



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 05:36 AM UTC

PDB ID : 8ZYK / pdb\_00008zyk  
Title : Crystal structure of hemagglutinin from HN/4-10 H3N8 influenza virus S228 mutant  
Authors : Hao, T.J.; Chai, Y.; Song, H.; Gao, G.F.  
Deposited on : 2024-06-18  
Resolution : 3.01 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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

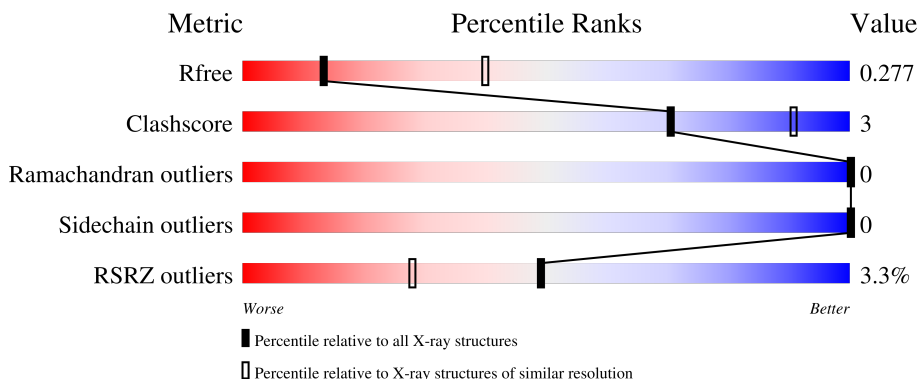
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.01 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	180053	3131 (3.04-3.00)
Clashscore	190562	3444 (3.04-3.00)
Ramachandran outliers	187476	3319 (3.04-3.00)
Sidechain outliers	187428	3322 (3.04-3.00)
RSRZ outliers	180081	3130 (3.04-3.00)

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	331	 88% 8% .
1	B	331	 88% 8% .
1	C	331	 89% 7% .
1	D	331	 86% 10% .
1	E	331	 87% 8% .

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Mol	Chain	Length	Quality of chain
1	F	331	 2% 87% 9%
2	R	177	 7% 87% 10%
2	S	177	 3% 86% 10%
2	T	177	 5% 89% 8%
2	U	177	 5% 87% 10%
2	V	177	 6% 89% 8%
2	W	177	 10% 85% 11%
3	G	3	 100%
3	J	3	 33% 33% 33%
3	P	3	 100%
4	H	2	 50% 50%
4	I	2	 50% 50%
4	K	2	 100%
4	N	2	 100%
4	Q	2	 100%
5	L	5	 60% 40%
6	M	4	 100%
7	O	4	 75% 25%

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 23628 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 Hemagglutinin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	317	Total 2452	C 1533	N 434	O 472	S 13	0	0	0
1	B	317	Total 2452	C 1533	N 434	O 472	S 13	0	0	0
1	C	318	Total 2461	C 1538	N 435	O 475	S 13	0	0	0
1	D	318	Total 2464	C 1541	N 436	O 474	S 13	0	0	0
1	E	317	Total 2455	C 1535	N 434	O 473	S 13	0	0	0
1	F	318	Total 2461	C 1538	N 435	O 475	S 13	0	0	0

- Molecule 2 is a protein called Hemagglutinin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	R	171	Total 1394	C 865	N 245	O 278	S 6	0	0	0
2	S	170	Total 1385	C 860	N 243	O 276	S 6	0	0	0
2	T	172	Total 1398	C 867	N 246	O 279	S 6	0	0	0
2	U	172	Total 1402	C 871	N 246	O 279	S 6	0	0	0
2	V	171	Total 1394	C 865	N 245	O 278	S 6	0	0	0
2	W	171	Total 1394	C 865	N 245	O 278	S 6	0	0	0

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



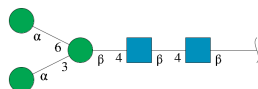
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	G	3	39	22	2	15	0	0	0
3	J	3	39	22	2	15	0	0	0
3	P	3	39	22	2	15	0	0	0

- 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	H	2	28	16	2	10	0	0	0
4	I	2	28	16	2	10	0	0	0
4	K	2	28	16	2	10	0	0	0
4	N	2	28	16	2	10	0	0	0
4	Q	2	28	16	2	10	0	0	0

- Molecule 5 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



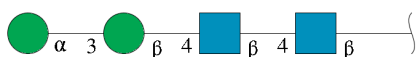
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	L	5	61	34	2	25	0	0	0

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



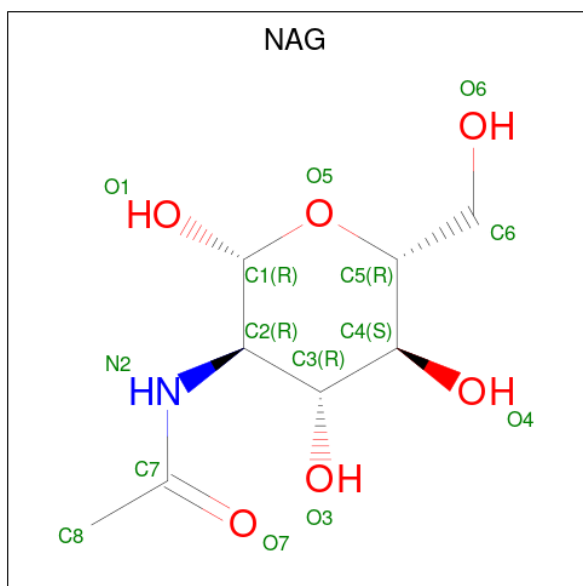
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
6	M	4	50	28	2	20	0	0	0

- Molecule 7 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-beta-D-mannopyranos e-(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			
7	O	4	50	28	2	20	0	0	0

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

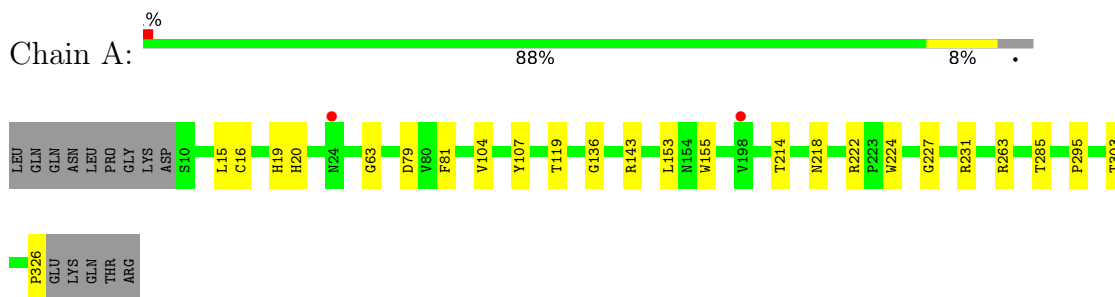


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	N	O	0	0
			14	8	1	5		
8	B	1	Total	C	N	O	0	0
			14	8	1	5		
8	C	1	Total	C	N	O	0	0
			14	8	1	5		
8	C	1	Total	C	N	O	0	0
			14	8	1	5		
8	D	1	Total	C	N	O	0	0
			14	8	1	5		
8	E	1	Total	C	N	O	0	0
			14	8	1	5		
8	E	1	Total	C	N	O	0	0
			14	8	1	5		

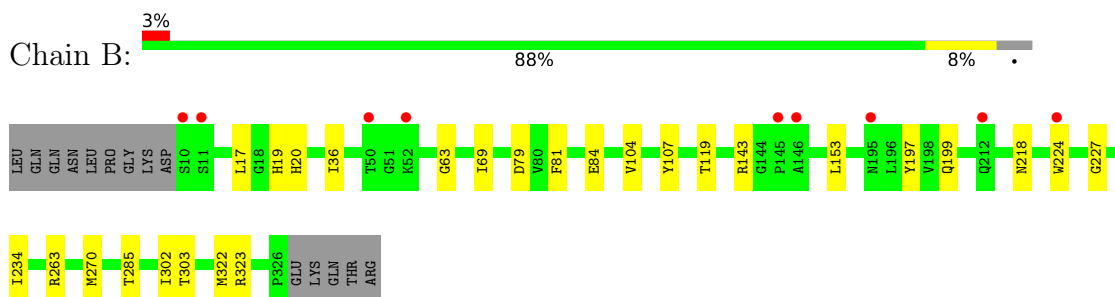
### 3 Residue-property plots [i](#)

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.

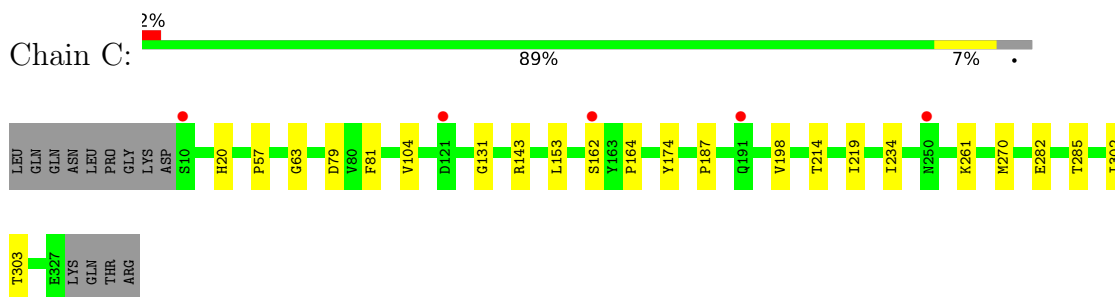
- Molecule 1: Hemagglutinin



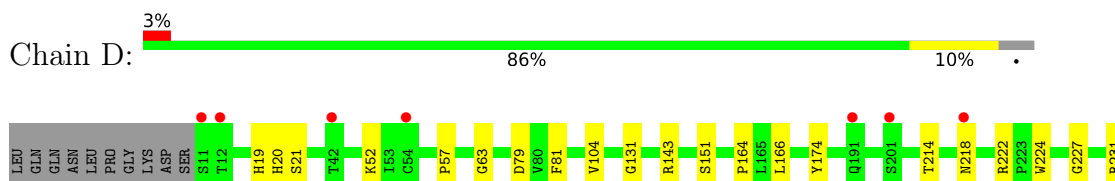
- Molecule 1: Hemagglutinin



- Molecule 1: Hemagglutinin

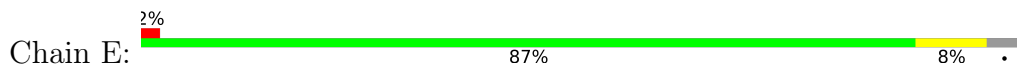


- Molecule 1: Hemagglutinin

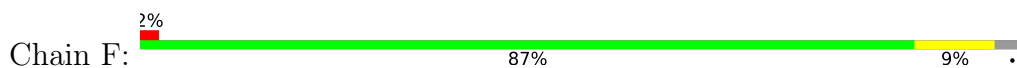




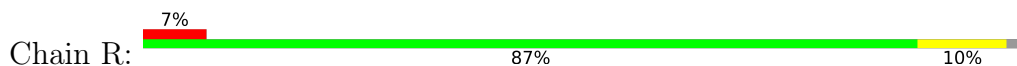
- Molecule 1: Hemagglutinin



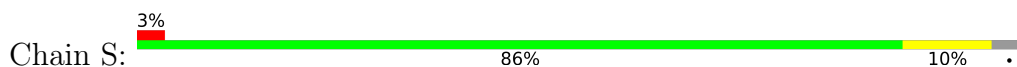
- Molecule 1: Hemagglutinin



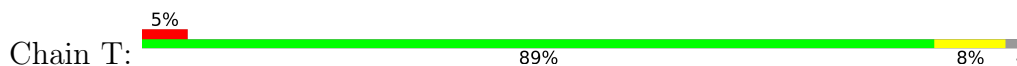
- Molecule 2: Hemagglutinin



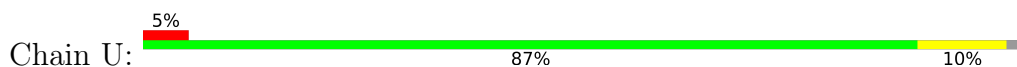
- Molecule 2: Hemagglutinin



- Molecule 2: Hemagglutinin

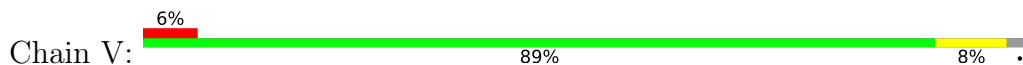


- Molecule 2: Hemagglutinin

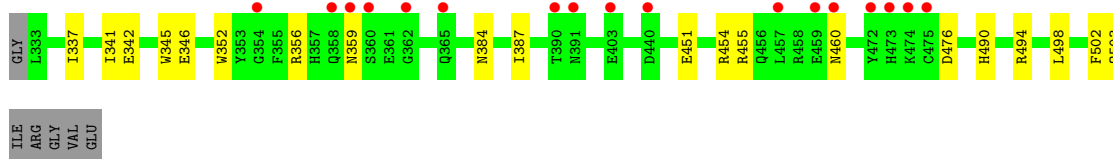
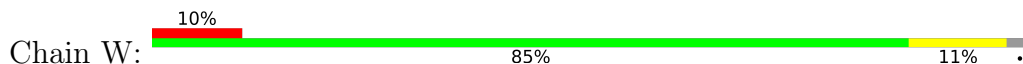




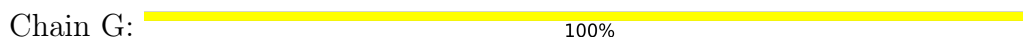
- Molecule 2: Hemagglutinin



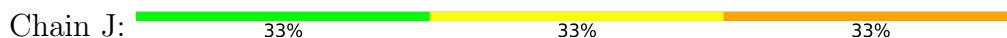
- Molecule 2: Hemagglutinin



- 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 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

Chain I: 50% 50%



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

Chain K: 100%



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

Chain N: 100%



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

Chain Q: 100%



- Molecule 5: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain L: 60% 40%




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

Chain M: 100%



- Molecule 7: alpha-D-mannopyranose-(1-3)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain O:  75% 25%

MAG1  
MAG2  
BMA3  
MAN4

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	136.83Å 167.32Å 206.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.53 – 3.01 28.53 – 3.01	Depositor EDS
% Data completeness (in resolution range)	96.2 (28.53-3.01) 96.0 (28.53-3.01)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.54 (at 3.00Å)	Xtrriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, $R_{free}$	0.238 , 0.278 0.239 , 0.277	Depositor DCC
$R_{free}$ test set	4454 reflections (4.71%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	61.9	Xtrriage
Anisotropy	0.108	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 21.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	23628	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 2.17% 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, MAN, 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	0.09	0/2509	0.26	0/3417
1	B	0.08	0/2509	0.26	0/3417
1	C	0.09	0/2518	0.26	0/3429
1	D	0.09	0/2521	0.28	0/3432
1	E	0.08	0/2512	0.26	0/3421
1	F	0.08	0/2518	0.26	0/3429
2	R	0.09	0/1418	0.26	0/1906
2	S	0.08	0/1409	0.27	0/1894
2	T	0.09	0/1422	0.27	0/1911
2	U	0.09	0/1426	0.29	0/1917
2	V	0.10	0/1418	0.29	0/1906
2	W	0.09	0/1418	0.27	0/1906
All	All	0.09	0/23598	0.27	0/31985

There are no bond length outliers.

There are no bond angle outliers.

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	2452	0	2390	18	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2452	0	2391	18	0
1	C	2461	0	2397	16	0
1	D	2464	0	2405	24	0
1	E	2455	0	2392	19	0
1	F	2461	0	2398	18	0
2	R	1394	0	1311	13	0
2	S	1385	0	1303	13	0
2	T	1398	0	1314	10	0
2	U	1402	0	1322	13	0
2	V	1394	0	1311	11	0
2	W	1394	0	1311	14	0
3	G	39	0	34	1	0
3	J	39	0	34	1	0
3	P	39	0	34	0	0
4	H	28	0	25	0	0
4	I	28	0	25	0	0
4	K	28	0	25	0	0
4	N	28	0	25	0	0
4	Q	28	0	25	0	0
5	L	61	0	52	2	0
6	M	50	0	43	1	0
7	O	50	0	43	0	0
8	A	14	0	13	0	0
8	B	14	0	13	0	0
8	C	28	0	26	0	0
8	D	14	0	13	1	0
8	E	28	0	26	0	0
All	All	23628	0	22701	158	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 3.

The worst 5 of 158 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:326:PRO:HG2	1:E:144:GLY:HA2	1.70	0.73
3:J:2:NAG:H62	3:J:3:BMA:H2	1.70	0.73
1:B:79:ASP:OD2	1:B:143:ARG:NH1	2.23	0.68
2:U:343:ASN:OD1	2:U:344:GLY:N	2.27	0.68
1:C:79:ASP:OD2	1:C:143:ARG:NH1	2.27	0.67

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	315/331 (95%)	309 (98%)	6 (2%)	0	100	100
1	B	315/331 (95%)	310 (98%)	5 (2%)	0	100	100
1	C	316/331 (96%)	308 (98%)	8 (2%)	0	100	100
1	D	316/331 (96%)	306 (97%)	10 (3%)	0	100	100
1	E	315/331 (95%)	310 (98%)	5 (2%)	0	100	100
1	F	316/331 (96%)	309 (98%)	7 (2%)	0	100	100
2	R	169/177 (96%)	158 (94%)	11 (6%)	0	100	100
2	S	168/177 (95%)	162 (96%)	6 (4%)	0	100	100
2	T	170/177 (96%)	165 (97%)	5 (3%)	0	100	100
2	U	170/177 (96%)	161 (95%)	9 (5%)	0	100	100
2	V	169/177 (96%)	158 (94%)	11 (6%)	0	100	100
2	W	169/177 (96%)	160 (95%)	9 (5%)	0	100	100
All	All	2908/3048 (95%)	2816 (97%)	92 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	280/293 (96%)	280 (100%)	0	100	100
1	B	280/293 (96%)	280 (100%)	0	100	100
1	C	281/293 (96%)	281 (100%)	0	100	100
1	D	281/293 (96%)	281 (100%)	0	100	100
1	E	280/293 (96%)	280 (100%)	0	100	100
1	F	281/293 (96%)	281 (100%)	0	100	100
2	R	147/151 (97%)	147 (100%)	0	100	100
2	S	146/151 (97%)	146 (100%)	0	100	100
2	T	147/151 (97%)	147 (100%)	0	100	100
2	U	148/151 (98%)	148 (100%)	0	100	100
2	V	147/151 (97%)	147 (100%)	0	100	100
2	W	147/151 (97%)	147 (100%)	0	100	100
All	All	2565/2664 (96%)	2565 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
2	U	378	GLN
1	E	218	ASN
1	F	213	GLN
1	E	199	GLN
2	V	373	GLN

### 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](#)

32 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	G	1	3,1	14,14,15	0.35	0	17,19,21	0.54	0
3	NAG	G	2	3	14,14,15	0.31	0	17,19,21	0.53	0
3	BMA	G	3	3	11,11,12	0.63	0	15,15,17	0.98	1 (6%)
4	NAG	H	1	4,1	14,14,15	0.25	0	17,19,21	0.89	1 (5%)
4	NAG	H	2	4	14,14,15	0.37	0	17,19,21	0.42	0
4	NAG	I	1	4,1	14,14,15	0.67	1 (7%)	17,19,21	0.63	0
4	NAG	I	2	4	14,14,15	0.37	0	17,19,21	0.49	0
3	NAG	J	1	3,1	14,14,15	0.27	0	17,19,21	0.45	0
3	NAG	J	2	3	14,14,15	0.38	0	17,19,21	0.58	0
3	BMA	J	3	3	11,11,12	0.67	0	15,15,17	1.22	1 (6%)
4	NAG	K	1	4,1	14,14,15	0.26	0	17,19,21	0.41	0
4	NAG	K	2	4	14,14,15	0.25	0	17,19,21	0.41	0
5	NAG	L	1	5,1	14,14,15	0.38	0	17,19,21	0.62	0
5	NAG	L	2	5	14,14,15	0.22	0	17,19,21	0.60	0
5	BMA	L	3	5	11,11,12	0.88	0	15,15,17	1.20	2 (13%)
5	MAN	L	4	5	11,11,12	0.74	0	15,15,17	1.20	2 (13%)
5	MAN	L	5	5	11,11,12	1.47	2 (18%)	15,15,17	1.84	3 (20%)
6	NAG	M	1	6,1	14,14,15	0.30	0	17,19,21	0.58	0
6	NAG	M	2	6	14,14,15	0.23	0	17,19,21	0.65	0
6	BMA	M	3	6	11,11,12	1.32	2 (18%)	15,15,17	1.01	0
6	MAN	M	4	6	11,11,12	0.60	0	15,15,17	0.98	2 (13%)
4	NAG	N	1	4,1	14,14,15	0.27	0	17,19,21	0.41	0
4	NAG	N	2	4	14,14,15	0.28	0	17,19,21	0.39	0
7	NAG	O	1	7,1	14,14,15	0.22	0	17,19,21	0.46	0
7	NAG	O	2	7	14,14,15	0.26	0	17,19,21	0.50	0
7	BMA	O	3	7	11,11,12	0.68	0	15,15,17	0.85	0
7	MAN	O	4	7	11,11,12	0.63	0	15,15,17	0.91	2 (13%)
3	NAG	P	1	3,1	14,14,15	0.27	0	17,19,21	0.59	0
3	NAG	P	2	3	14,14,15	0.26	0	17,19,21	0.58	0
3	BMA	P	3	3	11,11,12	0.65	0	15,15,17	0.81	0
4	NAG	Q	1	4,1	14,14,15	0.26	0	17,19,21	0.44	0
4	NAG	Q	2	4	14,14,15	0.26	0	17,19,21	0.40	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	G	1	3,1	-	2/6/23/26	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1
3	BMA	G	3	3	-	0/2/19/22	0/1/1/1
4	NAG	H	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	H	2	4	-	0/6/23/26	0/1/1/1
4	NAG	I	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	I	2	4	-	0/6/23/26	0/1/1/1
3	NAG	J	1	3,1	-	2/6/23/26	0/1/1/1
3	NAG	J	2	3	-	2/6/23/26	0/1/1/1
3	BMA	J	3	3	-	0/2/19/22	0/1/1/1
4	NAG	K	1	4,1	-	2/6/23/26	0/1/1/1
4	NAG	K	2	4	-	0/6/23/26	0/1/1/1
5	NAG	L	1	5,1	-	2/6/23/26	0/1/1/1
5	NAG	L	2	5	-	0/6/23/26	0/1/1/1
5	BMA	L	3	5	-	1/2/19/22	0/1/1/1
5	MAN	L	4	5	-	0/2/19/22	0/1/1/1
5	MAN	L	5	5	-	0/2/19/22	0/1/1/1
6	NAG	M	1	6,1	-	2/6/23/26	0/1/1/1
6	NAG	M	2	6	-	1/6/23/26	0/1/1/1
6	BMA	M	3	6	-	0/2/19/22	0/1/1/1
6	MAN	M	4	6	-	0/2/19/22	0/1/1/1
4	NAG	N	1	4,1	-	2/6/23/26	0/1/1/1
4	NAG	N	2	4	-	0/6/23/26	0/1/1/1
7	NAG	O	1	7,1	-	2/6/23/26	0/1/1/1
7	NAG	O	2	7	-	0/6/23/26	0/1/1/1
7	BMA	O	3	7	-	0/2/19/22	0/1/1/1
7	MAN	O	4	7	-	0/2/19/22	0/1/1/1
3	NAG	P	1	3,1	-	2/6/23/26	0/1/1/1
3	NAG	P	2	3	-	0/6/23/26	0/1/1/1
3	BMA	P	3	3	-	2/2/19/22	0/1/1/1
4	NAG	Q	1	4,1	-	2/6/23/26	0/1/1/1
4	NAG	Q	2	4	-	0/6/23/26	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	L	5	MAN	C1-C2	3.90	1.61	1.52
6	M	3	BMA	C1-C2	2.64	1.58	1.52
4	I	1	NAG	O5-C1	-2.30	1.39	1.43
5	L	5	MAN	O5-C1	2.18	1.47	1.43
6	M	3	BMA	O5-C1	2.04	1.47	1.43

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	5	MAN	C1-O5-C5	5.26	119.24	112.19
5	L	4	MAN	C1-O5-C5	3.68	117.12	112.19
3	J	3	BMA	C1-O5-C5	3.62	117.04	112.19
5	L	5	MAN	C1-C2-C3	3.55	114.81	109.64
4	H	1	NAG	C1-O5-C5	2.96	116.16	112.19

There are no chirality outliers.

5 of 24 torsion outliers are listed below:

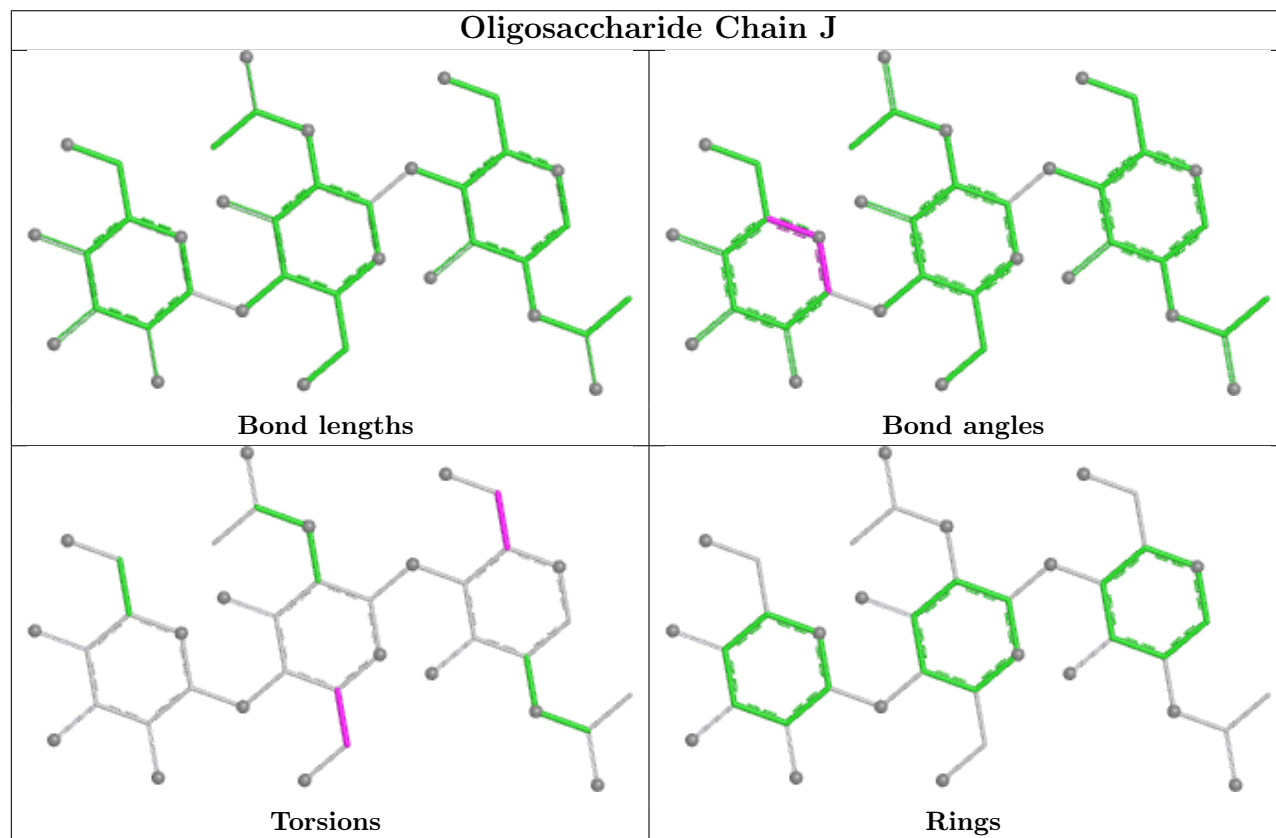
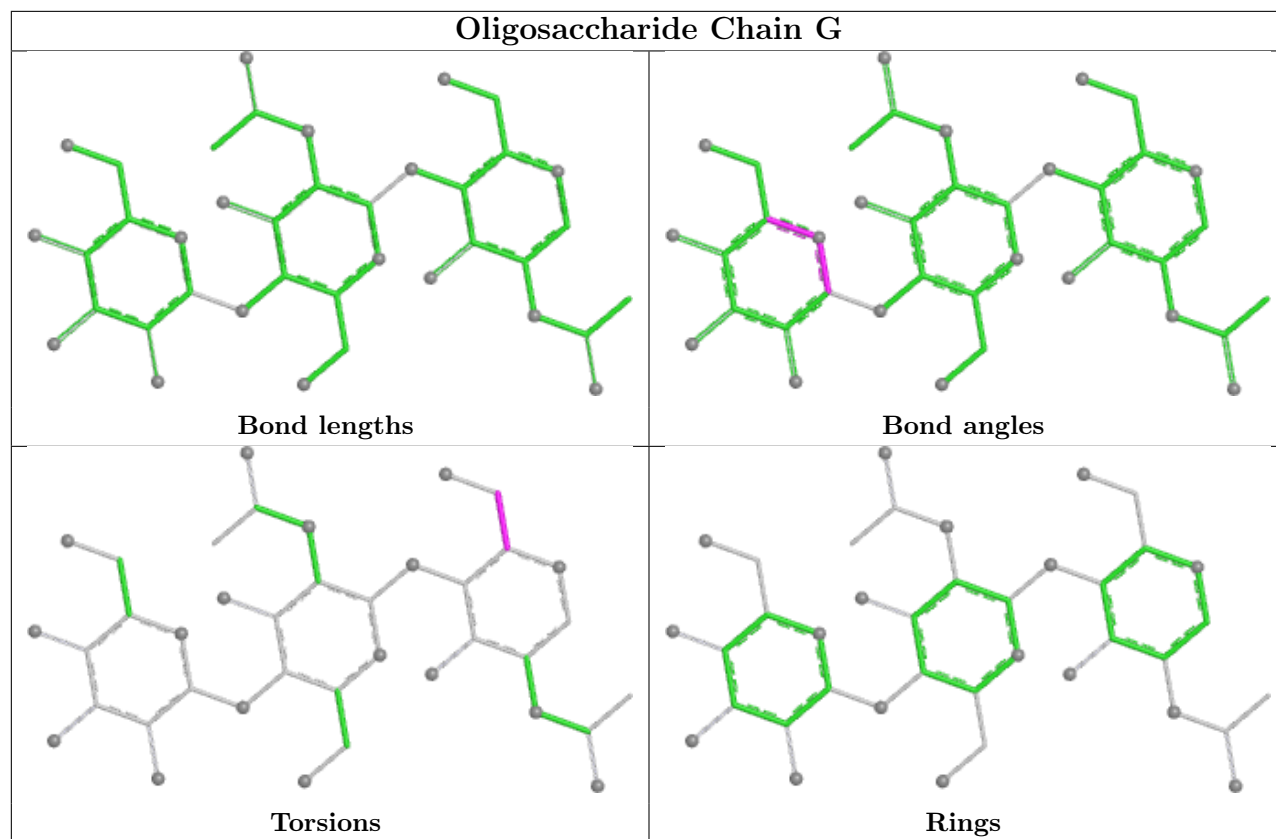
Mol	Chain	Res	Type	Atoms
5	L	1	NAG	O5-C5-C6-O6
3	G	1	NAG	O5-C5-C6-O6
3	J	1	NAG	O5-C5-C6-O6
6	M	1	NAG	O5-C5-C6-O6
4	N	1	NAG	C4-C5-C6-O6

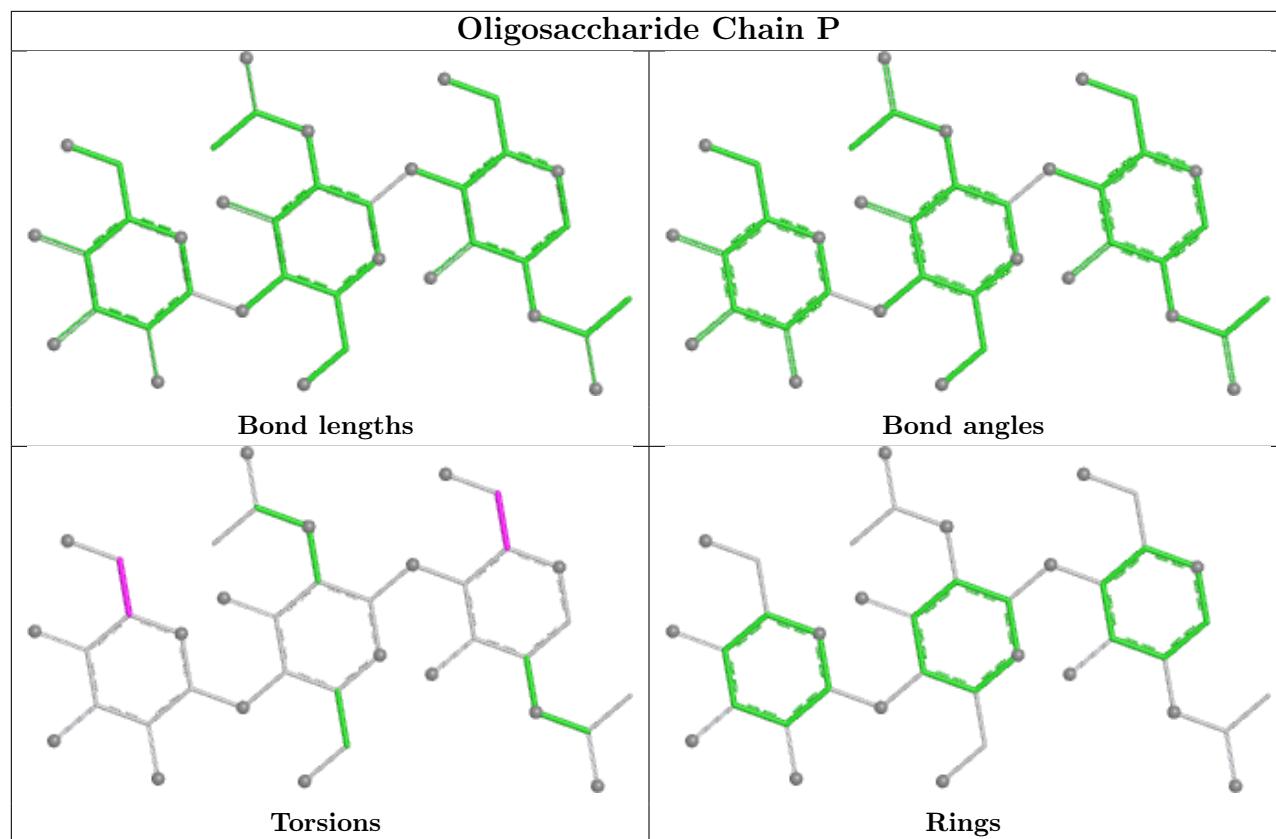
There are no ring outliers.

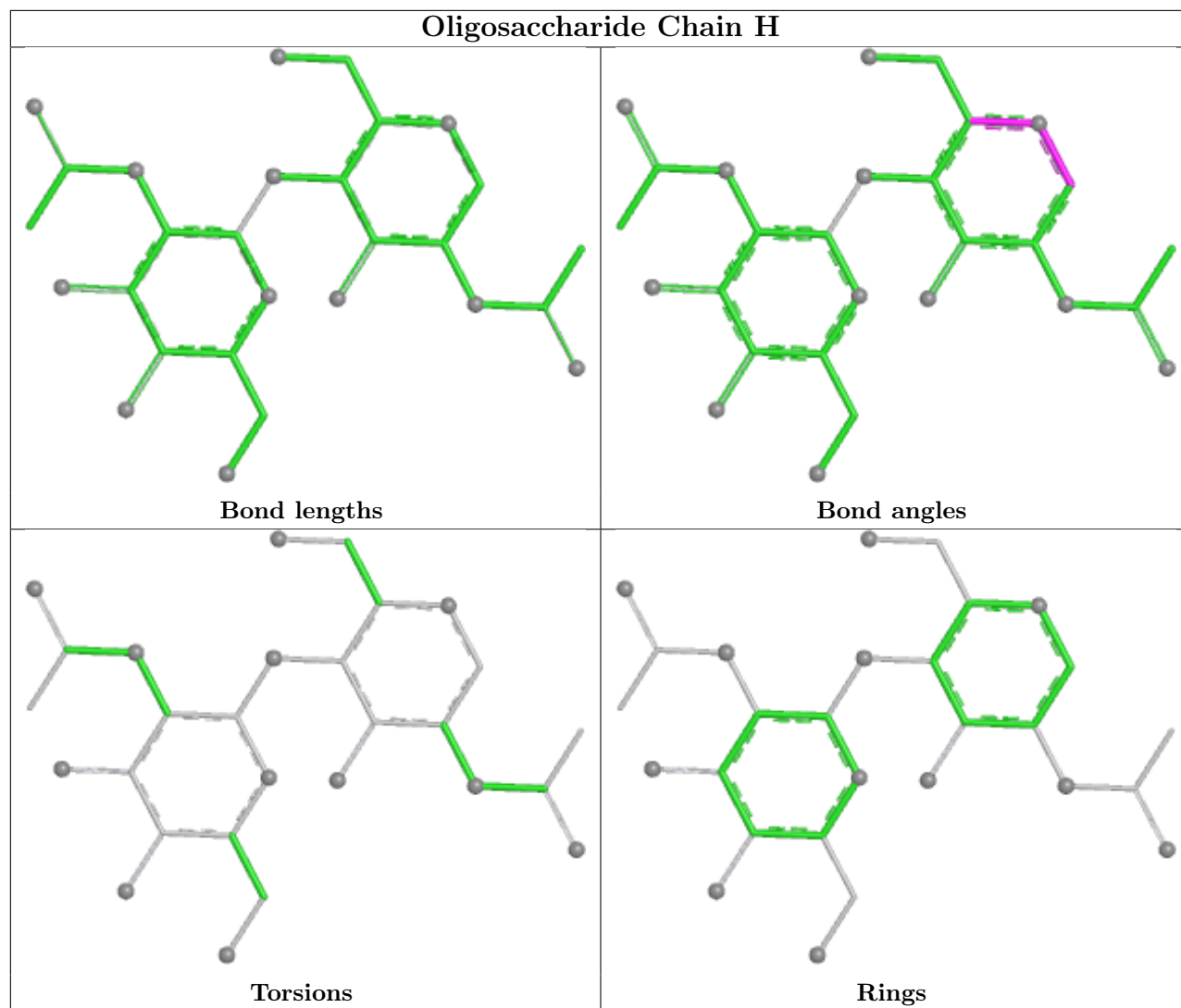
10 monomers are involved in 5 short contacts:

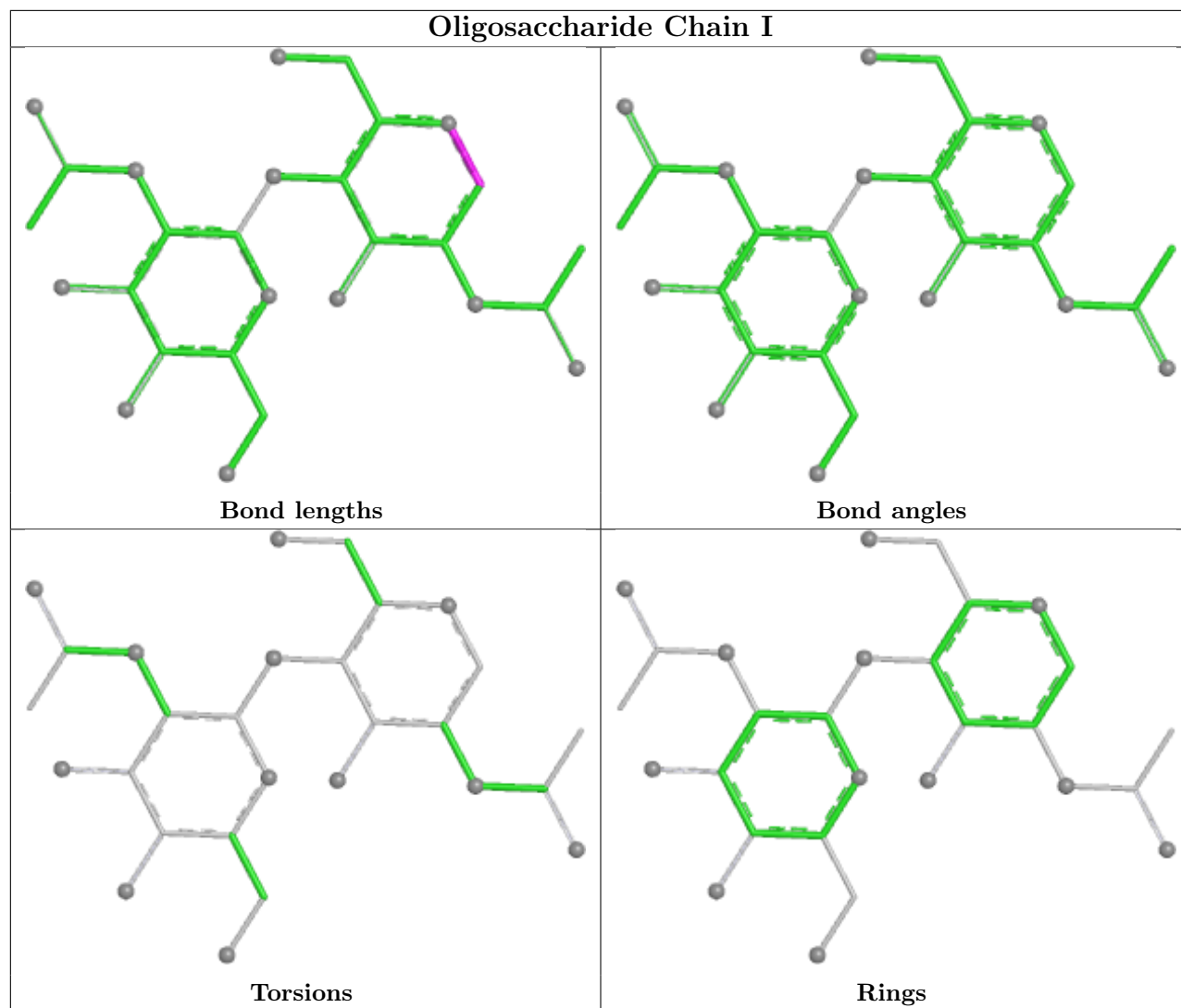
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	G	2	NAG	1	0
6	M	2	NAG	1	0
3	J	3	BMA	1	0
5	L	1	NAG	1	0
5	L	2	NAG	1	0
3	J	2	NAG	1	0
5	L	3	BMA	1	0
6	M	1	NAG	1	0
5	L	5	MAN	1	0
3	G	1	NAG	1	0

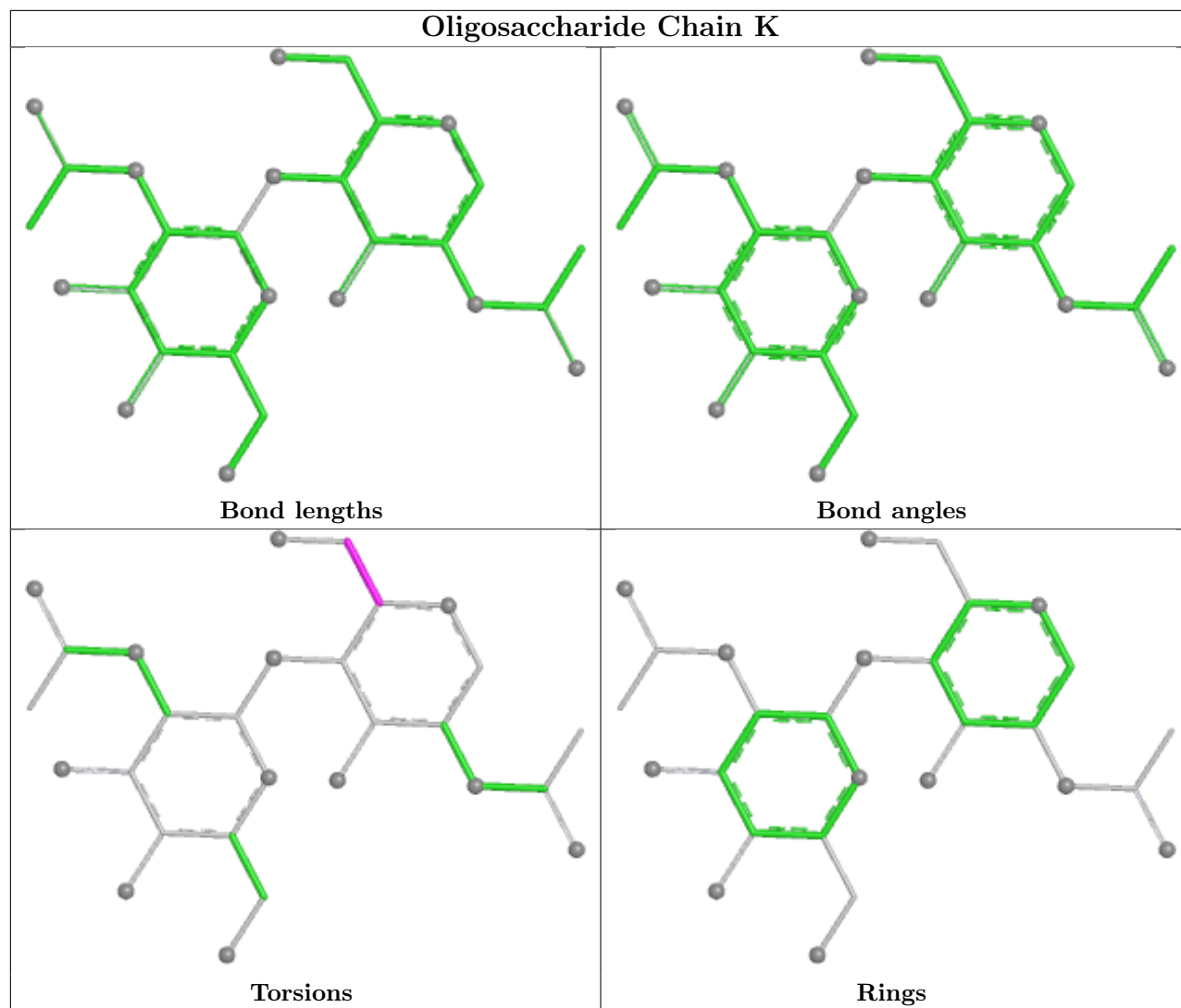
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

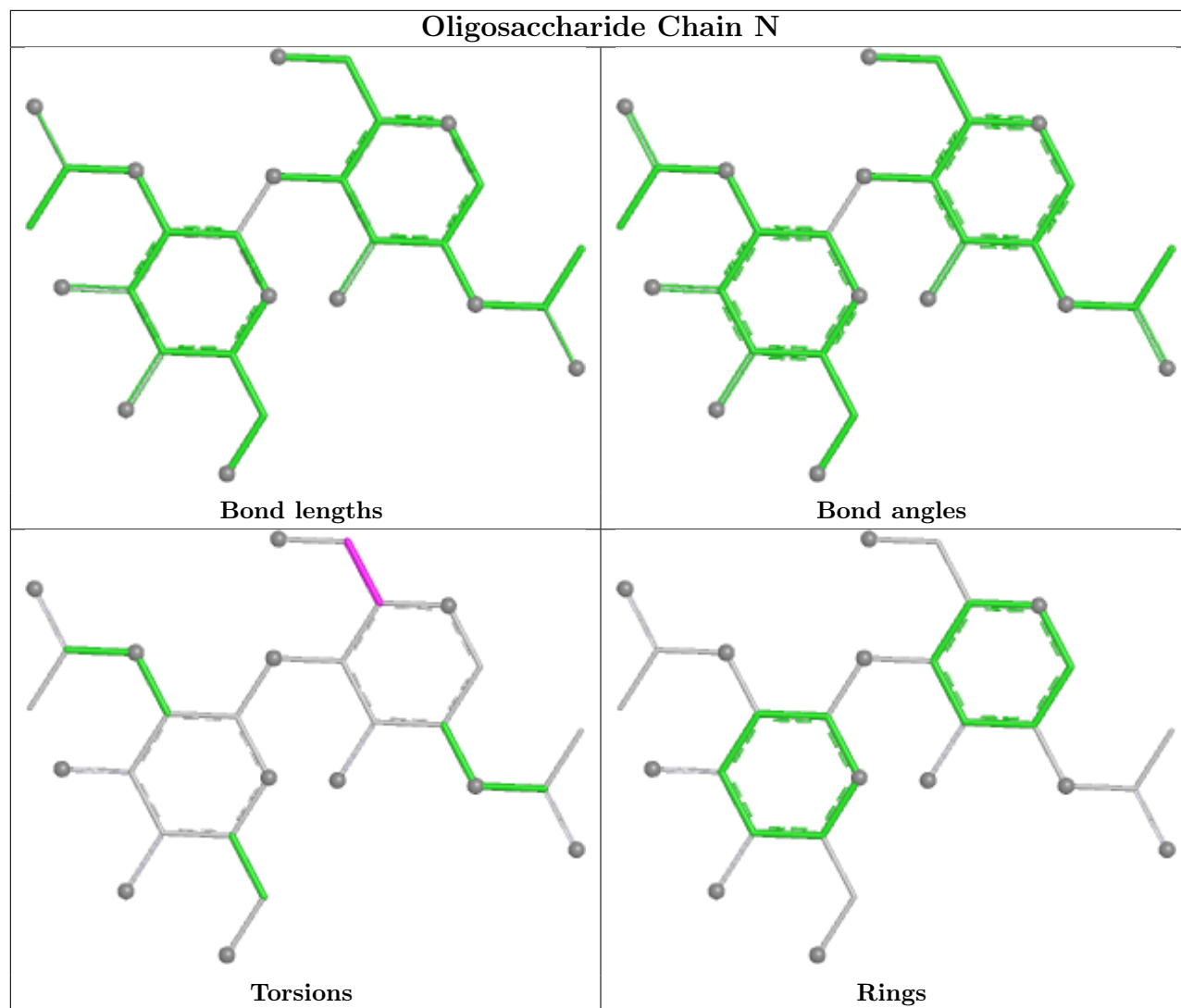


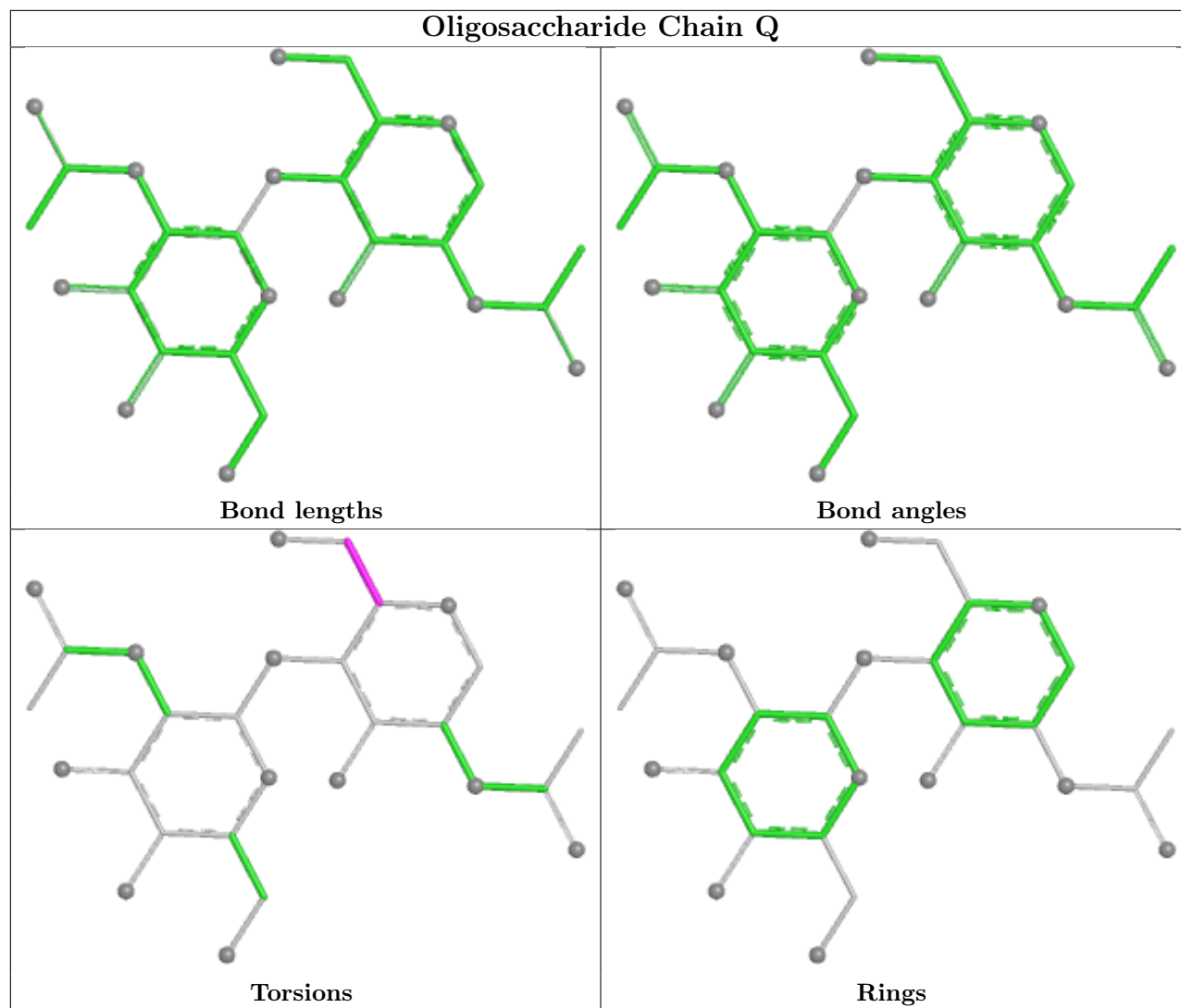


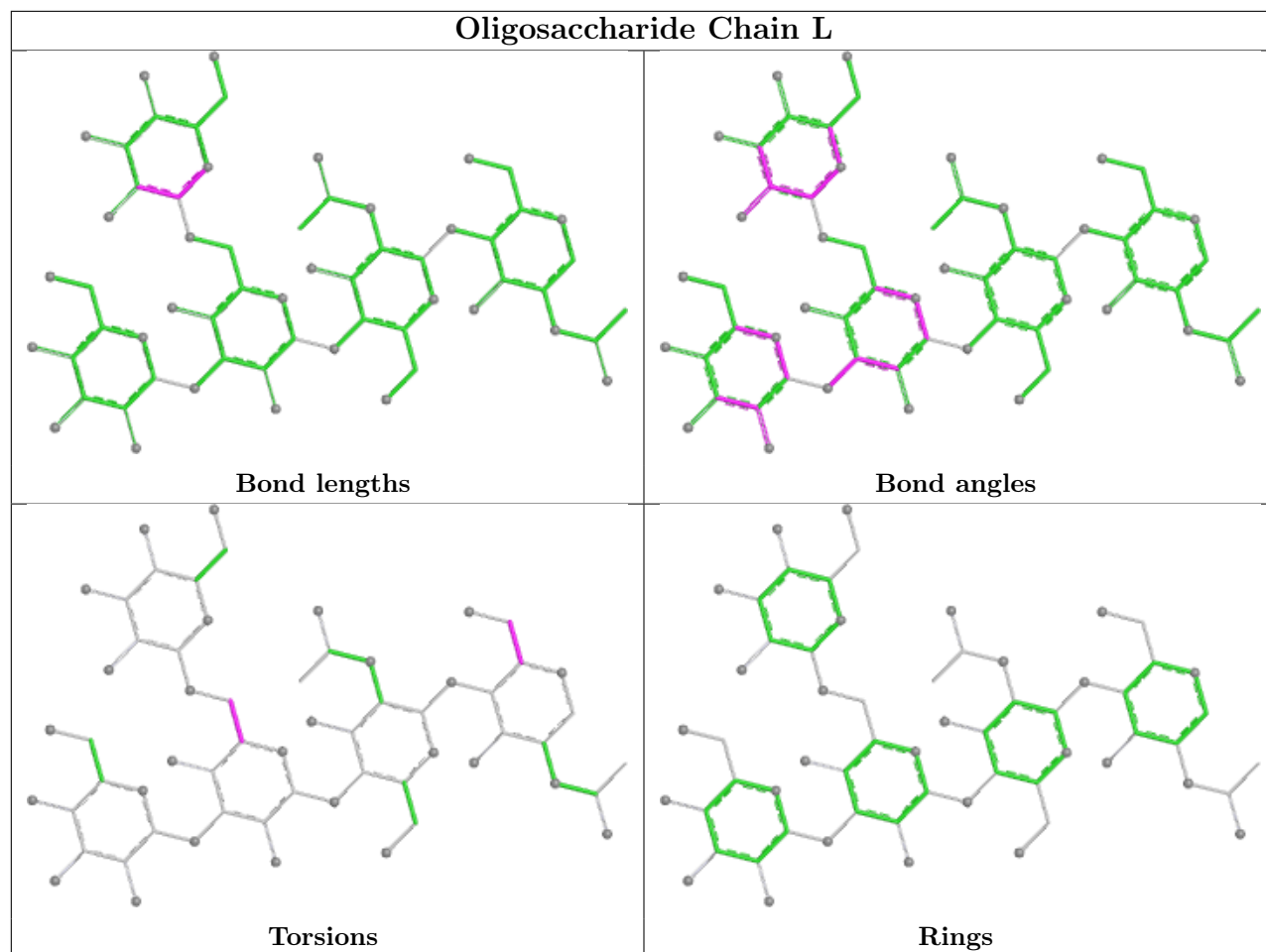


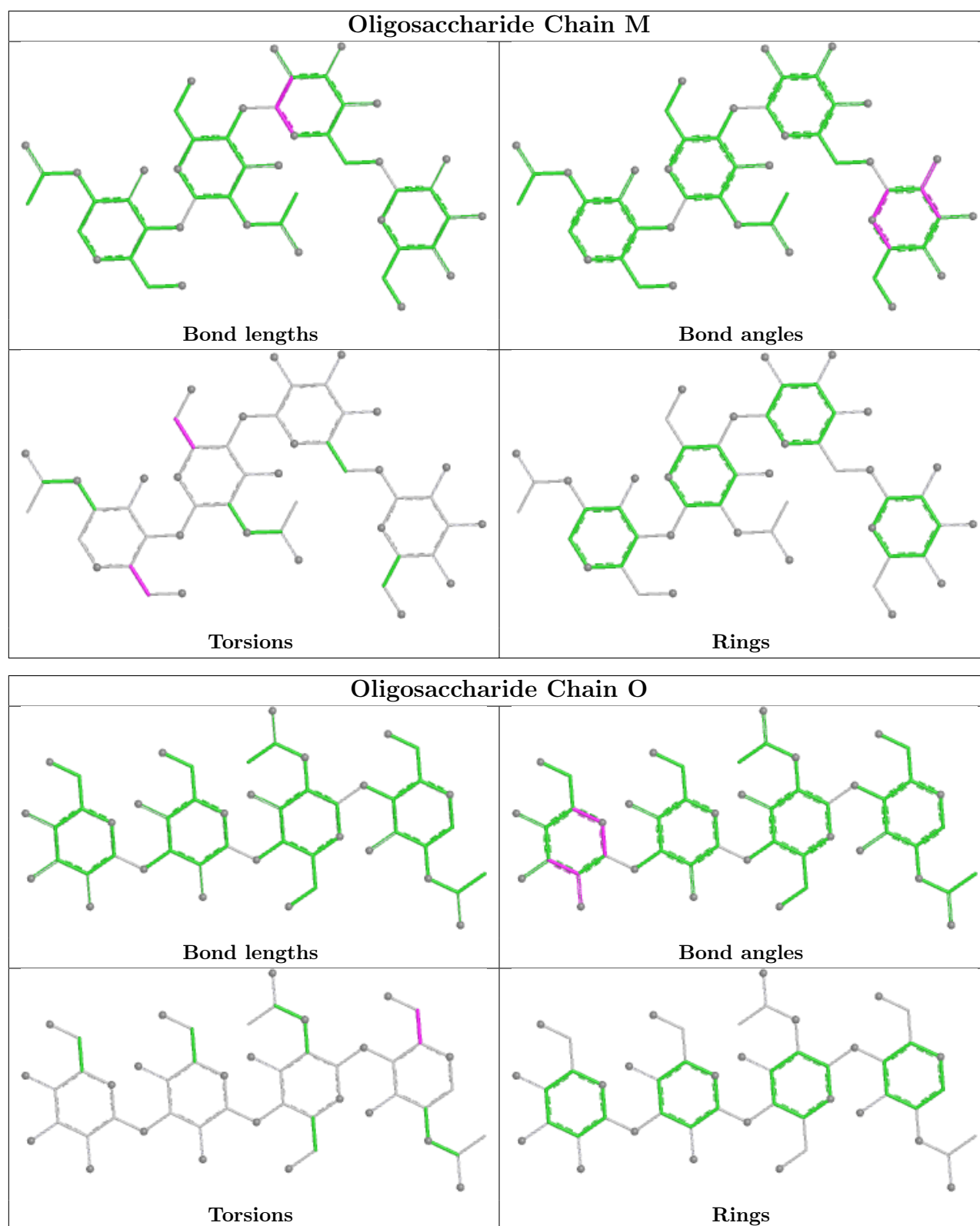












## 5.6 Ligand geometry [i](#)

7 ligands 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	$\# Z  > 2$
8	NAG	A	601	1	14,14,15	0.27	0	17,19,21	0.42	0
8	NAG	C	602	1	14,14,15	0.20	0	17,19,21	0.41	0
8	NAG	E	702	1	14,14,15	0.25	0	17,19,21	0.46	0
8	NAG	E	701	1	14,14,15	0.29	0	17,19,21	0.50	0
8	NAG	C	601	1	14,14,15	0.25	0	17,19,21	0.40	0
8	NAG	D	701	1	14,14,15	0.59	0	17,19,21	0.51	0
8	NAG	B	901	1	14,14,15	0.29	0	17,19,21	0.53	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
8	NAG	A	601	1	-	2/6/23/26	0/1/1/1
8	NAG	C	602	1	-	0/6/23/26	0/1/1/1
8	NAG	E	702	1	-	0/6/23/26	0/1/1/1
8	NAG	E	701	1	-	1/6/23/26	0/1/1/1
8	NAG	C	601	1	-	2/6/23/26	0/1/1/1
8	NAG	D	701	1	-	0/6/23/26	0/1/1/1
8	NAG	B	901	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	C	601	NAG	C4-C5-C6-O6
8	C	601	NAG	O5-C5-C6-O6
8	A	601	NAG	C4-C5-C6-O6
8	A	601	NAG	O5-C5-C6-O6
8	E	701	NAG	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	D	701	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 [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	317/331 (95%)	0.09	2 (0%) 85 69	33, 51, 69, 89	0
1	B	317/331 (95%)	0.20	9 (2%) 55 32	37, 53, 73, 90	0
1	C	318/331 (96%)	0.09	5 (1%) 70 47	35, 50, 70, 91	0
1	D	318/331 (96%)	0.20	9 (2%) 55 32	38, 54, 75, 98	0
1	E	317/331 (95%)	0.20	5 (1%) 70 47	37, 55, 74, 88	0
1	F	318/331 (96%)	0.30	5 (1%) 70 47	41, 56, 75, 92	0
2	R	171/177 (96%)	0.52	13 (7%) 20 10	30, 58, 82, 96	0
2	S	170/177 (96%)	0.34	5 (2%) 53 31	31, 56, 73, 86	0
2	T	172/177 (97%)	0.60	9 (5%) 33 16	32, 62, 89, 104	0
2	U	172/177 (97%)	0.56	8 (4%) 36 19	39, 63, 86, 94	0
2	V	171/177 (96%)	0.53	10 (5%) 29 14	40, 60, 74, 83	0
2	W	171/177 (96%)	0.74	17 (9%) 13 7	37, 66, 88, 103	0
All	All	2932/3048 (96%)	0.31	97 (3%) 49 28	30, 55, 78, 104	0

The worst 5 of 97 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	T	350	ASP	4.0
1	B	10	SER	3.5
1	D	11	SER	3.5
2	S	350	ASP	3.5
2	R	474	LYS	3.3

### 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](#)

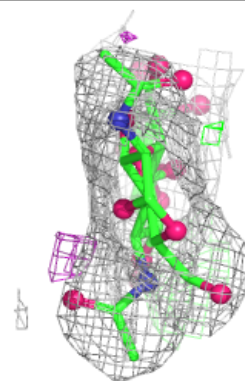
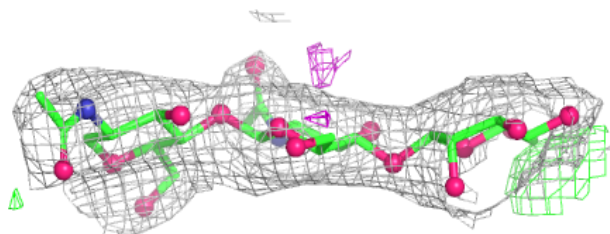
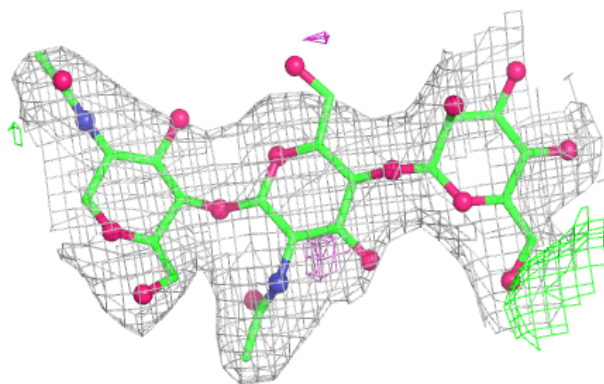
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 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
3	NAG	G	1	14/15	-	-	50,60,70,73	0
3	NAG	G	2	14/15	-	-	49,66,78,89	0
3	BMA	G	3	11/12	-	-	53,77,87,89	0
3	NAG	J	1	14/15	-	-	47,59,64,68	0
3	NAG	J	2	14/15	-	-	46,72,85,88	0
3	BMA	J	3	11/12	-	-	91,99,106,106	0
7	NAG	O	2	14/15	0.45	0.17	54,62,70,70	0
3	BMA	P	3	11/12	0.48	0.16	63,69,77,82	0
4	NAG	Q	2	14/15	0.66	0.15	68,83,90,93	0
4	NAG	H	1	14/15	-	-	49,79,88,91	0
4	NAG	H	2	14/15	-	-	82,92,104,111	0
4	NAG	I	1	14/15	-	-	78,94,99,100	0
4	NAG	I	2	14/15	-	-	82,96,101,103	0
4	NAG	K	1	14/15	-	-	51,62,69,74	0
4	NAG	K	2	14/15	-	-	58,82,96,97	0
7	NAG	O	1	14/15	0.67	0.21	60,67,79,84	0
4	NAG	N	1	14/15	0.68	0.15	43,63,75,80	0
6	BMA	M	3	11/12	0.68	0.12	89,97,102,108	0
4	NAG	N	2	14/15	0.70	0.13	65,79,90,92	0
5	NAG	L	1	14/15	-	-	44,53,64,69	0
5	NAG	L	2	14/15	-	-	44,60,73,83	0
5	BMA	L	3	11/12	-	-	72,81,90,90	0
5	MAN	L	4	11/12	-	-	82,95,100,104	0
5	MAN	L	5	11/12	-	-	71,82,91,92	0
6	NAG	M	2	14/15	0.81	0.15	56,71,89,97	0
6	NAG	M	1	14/15	0.83	0.12	65,71,74,76	0
3	NAG	P	2	14/15	0.84	0.13	45,56,65,82	0
6	MAN	M	4	11/12	-	-	95,102,105,108	0
3	NAG	P	1	14/15	0.86	0.11	44,52,76,89	0
4	NAG	Q	1	14/15	0.89	0.08	52,61,73,79	0
7	BMA	O	3	11/12	-	-	66,79,91,91	0
7	MAN	O	4	11/12	-	-	92,100,120,122	0

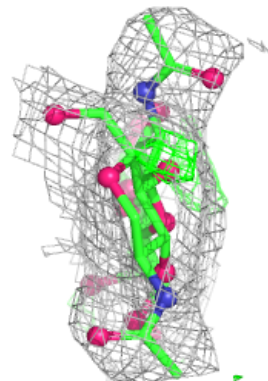
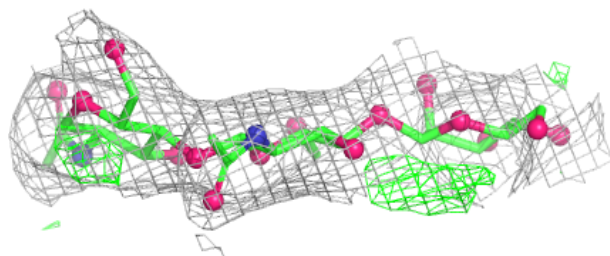
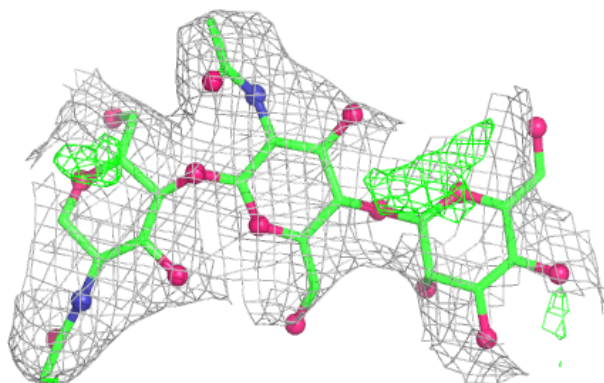
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

**Electron density around Chain G:**

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

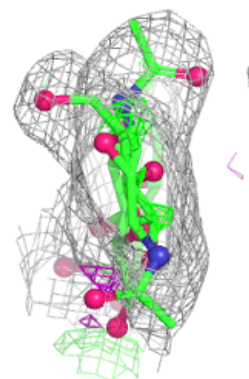
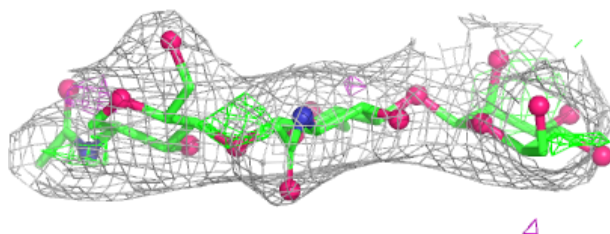
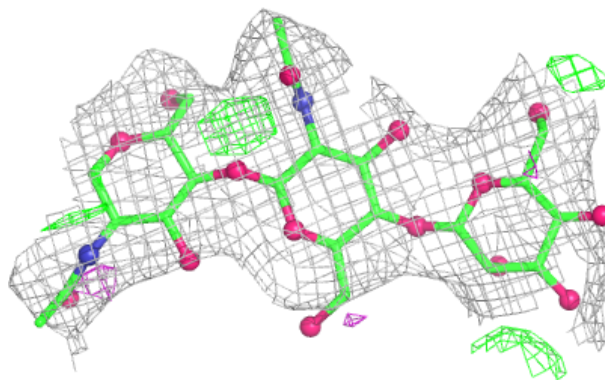
**Electron density around Chain J:**

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

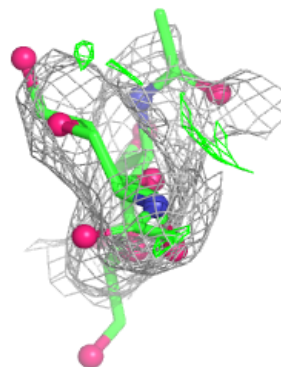
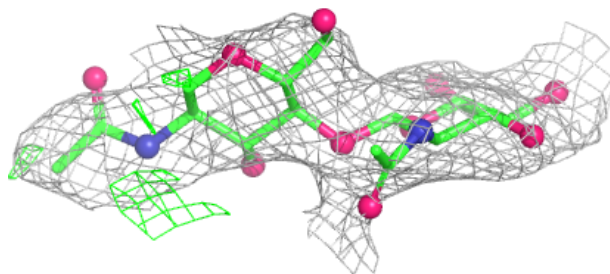
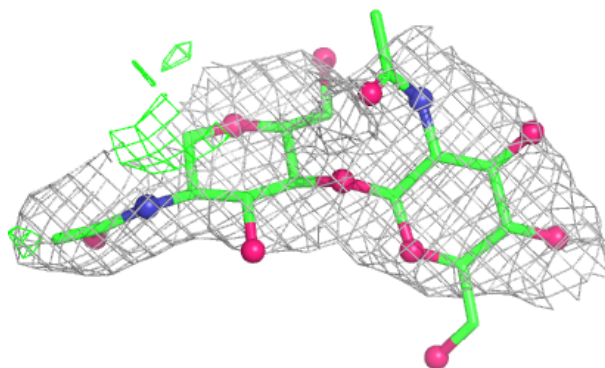


**Electron density around Chain P:**

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

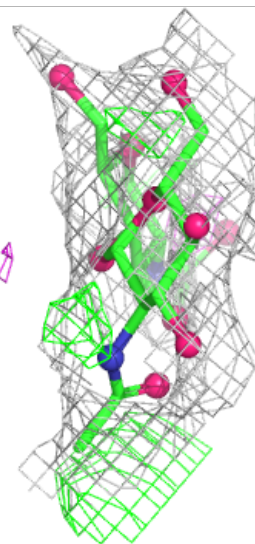
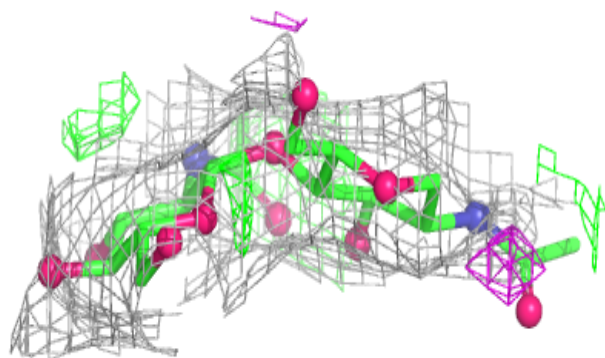
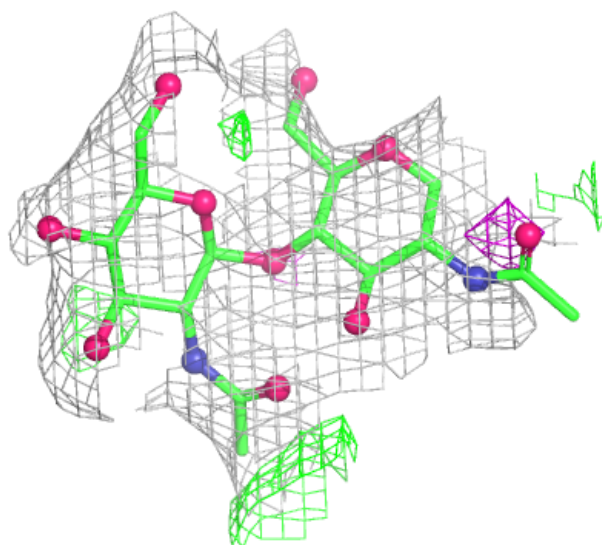
**Electron density around Chain H:**

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



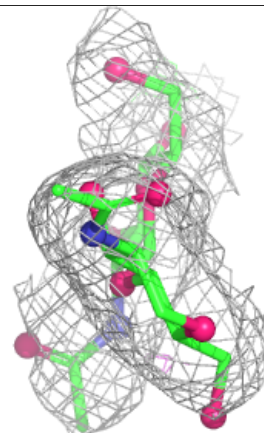
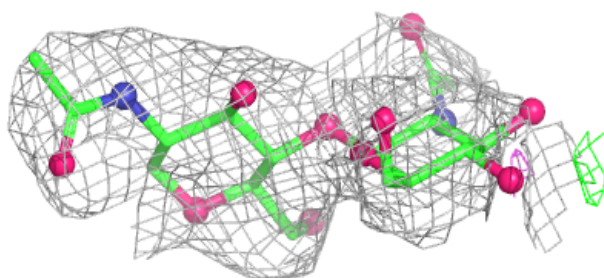
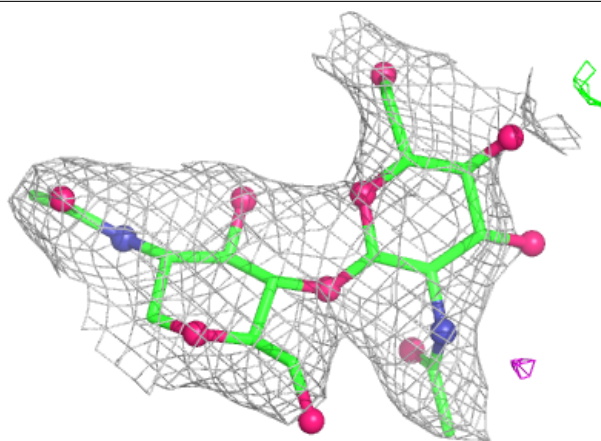
**Electron density around Chain I:**

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



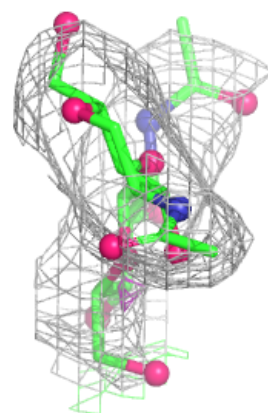
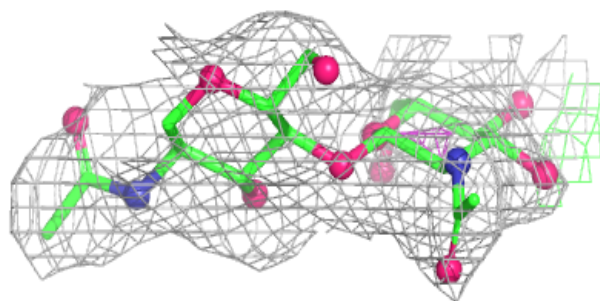
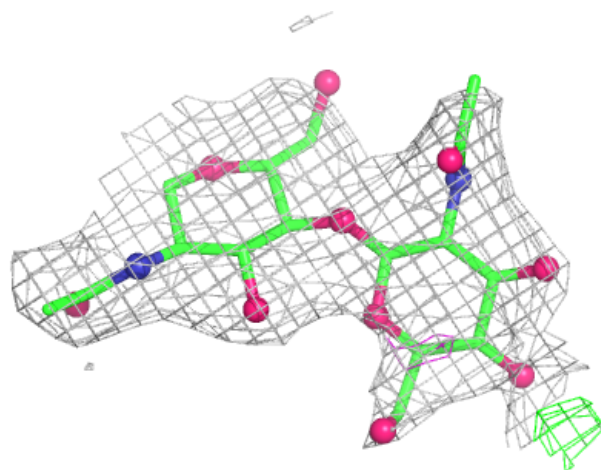
**Electron density around Chain K:**

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



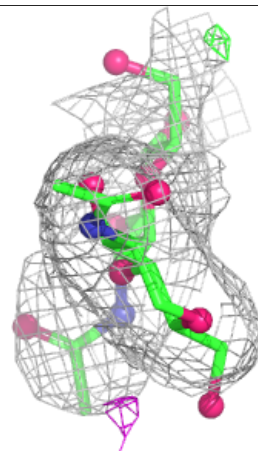
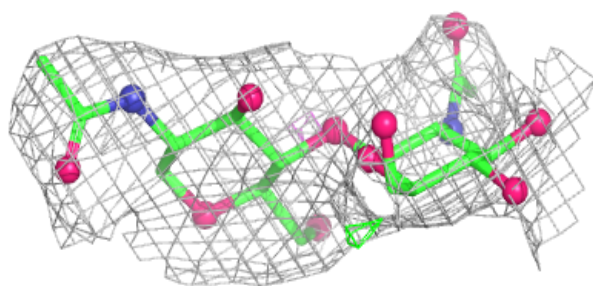
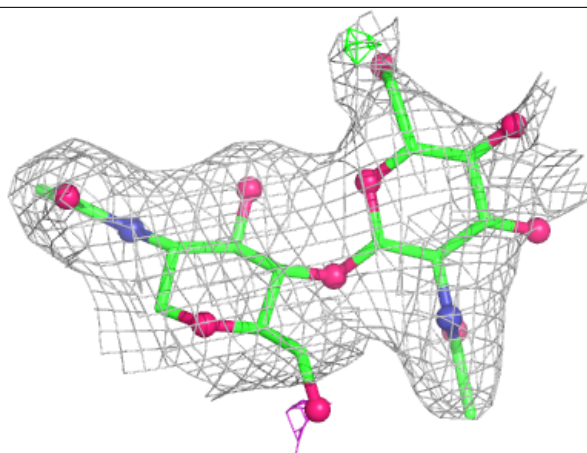
**Electron density around Chain N:**

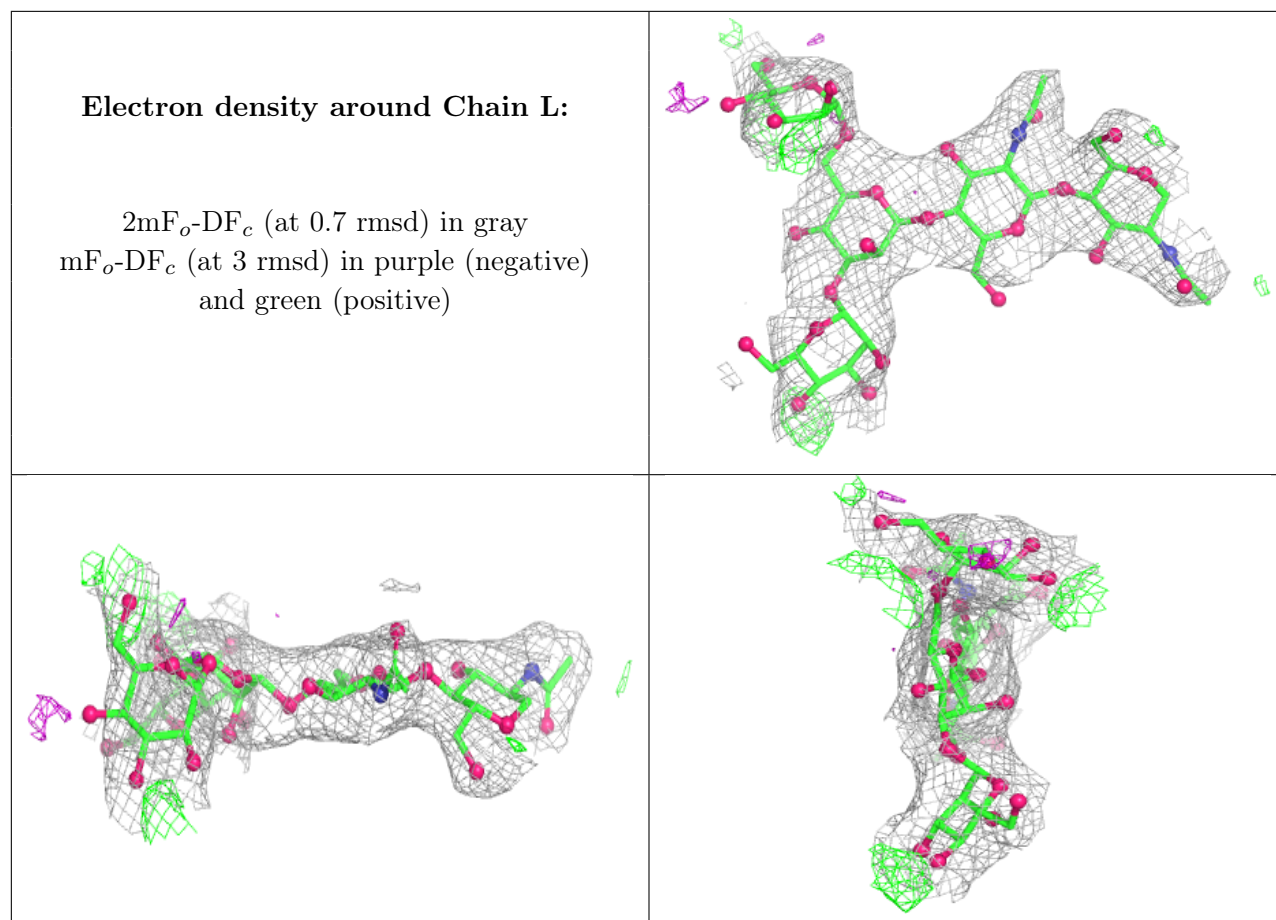
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain Q:**

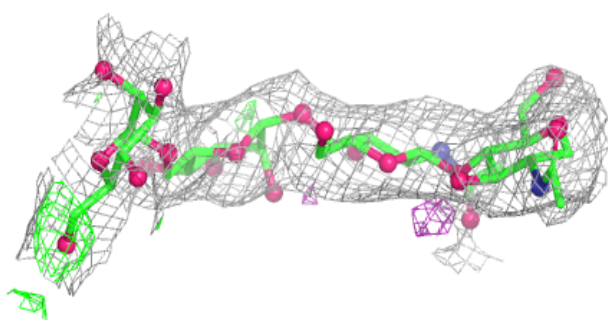
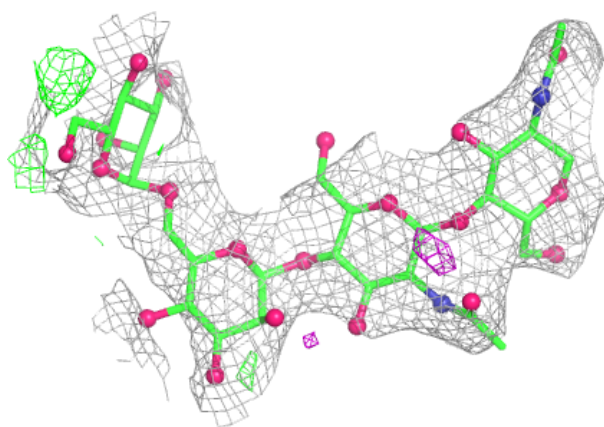
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



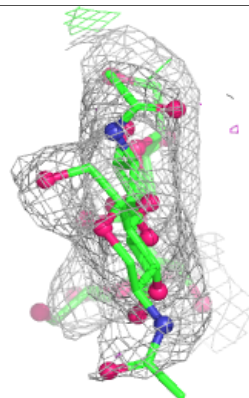
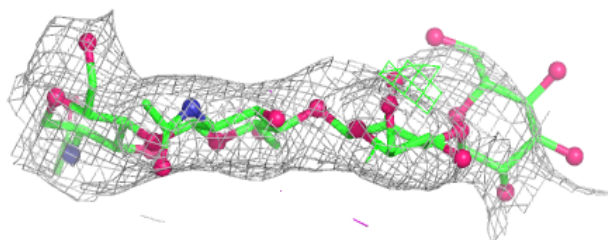
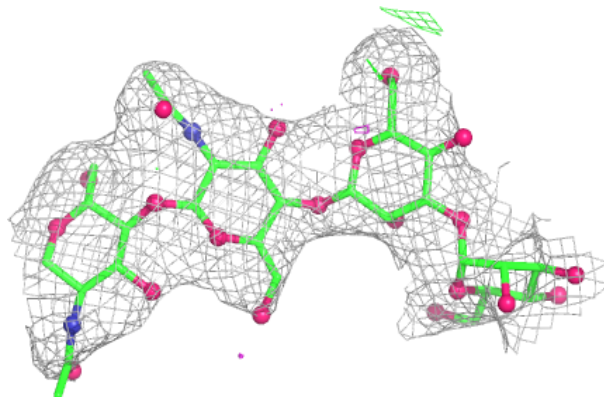


**Electron density around Chain M:**

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

**Electron density around Chain O:**

$2mF_o-DF_c$  (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(Å <sup>2</sup> )	Q<0.9
8	NAG	E	702	14/15	0.47	0.22	73,83,97,104	0
8	NAG	C	602	14/15	0.61	0.17	72,91,101,101	0
8	NAG	B	901	14/15	0.62	0.16	82,89,100,100	0
8	NAG	E	701	14/15	0.74	0.14	53,69,73,80	0
8	NAG	D	701	14/15	0.74	0.16	80,88,95,98	0
8	NAG	A	601	14/15	0.81	0.13	56,62,66,77	0
8	NAG	C	601	14/15	0.89	0.09	49,55,66,73	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.