Q6P179
A	962	HIS	-	expression tag	UNP Q6P179
A	963	HIS	-	expression tag	UNP Q6P179
A	964	HIS	-	expression tag	UNP Q6P179
A	965	HIS	-	expression tag	UNP Q6P179
A	966	HIS	-	expression tag	UNP Q6P179
A	967	HIS	-	expression tag	UNP Q6P179
B	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 a protein called GPI.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	6	Total	C	N	O	0	5	0
			80	52	17	11			
2	D	6	Total	C	N	O	0	0	0
			42	27	9	6			

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

eta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	3	39	22	2	15	0	0	0
3	G	3	39	22	2	15	0	0	0

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



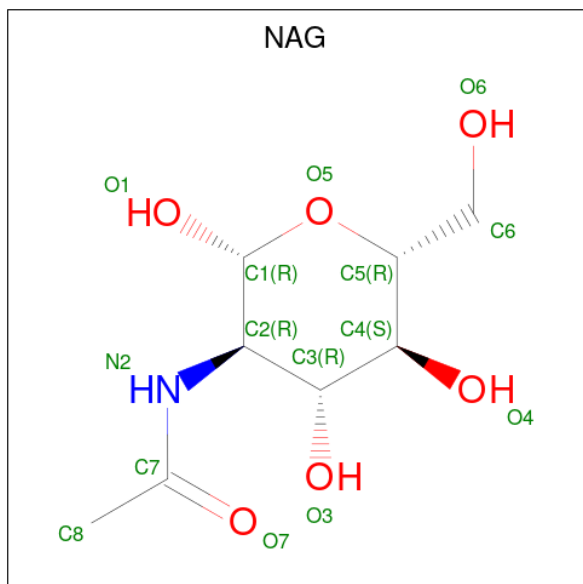
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	F	2	28	16	2	10	0	0	0
4	H	2	28	16	2	10	0	0	0
4	I	2	28	16	2	10	0	0	0
4	J	2	28	16	2	10	0	0	0
4	K	2	28	16	2	10	0	0	0
4	M	2	28	16	2	10	0	0	0
4	N	2	28	16	2	10	0	0	0

- Molecule 5 is an oligosaccharide called beta-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			
5	L	4	50	28	2	20	0	0	0

- 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
			Total	C	N	O		
6	A	1	14	8	1	5	0	0
6	A	1	14	8	1	5	0	0
6	B	1	14	8	1	5	0	0
6	B	1	14	8	1	5	0	0
6	B	1	14	8	1	5	0	0

- Molecule 7 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 8 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula:  $C_2H_6O_2$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C O 4 2 2	0	0
8	A	1	Total C O 4 2 2	0	0
8	A	1	Total C O 4 2 2	0	0
8	B	1	Total C O 4 2 2	0	0
8	B	1	Total C O 4 2 2	0	0
8	B	1	Total C O 4 2 2	0	0

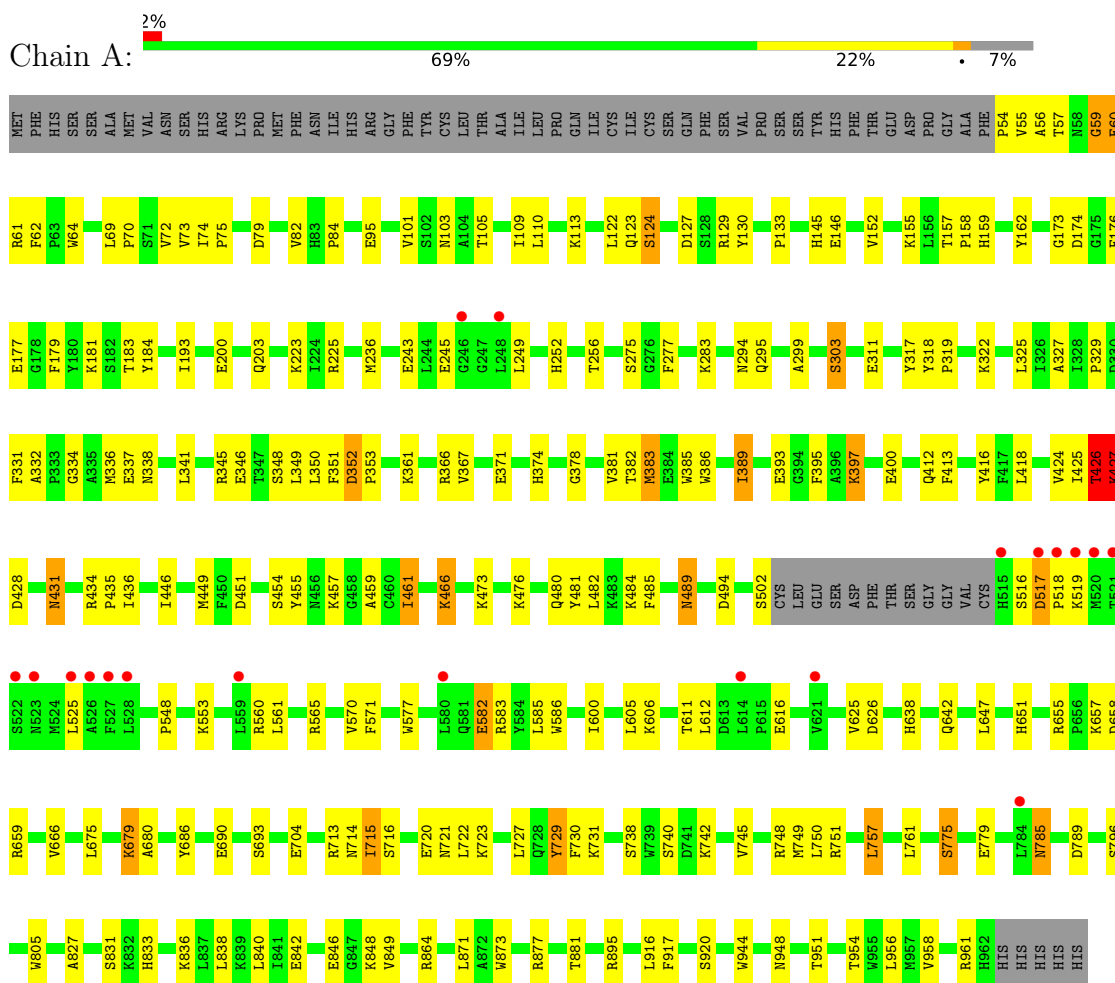
- Molecule 9 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	82	Total O 82 82	0	0
9	B	20	Total O 20 20	0	0

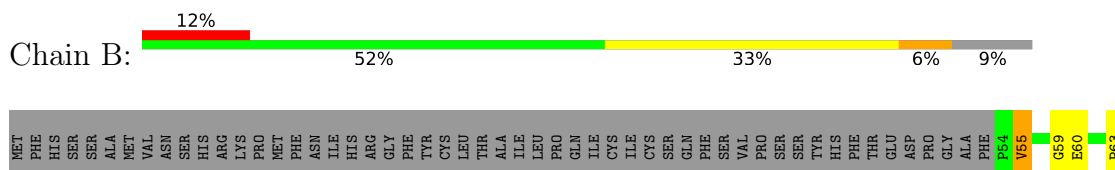
### 3 Residue-property plots [i](#)

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.

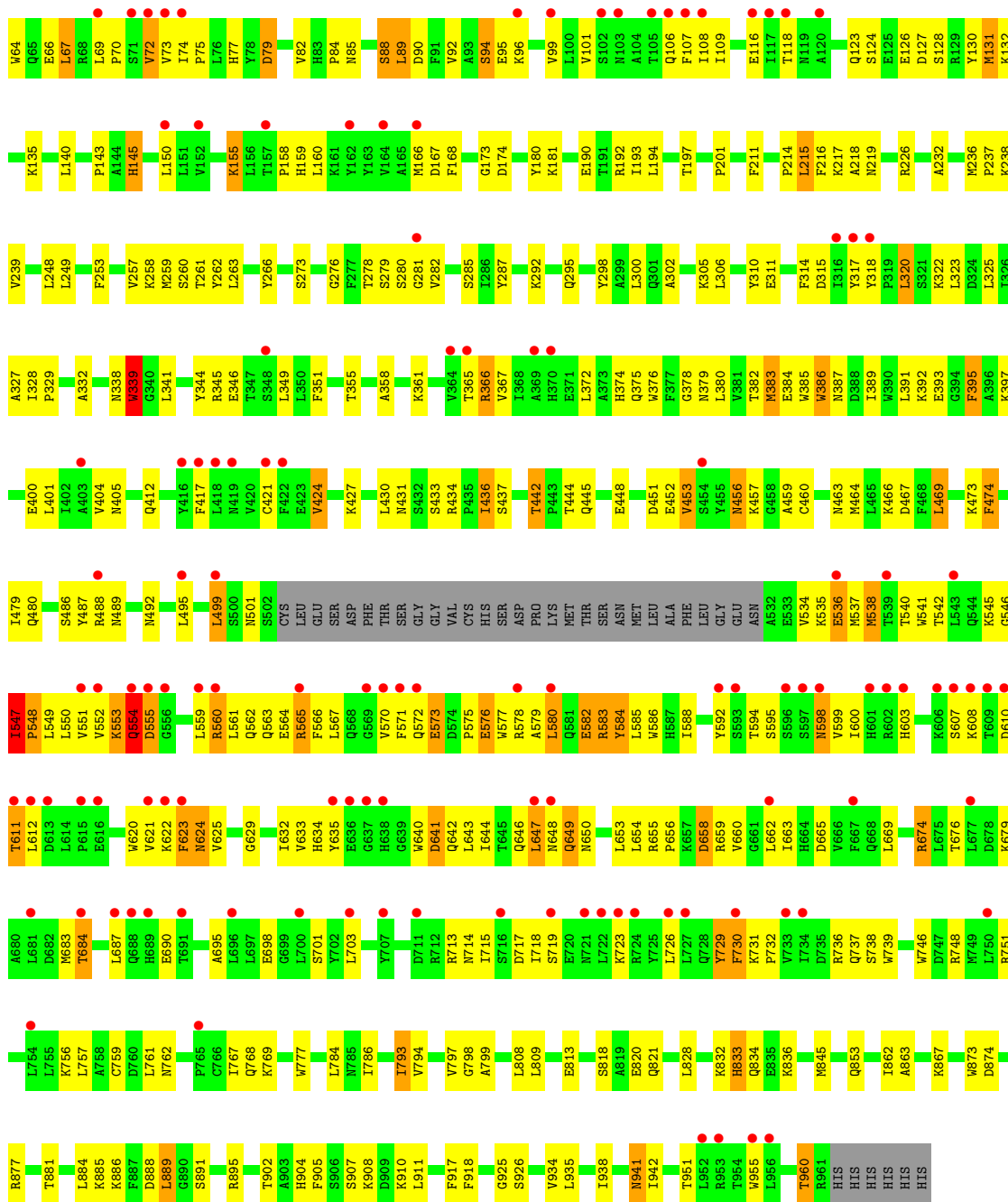
#### • Molecule 1: ENDOPLASMIC RETICULUM AMINOPEPTIDASE 2



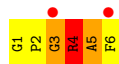
#### • Molecule 1: ENDOPLASMIC RETICULUM AMINOPEPTIDASE 2



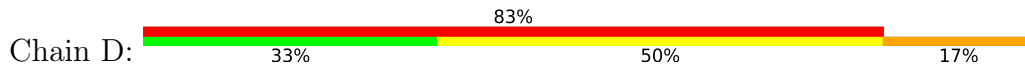




• Molecule 2: GPI

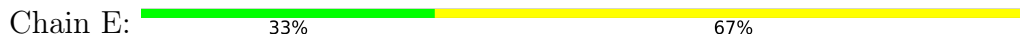


• Molecule 2: GPI

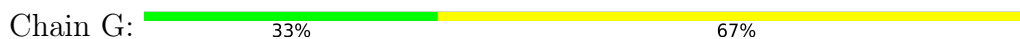




- Molecule 3: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



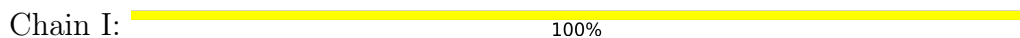
- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



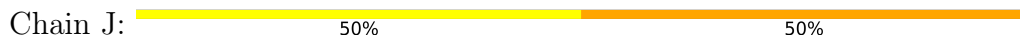
- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



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

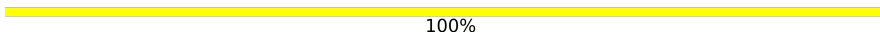


- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain K:  50% 50%

MAG1  
MAG2

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

Chain M:  100%

MAG1  
MAG2

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

Chain N:  50% 50%

MAG1  
MAG2

- Molecule 5: beta-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

Chain L:  100%

MAG1  
MAG2  
BMA3  
BMA4

## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	75.65Å 135.47Å 128.21Å 90.00° 90.24° 90.00°	Depositor
Resolution (Å)	49.01 – 2.73 49.01 – 2.73	Depositor EDS
% Data completeness (in resolution range)	98.8 (49.01-2.73) 98.6 (49.01-2.73)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.50 (at 2.73Å)	Xtrriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, $R_{free}$	0.223 , 0.286 0.226 , 0.286	Depositor DCC
$R_{free}$ test set	3395 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	65.7	Xtrriage
Anisotropy	0.200	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.28 , 52.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.021 for h,-k,-l	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	15144	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	75.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.05% 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: BMA, EDO, ZN, 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	0.59	1/7550 (0.0%)	0.69	0/10229
1	B	0.40	1/7334 (0.0%)	0.59	1/9939 (0.0%)
2	C	0.84	0/82	1.64	0/106
2	D	0.59	0/43	1.16	0/56
All	All	0.51	2/15009 (0.0%)	0.65	1/20330 (0.0%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
2	C	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	59	GLY	C-N	-6.35	1.19	1.34
1	B	548	PRO	N-CD	5.19	1.55	1.47

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	B	547	ILE	C-N-CD	5.70	140.37	128.40

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	C	3[A]	GLY	Peptide

## 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	7344	0	7297	146	0
1	B	7156	0	7112	330	0
2	C	80	0	79	11	0
2	D	42	0	42	6	0
3	E	39	0	34	0	0
3	G	39	0	34	0	0
4	F	28	0	25	0	0
4	H	28	0	25	0	0
4	I	28	0	25	0	0
4	J	28	0	25	2	0
4	K	28	0	25	1	0
4	M	28	0	25	1	0
4	N	28	0	25	1	0
5	L	50	0	43	6	0
6	A	28	0	26	0	0
6	B	42	0	39	0	0
7	A	1	0	0	0	0
7	B	1	0	0	0	0
8	A	12	0	18	0	0
8	B	12	0	18	0	0
9	A	82	0	0	10	0
9	B	20	0	0	7	0
All	All	15144	0	14917	490	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 16.

The worst 5 of 490 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:566:PHE:CE1	1:B:567:LEU:O	1.72	1.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:554:GLN:CG	1:B:560:ARG:HD2	1.59	1.31
1:B:566:PHE:CD1	1:B:567:LEU:N	2.10	1.18
1:B:554:GLN:HG2	1:B:560:ARG:HD2	1.32	1.12
1:B:554:GLN:HG2	1:B:560:ARG:CD	1.88	1.03

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	901/967 (93%)	814 (90%)	75 (8%)	12 (1%)	12	28
1	B	875/967 (90%)	732 (84%)	117 (13%)	26 (3%)	4	9
2	C	8/6 (133%)	4 (50%)	0	4 (50%)	0	0
2	D	4/6 (67%)	4 (100%)	0	0	100	100
All	All	1788/1946 (92%)	1554 (87%)	192 (11%)	42 (2%)	6	14

5 of 42 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	57	THR
1	A	60	GLU
1	A	245	GLU
1	A	582	GLU
1	A	616	GLU

### 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	813/870 (93%)	768 (94%)	45 (6%)	21	44
1	B	790/870 (91%)	715 (90%)	75 (10%)	8	19
2	C	6/3 (200%)	4 (67%)	2 (33%)	0	0
2	D	3/3 (100%)	2 (67%)	1 (33%)	0	0
All	All	1612/1746 (92%)	1489 (92%)	123 (8%)	13	29

5 of 123 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	193	ILE
1	B	768	GLN
1	B	456	ASN
1	B	759	CYS
1	B	941	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	562	GLN
1	B	581	GLN
1	B	624	ASN
1	B	634	HIS
1	B	959	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

24 monosaccharides are modelled in this entry.



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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	NAG	E	1	3,1	14,14,15	0.51	0	17,19,21	0.53	0
3	NAG	E	2	3	14,14,15	1.33	1 (7%)	17,19,21	1.69	1 (5%)
3	BMA	E	3	3	11,11,12	1.22	2 (18%)	15,15,17	1.49	3 (20%)
4	NAG	F	1	1,4	14,14,15	0.66	0	17,19,21	0.56	0
4	NAG	F	2	4	14,14,15	0.44	0	17,19,21	0.45	0
3	NAG	G	1	3,1	14,14,15	1.11	1 (7%)	17,19,21	0.55	0
3	NAG	G	2	3	14,14,15	0.55	0	17,19,21	0.66	0
3	BMA	G	3	3	11,11,12	2.08	4 (36%)	15,15,17	2.31	6 (40%)
4	NAG	H	1	1,4	14,14,15	0.31	0	17,19,21	0.75	0
4	NAG	H	2	4	14,14,15	0.40	0	17,19,21	0.36	0
4	NAG	I	1	1,4	14,14,15	0.68	1 (7%)	17,19,21	0.71	1 (5%)
4	NAG	I	2	4	14,14,15	0.90	1 (7%)	17,19,21	0.84	1 (5%)
4	NAG	J	1	1,4	14,14,15	0.32	0	17,19,21	1.33	2 (11%)
4	NAG	J	2	4	14,14,15	0.31	0	17,19,21	0.39	0
4	NAG	K	1	1,4	14,14,15	0.97	1 (7%)	17,19,21	1.00	1 (5%)
4	NAG	K	2	4	14,14,15	0.46	0	17,19,21	0.35	0
5	NAG	L	1	5,1	14,14,15	0.79	0	17,19,21	1.50	2 (11%)
5	NAG	L	2	5	14,14,15	0.64	0	17,19,21	1.39	1 (5%)
5	BMA	L	3	5	11,11,12	1.61	1 (9%)	15,15,17	1.20	2 (13%)
5	BMA	L	4	5	11,11,12	1.03	0	15,15,17	1.50	2 (13%)
4	NAG	M	1	1,4	14,14,15	0.39	0	17,19,21	0.57	0
4	NAG	M	2	4	14,14,15	0.49	0	17,19,21	0.50	0
4	NAG	N	1	1,4	14,14,15	0.32	0	17,19,21	0.89	0
4	NAG	N	2	4	14,14,15	0.68	1 (7%)	17,19,21	0.70	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
3	NAG	E	1	3,1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1
3	BMA	E	3	3	-	2/2/19/22	0/1/1/1
4	NAG	F	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	F	2	4	-	0/6/23/26	0/1/1/1
3	NAG	G	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1
3	BMA	G	3	3	-	2/2/19/22	0/1/1/1
4	NAG	H	1	1,4	-	0/6/23/26	0/1/1/1
4	NAG	H	2	4	-	2/6/23/26	0/1/1/1
4	NAG	I	1	1,4	-	2/6/23/26	0/1/1/1
4	NAG	I	2	4	-	2/6/23/26	0/1/1/1
4	NAG	J	1	1,4	-	3/6/23/26	0/1/1/1
4	NAG	J	2	4	-	2/6/23/26	0/1/1/1
4	NAG	K	1	1,4	-	2/6/23/26	0/1/1/1
4	NAG	K	2	4	-	2/6/23/26	0/1/1/1
5	NAG	L	1	5,1	-	4/6/23/26	0/1/1/1
5	NAG	L	2	5	-	2/6/23/26	0/1/1/1
5	BMA	L	3	5	-	2/2/19/22	0/1/1/1
5	BMA	L	4	5	-	0/2/19/22	0/1/1/1
4	NAG	M	1	1,4	-	3/6/23/26	0/1/1/1
4	NAG	M	2	4	-	2/6/23/26	0/1/1/1
4	NAG	N	1	1,4	-	2/6/23/26	0/1/1/1
4	NAG	N	2	4	-	1/6/23/26	0/1/1/1

The worst 5 of 13 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	2	NAG	O5-C1	4.81	1.51	1.43
5	L	3	BMA	C2-C3	4.12	1.58	1.52
3	G	3	BMA	C1-C2	3.95	1.61	1.52
3	G	3	BMA	O5-C5	3.75	1.51	1.43
3	G	1	NAG	O5-C1	-3.73	1.37	1.43

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	2	NAG	C1-O5-C5	6.57	121.09	112.19
3	G	3	BMA	C1-O5-C5	6.38	120.83	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	2	NAG	C1-O5-C5	4.79	118.68	112.19
4	J	1	NAG	C2-N2-C7	4.34	129.08	122.90
5	L	1	NAG	O4-C4-C3	-4.11	100.85	110.35

There are no chirality outliers.

5 of 37 torsion outliers are listed below:

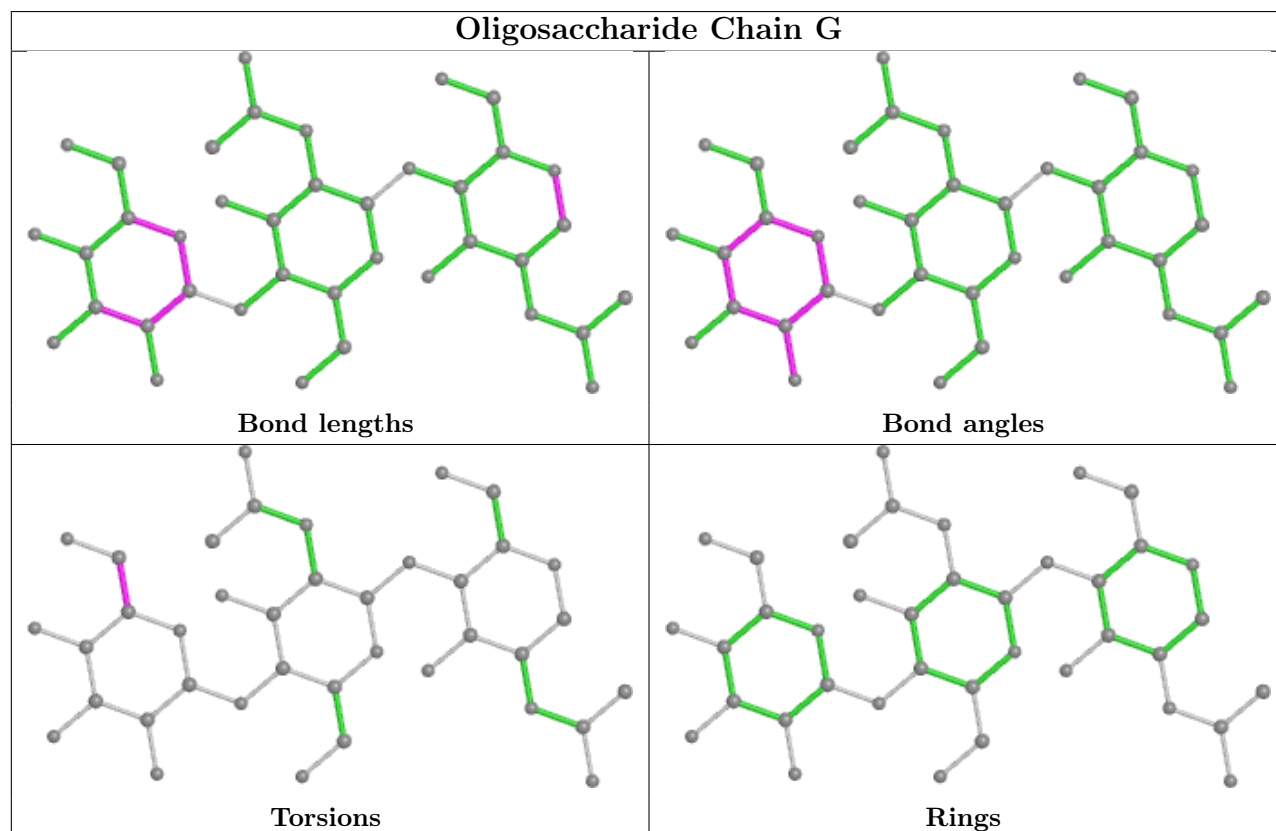
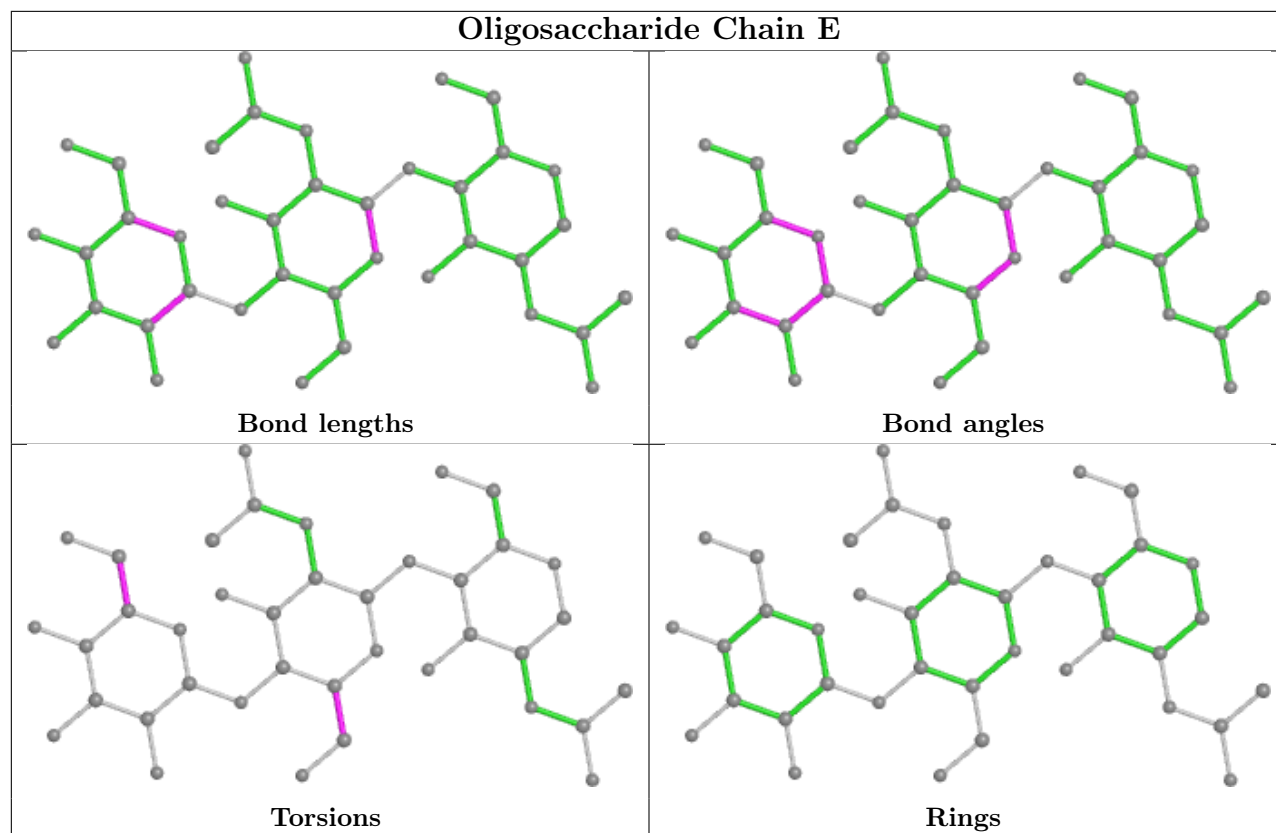
Mol	Chain	Res	Type	Atoms
5	L	1	NAG	C3-C2-N2-C7
4	M	2	NAG	O5-C5-C6-O6
3	E	3	BMA	O5-C5-C6-O6
4	K	1	NAG	C4-C5-C6-O6
4	K	1	NAG	O5-C5-C6-O6

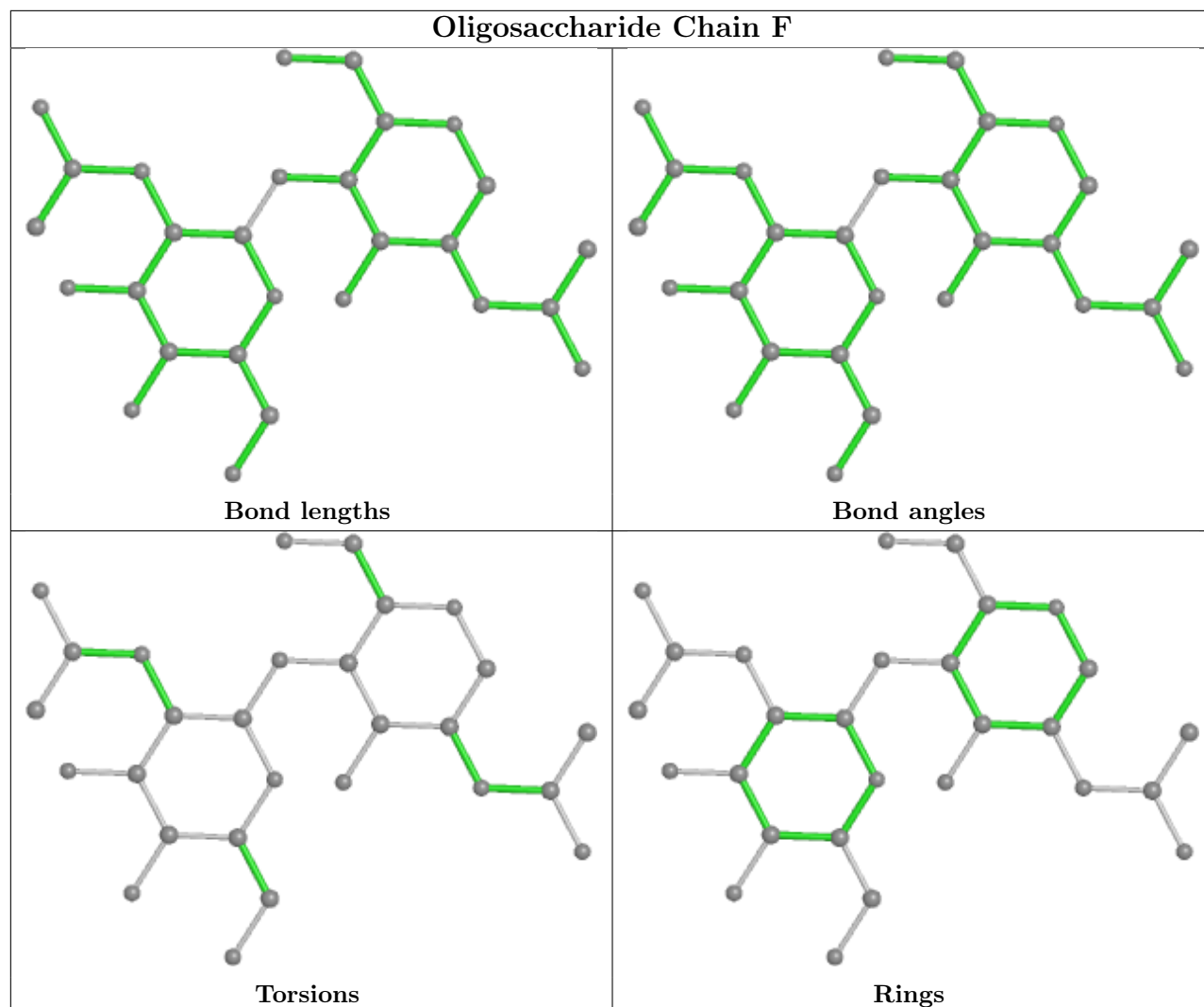
There are no ring outliers.

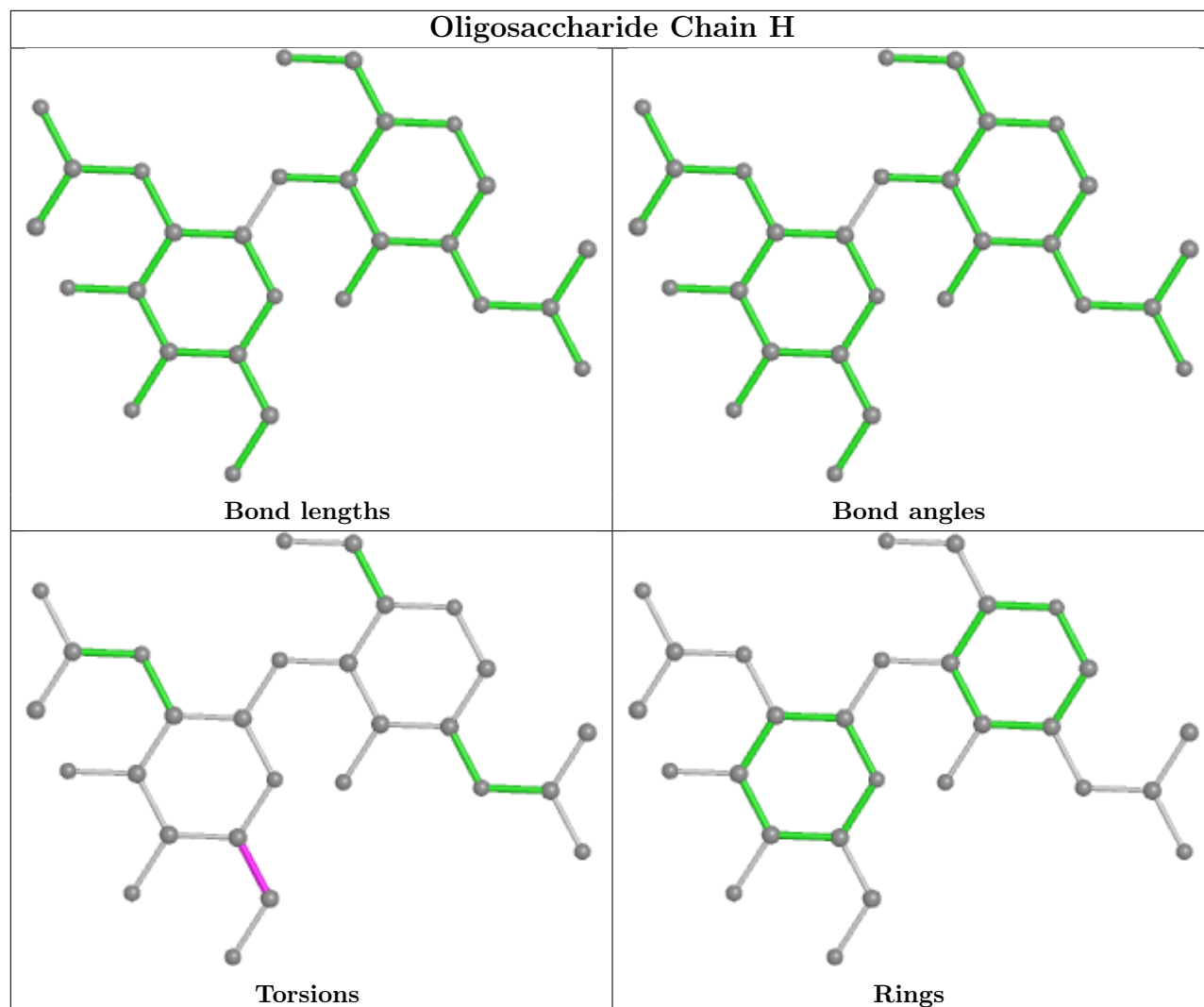
10 monomers are involved in 11 short contacts:

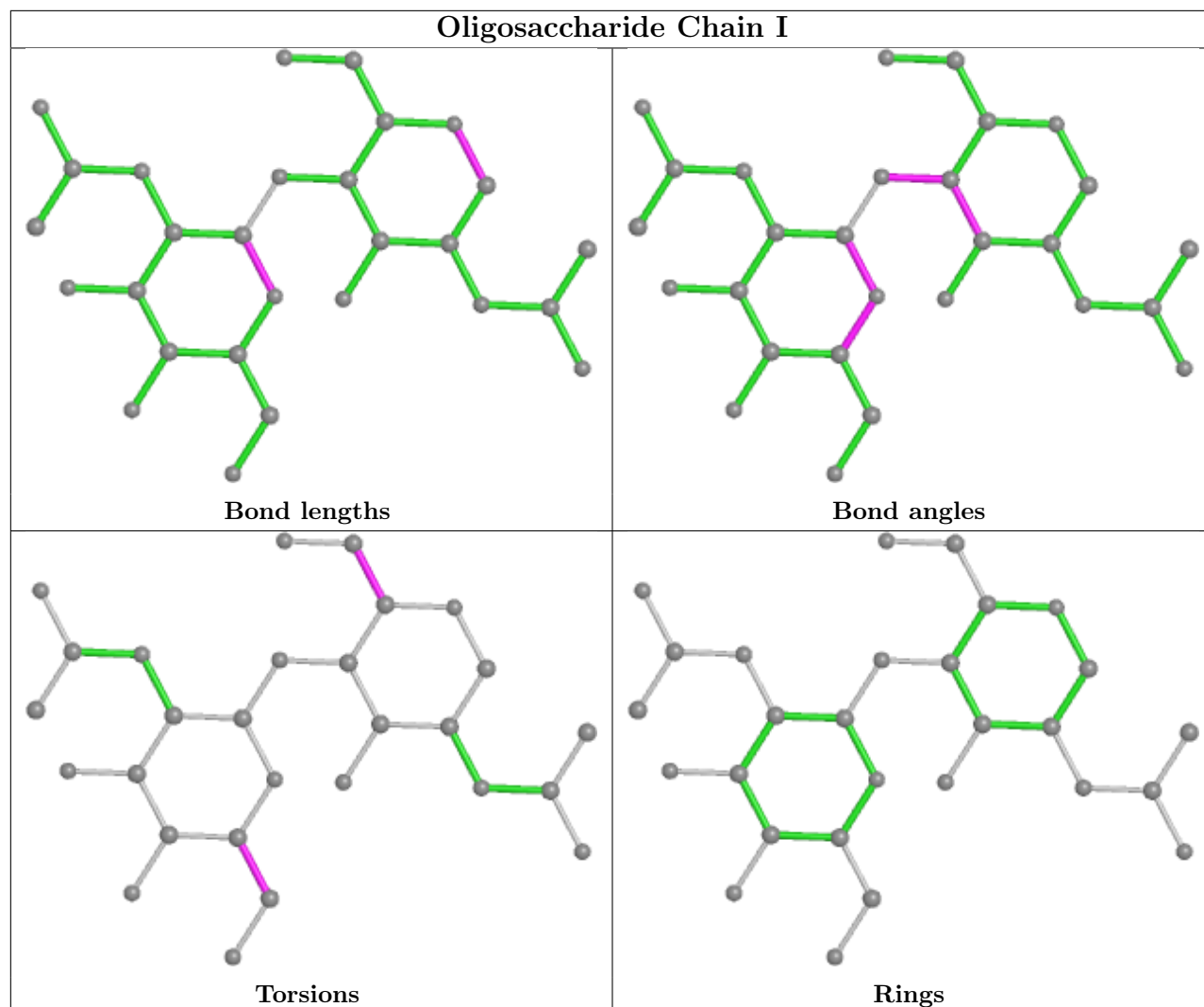
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	J	1	NAG	2	0
4	N	2	NAG	1	0
4	M	1	NAG	1	0
4	K	1	NAG	1	0
5	L	1	NAG	5	0
4	J	2	NAG	1	0
5	L	3	BMA	1	0
5	L	4	BMA	1	0
4	M	2	NAG	1	0
5	L	2	NAG	1	0

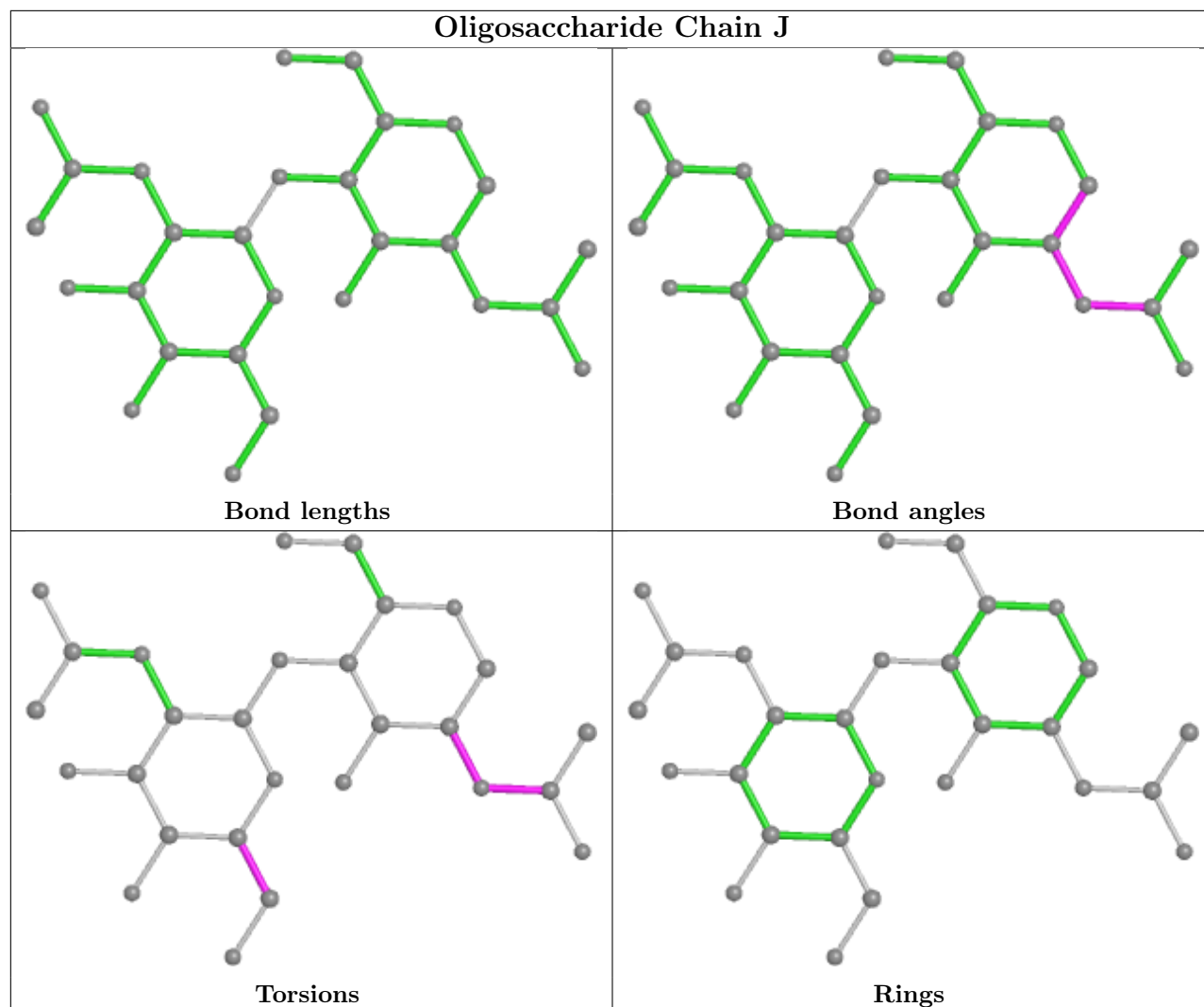
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



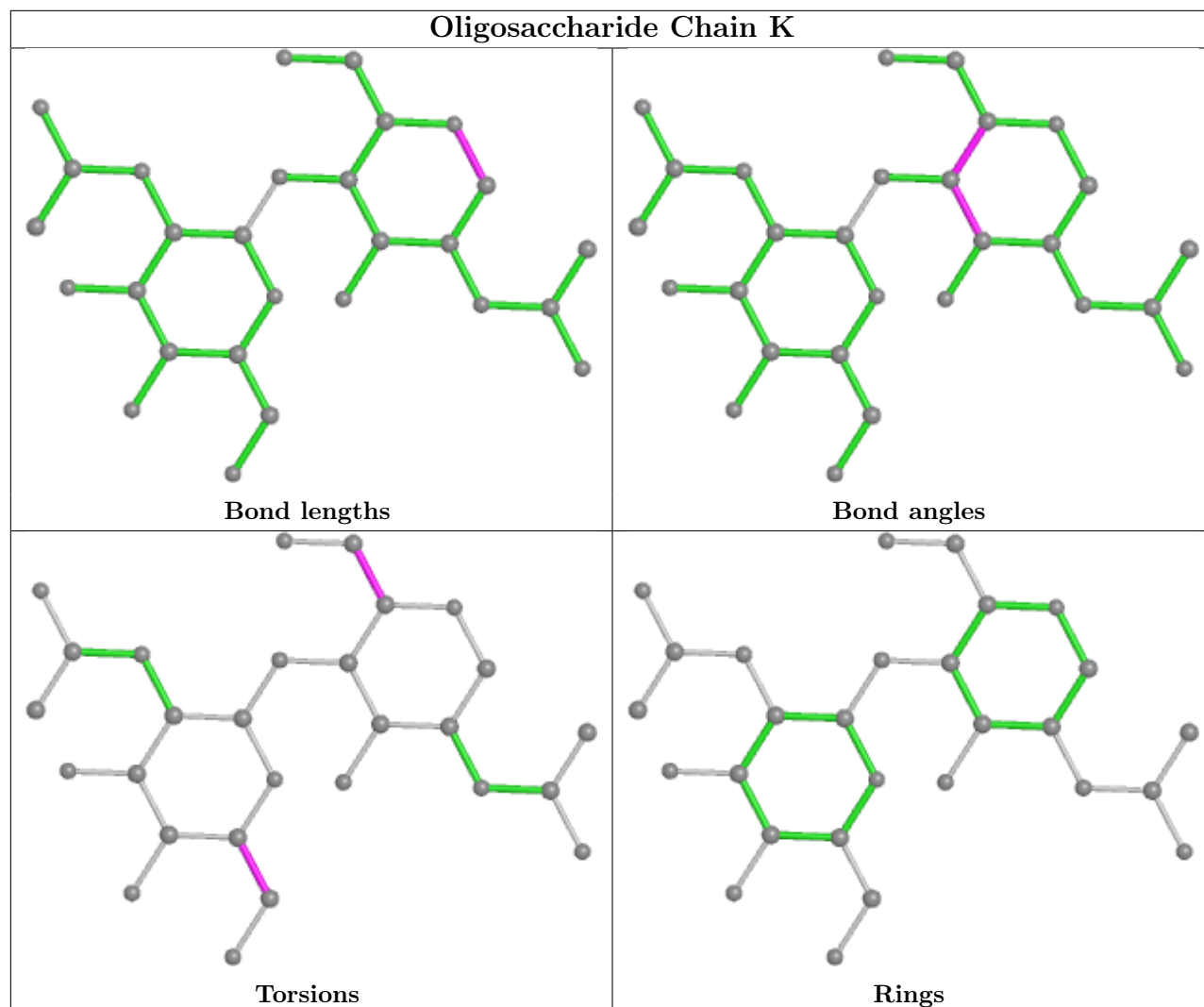


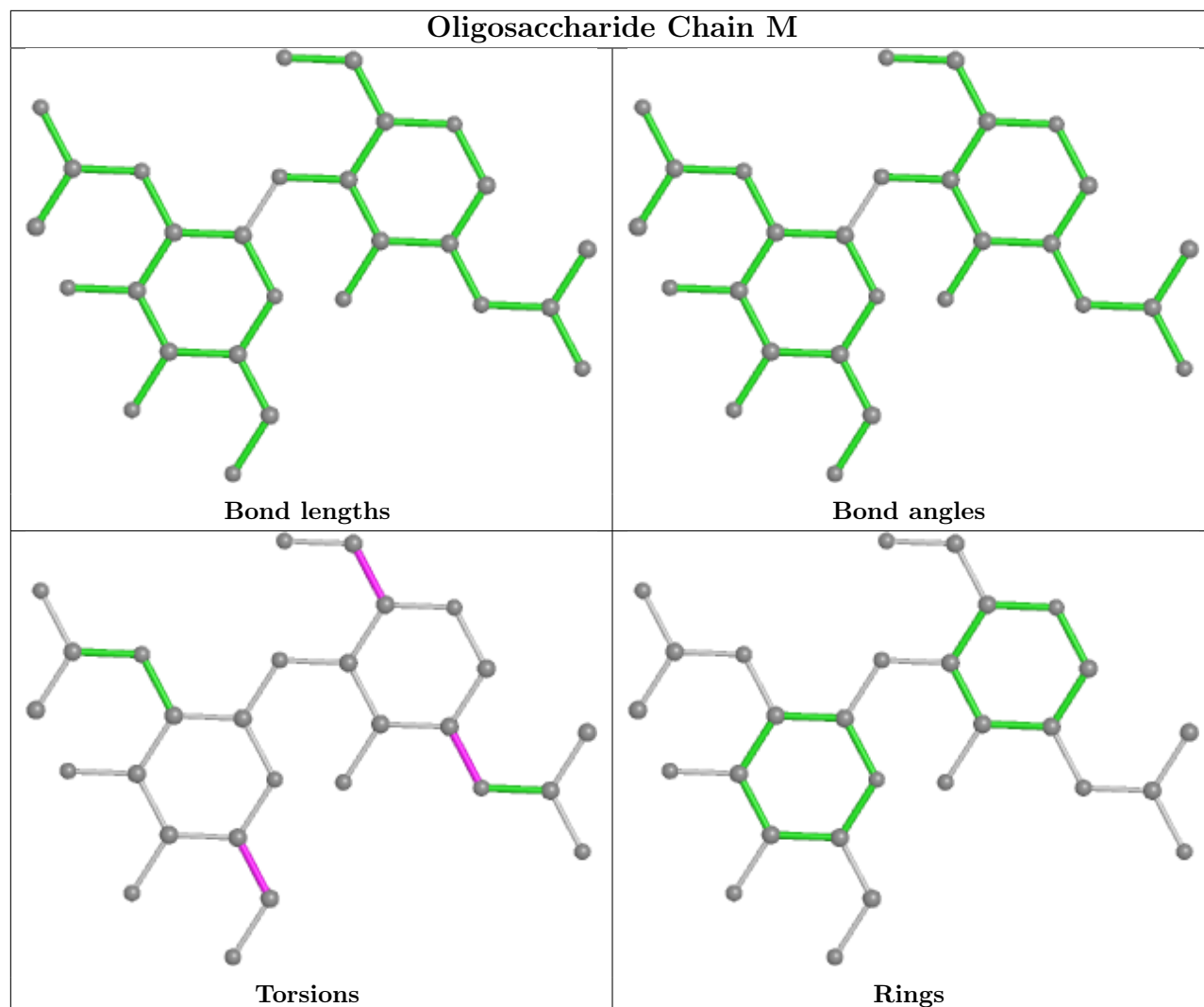


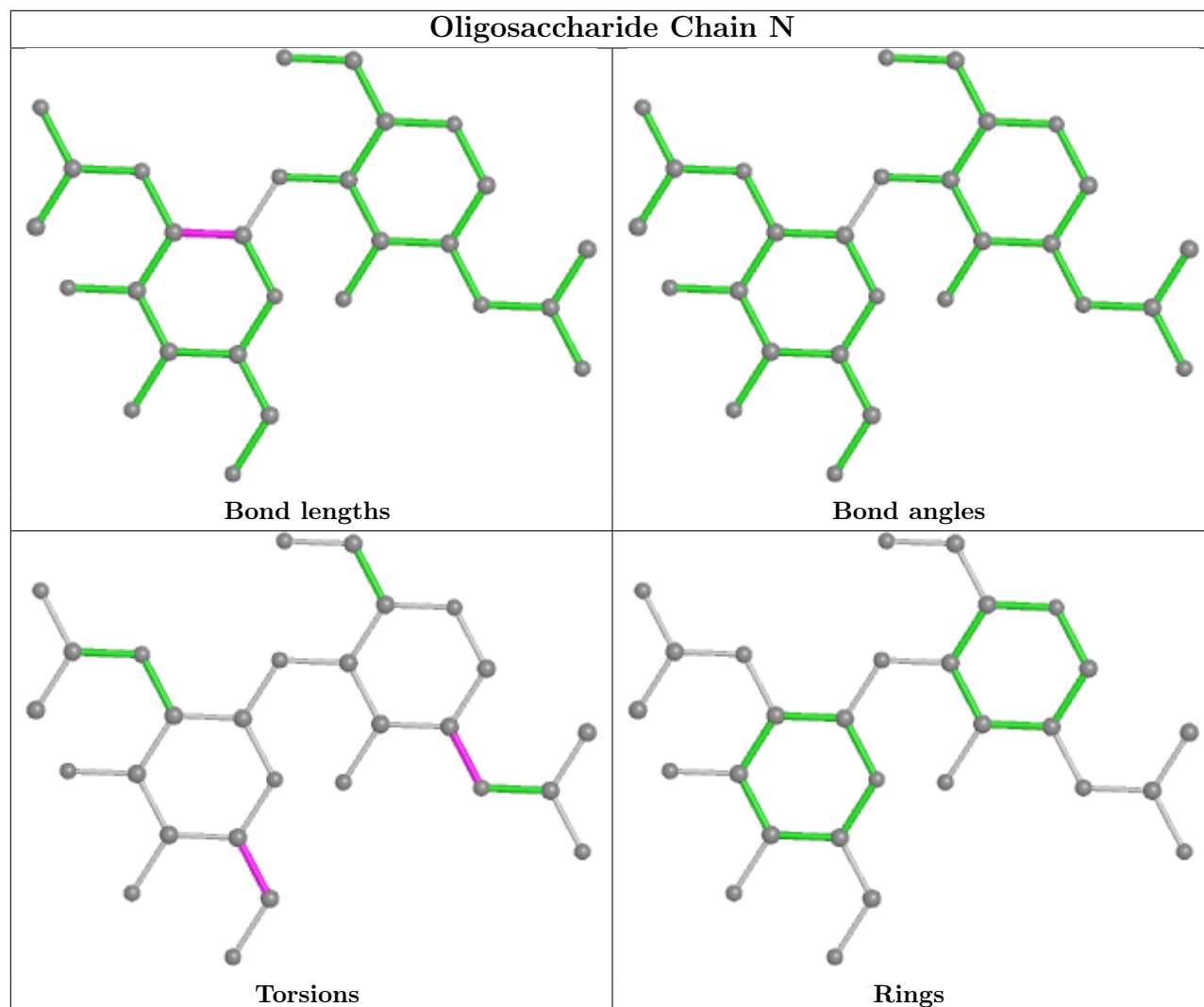


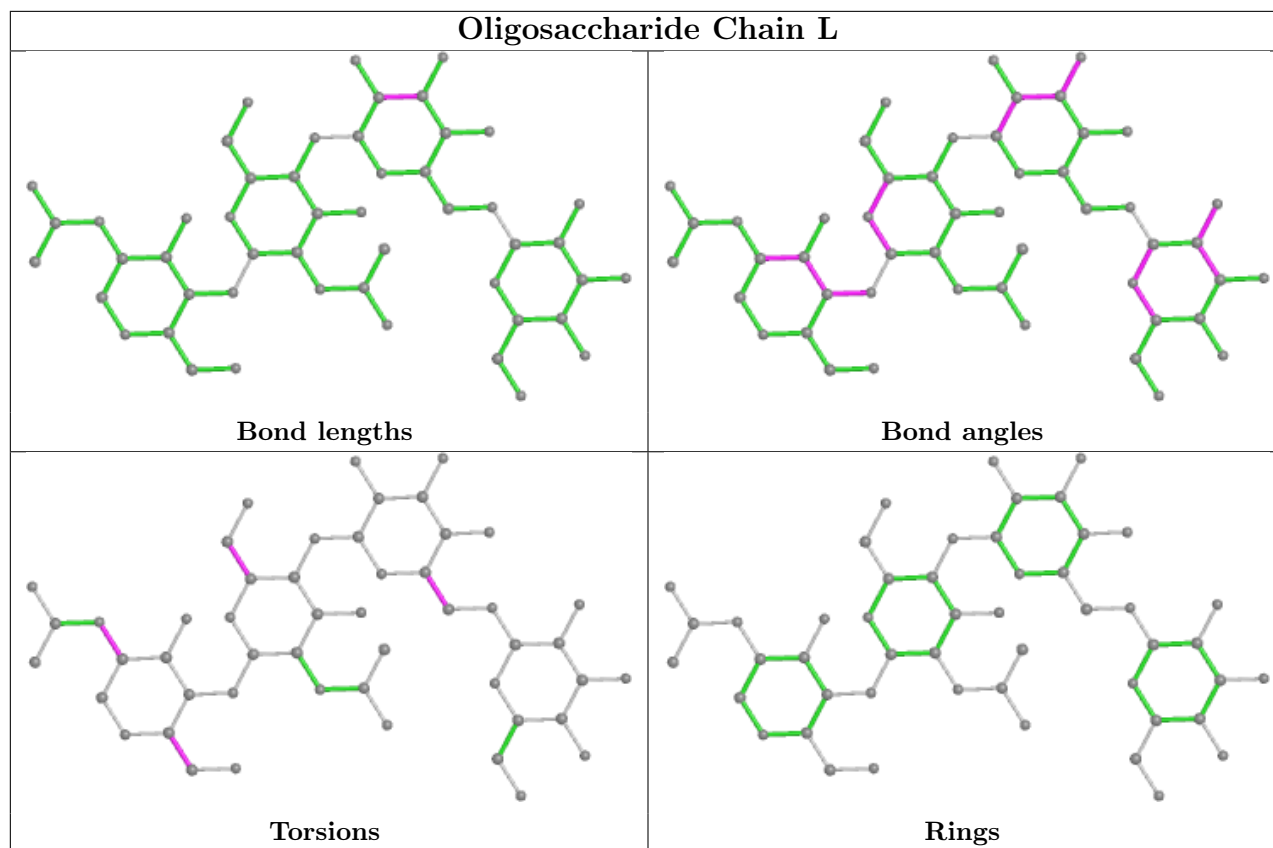












## 5.6 Ligand geometry [i](#)

Of 13 ligands modelled in this entry, 2 are monoatomic - leaving 11 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	1010	1	14,14,15	0.35	0	17,19,21	0.46	0
6	NAG	A	1009	1	14,14,15	0.33	0	17,19,21	0.82	1 (5%)
8	EDO	A	1962	-	3,3,3	0.68	0	2,2,2	0.17	0
8	EDO	A	1963	-	3,3,3	0.47	0	2,2,2	0.37	0
6	NAG	B	1005	1	14,14,15	0.52	0	17,19,21	0.61	1 (5%)
6	NAG	B	1011	1	14,14,15	0.51	0	17,19,21	0.45	0
6	NAG	A	1018	1	14,14,15	0.48	0	17,19,21	0.55	0
8	EDO	A	1964	-	3,3,3	0.54	0	2,2,2	0.20	0
8	EDO	B	1963	-	3,3,3	0.44	0	2,2,2	0.36	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
8	EDO	B	1962	-	3,3,3	0.47	0	2,2,2	0.33	0
8	EDO	B	1961	-	3,3,3	0.51	0	2,2,2	0.15	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	B	1010	1	-	2/6/23/26	0/1/1/1
6	NAG	A	1009	1	-	2/6/23/26	0/1/1/1
8	EDO	A	1962	-	-	1/1/1/1	-
8	EDO	A	1963	-	-	0/1/1/1	-
6	NAG	B	1005	1	-	2/6/23/26	0/1/1/1
6	NAG	B	1011	1	-	4/6/23/26	0/1/1/1
6	NAG	A	1018	1	-	4/6/23/26	0/1/1/1
8	EDO	A	1964	-	-	0/1/1/1	-
8	EDO	B	1963	-	-	0/1/1/1	-
8	EDO	B	1962	-	-	0/1/1/1	-
8	EDO	B	1961	-	-	0/1/1/1	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
6	A	1009	NAG	C1-O5-C5	2.28	115.28	112.19
6	B	1005	NAG	C1-O5-C5	2.01	114.92	112.19

There are no chirality outliers.

5 of 15 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	1010	NAG	O5-C5-C6-O6
6	A	1018	NAG	O5-C5-C6-O6
6	B	1011	NAG	O5-C5-C6-O6
6	B	1010	NAG	C4-C5-C6-O6
6	A	1018	NAG	C4-C5-C6-O6

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	59:GLY	C	60:GLU	N	1.19

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

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

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	897/967 (92%)	-0.04	19 (2%) 63 65	24, 47, 86, 151	0
1	B	879/967 (90%)	0.82	119 (13%) 3 2	30, 100, 150, 170	0
2	C	6/6 (100%)	1.92	2 (33%) 0 0	42, 47, 52, 54	0
2	D	6/6 (100%)	5.31	5 (83%) 0 0	74, 77, 84, 90	6 (100%)
All	All	1788/1946 (91%)	0.41	145 (8%) 12 10	24, 66, 137, 170	6 (0%)

The worst 5 of 145 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	580	LEU	8.7
1	A	520	MET	8.2
1	B	602	ARG	7.7
2	D	6	PHE	7.6
1	B	72	VAL	7.6

### 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
4	NAG	F	2	14/15	0.66	0.38	142,155,160,161	0
4	NAG	J	2	14/15	0.67	0.26	119,132,141,141	0

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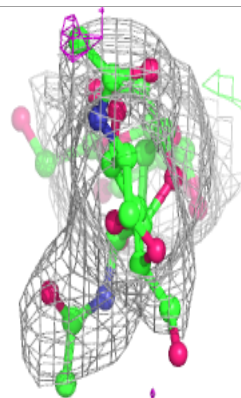
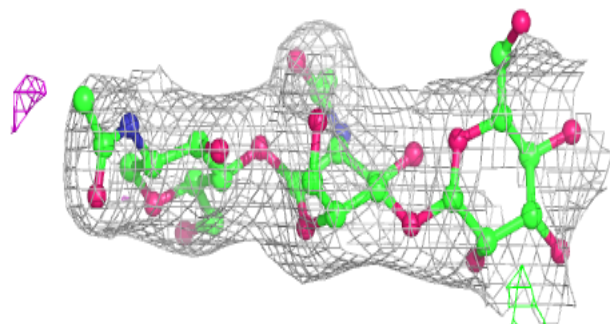
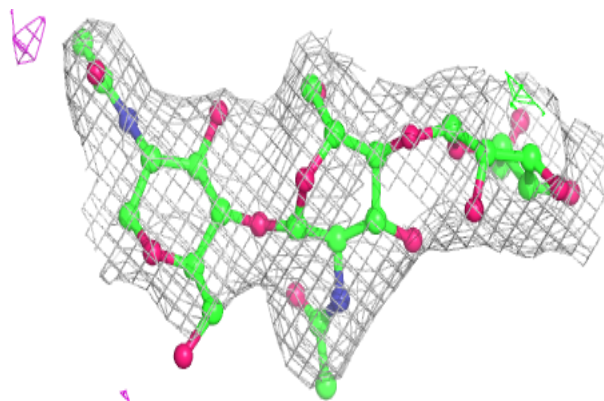
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	NAG	I	2	14/15	0.69	0.25	112,122,130,132	0
4	NAG	M	1	14/15	0.70	0.20	138,153,159,164	0
4	NAG	K	2	14/15	0.76	0.30	115,128,133,139	0
3	BMA	G	3	11/12	0.76	0.15	90,97,105,107	0
4	NAG	N	2	14/15	0.76	0.25	121,133,137,140	0
4	NAG	M	2	14/15	0.78	0.23	131,158,162,163	0
5	BMA	L	3	11/12	0.79	0.13	73,98,104,104	0
4	NAG	H	2	14/15	0.80	0.23	103,114,118,119	0
4	NAG	J	1	14/15	0.80	0.18	106,127,136,138	0
4	NAG	K	1	14/15	0.81	0.18	57,92,108,122	0
5	BMA	L	4	11/12	0.82	0.18	73,100,109,113	0
4	NAG	F	1	14/15	0.83	0.25	91,119,136,146	0
3	BMA	E	3	11/12	0.83	0.23	109,117,121,122	0
4	NAG	N	1	14/15	0.83	0.16	91,115,128,134	0
4	NAG	I	1	14/15	0.86	0.17	95,103,114,117	0
5	NAG	L	2	14/15	0.87	0.14	50,77,88,88	0
5	NAG	L	1	14/15	0.89	0.23	57,67,76,79	0
4	NAG	H	1	14/15	0.89	0.12	76,84,97,106	0
3	NAG	G	2	14/15	0.91	0.12	46,66,84,88	0
3	NAG	E	2	14/15	0.91	0.21	79,90,107,113	0
3	NAG	E	1	14/15	0.95	0.25	43,68,77,77	0
3	NAG	G	1	14/15	0.96	0.13	41,46,56,62	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.

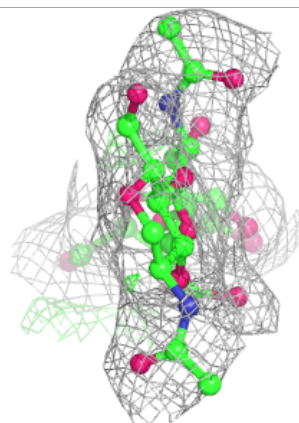
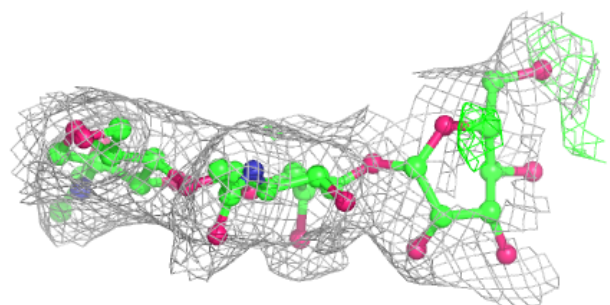
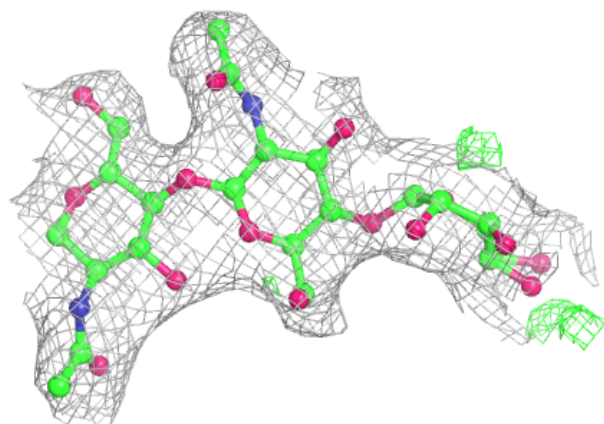


**Electron density around Chain E:**

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

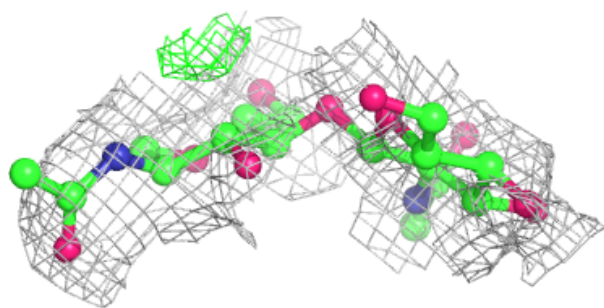
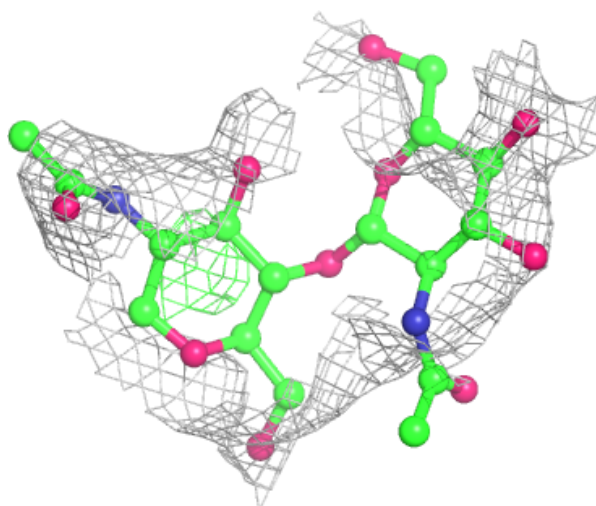
**Electron density around Chain G:**

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



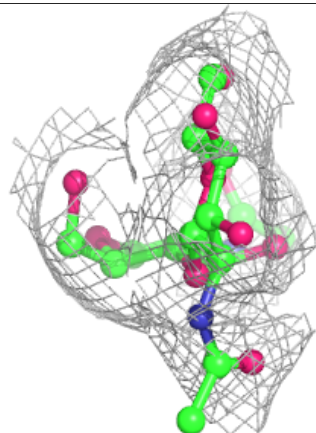
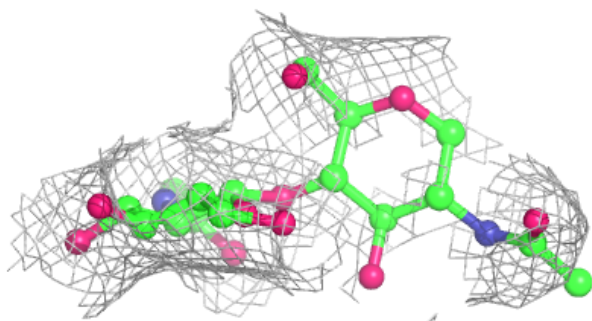
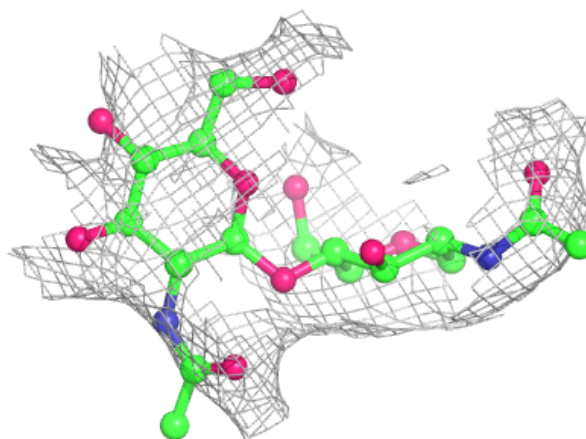
**Electron density around Chain F:**

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



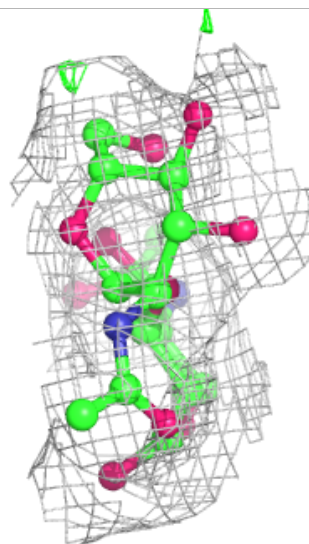
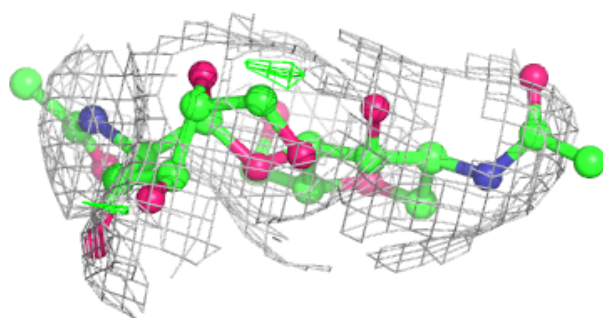
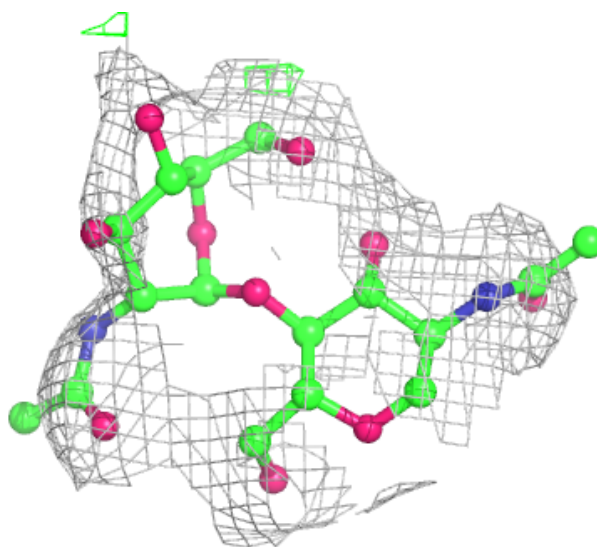
**Electron density around Chain H:**

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



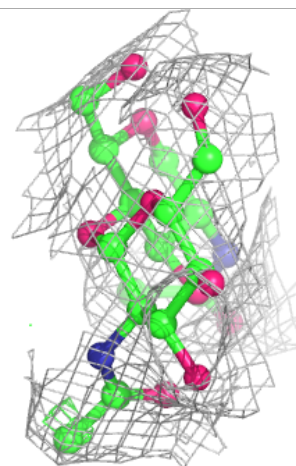
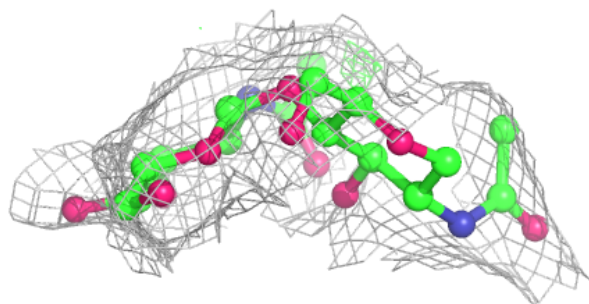
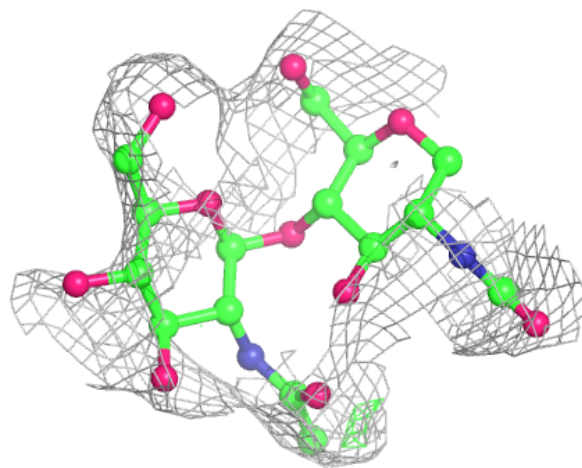
**Electron density around Chain I:**

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



**Electron density around Chain J:**

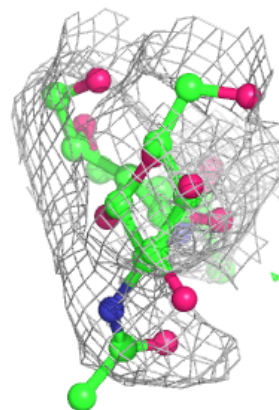
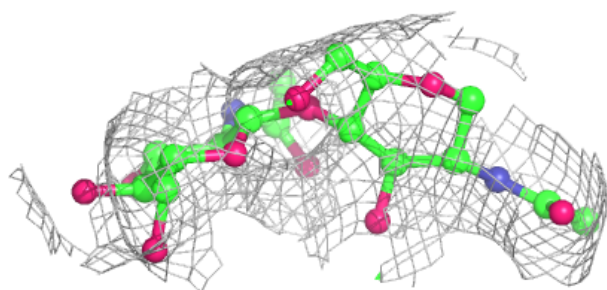
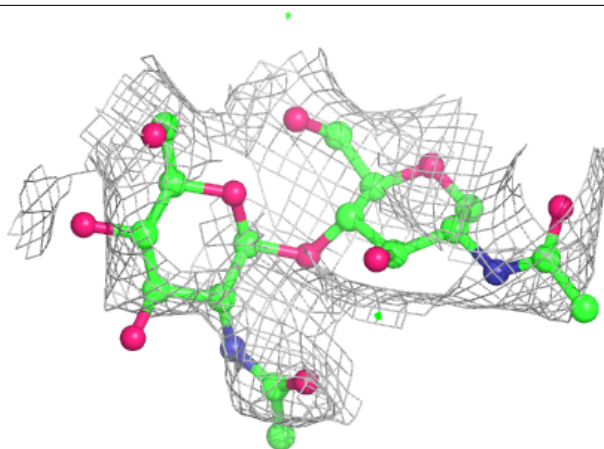
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





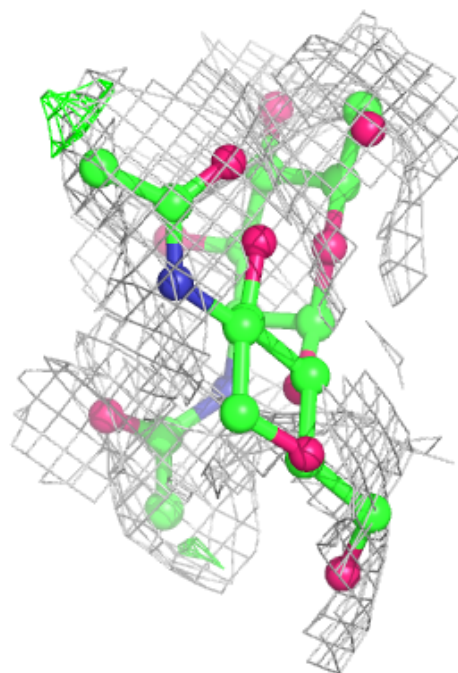
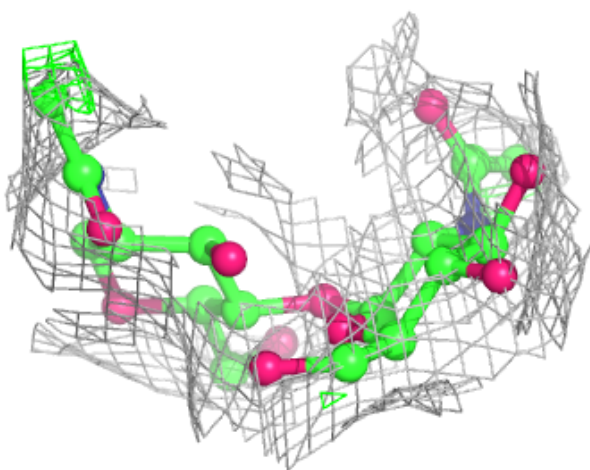
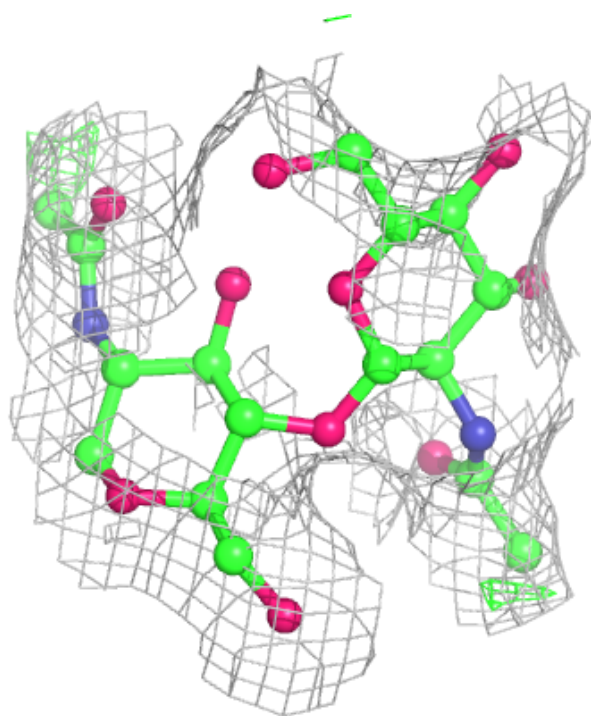
**Electron density around Chain K:**

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



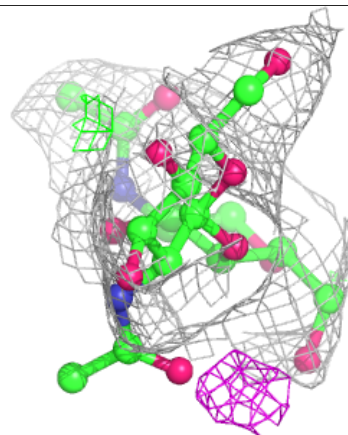
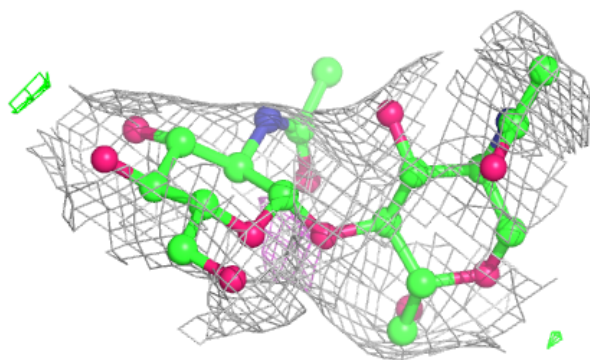
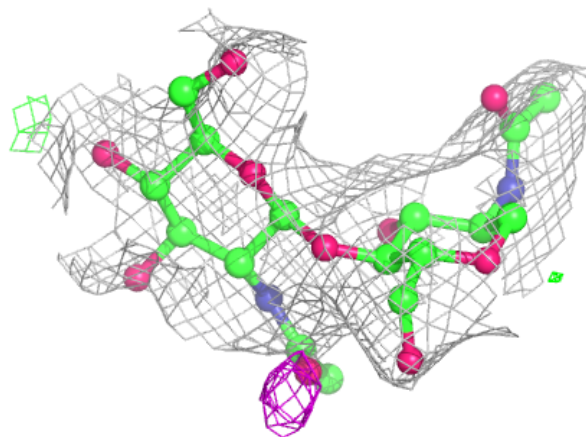
**Electron density around Chain M:**

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

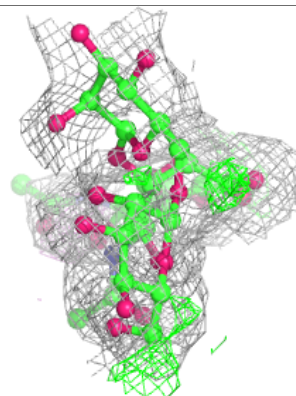
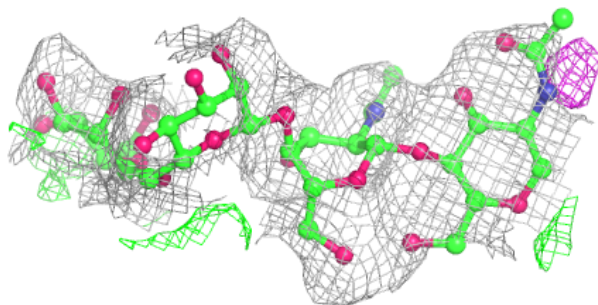
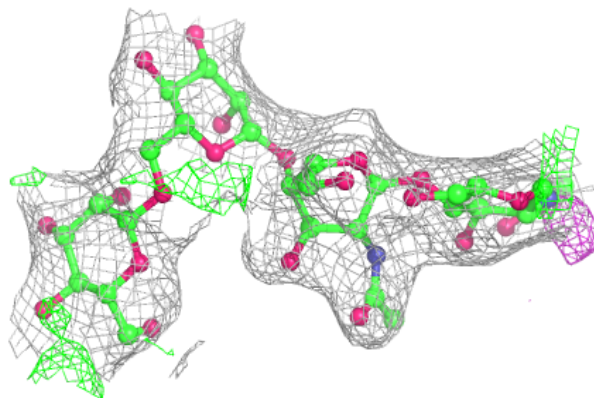


**Electron density around Chain N:**

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

**Electron density around Chain L:**

$2mF_o-DF_c$  (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	B	1010	14/15	0.39	0.47	112,136,147,147	0
6	NAG	B	1011	14/15	0.66	0.27	132,143,148,150	0
6	NAG	B	1005	14/15	0.69	0.29	143,151,154,154	0
8	EDO	A	1964	4/4	0.69	0.31	74,80,84,88	0
8	EDO	B	1961	4/4	0.77	0.29	81,93,96,97	0
8	EDO	B	1962	4/4	0.78	0.38	96,99,103,116	0
6	NAG	A	1018	14/15	0.80	0.23	97,110,122,129	0
8	EDO	B	1963	4/4	0.83	0.26	99,99,104,120	0
8	EDO	A	1962	4/4	0.87	0.11	51,56,57,65	0
6	NAG	A	1009	14/15	0.91	0.17	60,84,88,89	0
8	EDO	A	1963	4/4	0.91	0.10	83,89,90,96	0
7	ZN	B	1119	1/1	0.97	0.22	60,60,60,60	0
7	ZN	A	1119	1/1	0.99	0.21	28,28,28,28	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.