W O R L D W I D E

wwPDB

P R O T E I N D A T A B A N K

wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2025 – 01:37 pm BST

PDB ID	:	6HFY / pdb_00006hfy
Title	:	Influenza A virus N6 neuraminidase complex with DANA (Duck/England/56).
Authors	:	Salinger, M.T.; Hobbs, J.R.; Murray, J.W.; Laver, W.G.; Kuhn, P.; Garman, E.F.
Deposited on	:	2018-08-22
Resolution	:	1.65 Å(reported)

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

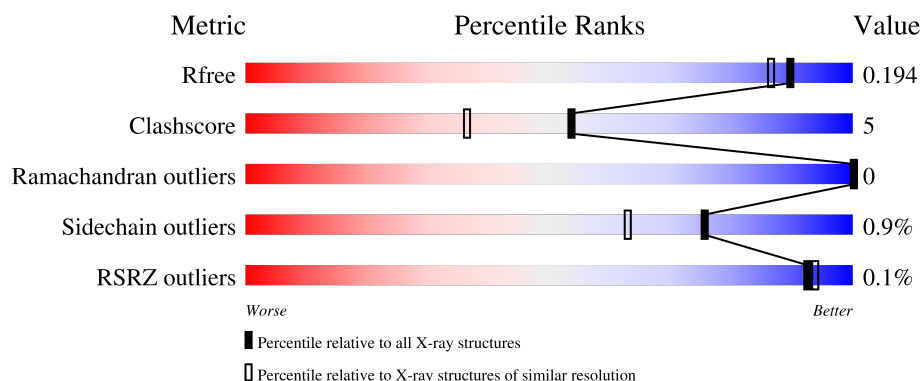|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

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 1.65 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	Percentile Ranks	Value
Rfree		0.194
Clashscore		5
Ramachandran outliers		0
Sidechain outliers		0.9%
RSRZ outliers		0.1%

Worse ___ *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	2328 (1.66-1.66)
Clashscore	180529	2515 (1.66-1.66)
Ramachandran outliers	177936	2475 (1.66-1.66)
Sidechain outliers	177891	2475 (1.66-1.66)
RSRZ outliers	164620	2328 (1.66-1.66)

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 <=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	389	88% 11% ·
1	B	389	91% 9%
1	C	389	% 90% 9% ·
1	D	389	90% 8% ··
2	E	2	100%

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Mol	Chain	Length	Quality of chain
2	G	2	100%
3	F	7	86% 14%
4	H	6	83% 17%
4	I	6	67% 33%
4	J	6	100%

2 Entry composition ⓘ

There are 9 unique types of molecules in this entry. The entry contains 14206 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 Neuraminidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	389	Total	C	N	O	S	0	8	0
			3072	1912	547	585	28			
1	B	389	Total	C	N	O	S	0	12	0
			3110	1938	555	590	27			
1	C	389	Total	C	N	O	S	0	8	0
			3072	1911	545	589	27			
1	D	389	Total	C	N	O	S	0	8	0
			3082	1919	546	589	28			

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

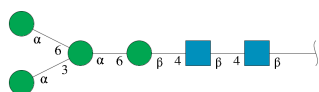| Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	E	2	Total	C	N	O	0	0	0
			28	16	2	10			
2	G	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]alpha-D-mannopyranose-(1-6)-[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.
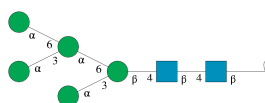
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	F	7	Total	C	N	O	0	0	0
			83	46	2	35			

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyran ose-(1-6)]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.
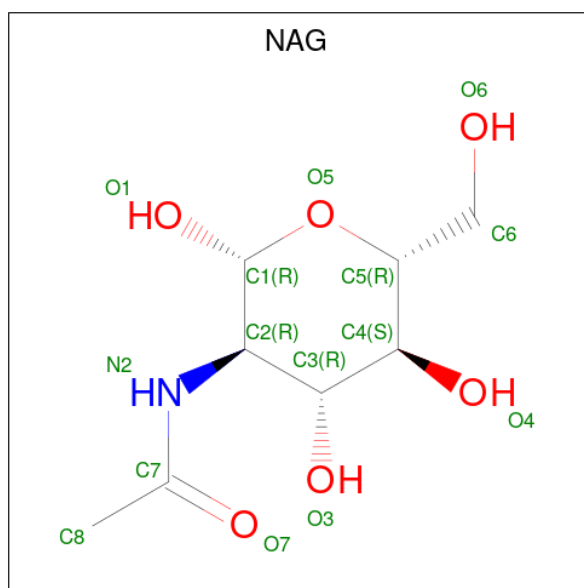

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	H	6	Total	C	N	O	0	0	0
			72	40	2	30			
4	I	6	Total	C	N	O	0	0	0
			72	40	2	30			
4	J	6	Total	C	N	O	0	0	0
			72	40	2	30			

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).

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

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

- Molecule 6 is 2-DEOXY-2,3-DEHYDRO-N-ACETYL-NEURAMINIC ACID (CCD ID: DAN) (formula: $C_{11}H_{17}NO_8$).
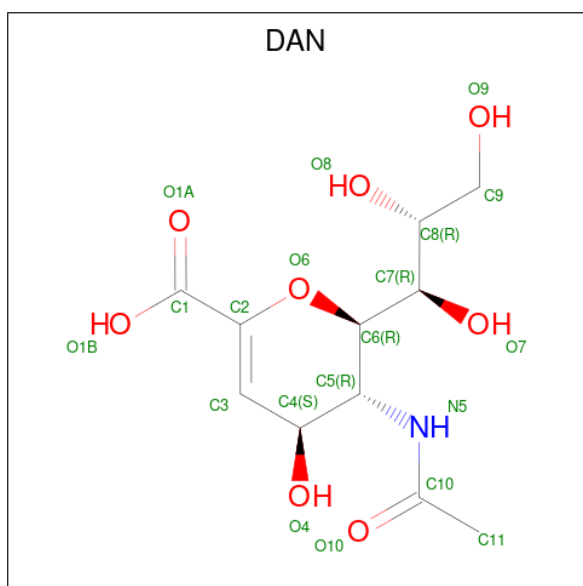
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total 20	C 11	N 1	O 8	0	0
6	B	1	Total 20	C 11	N 1	O 8	0	0
6	C	1	Total 20	C 11	N 1	O 8	0	0
6	D	1	Total 20	C 11	N 1	O 8	0	0

- Molecule 7 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).

GOL

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total 6	C 3	O 3	0	0
7	A	1	Total 6	C 3	O 3	0	0
7	B	1	Total 6	C 3	O 3	0	0
7	B	1	Total 6	C 3	O 3	0	0
7	B	1	Total 6	C 3	O 3	0	0
7	C	1	Total 6	C 3	O 3	0	0
7	C	1	Total 6	C 3	O 3	0	0
7	D	1	Total 6	C 3	O 3	0	0
7	D	1	Total 6	C 3	O 3	0	0

- Molecule 8 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	D	1	Total 1	Ca 1	0	0

- Molecule 9 is water.

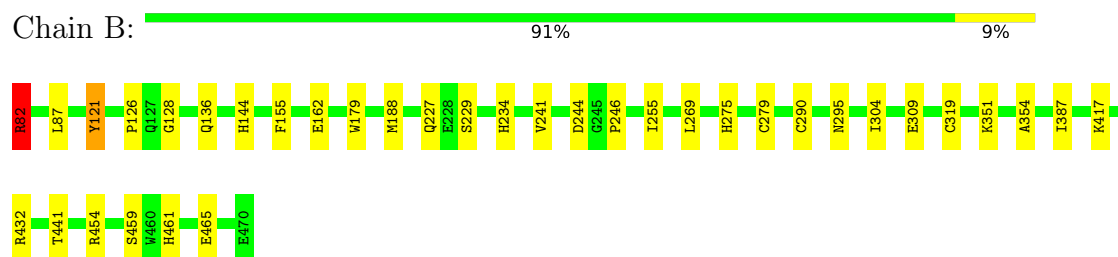| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	335	Total 335	O 335	0	0
9	B	327	Total 327	O 327	0	0
9	C	322	Total 322	O 322	0	0
9	D	322	Total 322	O 322	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.
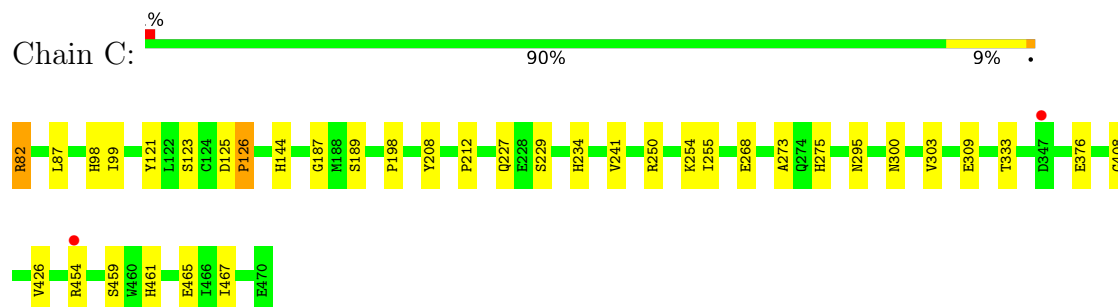
- Molecule 1: Neuraminidase
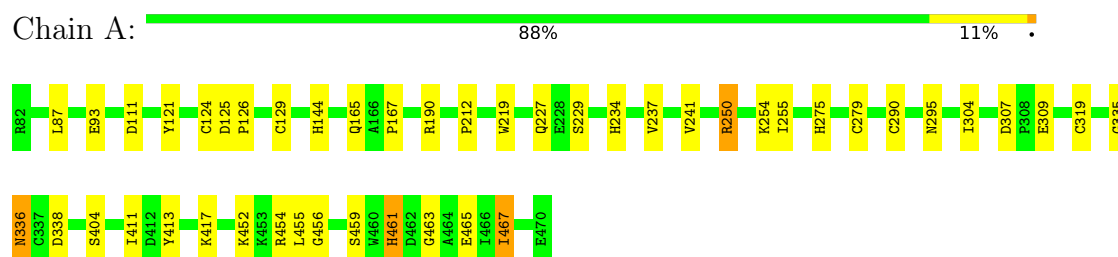
Chain A:
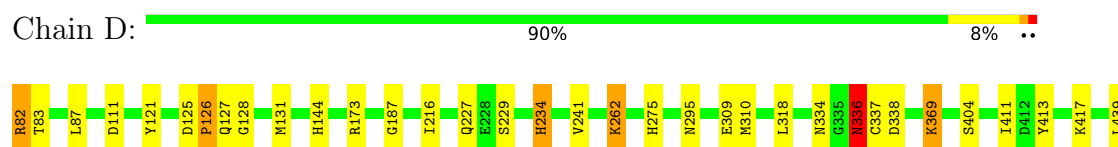
- Molecule 1: Neuraminidase

Chain B:

- Molecule 1: Neuraminidase

Chain C:

- Molecule 1: Neuraminidase

Chain D:

R454 L455 G456 S457 W458 A464 E465 Y468 F469 E470

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

Chain E: 100%

NAG1 NAG2

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

Chain G: 100%

NAG1 NAG2

• Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]alpha-D-mannopyranose-(1-6)-[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 F: 86%   14%
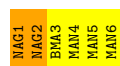
NAG1 NAG2 BMA3 MAN4 MAN5 MAN6 MAN7

• Molecule 4: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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 H: 83%   17%

NAG1 NAG2 BMA3 MAN4 MAN5 MAN6

• Molecule 4: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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 I: 67%   33%

NAG1 NAG2 BMA3 MAN4 MAN5 MAN6

• Molecule 4: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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 J: 100%

NAG1 NAG2 BMA3 MAN4 MAN5 MAN6

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	106.00Å 75.76Å 105.98Å 90.00° 90.50° 90.00°	Depositor
Resolution (Å)	20.05 – 1.65 20.05 – 1.65	Depositor EDS
% Data completeness (in resolution range)	91.2 (20.05-1.65) 91.3 (20.05-1.65)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	2.47 (at 1.65Å)	Xtriage
Refinement program	REFMAC 5.8.0230	Depositor
R, R_{free}	0.156 , 0.185 0.167 , 0.194	Depositor DCC
R_{free} test set	9170 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	12.8	Xtriage
Anisotropy	0.249	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 36.4	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.51, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.000 for -l,k,h 0.010 for -h,-k,l 0.010 for l,-k,h	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14206	wwPDB-VP
Average B, all atoms (Å^2)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< \lvert L \rvert >$, $< L^2 >$ 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: DAN, CA, NAG, GOL, MAN, BMA

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	1.14	6/3147 (0.2%)	1.06	1/4267 (0.0%)
1	B	1.07	6/3186 (0.2%)	1.02	0/4318
1	C	1.12	8/3147 (0.3%)	1.05	1/4269 (0.0%)
1	D	1.15	6/3157 (0.2%)	1.08	4/4280 (0.1%)
All	All	1.12	26/12637 (0.2%)	1.05	6/17134 (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
1	A	0	2
1	B	0	3
1	C	0	3
1	D	0	2
All	All	0	10

The worst 5 of 26 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	121	TYR	C-O	-6.61	1.17	1.24
1	D	336	ASN	C-O	-6.61	1.16	1.23
1	C	99	ILE	C-O	-6.49	1.17	1.24
1	B	144	HIS	CE1-NE2	6.18	1.38	1.32
1	C	98	HIS	CE1-NE2	5.97	1.38	1.32

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	334	ASN	CA-CB-CG	5.92	118.52	112.60
1	D	83	THR	CA-CB-OG1	-5.77	100.94	109.60
1	A	404	SER	CA-C-O	5.55	121.83	118.33
1	D	128	GLY	CA-C-O	-5.11	117.39	120.91
1	C	300	ASN	CA-CB-CG	5.09	117.69	112.60

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	250[A]	ARG	Sidechain
1	A	454	ARG	Sidechain
1	B	432	ARG	Sidechain
1	B	454	ARG	Sidechain
1	B	82	ARG	Sidechain

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	3072	0	2944	37	0
1	B	3110	0	2987	29	0
1	C	3072	0	2937	33	0
1	D	3082	0	2953	33	0
2	E	28	0	25	0	0
2	G	28	0	25	0	0
3	F	83	0	70	1	0
4	H	72	0	61	2	0
4	I	72	0	61	2	0
4	J	72	0	61	0	0
5	A	14	0	13	0	0
5	B	14	0	13	0	0
5	C	28	0	26	0	0
5	D	14	0	13	0	0
6	A	20	0	16	0	0
6	B	20	0	16	0	0
6	C	20	0	16	0	0
6	D	20	0	16	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	12	0	16	1	0
7	B	18	0	24	3	0
7	C	12	0	16	1	0
7	D	12	0	16	2	0
8	A	1	0	0	0	0
8	B	2	0	0	0	0
8	C	1	0	0	0	0
8	D	1	0	0	0	0
9	A	335	0	0	5	0
9	B	327	0	0	1	0
9	C	322	0	0	3	0
9	D	322	0	0	5	0
All	All	14206	0	12325	121	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 5.

The worst 5 of 121 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:C:465[A]:GLU:HG3	1:C:467:ILE:HG22	1.45	0.96
1:B:82:ARG:HH21	1:B:82:ARG:HB2	1.29	0.94
1:C:465[A]:GLU:CG	1:C:467:ILE:HG22	1.97	0.93
1:D:87:LEU:H	1:D:234:HIS:HD2	1.20	0.90
1:A:144:HIS:HE1	1:C:465[A]:GLU:H	1.21	0.88

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	395/389 (102%)	380 (96%)	15 (4%)	0	100	100
1	B	399/389 (103%)	384 (96%)	15 (4%)	0	100	100
1	C	395/389 (102%)	384 (97%)	11 (3%)	0	100	100
1	D	396/389 (102%)	382 (96%)	14 (4%)	0	100	100
All	All	1585/1556 (102%)	1530 (96%)	55 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	339/331 (102%)	334 (98%)	5 (2%)	60	41
1	B	343/331 (104%)	340 (99%)	3 (1%)	75	63
1	C	339/331 (102%)	339 (100%)	0	100	100
1	D	340/331 (103%)	335 (98%)	5 (2%)	60	41
All	All	1361/1324 (103%)	1348 (99%)	13 (1%)	75	59

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	179	TRP
1	D	262	LYS
1	D	454	ARG
1	D	369	LYS
1	D	439	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 46 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	227	GLN
1	C	421	ASN
1	C	234	HIS

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Mol	Chain	Res	Type
1	C	334	ASN
1	C	461	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

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	E	1	1,2	14,14,15	0.74	0	17,19,21	1.35	2 (11%)
2	NAG	E	2	2	14,14,15	0.93	0	17,19,21	2.05	5 (29%)
3	NAG	F	1	1,3	14,14,15	1.46	2 (14%)	17,19,21	1.91	3 (17%)
3	NAG	F	2	3	14,14,15	0.86	1 (7%)	17,19,21	1.51	3 (17%)
3	BMA	F	3	3	11,11,12	1.05	1 (9%)	15,15,17	1.30	2 (13%)
3	MAN	F	4	3	11,11,12	1.47	2 (18%)	15,15,17	1.32	2 (13%)
3	MAN	F	5	3	11,11,12	0.93	0	15,15,17	1.31	3 (20%)
3	MAN	F	6	3	11,11,12	1.38	3 (27%)	15,15,17	1.51	4 (26%)
3	MAN	F	7	3	11,11,12	1.57	3 (27%)	15,15,17	1.36	3 (20%)
2	NAG	G	1	1,2	14,14,15	0.96	0	17,19,21	1.21	1 (5%)
2	NAG	G	2	2	14,14,15	0.61	0	17,19,21	1.39	3 (17%)
4	NAG	H	1	1,4	14,14,15	0.82	0	17,19,21	2.36	7 (41%)
4	NAG	H	2	4	14,14,15	1.06	1 (7%)	17,19,21	1.70	5 (29%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
4	BMA	H	3	4	11,11,12	1.16	1 (9%)	15,15,17	1.18	2 (13%)
4	MAN	H	4	4	11,11,12	1.01	1 (9%)	15,15,17	1.43	1 (6%)
4	MAN	H	5	4	11,11,12	1.21	1 (9%)	15,15,17	1.48	3 (20%)
4	MAN	H	6	4	11,11,12	2.08	4 (36%)	15,15,17	1.45	2 (13%)
4	NAG	I	1	1,4	14,14,15	1.08	1 (7%)	17,19,21	1.88	5 (29%)
4	NAG	I	2	4	14,14,15	0.63	0	17,19,21	1.33	1 (5%)
4	BMA	I	3	4	11,11,12	0.84	0	15,15,17	2.16	4 (26%)
4	MAN	I	4	4	11,11,12	1.09	1 (9%)	15,15,17	1.50	2 (13%)
4	MAN	I	5	4	11,11,12	1.16	0	15,15,17	1.23	1 (6%)
4	MAN	I	6	4	11,11,12	1.67	4 (36%)	15,15,17	1.56	4 (26%)
4	NAG	J	1	1,4	14,14,15	1.33	1 (7%)	17,19,21	2.25	5 (29%)
4	NAG	J	2	4	14,14,15	1.02	1 (7%)	17,19,21	1.33	2 (11%)
4	BMA	J	3	4	11,11,12	1.29	1 (9%)	15,15,17	2.71	8 (53%)
4	MAN	J	4	4	11,11,12	1.41	2 (18%)	15,15,17	1.29	2 (13%)
4	MAN	J	5	4	11,11,12	0.93	0	15,15,17	1.49	3 (20%)
4	MAN	J	6	4	11,11,12	1.61	2 (18%)	15,15,17	2.02	3 (20%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	E	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	E	2	2	-	0/6/23/26	0/1/1/1
3	NAG	F	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	F	2	3	-	0/6/23/26	0/1/1/1
3	BMA	F	3	3	-	0/2/19/22	0/1/1/1
3	MAN	F	4	3	-	0/2/19/22	0/1/1/1
3	MAN	F	5	3	-	1/2/19/22	0/1/1/1
3	MAN	F	6	3	-	0/2/19/22	0/1/1/1
3	MAN	F	7	3	-	0/2/19/22	0/1/1/1
2	NAG	G	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	G	2	2	-	0/6/23/26	0/1/1/1
4	NAG	H	1	1,4	-	4/6/23/26	0/1/1/1
4	NAG	H	2	4	-	0/6/23/26	0/1/1/1
4	BMA	H	3	4	-	0/2/19/22	0/1/1/1
4	MAN	H	4	4	-	0/2/19/22	0/1/1/1

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

The worst 5 of 33 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	H	6	MAN	O2-C2	4.10	1.52	1.43
4	J	1	NAG	O5-C1	3.73	1.49	1.43
4	J	6	MAN	C2-C3	3.47	1.57	1.52
3	F	7	MAN	C2-C3	3.43	1.57	1.52
3	F	4	MAN	O4-C4	3.12	1.50	1.43

The worst 5 of 91 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	J	1	NAG	O5-C1-C2	-7.12	100.05	111.29
4	J	6	MAN	C1-O5-C5	5.83	120.09	112.19
3	F	1	NAG	O5-C1-C2	-5.38	102.79	111.29
4	H	1	NAG	C1-O5-C5	5.15	119.16	112.19
4	J	3	BMA	O5-C5-C6	-5.14	99.14	107.20

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	I	6	MAN	O5-C5-C6-O6
4	I	6	MAN	C4-C5-C6-O6
4	H	1	NAG	O5-C5-C6-O6
4	H	1	NAG	C8-C7-N2-C2

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Mol	Chain	Res	Type	Atoms
4	H	1	NAG	O7-C7-N2-C2

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	I	2	NAG	1	0
4	H	1	NAG	2	0
3	F	5	MAN	1	0
4	I	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.

Oligosaccharide Chain E

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain G

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain F

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain H

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain I

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain J

Bond lengths

Bond angles

Torsions

Rings
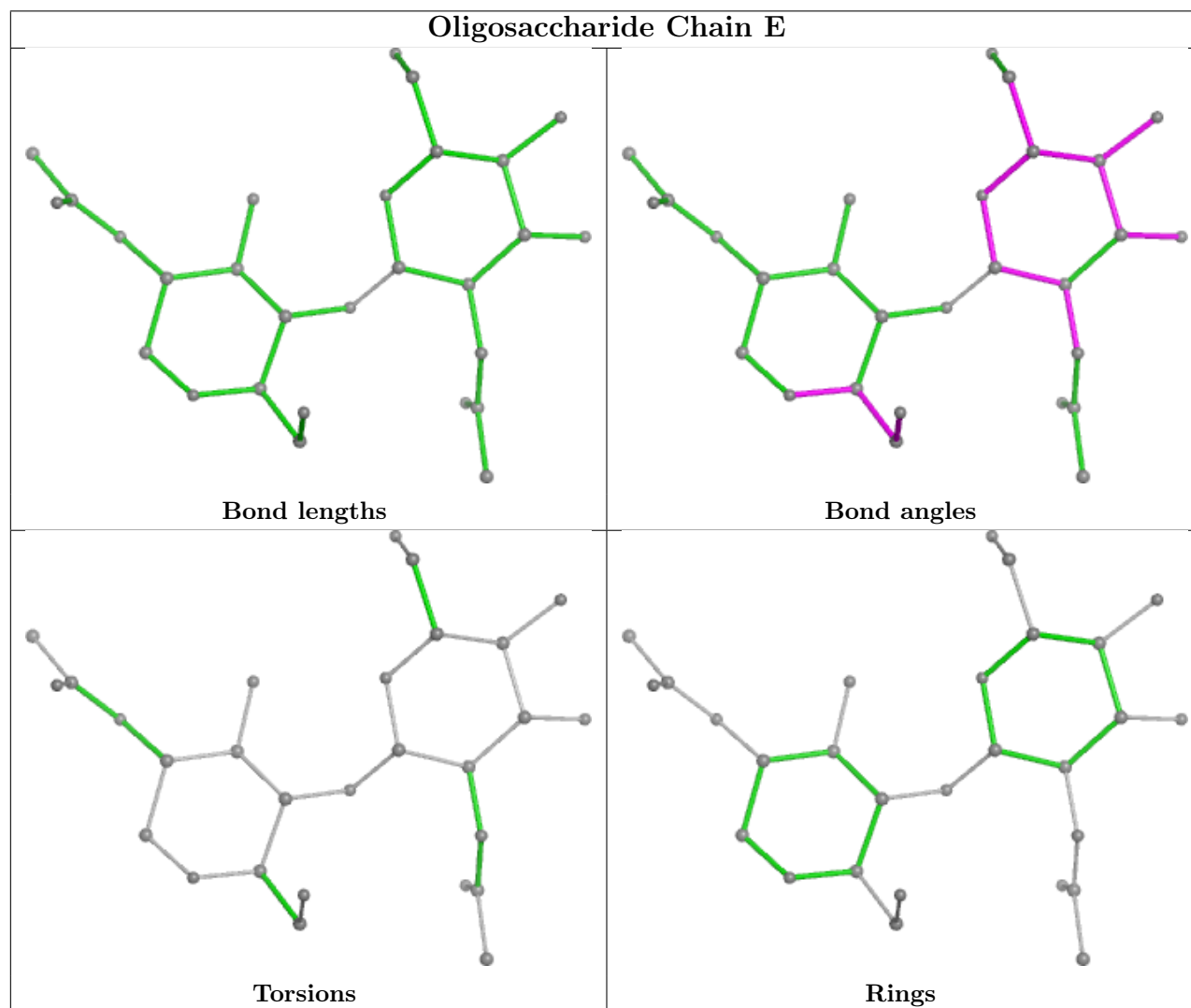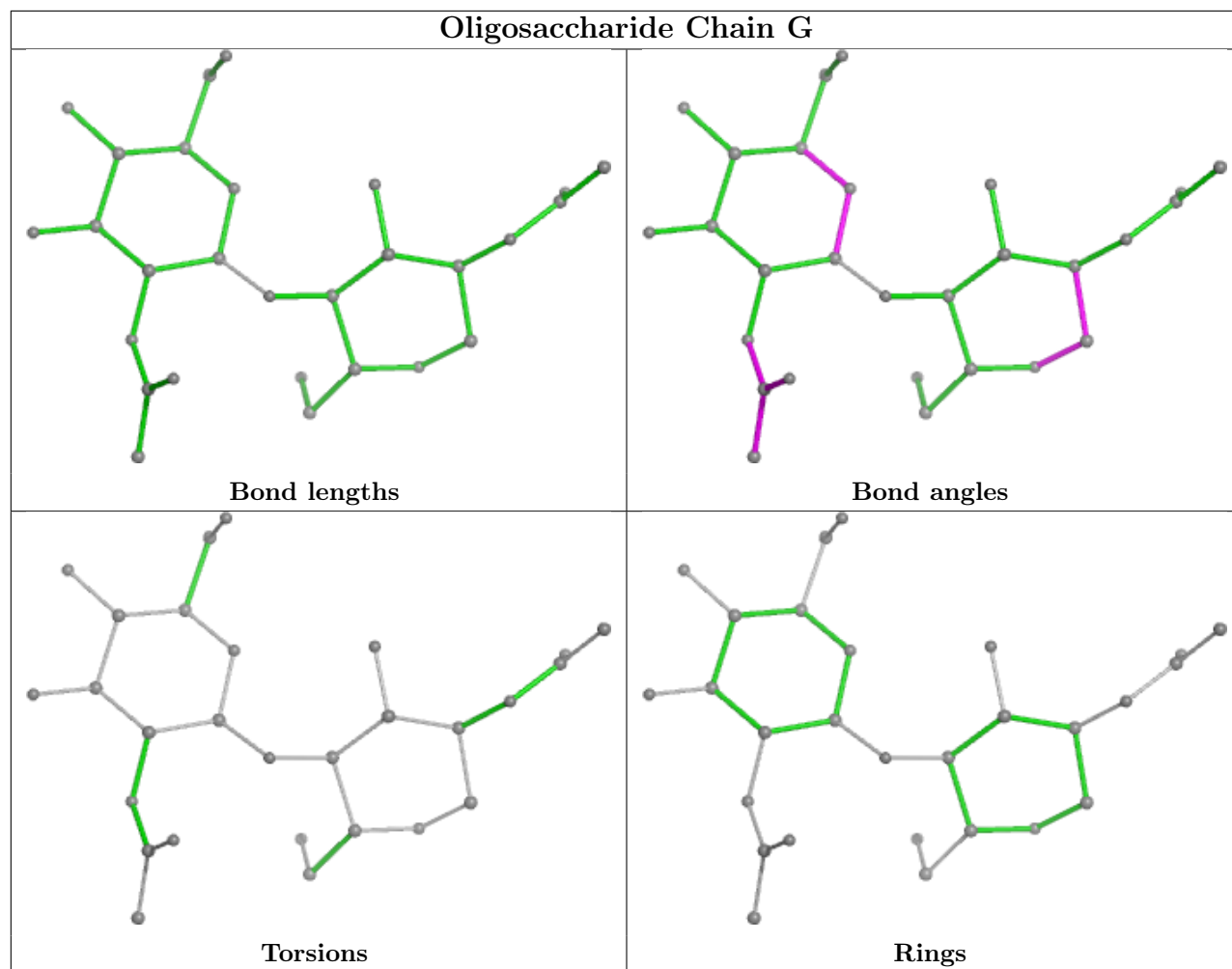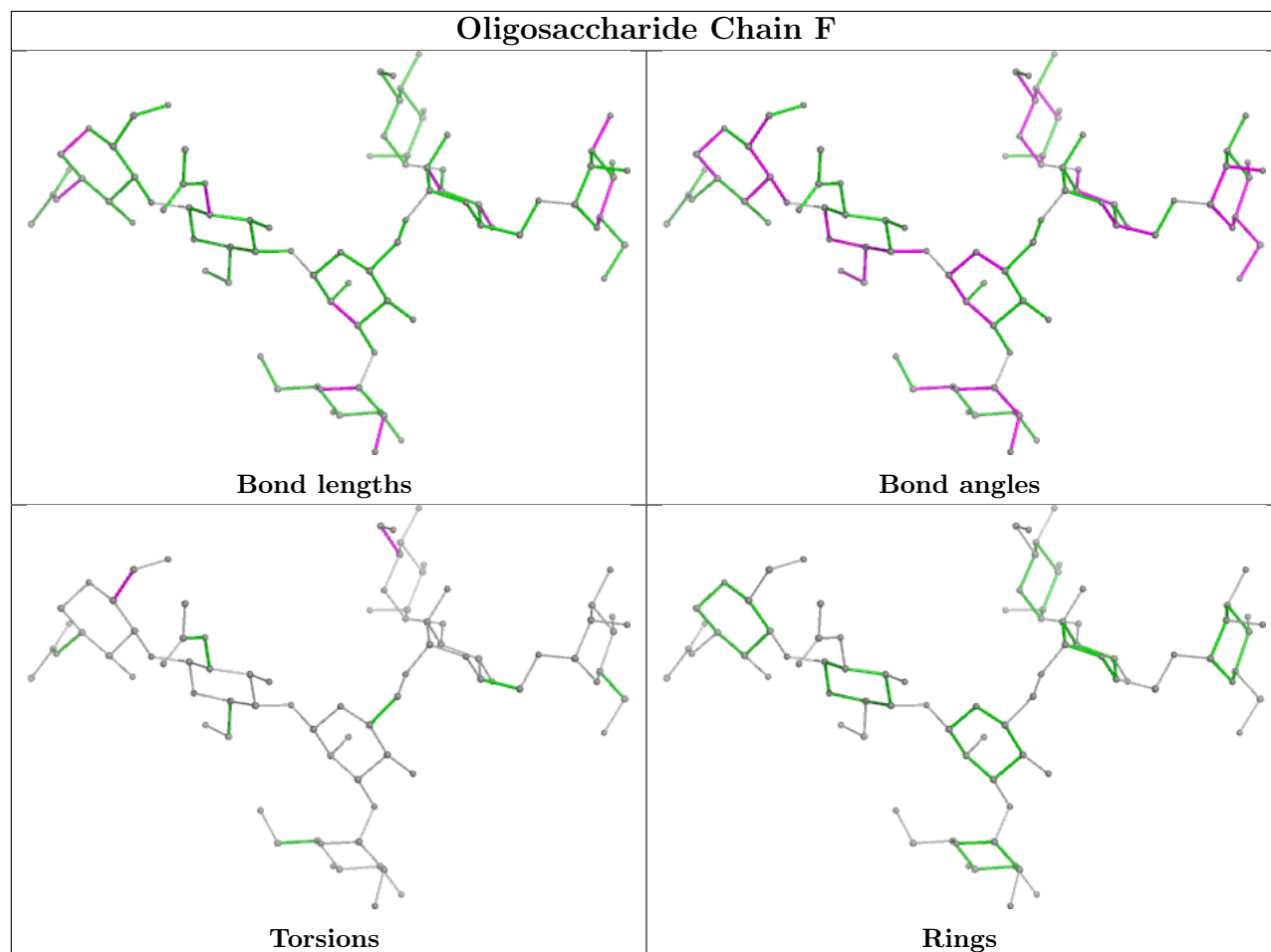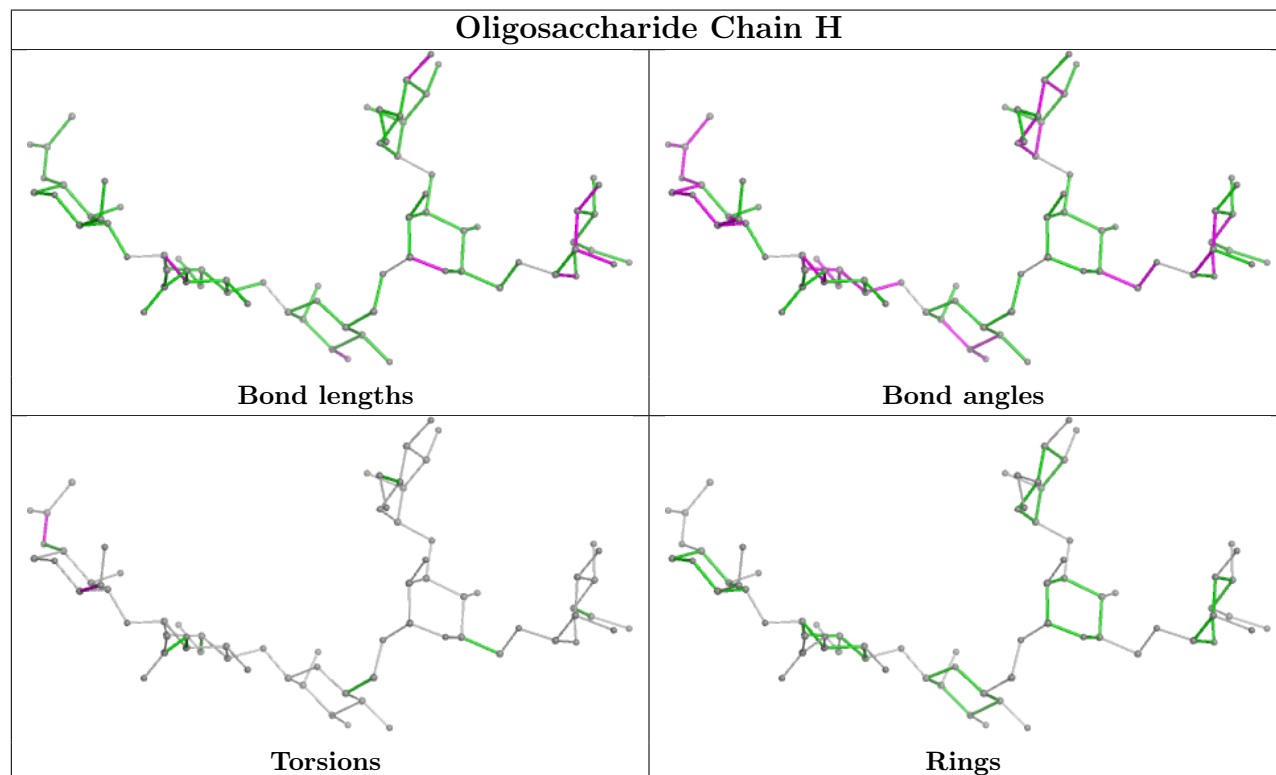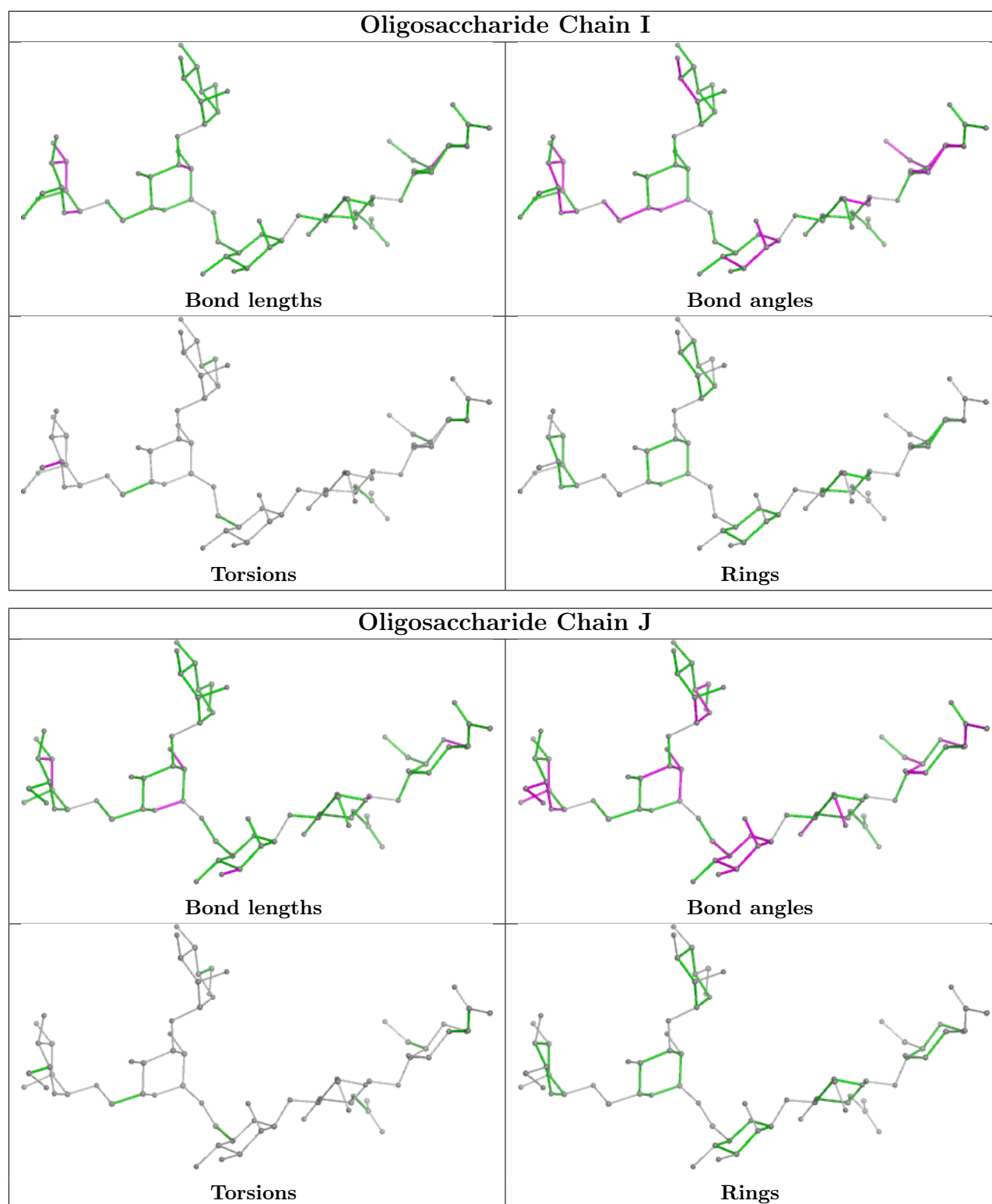
5.6 Ligand geometry ⓘ

Of 23 ligands modelled in this entry, 5 are monoatomic - leaving 18 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	$\#|Z| > 2$
7	GOL	C	510	-	5,5,5	0.28	0	5,5,5	0.67	0
5	NAG	B	501	1	14,14,15	0.96	0	17,19,21	1.80	4 (23%)
6	DAN	A	511	-	20,20,20	0.84	1 (5%)	23,28,28	0.93	1 (4%)
7	GOL	B	511	-	5,5,5	0.53	0	5,5,5	1.11	0
7	GOL	D	509	-	5,5,5	0.38	0	5,5,5	1.21	0
7	GOL	A	513	-	5,5,5	0.60	0	5,5,5	0.65	0
7	GOL	C	511	-	5,5,5	1.27	1 (20%)	5,5,5	2.03	1 (20%)
5	NAG	A	501	1	14,14,15	1.38	1 (7%)	17,19,21	1.52	3 (17%)
6	DAN	C	509	-	20,20,20	0.61	0	23,28,28	0.86	0
7	GOL	B	513	-	5,5,5	0.76	0	5,5,5	1.15	1 (20%)
7	GOL	A	512	-	5,5,5	0.50	0	5,5,5	1.22	0
7	GOL	B	512	-	5,5,5	0.85	0	5,5,5	1.18	0
5	NAG	C	502	1	14,14,15	1.11	1 (7%)	17,19,21	1.86	4 (23%)
5	NAG	D	501	1	14,14,15	1.33	2 (14%)	17,19,21	2.04	6 (35%)
7	GOL	D	510	-	5,5,5	0.65	0	5,5,5	1.16	0
6	DAN	B	510	-	20,20,20	0.70	1 (5%)	23,28,28	0.79	1 (4%)
5	NAG	C	501	1	14,14,15	1.15	2 (14%)	17,19,21	2.22	5 (29%)
6	DAN	D	508	-	20,20,20	0.61	0	23,28,28	0.93	1 (4%)

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
7	GOL	C	510	-	-	2/4/4/4	-
5	NAG	B	501	1	-	1/6/23/26	0/1/1/1
6	DAN	A	511	-	-	0/18/34/34	0/1/1/1
7	GOL	B	511	-	-	0/4/4/4	-
7	GOL	D	509	-	-	2/4/4/4	-
7	GOL	A	513	-	-	0/4/4/4	-
7	GOL	C	511	-	-	1/4/4/4	-
5	NAG	A	501	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	DAN	C	509	-	-	0/18/34/34	0/1/1/1
7	GOL	B	513	-	-	2/4/4/4	-
7	GOL	A	512	-	-	0/4/4/4	-
7	GOL	B	512	-	-	0/4/4/4	-
5	NAG	C	502	1	-	0/6/23/26	0/1/1/1
5	NAG	D	501	1	-	0/6/23/26	0/1/1/1
7	GOL	D	510	-	-	2/4/4/4	-
6	DAN	B	510	-	-	0/18/34/34	0/1/1/1
5	NAG	C	501	1	-	0/6/23/26	0/1/1/1
6	DAN	D	508	-	-	0/18/34/34	0/1/1/1

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	501	NAG	O4-C4	3.49	1.51	1.43
6	A	511	DAN	O1B-C1	-3.28	1.21	1.30
5	A	501	NAG	O5-C1	2.90	1.48	1.43
6	B	510	DAN	O1B-C1	-2.78	1.22	1.30
7	C	511	GOL	O1-C1	2.50	1.53	1.42

The worst 5 of 27 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	D	501	NAG	O4-C4-C5	5.25	122.33	109.30
5	C	501	NAG	O4-C4-C5	4.39	120.20	109.30
5	C	502	NAG	O5-C1-C2	-4.37	104.38	111.29
5	C	501	NAG	O6-C6-C5	-4.09	97.27	111.29
5	B	501	NAG	O5-C5-C6	4.07	113.58	107.20

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	B	513	GOL	C1-C2-C3-O3
7	C	510	GOL	C1-C2-C3-O3
7	D	509	GOL	C1-C2-C3-O3
7	C	510	GOL	O2-C2-C3-O3
7	D	510	GOL	O2-C2-C3-O3

There are no ring outliers.

5 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	513	GOL	1	0
7	C	511	GOL	1	0
7	B	513	GOL	1	0
7	B	512	GOL	2	0
7	D	510	GOL	2	0

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 then 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.

Ligand DAN A 511

Bond lengths

Bond angles

Torsions

Rings

Ligand DAN B 510

Bond lengths

Bond angles

Torsions

Rings

Ligand DAN D 508

Bond lengths

Bond angles

Torsions

Rings
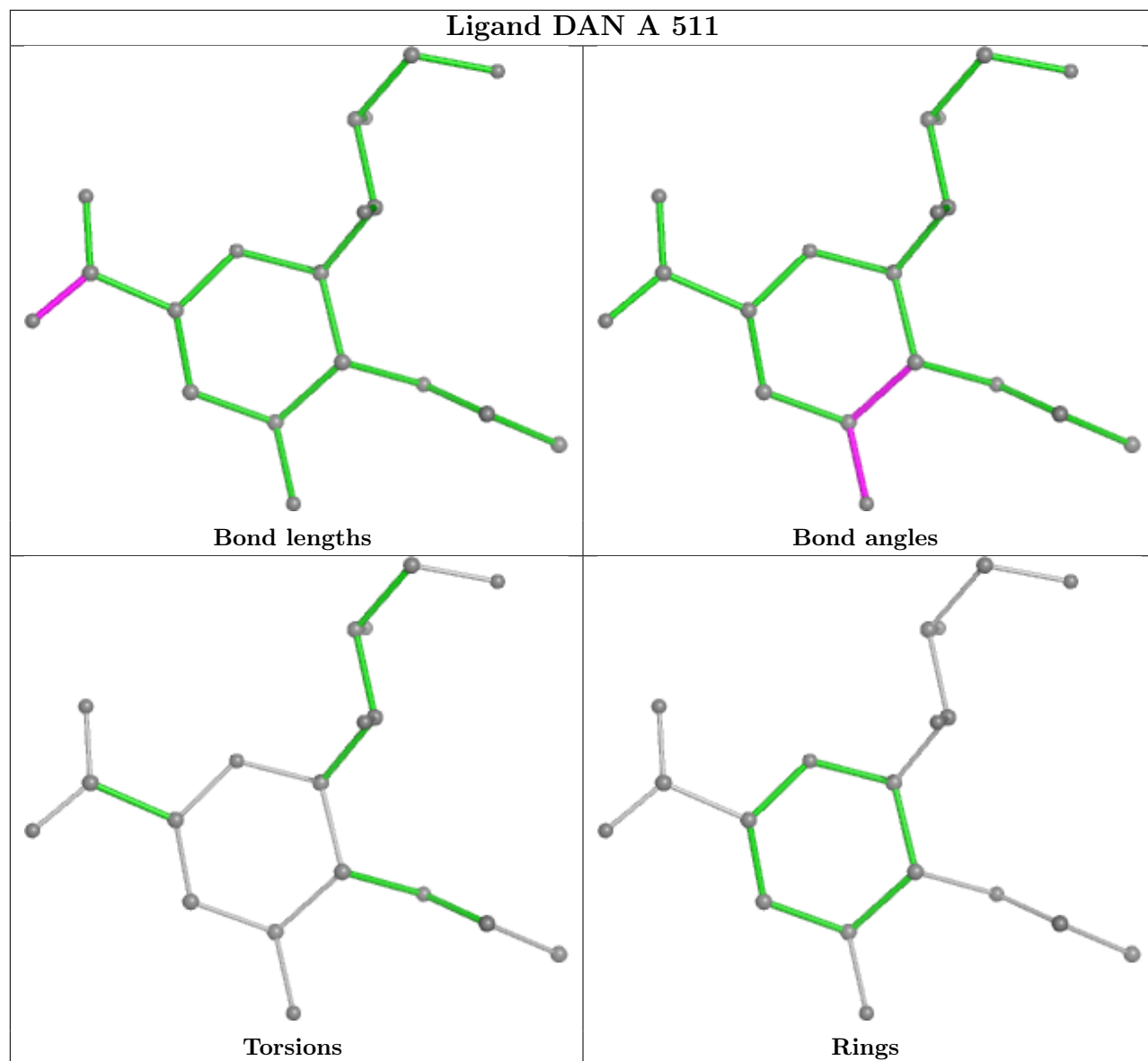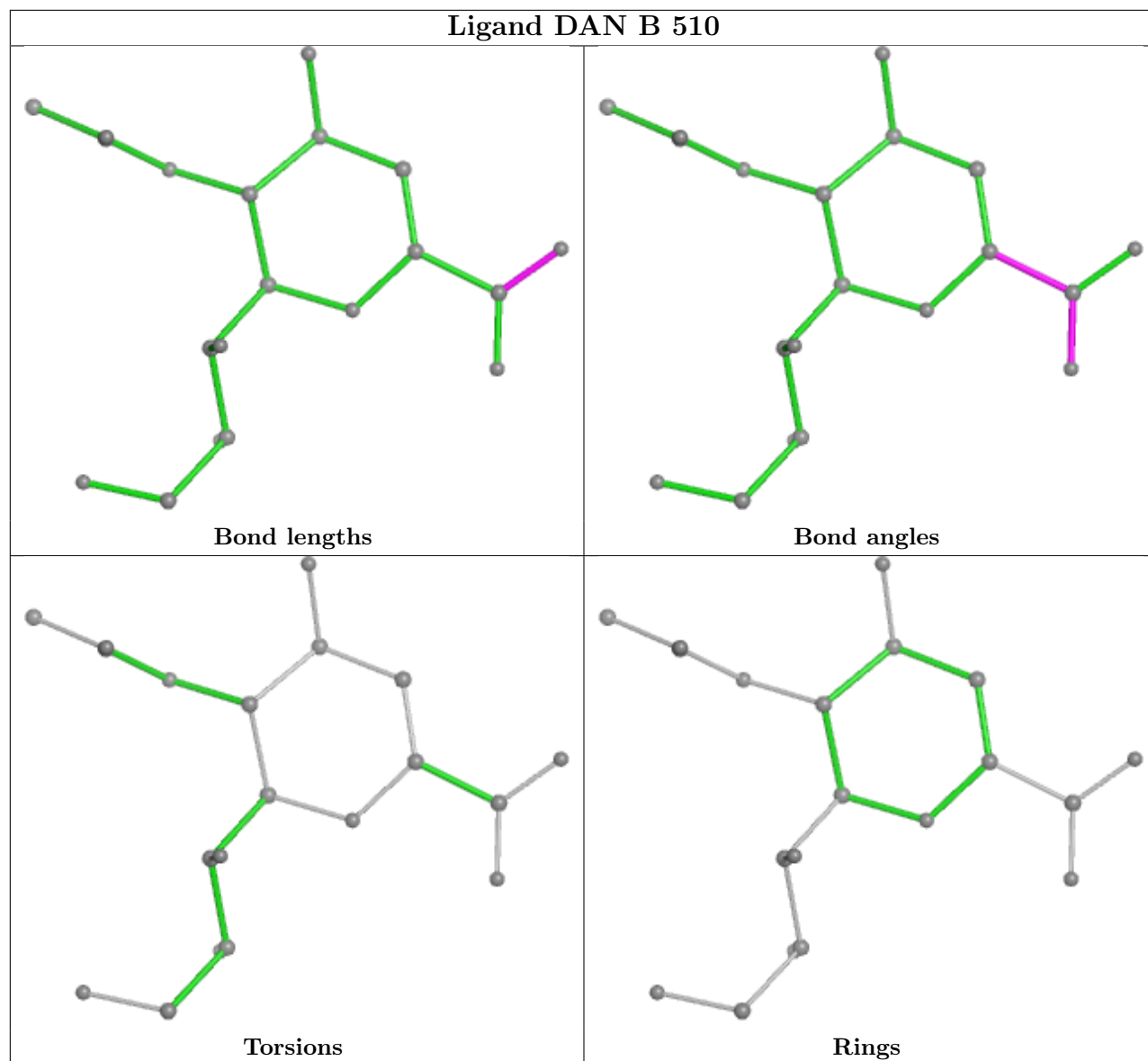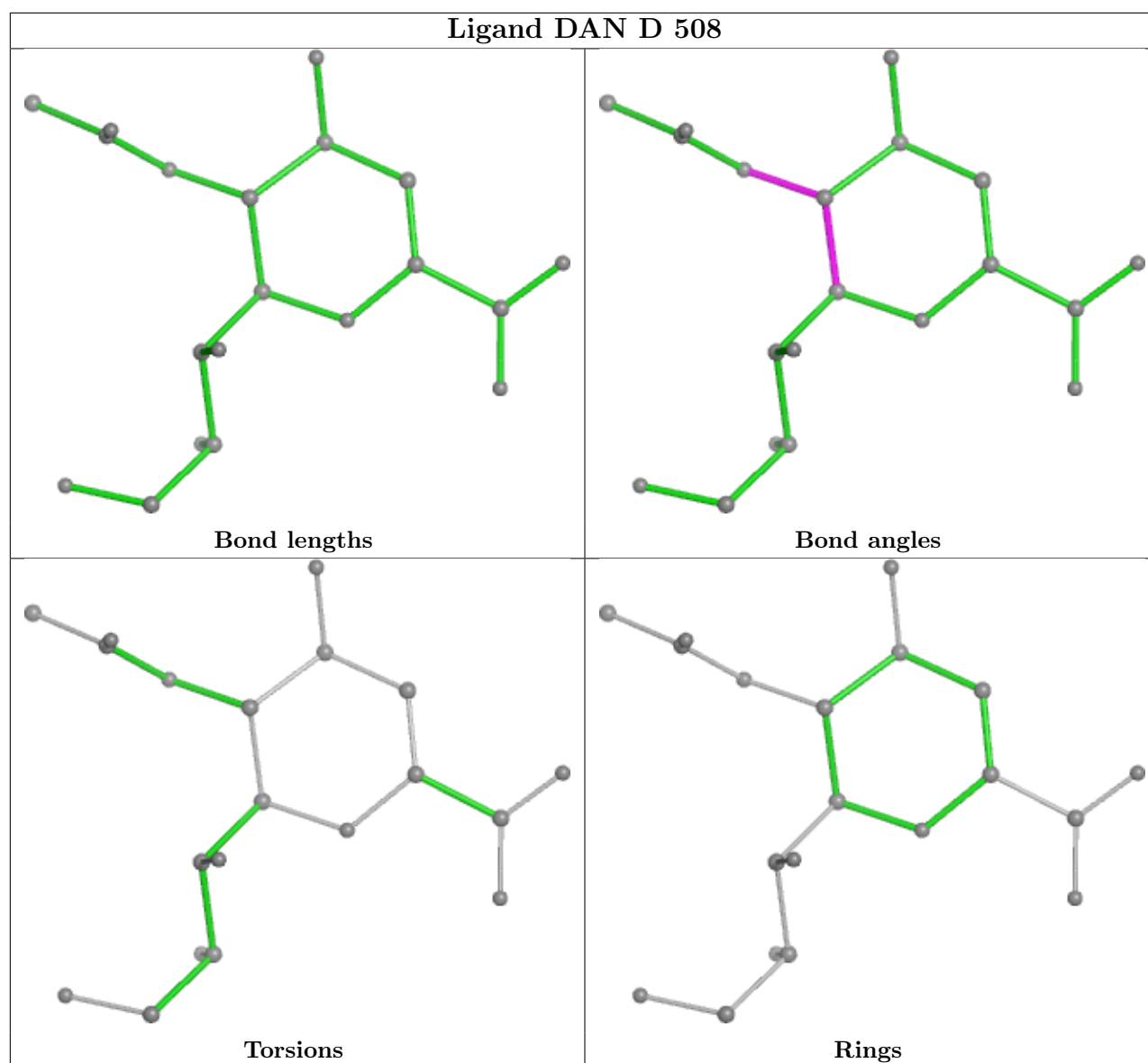
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	389/389 (100%)	-0.54	0	100	100	7, 15, 24, 33	8 (2%)
1	B	389/389 (100%)	-0.57	0	100	100	6, 14, 22, 41	12 (3%)
1	C	389/389 (100%)	-0.61	2 (0%)	87	90	8, 14, 22, 37	8 (2%)
1	D	389/389 (100%)	-0.56	0	100	100	6, 15, 22, 35	8 (2%)
All	All	1556/1556 (100%)	-0.57	2 (0%)	92	94	6, 14, 23, 41	36 (2%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	347[A]	ASP	2.7
1	C	454	ARG	2.3

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

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	E	2	14/15	0.65	0.16	42,53,65,67	0
4	MAN	I	6	11/12	0.76	0.14	44,46,50,52	0
4	BMA	J	3	11/12	0.77	0.13	33,36,38,40	0
4	MAN	I	5	11/12	0.78	0.14	43,48,50,51	0
4	BMA	I	3	11/12	0.79	0.13	36,39,41,42	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
4	MAN	J	6	11/12	0.79	0.13	38,40,46,48	0
3	NAG	F	1	14/15	0.80	0.13	31,33,40,41	0
2	NAG	G	2	14/15	0.80	0.12	43,47,56,62	0
4	MAN	J	5	11/12	0.81	0.13	38,43,45,48	0
4	NAG	H	1	14/15	0.83	0.13	30,35,42,47	0
4	NAG	J	2	14/15	0.85	0.11	25,28,32,34	0
4	NAG	I	1	14/15	0.85	0.12	27,29,36,38	0
3	MAN	F	6	11/12	0.86	0.11	31,32,36,39	0
4	MAN	H	6	11/12	0.86	0.12	38,39,42,45	0
3	NAG	F	2	14/15	0.87	0.09	25,27,31,32	0
4	NAG	J	1	14/15	0.87	0.10	25,28,30,30	0
4	MAN	H	4	11/12	0.88	0.11	33,34,36,37	0
4	MAN	H	5	11/12	0.88	0.11	30,32,34,36	0
4	MAN	J	4	11/12	0.88	0.11	37,39,40,41	0
3	MAN	F	7	11/12	0.88	0.09	32,35,36,36	0
4	NAG	H	2	14/15	0.88	0.10	26,28,31,34	0
4	NAG	I	2	14/15	0.90	0.09	28,30,32,34	0
4	BMA	H	3	11/12	0.90	0.09	30,32,33,34	0
4	MAN	I	4	11/12	0.91	0.10	42,44,45,48	0
3	MAN	F	5	11/12	0.91	0.08	25,26,28,30	0
2	NAG	G	1	14/15	0.91	0.08	22,23,31,36	0
2	NAG	E	1	14/15	0.93	0.08	22,24,31,39	0
3	BMA	F	3	11/12	0.93	0.07	25,26,27,30	0
3	MAN	F	4	11/12	0.93	0.08	26,27,29,30	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.
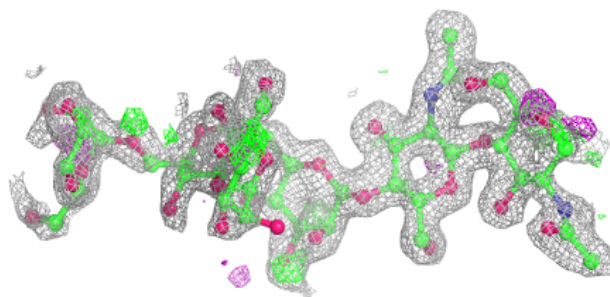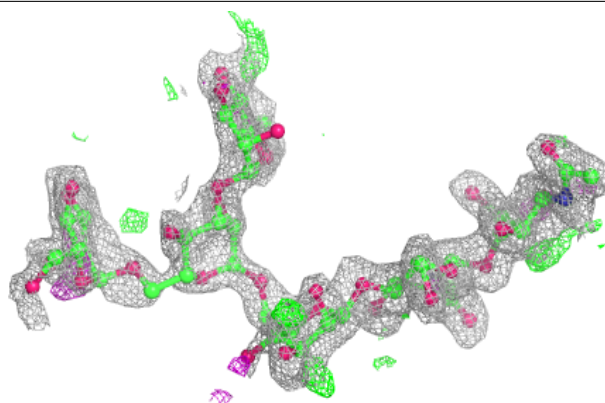
Electron density around Chain E:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
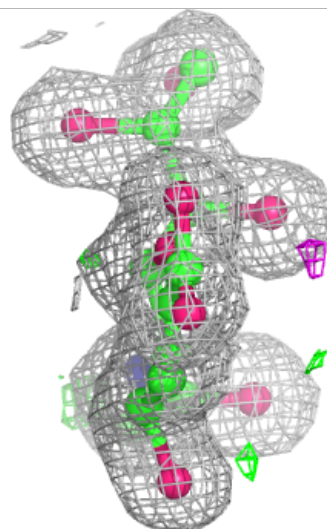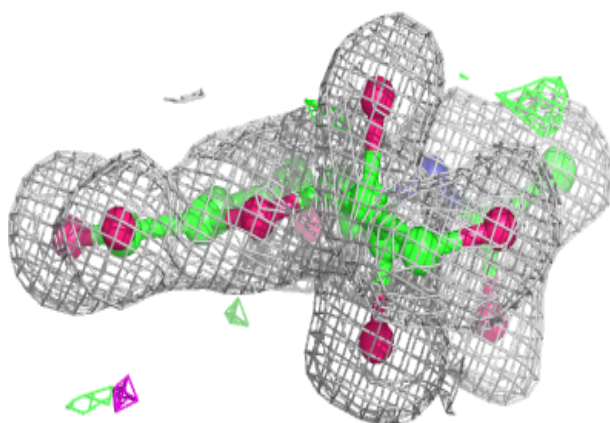mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
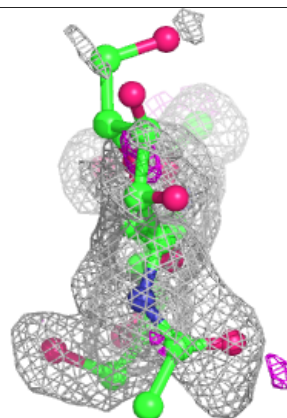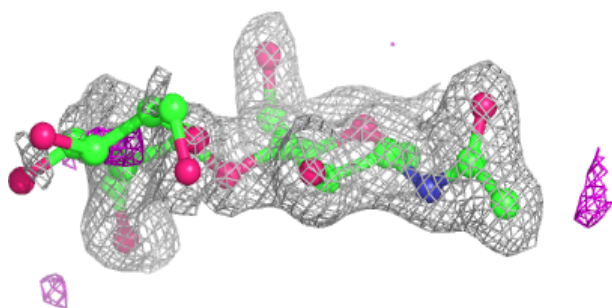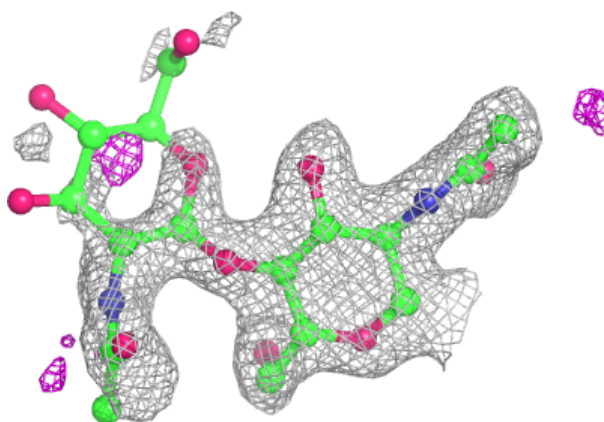
Electron density around Chain G:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
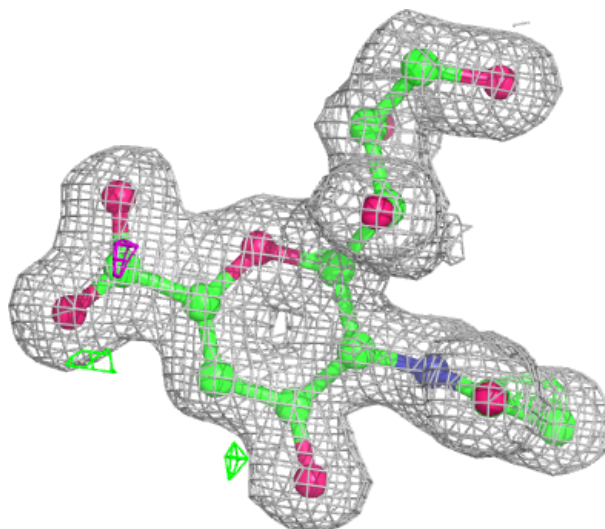mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
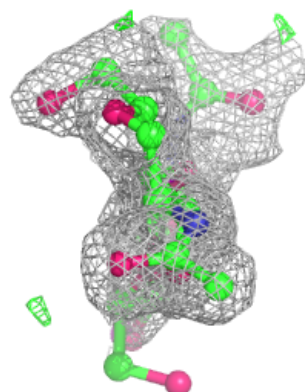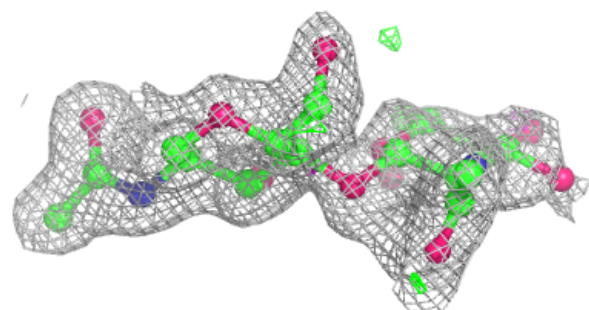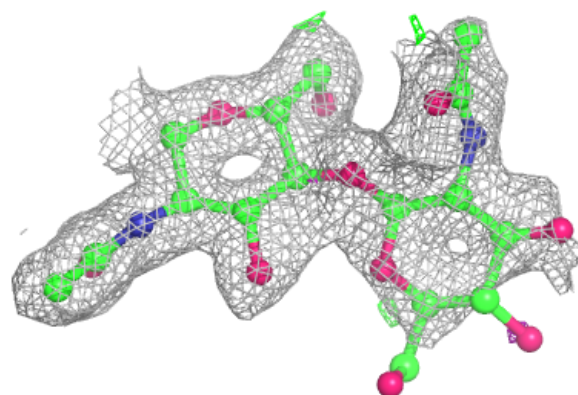
Electron density around Chain F:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
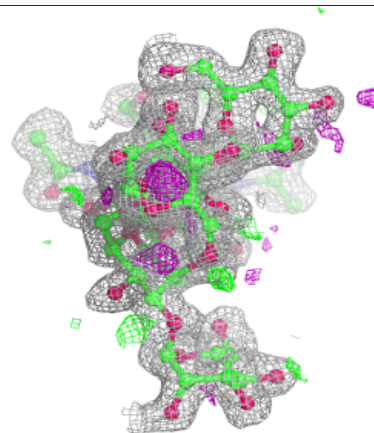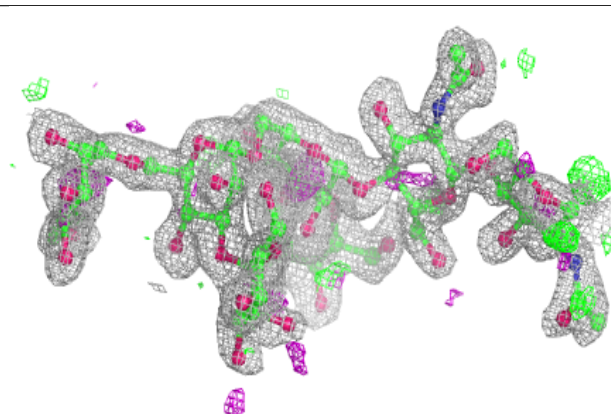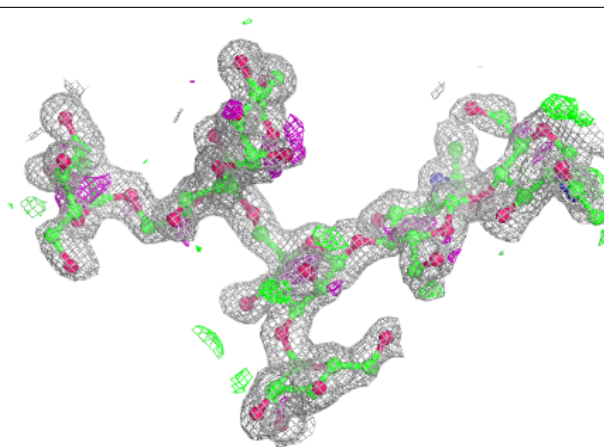
Electron density around Chain H:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
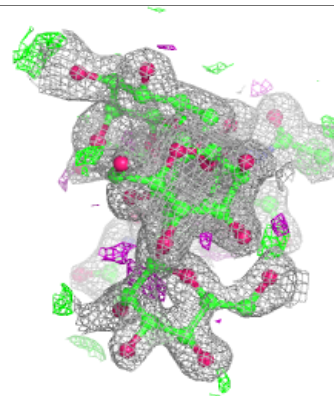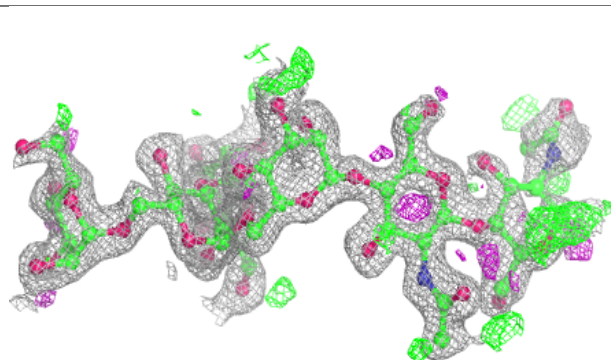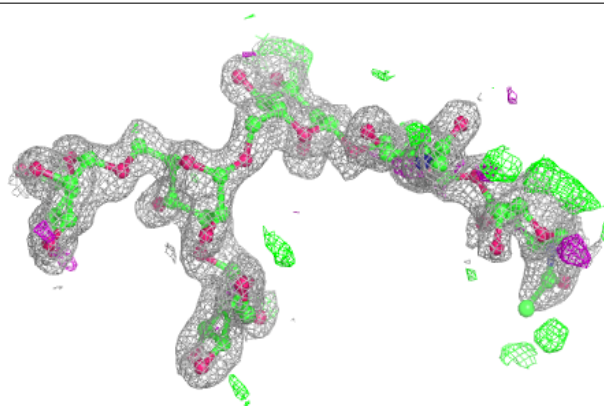
Electron density around Chain I:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
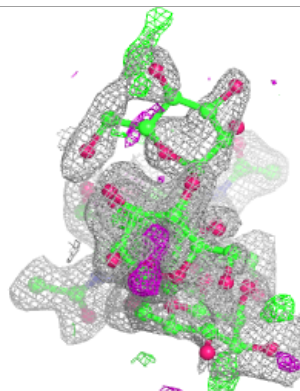
Electron density around Chain J:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
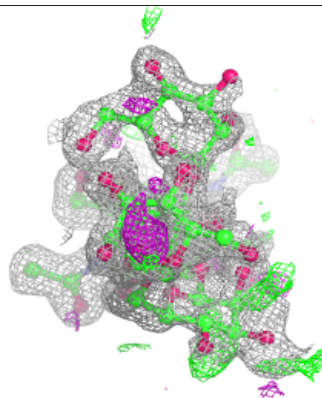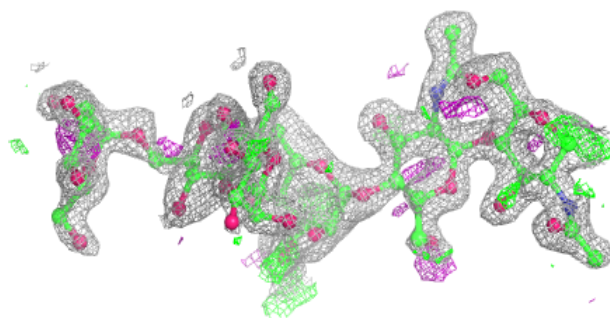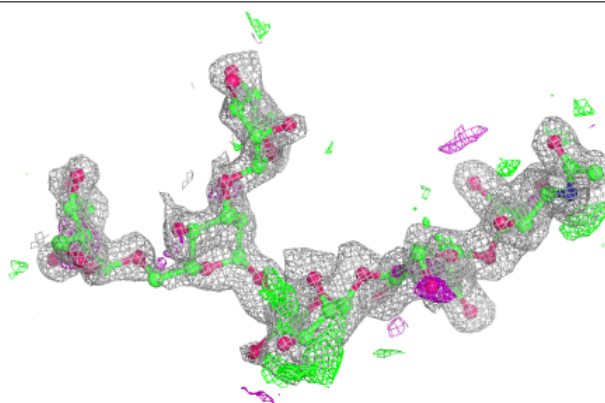
6.4 Ligands ⓘ

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($\mathring{A}^2$)	Q<0.9
5	NAG	B	501	14/15	0.61	0.16	52,61,64,65	0
7	GOL	B	512	6/6	0.79	0.17	33,41,42,53	0
5	NAG	C	502	14/15	0.80	0.11	32,38,45,46	0
7	GOL	A	513	6/6	0.83	0.13	26,35,39,43	0
7	GOL	C	510	6/6	0.83	0.15	28,30,34,35	0
7	GOL	D	510	6/6	0.85	0.16	26,38,41,43	0
7	GOL	C	511	6/6	0.86	0.14	21,26,27,39	0
7	GOL	B	511	6/6	0.86	0.12	22,23,24,26	0
7	GOL	D	509	6/6	0.89	0.10	27,29,31,34	0
7	GOL	B	513	6/6	0.89	0.11	26,30,33,39	0
5	NAG	A	501	14/15	0.90	0.09	25,29,32,32	0
5	NAG	D	501	14/15	0.92	0.07	21,23,28,30	0
5	NAG	C	501	14/15	0.93	0.07	21,23,30,31	0
7	GOL	A	512	6/6	0.94	0.08	22,24,25,25	0
6	DAN	A	511	20/20	0.96	0.05	12,13,15,16	0
6	DAN	C	509	20/20	0.96	0.05	11,12,13,15	0
6	DAN	D	508	20/20	0.96	0.05	12,13,14,15	0
6	DAN	B	510	20/20	0.97	0.04	11,12,13,13	0
8	CA	A	514	1/1	0.99	0.10	22,22,22,22	0
8	CA	B	514	1/1	0.99	0.11	22,22,22,22	0
8	CA	B	515	1/1	0.99	0.21	32,32,32,32	0
8	CA	C	512	1/1	0.99	0.12	21,21,21,21	0
8	CA	D	511	1/1	0.99	0.12	23,23,23,23	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.
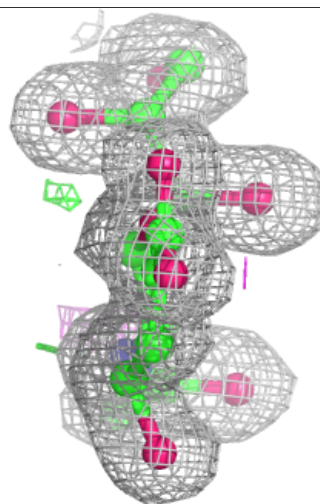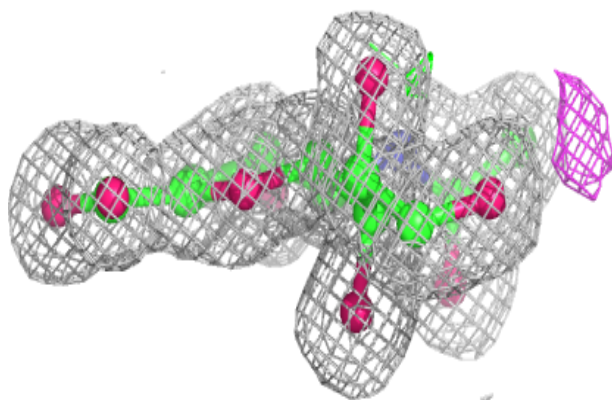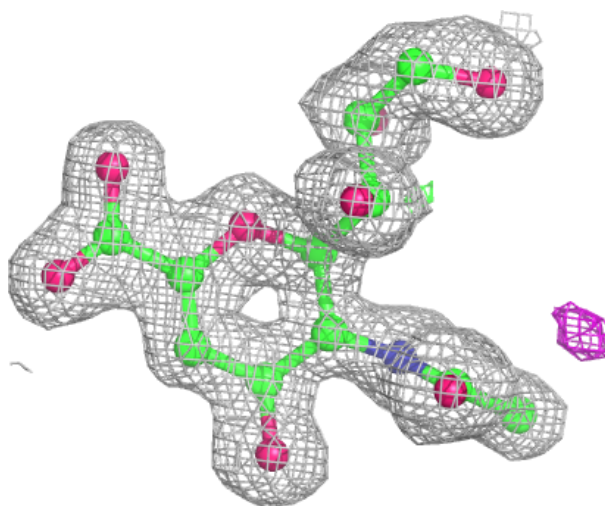
Electron density around DAN A 511:

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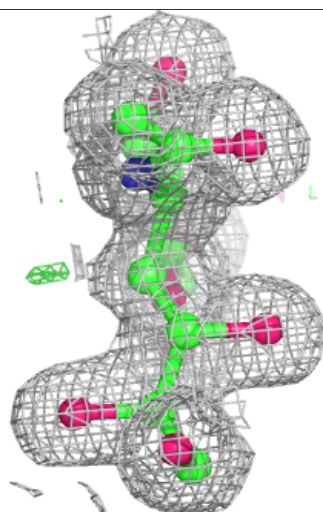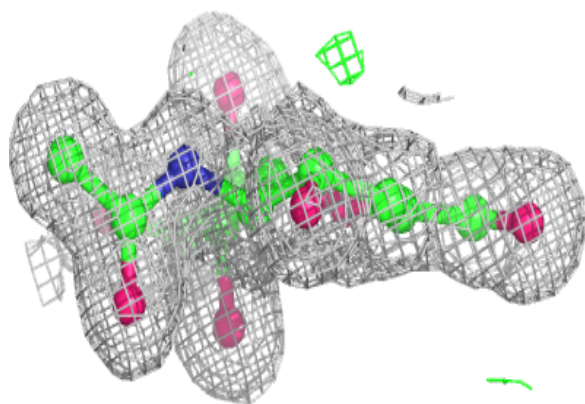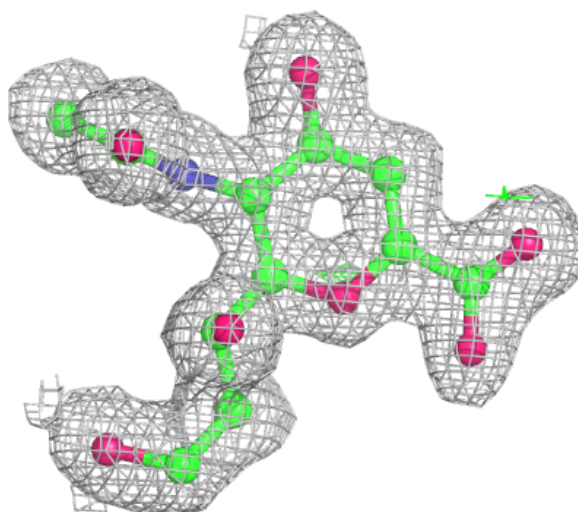and green (positive)

Electron density around DAN D 508:

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

Electron density around DAN B 510:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.