



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 20, 2023 – 07:34 PM EDT

PDB ID : 5FI9
Title : Closed form of murine Acid Sphingomyelinase in complex with bisphosphonate inhibitor AbPA
Authors : Gorelik, A.; Illes, K.; Heinz, L.X.; Superti-Furga, G.; Nagar, B.
Deposited on : 2015-12-22
Resolution : 2.54 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.35.1
buster-report : 1.1.7 (2018)
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) : 2.35.1

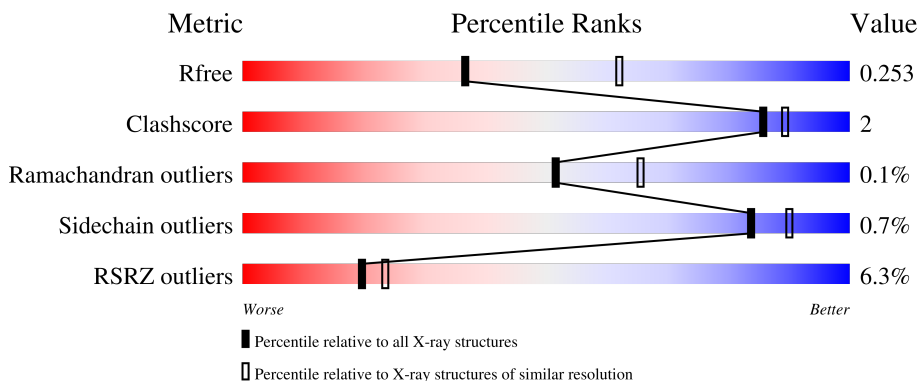
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.54 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.




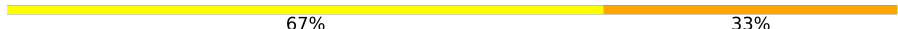
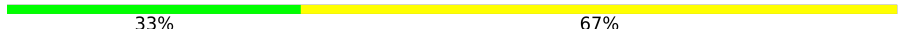
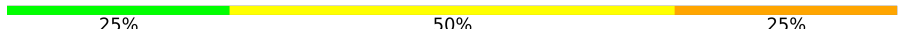
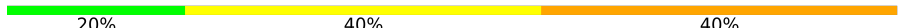
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1284 (2.56-2.52)
Clashscore	141614	1332 (2.56-2.52)
Ramachandran outliers	138981	1315 (2.56-2.52)
Sidechain outliers	138945	1315 (2.56-2.52)
RSRZ outliers	127900	1272 (2.56-2.52)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	538	 8% 93% 5%
1	B	538	 4% 94% 5%
2	C	2	 50% 50%
2	E	2	 100%
2	G	2	 50% 50%

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Mol	Chain	Length	Quality of chain
2	J	2	 100%
3	D	3	 100%
3	I	3	 67% 33%
4	F	6	 33% 67%
5	H	4	 25% 50% 25%
6	K	5	 20% 40% 40%

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	G	2	-	-	-	X

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 17178 atoms, of which 8420 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 Spingomyelin phosphodiesterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	523	8121	2656	3995	709	738	23	0	0	0
1	B	529	8199	2682	4031	717	746	23	0	0	0

There are 20 discrepancies between the modelled and reference sequences:

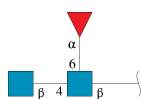
Chain	Residue	Modelled	Actual	Comment	Reference
A	74	ASP	-	expression tag	UNP Q04519
A	75	ARG	-	expression tag	UNP Q04519
A	76	HIS	-	expression tag	UNP Q04519
A	77	HIS	-	expression tag	UNP Q04519
A	78	HIS	-	expression tag	UNP Q04519
A	79	HIS	-	expression tag	UNP Q04519
A	80	HIS	-	expression tag	UNP Q04519
A	81	HIS	-	expression tag	UNP Q04519
A	82	LYS	-	expression tag	UNP Q04519
A	83	LEU	-	expression tag	UNP Q04519
B	74	ASP	-	expression tag	UNP Q04519
B	75	ARG	-	expression tag	UNP Q04519
B	76	HIS	-	expression tag	UNP Q04519
B	77	HIS	-	expression tag	UNP Q04519
B	78	HIS	-	expression tag	UNP Q04519
B	79	HIS	-	expression tag	UNP Q04519
B	80	HIS	-	expression tag	UNP Q04519
B	81	HIS	-	expression tag	UNP Q04519
B	82	LYS	-	expression tag	UNP Q04519
B	83	LEU	-	expression tag	UNP Q04519

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



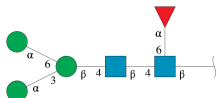
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	C	2	Total	C	H	N	O	0	0	0
			55	16	27	2	10			
2	E	2	Total	C	H	N	O	0	0	0
			55	16	27	2	10			
2	G	2	Total	C	H	N	O	0	0	0
			55	16	27	2	10			
2	J	2	Total	C	H	N	O	0	0	0
			55	16	27	2	10			

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



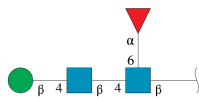
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
3	D	3	Total	C	H	N	O	0	0	0
			75	22	37	2	14			
3	I	3	Total	C	H	N	O	0	0	0
			75	22	37	2	14			

- Molecule 4 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)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



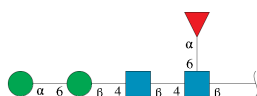
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
4	F	6	Total	C	H	N	O	0	0	0
			137	40	66	2	29			

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
			Total	C	H	N				O
5	H	4	96	28	47	2	19	0	0	0

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

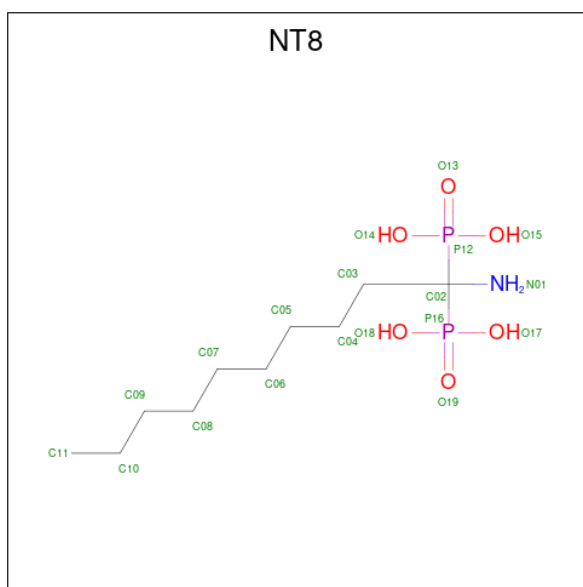


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
			Total	C	H	N				O
6	K	5	117	34	57	2	24	0	0	0

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	2	Total	Zn	0	0
			2	2		
7	B	2	Total	Zn	0	0
			2	2		

- Molecule 8 is (1-azanyl-1-phosphono-decyl)phosphonic acid (three-letter code: NT8) (formula: C₁₀H₂₅NO₆P₂).




Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	H	N	O			P
8	A	1	40	10	21	1	6	2	0	0
8	B	1	40	10	21	1	6	2	0	0

- Molecule 9 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	25	Total O 25 25	0	0
9	B	29	Total O 29 29	0	0

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

Chain G:  50% 50%

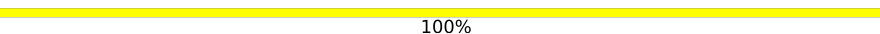
MAG1
MAG2

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

Chain J:  100%

MAG1
MAG2

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

Chain D:  100%

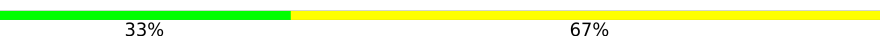
MAG1
MAG2
FUC3

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

Chain I:  67% 33%

MAG1
MAG2
FUC3

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

Chain F:  33% 67%

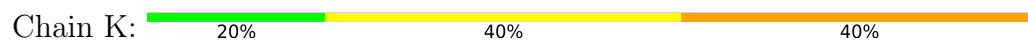
MAG1
MAG2
BMA3
MAN4
MAN5
FUC6

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

Chain H:  25% 50% 25%

MAG1
MAG2
BMA3
FUC4

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



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	57.39Å 72.02Å 74.42Å 80.47° 71.52° 83.60°	Depositor
Resolution (Å)	46.65 – 2.54 44.49 – 2.54	Depositor EDS
% Data completeness (in resolution range)	92.0 (46.65-2.54) 61.9 (44.49-2.54)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.22 (at 2.54Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, R_{free}	0.201 , 0.252 0.202 , 0.253	Depositor DCC
R_{free} test set	1207 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	34.1	Xtrriage
Anisotropy	0.092	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 25.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	17178	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.92% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, NT8, NAG, MAN, BMA, FUC

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	0.25	0/4265	0.42	0/5835
1	B	0.24	0/4310	0.42	0/5899
All	All	0.25	0/8575	0.42	0/11734

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

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	4126	3995	3994	12	0
1	B	4168	4031	4030	12	0
2	C	28	27	25	1	0
2	E	28	27	25	0	0
2	G	28	27	25	4	0
2	J	28	27	25	0	0
3	D	38	37	34	0	0
3	I	38	37	34	2	0
4	F	71	66	61	0	0
5	H	49	47	43	3	0
6	K	60	57	52	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	2	0	0	0	0
7	B	2	0	0	0	0
8	A	19	21	0	0	0
8	B	19	21	0	0	0
9	A	25	0	0	1	0
9	B	29	0	0	0	0
All	All	8758	8420	8348	37	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 2.

The worst 5 of 37 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:H:2:NAG:O7	5:H:2:NAG:O3	2.00	0.79
1:B:142:GLU:OE1	1:B:146:ARG:NH2	2.19	0.76
1:A:140:VAL:O	1:A:144:TRP:N	2.19	0.75
2:G:1:NAG:O3	2:G:2:NAG:O5	2.04	0.75
3:I:2:NAG:O7	3:I:2:NAG:O3	2.10	0.70

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	519/538 (96%)	487 (94%)	32 (6%)	0	100	100
1	B	527/538 (98%)	492 (93%)	34 (6%)	1 (0%)	47	60
All	All	1046/1076 (97%)	979 (94%)	66 (6%)	1 (0%)	51	65

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	107	VAL

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	446/460 (97%)	443 (99%)	3 (1%)	84	90
1	B	450/460 (98%)	447 (99%)	3 (1%)	84	90
All	All	896/920 (97%)	890 (99%)	6 (1%)	84	90

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	367	LEU
1	B	383	CYS
1	B	547	MET
1	A	383	CYS
1	A	318	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

29 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAG	C	1	1,2	14,14,15	1.11	1 (7%)	17,19,21	1.05	0
2	NAG	C	2	2	14,14,15	1.35	2 (14%)	17,19,21	1.41	1 (5%)
3	NAG	D	1	1,3	14,14,15	1.76	3 (21%)	17,19,21	1.25	1 (5%)
3	NAG	D	2	3	14,14,15	0.43	0	17,19,21	0.90	1 (5%)
3	FUC	D	3	3	10,10,11	1.27	1 (10%)	14,14,16	1.89	4 (28%)
2	NAG	E	1	1,2	14,14,15	0.49	0	17,19,21	0.52	0
2	NAG	E	2	2	14,14,15	0.23	0	17,19,21	0.49	0
4	NAG	F	1	1,4	14,14,15	1.37	1 (7%)	17,19,21	0.69	0
4	NAG	F	2	4	14,14,15	0.24	0	17,19,21	0.44	0
4	BMA	F	3	4	11,11,12	0.68	0	15,15,17	1.08	0
4	MAN	F	4	4	11,11,12	0.75	0	15,15,17	0.89	2 (13%)
4	MAN	F	5	4	11,11,12	0.98	1 (9%)	15,15,17	1.63	2 (13%)
4	FUC	F	6	4	10,10,11	0.98	1 (10%)	14,14,16	1.85	3 (21%)
2	NAG	G	1	1,2	14,14,15	1.53	1 (7%)	17,19,21	2.17	4 (23%)
2	NAG	G	2	2	14,14,15	0.29	0	17,19,21	0.94	0
5	NAG	H	1	1,5	14,14,15	0.27	0	17,19,21	0.57	0
5	NAG	H	2	5	14,14,15	0.22	0	17,19,21	0.68	0
5	BMA	H	3	5	11,11,12	0.86	1 (9%)	15,15,17	1.07	1 (6%)
5	FUC	H	4	5	10,10,11	1.29	1 (10%)	14,14,16	2.05	4 (28%)
3	NAG	I	1	1,3	14,14,15	0.41	0	17,19,21	0.43	0
3	NAG	I	2	3	14,14,15	0.55	0	17,19,21	0.66	1 (5%)
3	FUC	I	3	3	10,10,11	1.71	2 (20%)	14,14,16	2.28	4 (28%)
2	NAG	J	1	1,2	14,14,15	0.49	0	17,19,21	0.60	0
2	NAG	J	2	2	14,14,15	0.41	0	17,19,21	0.42	0
6	NAG	K	1	1,6	14,14,15	0.58	0	17,19,21	0.45	0
6	NAG	K	2	6	14,14,15	0.33	0	17,19,21	0.66	1 (5%)
6	BMA	K	3	6	11,11,12	0.59	0	15,15,17	0.83	0
6	MAN	K	4	6	11,11,12	0.68	0	15,15,17	1.15	2 (13%)
6	FUC	K	5	6	10,10,11	1.11	1 (10%)	14,14,16	1.76	3 (21%)

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. '2' means no outliers of that kind were identified.

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

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	G	1	NAG	O5-C1	5.40	1.52	1.43
3	D	1	NAG	O5-C1	-4.96	1.35	1.43
4	F	1	NAG	O5-C1	-4.91	1.35	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	I	3	FUC	C1-C2	4.42	1.62	1.52
2	C	2	NAG	O5-C1	4.00	1.50	1.43

The worst 5 of 34 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	1	NAG	C1-O5-C5	7.36	122.16	112.19
2	C	2	NAG	C1-O5-C5	5.39	119.49	112.19
4	F	5	MAN	C1-O5-C5	5.34	119.42	112.19
3	I	3	FUC	C1-C2-C3	5.04	115.86	109.67
5	H	4	FUC	O5-C5-C4	4.75	118.05	109.52

There are no chirality outliers.

5 of 39 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	G	2	NAG	C3-C2-N2-C7
3	I	2	NAG	C1-C2-N2-C7
2	J	2	NAG	O5-C5-C6-O6
5	H	1	NAG	O5-C5-C6-O6
5	H	2	NAG	O5-C5-C6-O6

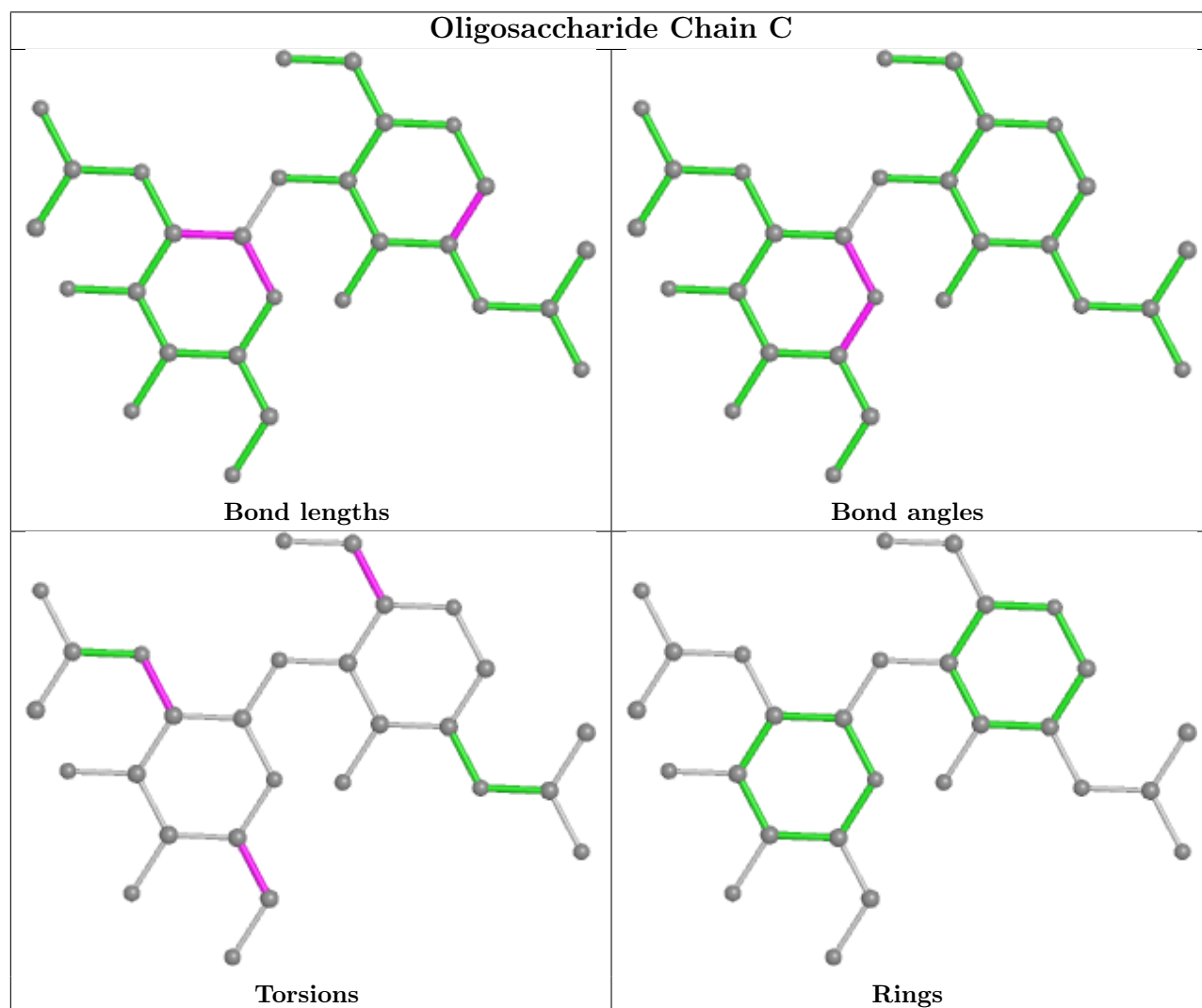
All (1) ring outliers are listed below:

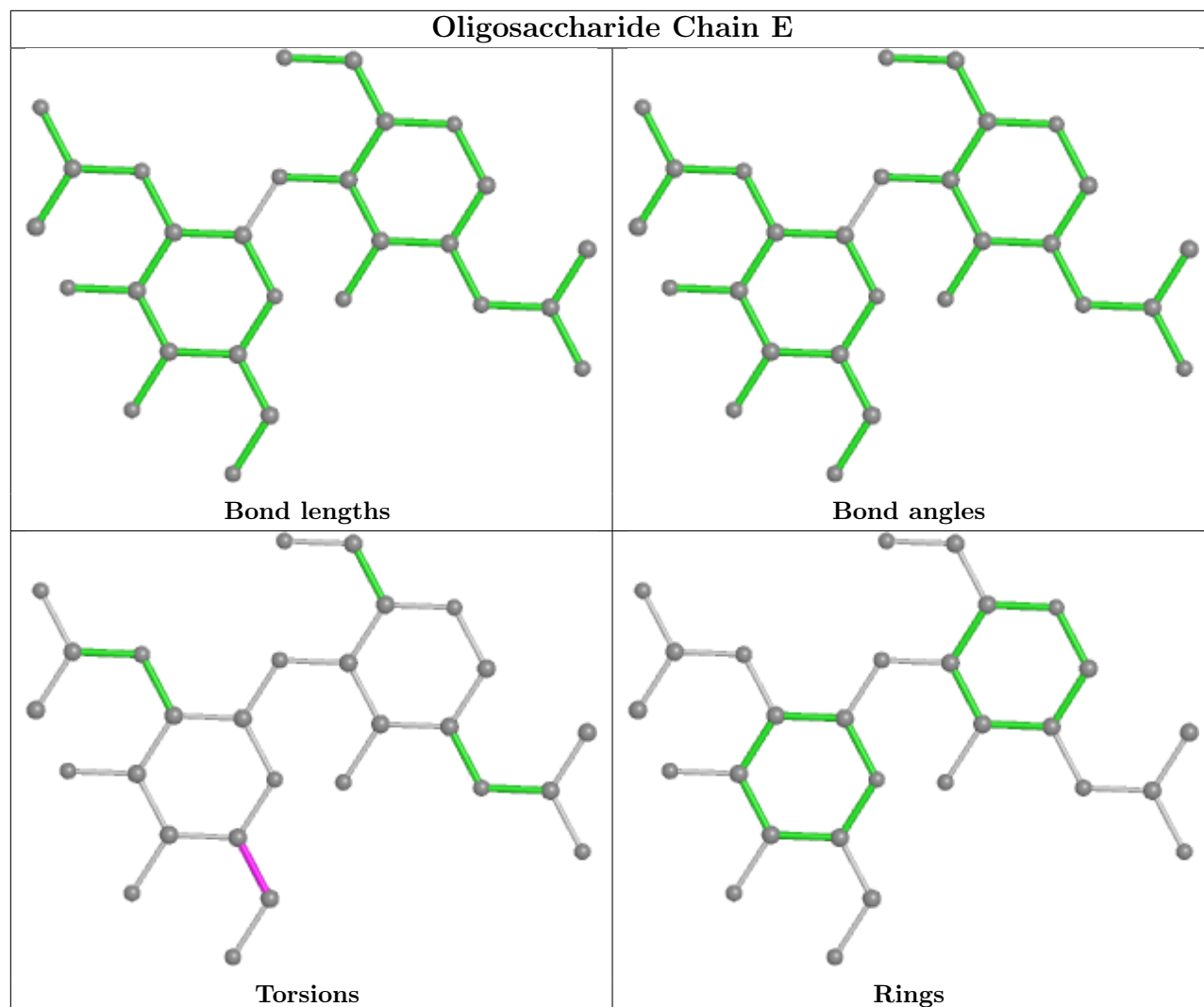
Mol	Chain	Res	Type	Atoms
6	K	4	MAN	C1-C2-C3-C4-C5-O5

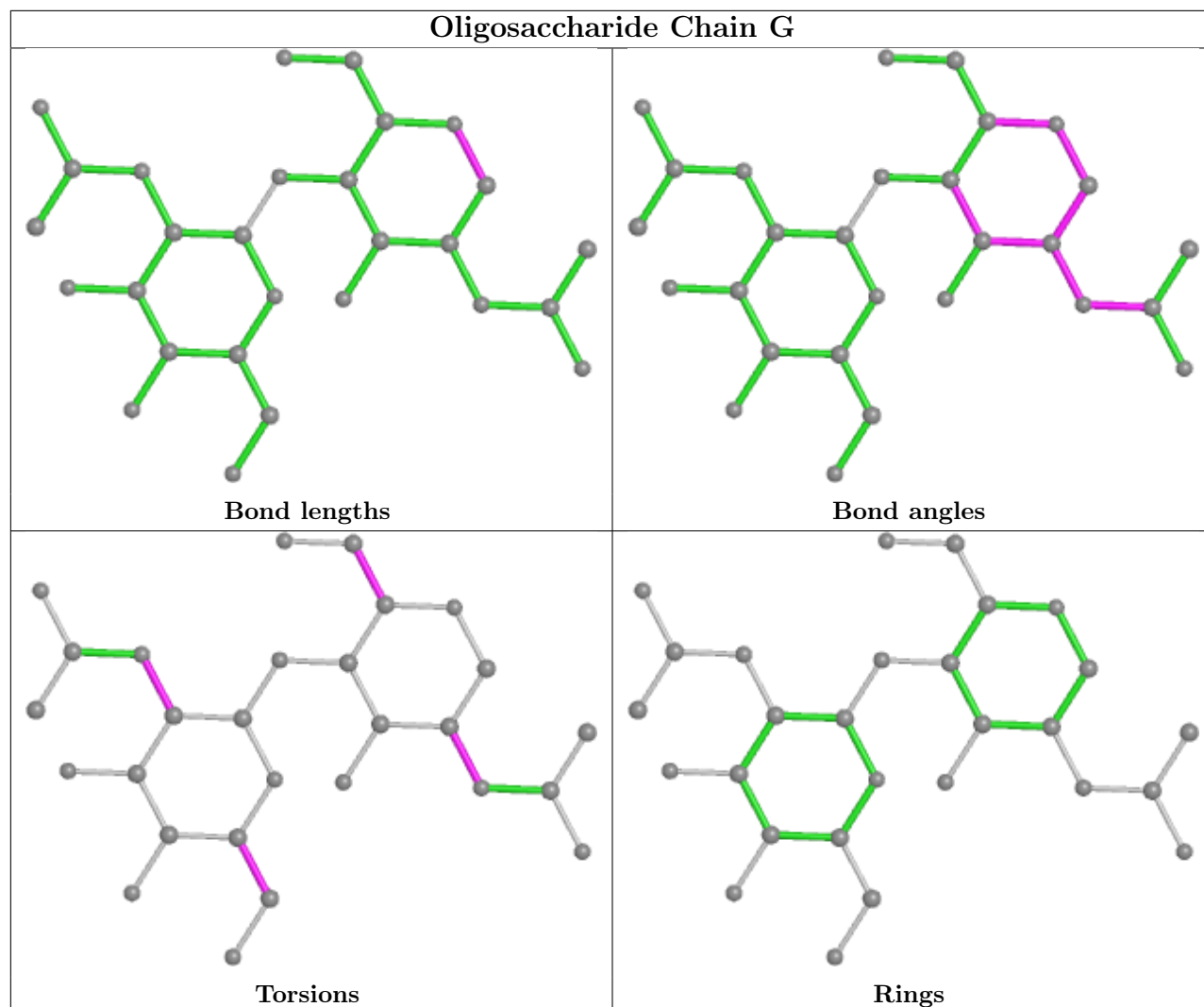
10 monomers are involved in 14 short contacts:

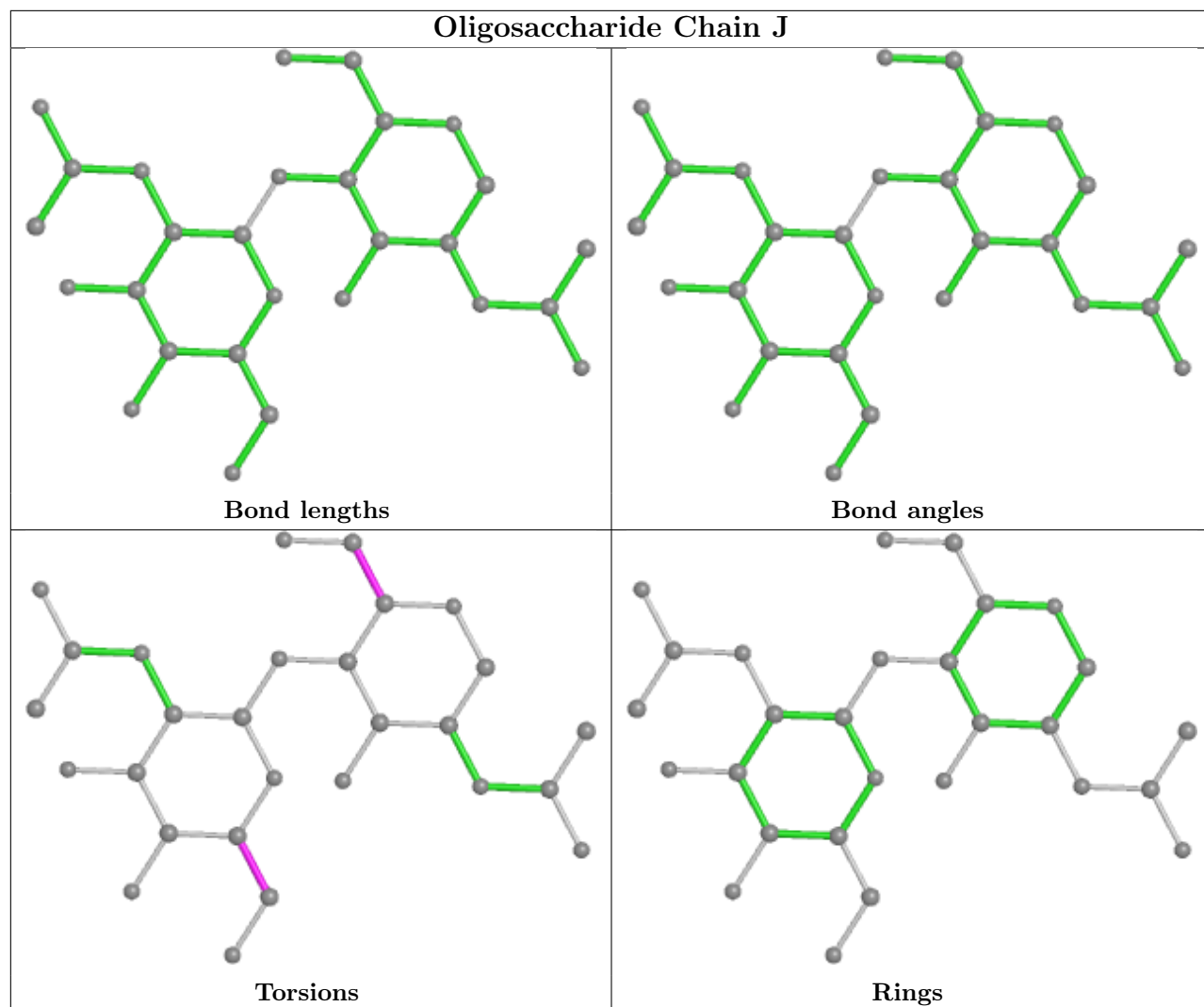
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	H	3	BMA	1	0
2	G	1	NAG	4	0
3	I	2	NAG	2	0
6	K	1	NAG	2	0
2	C	1	NAG	1	0
3	I	1	NAG	1	0
6	K	5	FUC	2	0
5	H	2	NAG	3	0
2	G	2	NAG	4	0
6	K	2	NAG	3	0

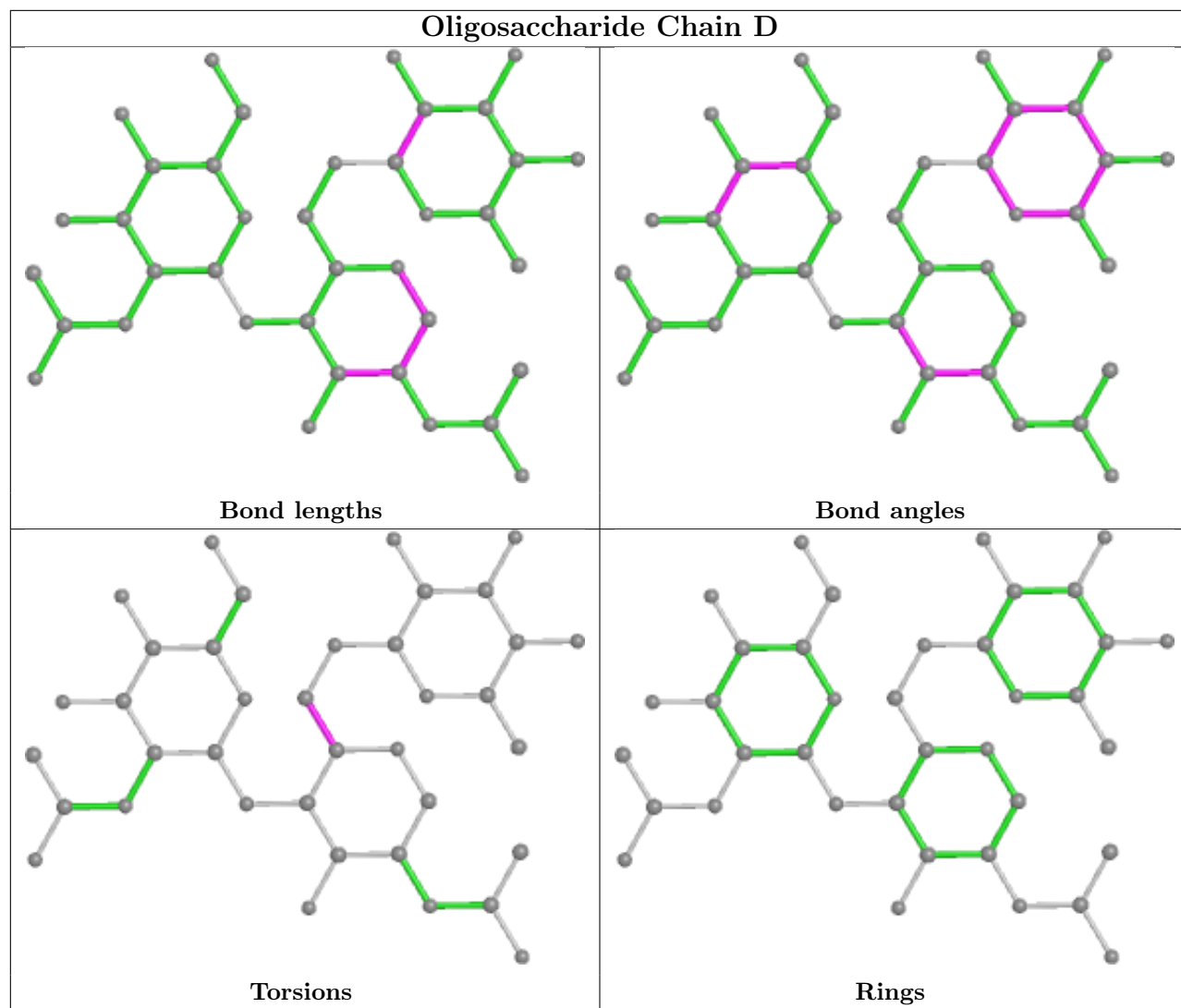
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

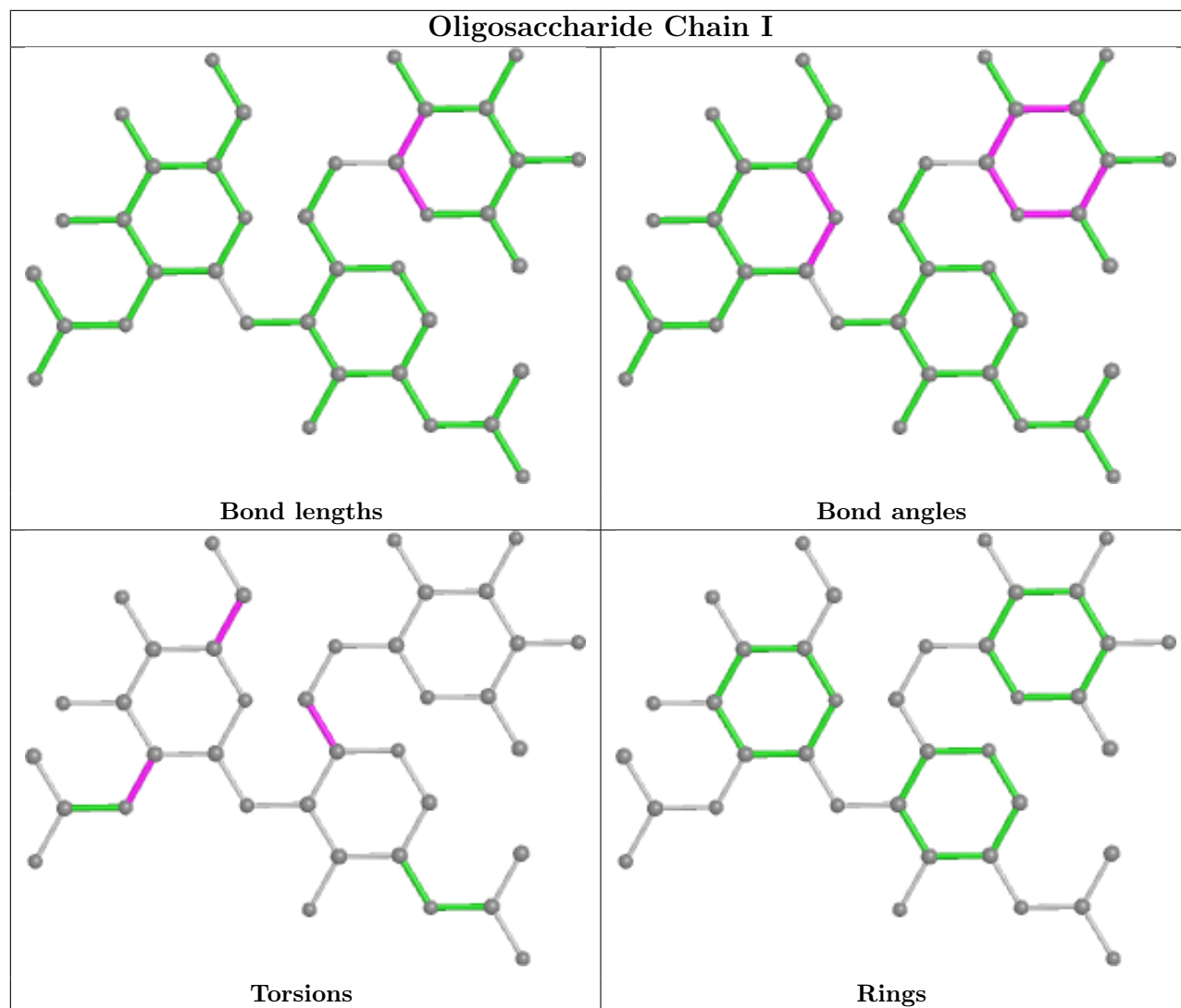


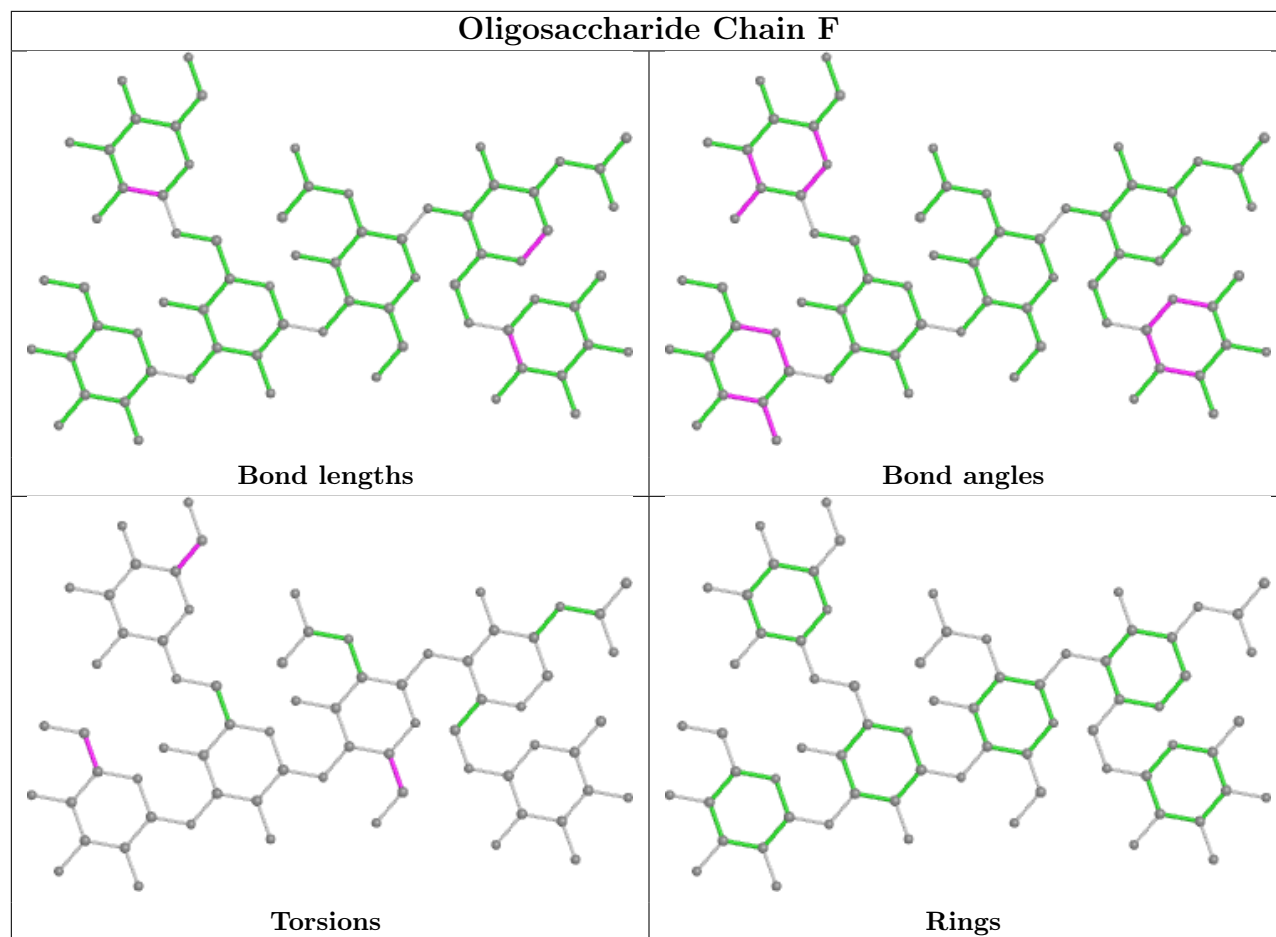


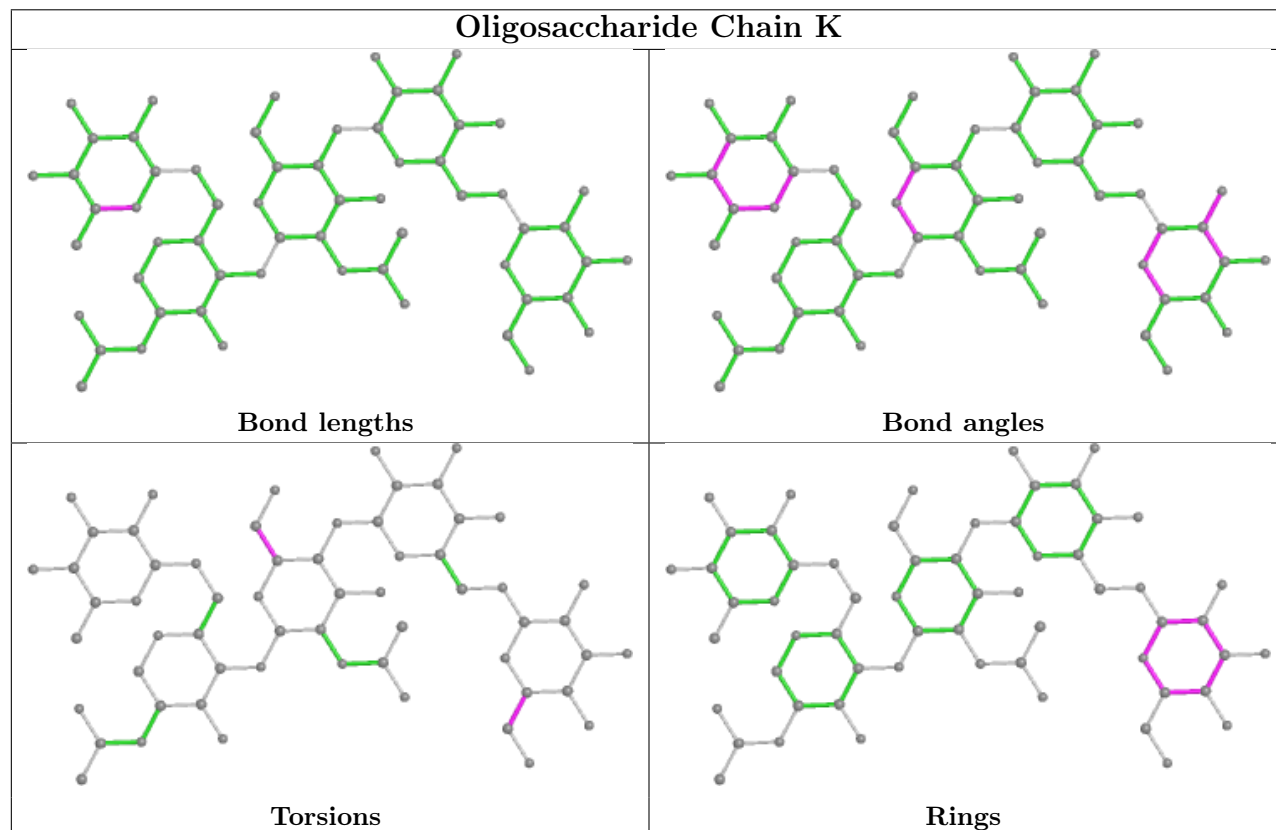
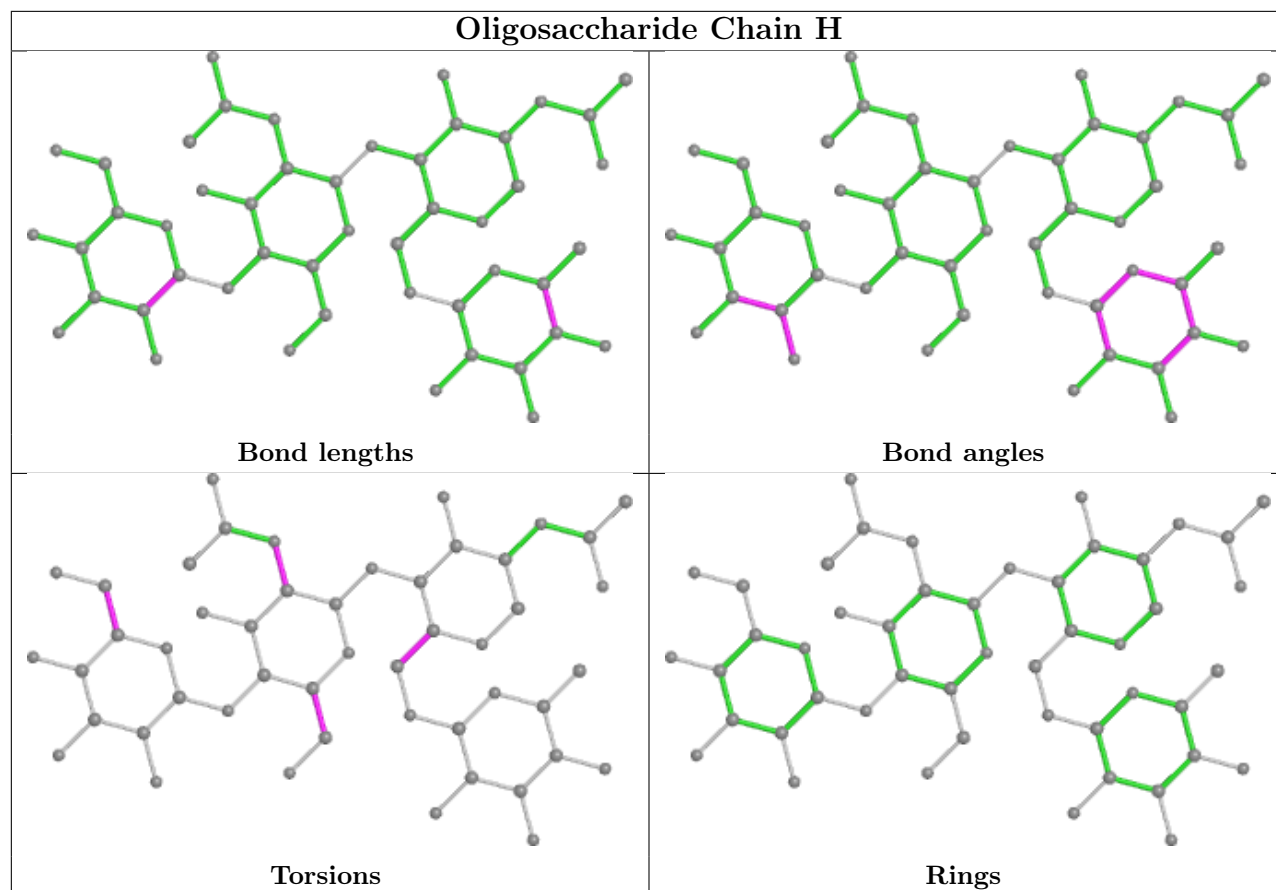












5.6 Ligand geometry

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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
8	NT8	B	717	7	14,18,18	0.98	0	14,26,26	0.96	0
8	NT8	A	718	7	14,18,18	0.99	0	14,26,26	0.98	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	NT8	B	717	7	-	4/27/28/28	-
8	NT8	A	718	7	-	5/27/28/28	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

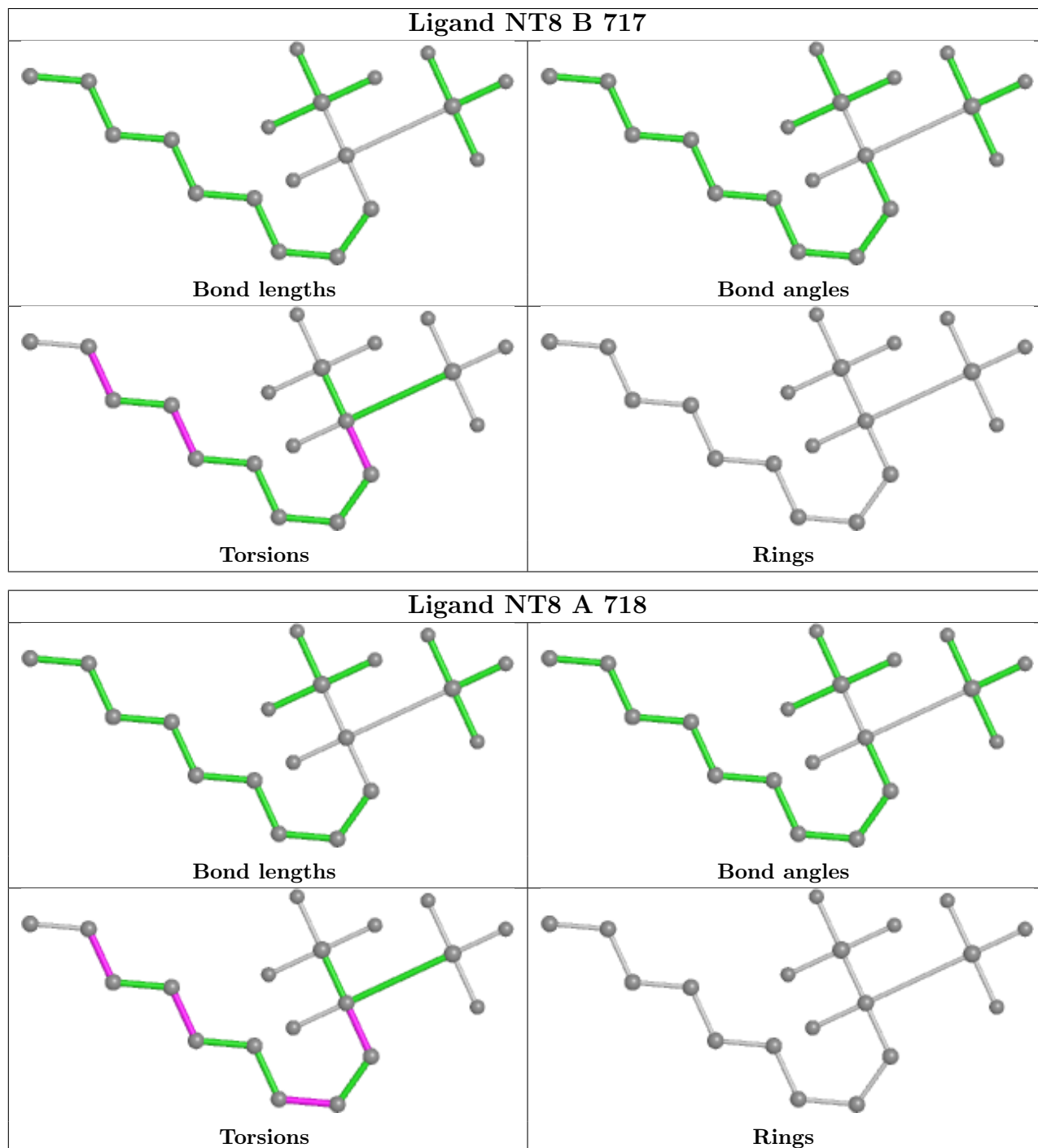
Mol	Chain	Res	Type	Atoms
8	A	718	NT8	P12-C02-C03-C04
8	A	718	NT8	P16-C02-C03-C04
8	B	717	NT8	P12-C02-C03-C04
8	B	717	NT8	P16-C02-C03-C04
8	A	718	NT8	C06-C07-C08-C09

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will

also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

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

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

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	523/538 (97%)	0.43	43 (8%) 11 14	23, 40, 88, 124	0
1	B	529/538 (98%)	0.19	23 (4%) 35 42	20, 33, 69, 109	0
All	All	1052/1076 (97%)	0.31	66 (6%) 20 23	20, 36, 79, 124	0

The worst 5 of 66 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	148	VAL	13.4
1	A	149	LEU	10.9
1	A	146	ARG	7.3
1	A	143	VAL	6.9
1	A	147	SER	6.8

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

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

6.3 Carbohydrates [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	G	1	14/15	0.75	0.35	66,91,124,131	0
2	NAG	G	2	14/15	0.78	0.46	91,113,134,137	0
3	NAG	D	2	14/15	0.78	0.40	54,79,93,97	0
4	FUC	F	6	10/11	0.80	0.24	52,64,77,83	0
5	BMA	H	3	11/12	0.81	0.33	69,85,101,105	0

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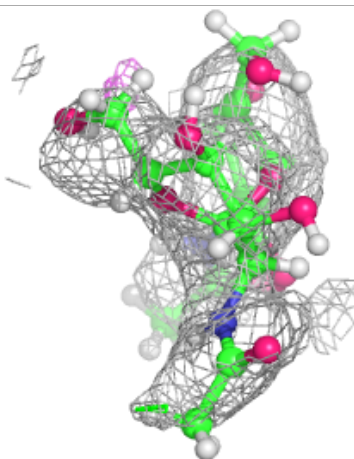
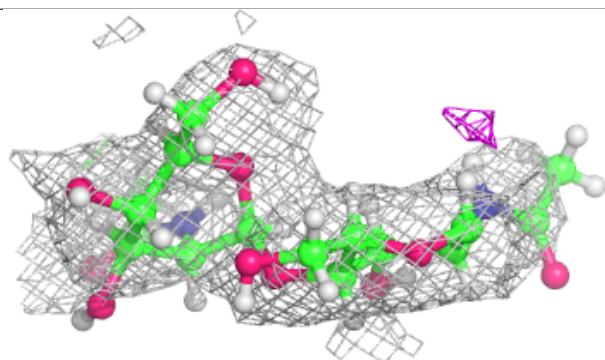
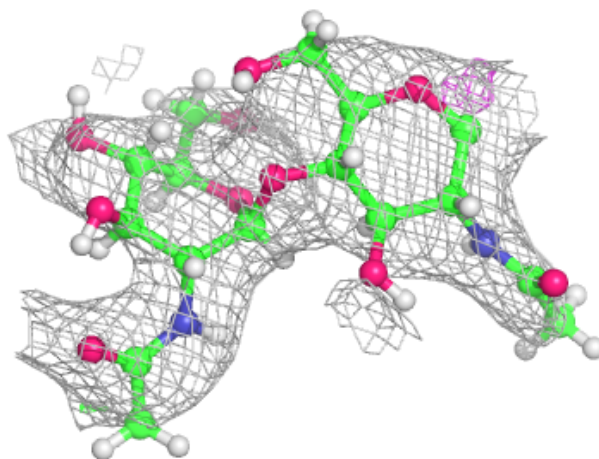
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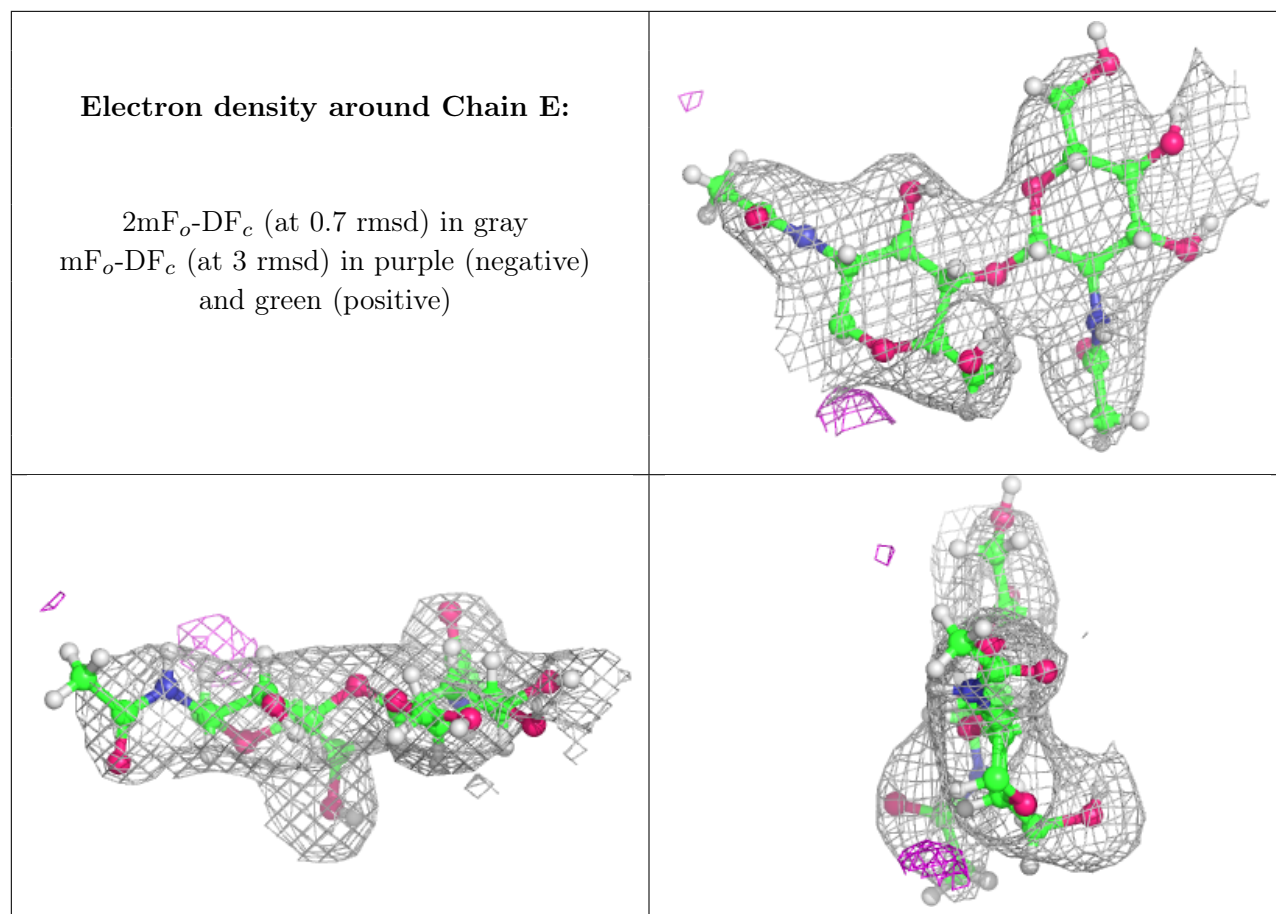
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	NAG	C	2	14/15	0.82	0.29	59,81,99,103	0
2	NAG	J	2	14/15	0.82	0.27	58,75,89,90	0
3	NAG	D	1	14/15	0.82	0.23	56,67,81,91	0
4	MAN	F	5	11/12	0.85	0.33	62,80,96,103	0
3	FUC	D	3	10/11	0.85	0.41	52,65,78,84	0
5	NAG	H	2	14/15	0.85	0.16	47,66,81,86	0
4	MAN	F	4	11/12	0.85	0.22	68,77,90,95	0
6	MAN	K	4	11/12	0.85	0.31	72,93,112,122	0
6	FUC	K	5	10/11	0.85	0.22	60,75,92,96	0
3	NAG	I	2	14/15	0.86	0.51	64,81,96,110	0
5	FUC	H	4	10/11	0.87	0.23	55,71,83,85	0
2	NAG	E	2	14/15	0.88	0.25	61,76,91,103	0
6	BMA	K	3	11/12	0.89	0.14	63,76,87,93	0
3	NAG	I	1	14/15	0.90	0.22	52,63,77,83	0
2	NAG	C	1	14/15	0.90	0.30	61,71,84,96	0
3	FUC	I	3	10/11	0.90	0.32	52,62,73,88	0
4	BMA	F	3	11/12	0.91	0.15	45,65,76,78	0
2	NAG	J	1	14/15	0.94	0.19	33,44,56,57	0
5	NAG	H	1	14/15	0.94	0.18	45,59,70,71	0
6	NAG	K	2	14/15	0.95	0.13	42,54,68,70	0
4	NAG	F	2	14/15	0.95	0.11	38,45,53,60	0
2	NAG	E	1	14/15	0.95	0.14	46,58,68,72	0
4	NAG	F	1	14/15	0.95	0.10	41,50,57,60	0
6	NAG	K	1	14/15	0.96	0.21	51,64,70,74	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 C:

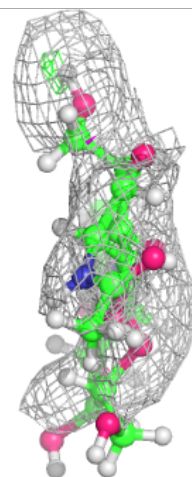
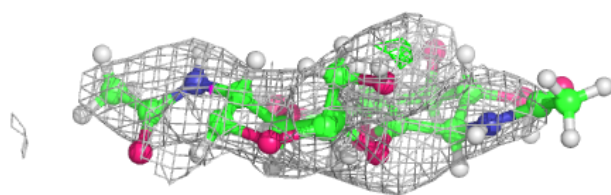
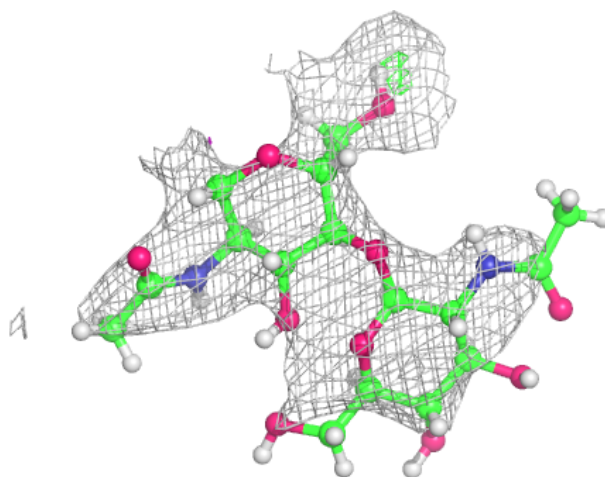
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

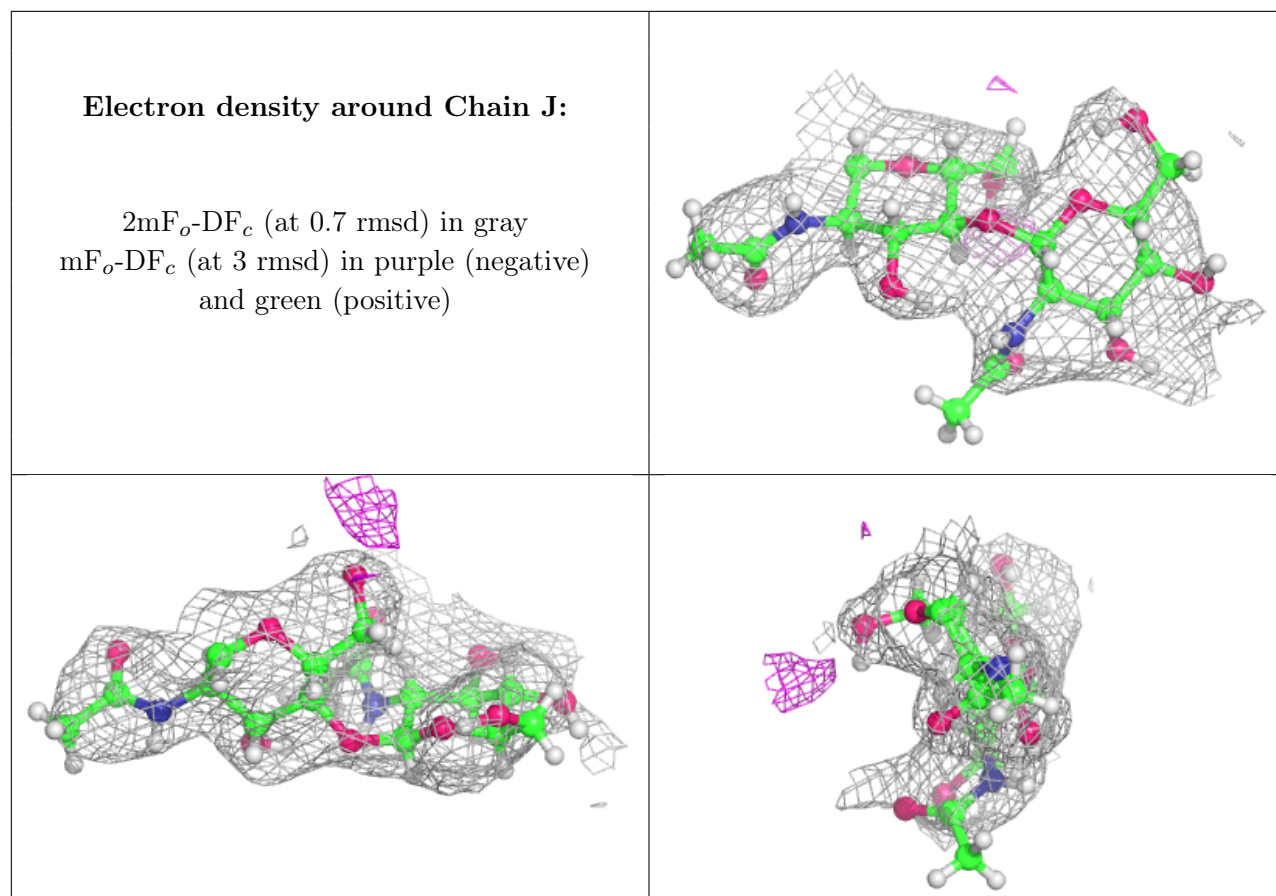




Electron density around Chain G:

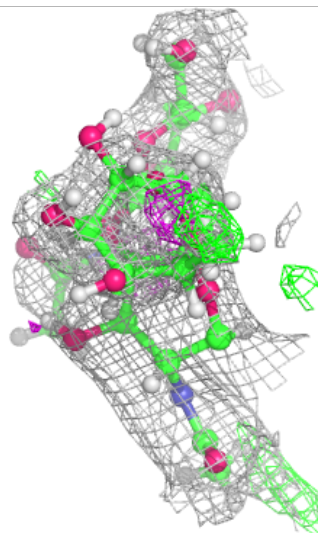
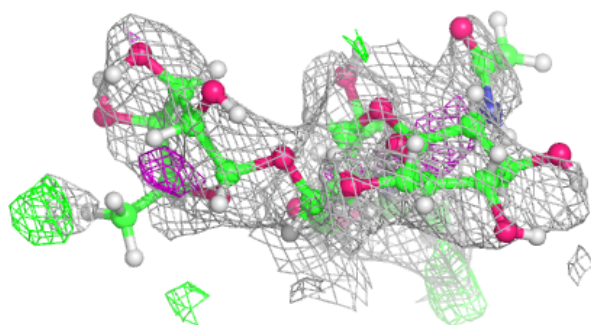
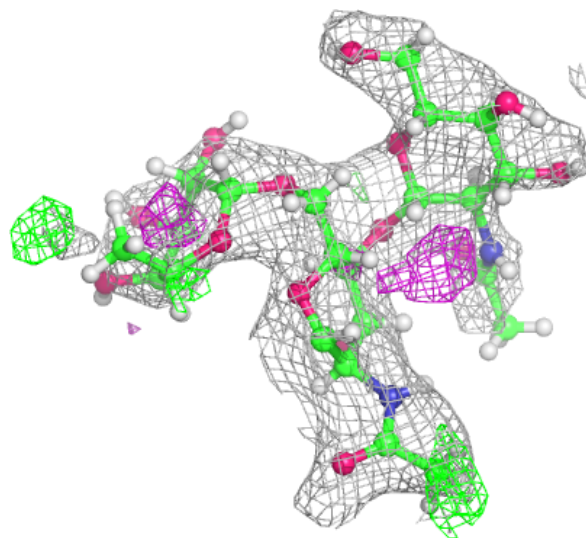
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





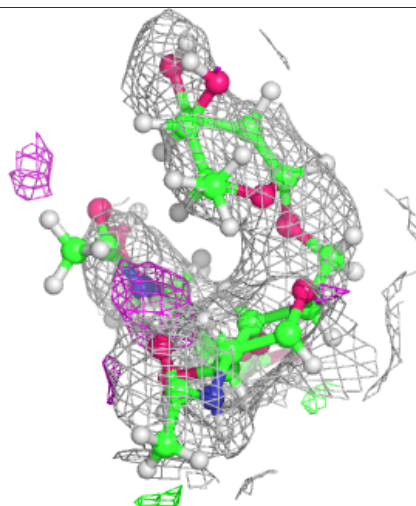
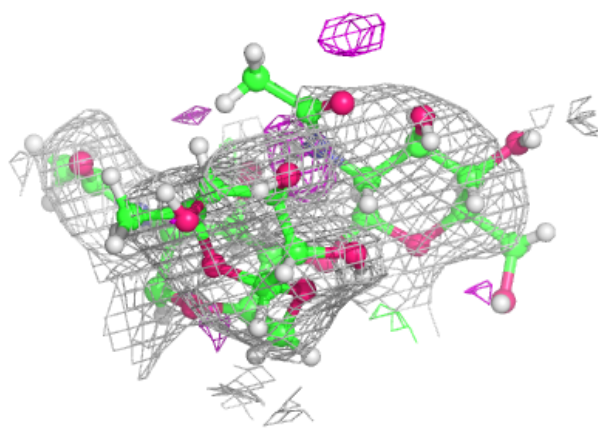
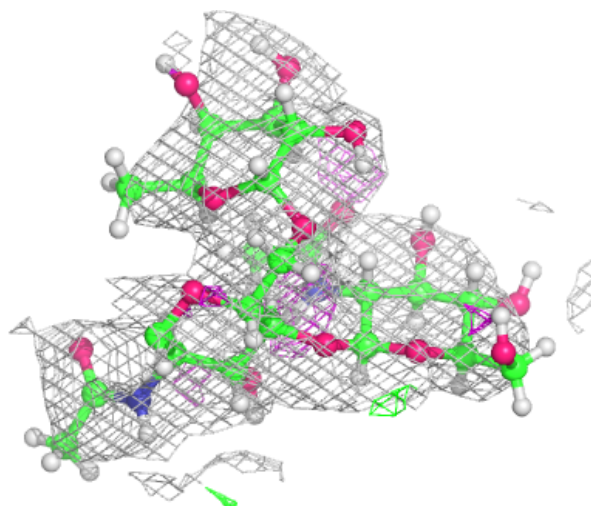
Electron density around Chain D:

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



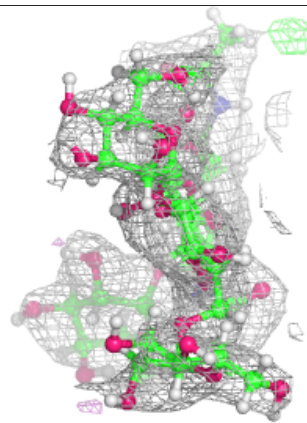
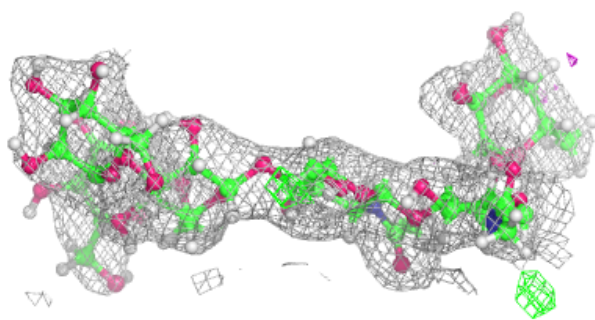
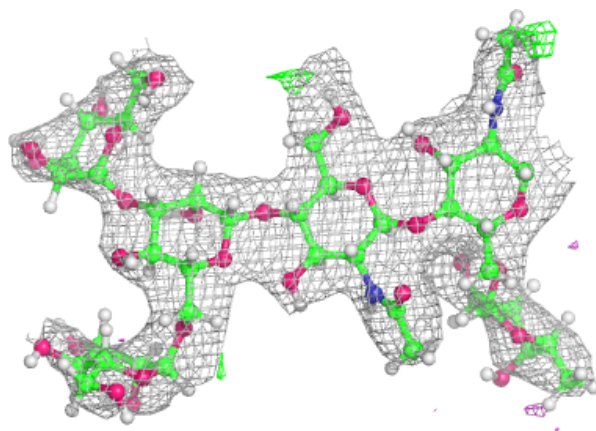
Electron density around Chain I:

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



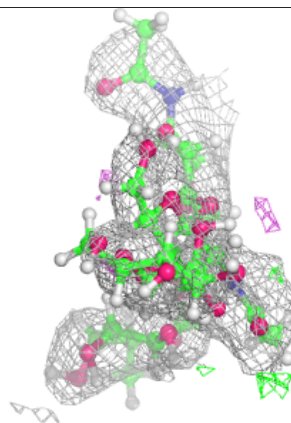
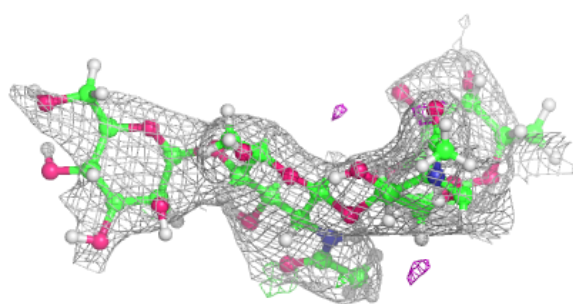
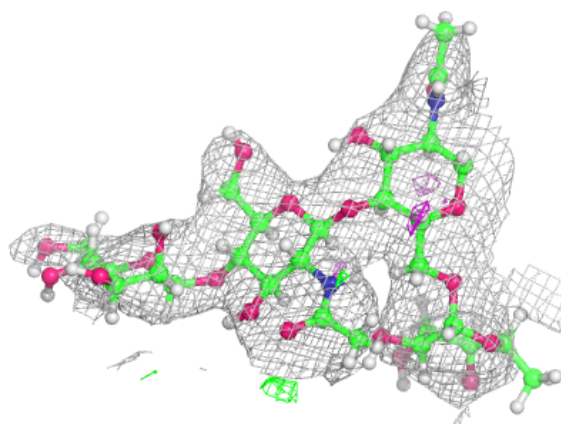
Electron density around Chain F:

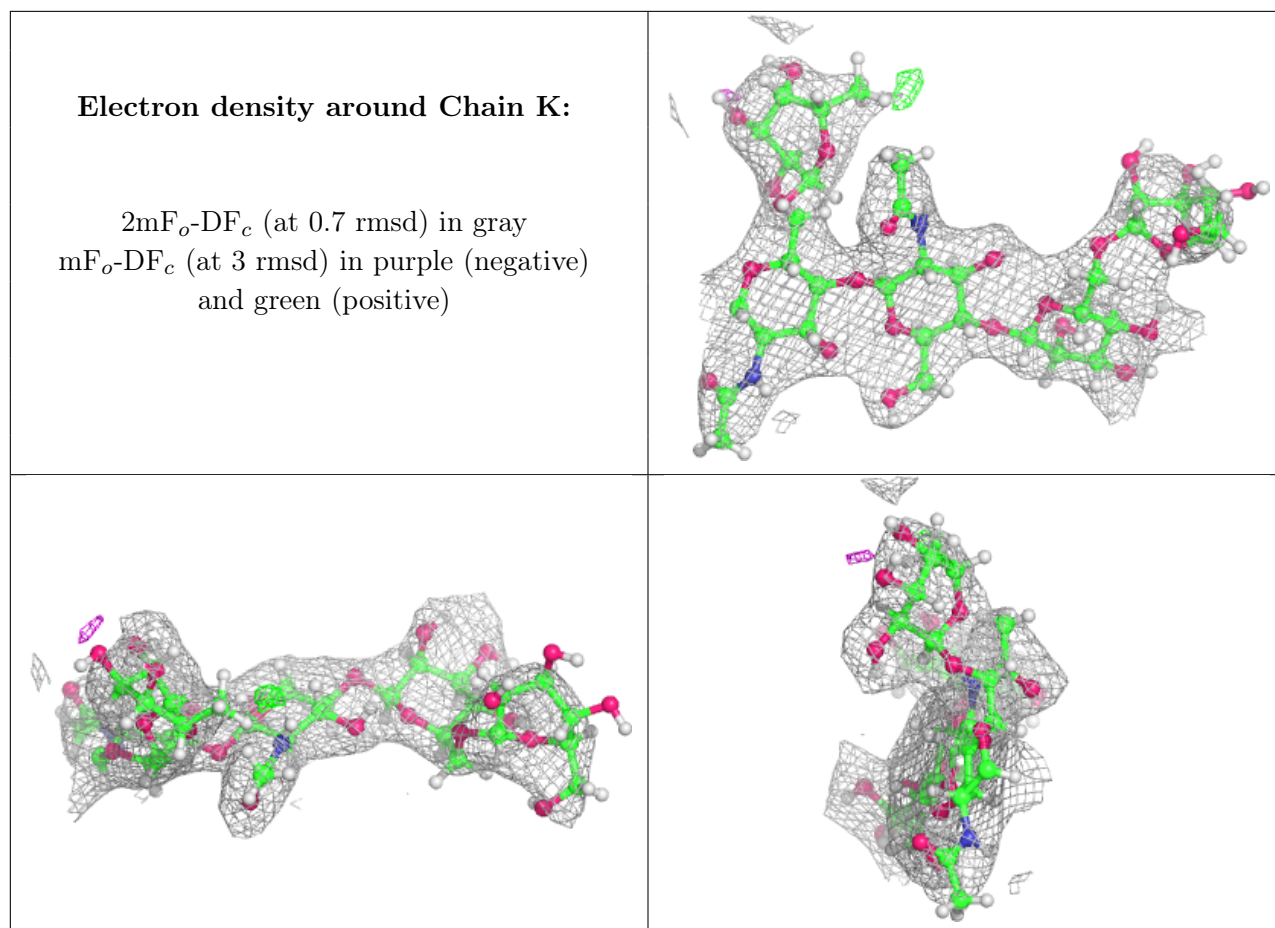
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain H:

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





6.4 Ligands [i](#)

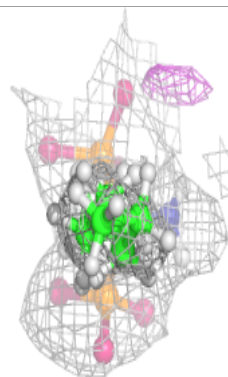
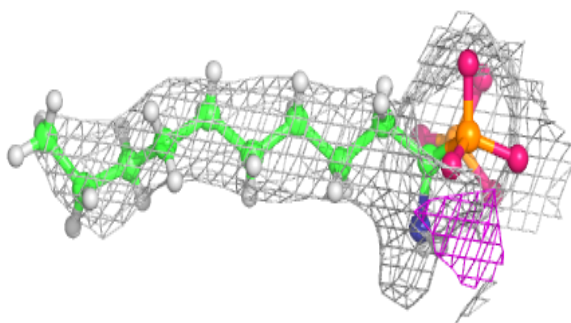
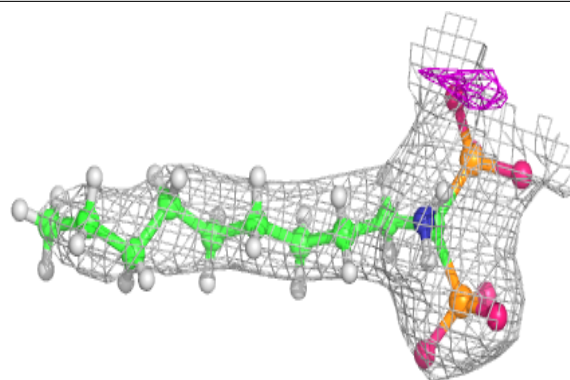
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	ZN	A	701	1/1	0.96	0.13	43,43,43,43	0
8	NT8	A	718	19/19	0.96	0.16	35,51,64,64	0
8	NT8	B	717	19/19	0.96	0.18	24,36,47,50	0
7	ZN	B	701	1/1	0.97	0.12	36,36,36,36	0
7	ZN	A	702	1/1	0.98	0.10	47,47,47,47	0
7	ZN	B	702	1/1	0.98	0.07	38,38,38,38	0

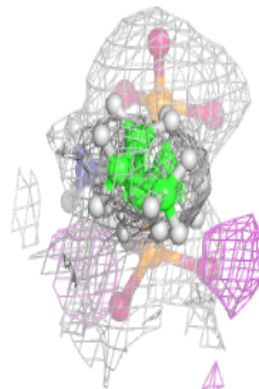
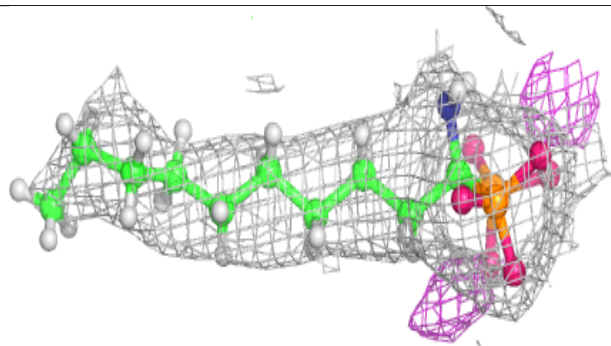
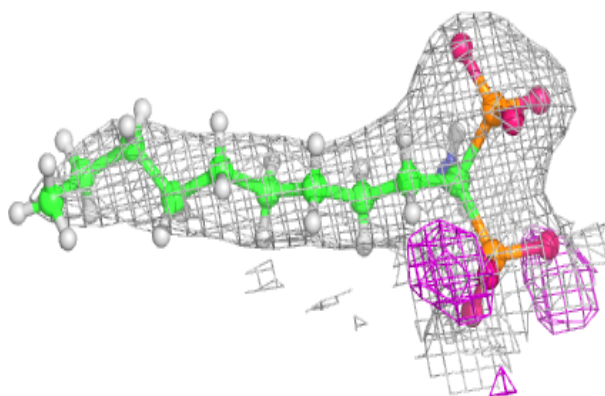
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around NT8 A 718:

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

**Electron density around NT8 B 717:**

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



6.5 Other polymers [i](#)

There are no such residues in this entry.