Full wwPDB X-ray Structure Validation Report (i)

Feb 24, 2026 – 03:27 pm GMT

PDB ID : 8BOL / pdb_00008bol
Title : X-ray structure of human glutamate carboxypeptidase II (GCPII) in complex with an inhibitor P18
Authors : Motlova, L.; Barinka, C.; Benesova, M.
Deposited on : 2022-11-15
Resolution : 1.55 Å(reported)

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

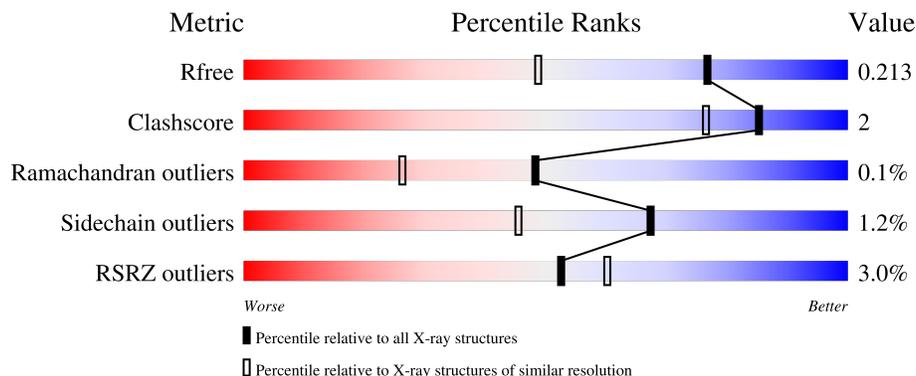|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.48.1

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 1.55 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		0.213
Clashscore		2
Ramachandran outliers		0.1%
Sidechain outliers		1.2%
RSRZ outliers		3.0%

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	1935 (1.56-1.56)
Clashscore	180529	2073 (1.56-1.56)
Ramachandran outliers	177936	2037 (1.56-1.56)
Sidechain outliers	177891	2034 (1.56-1.56)
RSRZ outliers	164620	1935 (1.56-1.56)

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	707	3% / 91% / 7% / •
2	B	3	33% / 67%
2	F	3	33% / 67%
3	C	5	100%
4	D	2	100%

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Mol	Chain	Length	Quality of chain
5	E	4	50%　　　　　　　　　50%

2 Entry composition ⓘ

There are 12 unique types of molecules in this entry. The entry contains 6644 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 Glutamate carboxypeptidase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	693	Total	C	N	O	S	0	54	0
			5775	3715	959	1079	22			

- Molecule 2 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
2	B	3	Total	C	N	O	0	0	0
			39	22	2	15			
2	F	3	Total	C	N	O	0	0	0
			39	22	2	15			

- Molecule 3 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.
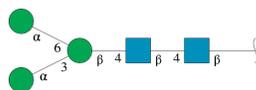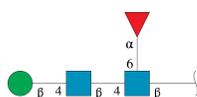

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	5	Total	C	N	O	0	0	0
			61	34	2	25			

- 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	D	2	28	16	2	10	0	0	0

- 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	N	O			
5	E	4	49	28	2	19	0	0	0

- Molecule 6 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
6	A	2	2	2	0	0

- Molecule 7 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 8 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Cl		
8	A	1	1	1	0	0

- Molecule 9 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).
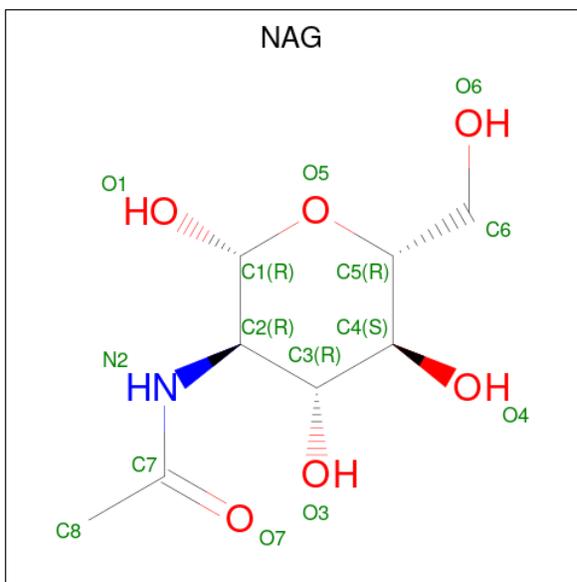
NAG

O6
OH

O1
HO

O5
O

C6

C1(R)   C5(R)

C2(R)   C4(S)

C3(R)

N2
HN

OH
O4

C7

OH
O3

C8

O
O7

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

- Molecule 10 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	1	Total 1	Na 1	0	0

- Molecule 11 is (((S)-1-carboxy-5-((S,E)-5-phenyl-2-(4-((2-(4,7,10-tris(carboxymethyl)-1,4, 7,10-tetraazacyclododecan-1-yl)acetamido)methyl)benzamido)pent-4-enamido)pentyl)carb amoyl)-L-glutamic acid (CCD ID: A1J0C) (formula: $C_{47}H_{65}N_9O_{16}$) (labeled as "Ligand of Interest" by depositor).

A1J0C
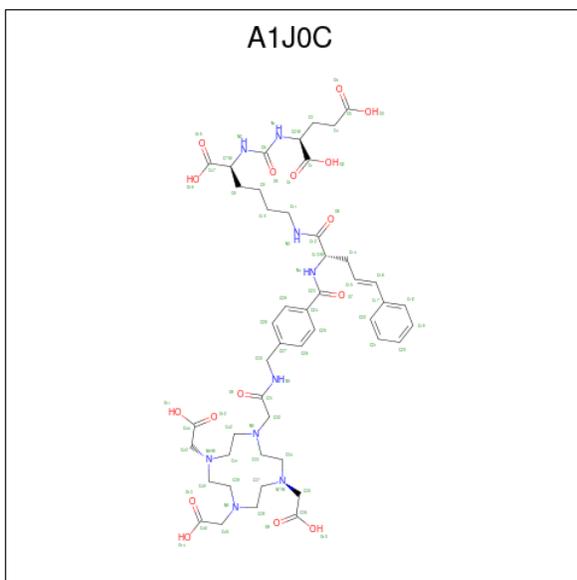
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	A	1	Total 72	C 47	N 9	O 16	0	0

- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	547	Total 548	O 548	0	1

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.

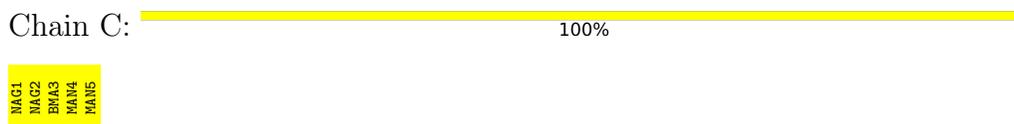• Molecule 1: Glutamate carboxypeptidase 2
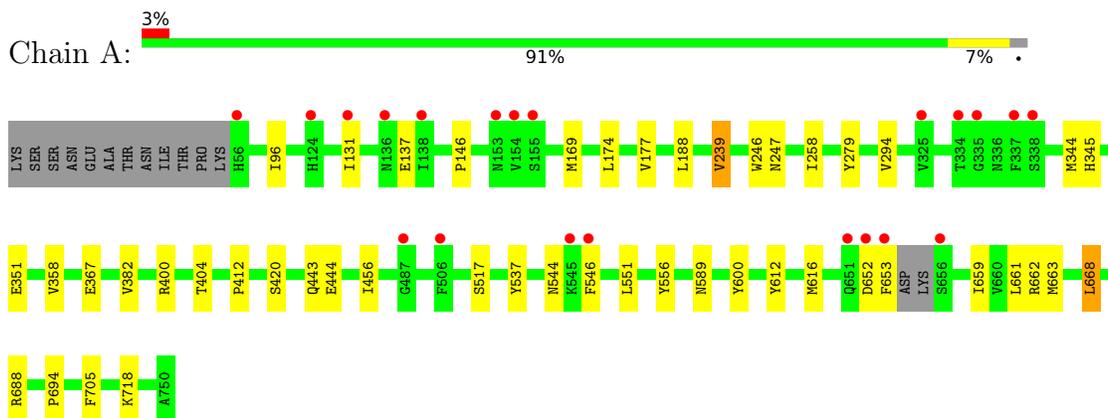
Chain A:

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

Chain B:

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

Chain F:

• Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyrano se-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyra nose

Chain C:

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

Chain D:

NAG1 NAG2

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

Chain E:

NAG1 NAG2 BMA3 FUC4

4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	101.69Å 130.25Å 159.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.01 – 1.55 50.01 – 1.55	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.01-1.55) 99.9 (50.01-1.55)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.03 (at 1.55Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.192 , 0.213 0.192 , 0.213	Depositor DCC
R_{free} test set	7628 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	21.1	Xtriage
Anisotropy	0.627	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 40.9	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	6644	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.73% 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 $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, BMA, CA, MAN, A1J0C, NA, NAG, FUC, ZN

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	0.90	1/6092 (0.0%)	0.92	3/8250 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	705	PHE	N-CA	5.01	1.50	1.46

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	652	ASP	N-CA-C	6.53	121.07	111.87
1	A	146	PRO	CA-C-N	-5.28	115.86	119.66
1	A	146	PRO	C-N-CA	-5.28	115.86	119.66

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	5775	0	5683	25	0
2	B	39	0	34	0	0
2	F	39	0	34	0	0
3	C	61	0	52	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	D	28	0	25	0	0
5	E	49	0	43	0	0
6	A	2	0	0	0	0
7	A	1	0	0	0	0
8	A	1	0	0	0	0
9	A	28	0	26	1	0
10	A	1	0	0	0	0
11	A	72	0	0	0	0
12	A	548	0	0	2	0
All	All	6644	0	5897	25	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.

All (25) 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:688[B]:ARG:NH1	12:A:903:HOH:O	2.29	0.64
1:A:400:ARG:O	1:A:404[B]:THR:HG23	2.02	0.59
1:A:169:MET:HE3	1:A:345:HIS:HD2	1.70	0.56
1:A:612:TYR:CZ	1:A:616:MET:HG3	2.41	0.55
1:A:367:GLU:OE1	1:A:662[A]:ARG:NH1	2.39	0.53
1:A:412:PRO:HA	1:A:589[B]:ASN:OD1	2.12	0.49
1:A:653:PHE:HE2	1:A:661[A]:LEU:HB2	1.77	0.49
1:A:131[B]:ILE:O	1:A:131[B]:ILE:HG23	2.11	0.49
1:A:96[B]:ILE:HD13	12:A:1048:HOH:O	2.12	0.48
1:A:659[B]:ILE:O	1:A:663[B]:MET:HG3	2.15	0.47
1:A:177:VAL:HG12	1:A:188:LEU:HD11	1.97	0.47
1:A:169:MET:HE3	1:A:345:HIS:CD2	2.49	0.46
1:A:131[A]:ILE:HG22	1:A:137:GLU:HG2	1.98	0.46
1:A:544:ASN:HB3	1:A:546:PHE:CE2	2.51	0.45
1:A:443[B]:GLN:HG3	1:A:444:GLU:CD	2.43	0.44
1:A:169:MET:HA	1:A:344:MET:O	2.18	0.43
1:A:246:TRP:CD1	9:A:806:NAG:H83	2.53	0.43
1:A:358:VAL:HB	1:A:420:SER:HB3	1.99	0.42
1:A:517[A]:SER:HB2	1:A:694:PRO:HG3	2.01	0.42
1:A:551:LEU:HD22	1:A:556:TYR:HB2	2.01	0.41
1:A:718:LYS:HA	1:A:718:LYS:HD3	1.94	0.41
1:A:258:ILE:HD13	1:A:294:VAL:HB	2.02	0.41
1:A:239[A]:VAL:HG22	1:A:247:ASN:ND2	2.36	0.41

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	742/707 (105%)	724 (98%)	17 (2%)	1 (0%)	48	26

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	382	VAL

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	644/603 (107%)	635 (99%)	9 (1%)	62	37

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	174	LEU
1	A	239[A]	VAL
1	A	239[B]	VAL
1	A	351	GLU
1	A	456	ILE
1	A	537	TYR
1	A	600	TYR

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Mol	Chain	Res	Type
1	A	668[A]	LEU
1	A	668[B]	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	GLN
1	A	95	GLN
1	A	347	HIS

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)

17 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#$|Z| > 2$	Counts	RMSZ	#$|Z| > 2$
2	NAG	B	1	1,2	14,14,15	0.39	0	17,19,21	1.06	1 (5%)
2	NAG	B	2	2	14,14,15	0.58	0	17,19,21	1.12	2 (11%)
2	BMA	B	3	2	11,11,12	0.80	0	15,15,17	0.99	0
3	NAG	C	1	1,3	14,14,15	0.68	0	17,19,21	1.67	3 (17%)
3	NAG	C	2	3	14,14,15	0.56	0	17,19,21	1.36	2 (11%)
3	BMA	C	3	3	11,11,12	0.53	0	15,15,17	1.08	2 (13%)
3	MAN	C	4	3	11,11,12	0.69	0	15,15,17	1.46	3 (20%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
3	MAN	C	5	3	11,11,12	0.66	0	15,15,17	0.98	1 (6%)
4	NAG	D	1	1,4	14,14,15	0.69	0	17,19,21	1.71	4 (23%)
4	NAG	D	2	4	14,14,15	0.65	0	17,19,21	1.17	2 (11%)
5	NAG	E	1	1,5	14,14,15	0.73	0	17,19,21	1.43	2 (11%)
5	NAG	E	2	5	14,14,15	0.66	0	17,19,21	1.39	2 (11%)
5	BMA	E	3	5	11,11,12	0.70	0	15,15,17	0.98	0
5	FUC	E	4	5	10,10,11	0.87	0	14,14,16	0.89	0
2	NAG	F	1	1,2	14,14,15	0.51	0	17,19,21	1.10	2 (11%)
2	NAG	F	2	2	14,14,15	0.39	0	17,19,21	0.67	0
2	BMA	F	3	2	11,11,12	0.61	0	15,15,17	1.40	2 (13%)

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

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

There are no bond length outliers.

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	1	NAG	C1-O5-C5	4.45	118.22	112.19
5	E	1	NAG	C2-N2-C7	4.09	128.73	122.90
5	E	2	NAG	C4-C3-C2	4.01	116.89	111.02
2	F	3	BMA	C1-O5-C5	3.65	117.13	112.19
4	D	1	NAG	C1-O5-C5	3.50	116.94	112.19
3	C	2	NAG	C1-O5-C5	3.37	116.76	112.19
3	C	1	NAG	O5-C1-C2	-3.31	106.06	111.29
4	D	1	NAG	C1-C2-N2	-3.22	104.99	110.49
4	D	1	NAG	C4-C3-C2	3.19	115.70	111.02
3	C	3	BMA	O3-C3-C2	-2.91	104.43	109.99
4	D	2	NAG	C1-O5-C5	2.88	116.09	112.19
2	B	2	NAG	C4-C3-C2	2.85	115.20	111.02
3	C	5	MAN	O5-C5-C6	2.84	111.66	107.20
2	F	3	BMA	C3-C4-C5	2.75	115.14	110.24
2	B	2	NAG	C1-O5-C5	2.61	115.72	112.19
4	D	1	NAG	O4-C4-C3	-2.59	104.36	110.35
5	E	1	NAG	C8-C7-N2	2.59	120.48	116.10
5	E	2	NAG	C2-N2-C7	2.57	126.57	122.90
2	B	1	NAG	C1-O5-C5	2.51	115.60	112.19
2	F	1	NAG	O5-C5-C4	-2.47	104.83	110.83
4	D	2	NAG	C2-N2-C7	2.38	126.30	122.90
3	C	3	BMA	C1-O5-C5	2.33	115.34	112.19
3	C	1	NAG	O4-C4-C5	-2.28	103.64	109.30
3	C	4	MAN	O3-C3-C4	-2.27	105.11	110.35
3	C	2	NAG	O4-C4-C5	-2.23	103.76	109.30
2	F	1	NAG	O5-C1-C2	-2.18	107.85	111.29
3	C	4	MAN	C2-C3-C4	2.17	114.65	110.89
3	C	4	MAN	C1-O5-C5	2.05	114.98	112.19

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	E	3	BMA	O5-C5-C6-O6
5	E	1	NAG	C8-C7-N2-C2
5	E	1	NAG	O7-C7-N2-C2
2	F	3	BMA	C4-C5-C6-O6
4	D	1	NAG	C4-C5-C6-O6
3	C	5	MAN	O5-C5-C6-O6
5	E	3	BMA	C4-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
2	F	3	BMA	O5-C5-C6-O6
4	D	1	NAG	O5-C5-C6-O6

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| Mol	Chain	Res	Type	Atoms
5	E	2	NAG	C4-C5-C6-O6
3	C	1	NAG	O5-C5-C6-O6
3	C	2	NAG	C4-C5-C6-O6
3	C	5	MAN	C4-C5-C6-O6
4	D	2	NAG	C4-C5-C6-O6

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 oligosaccharide.

Oligosaccharide Chain B

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain F

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain C

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain D

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain E

Bond lengths

Bond angles

Torsions

Rings
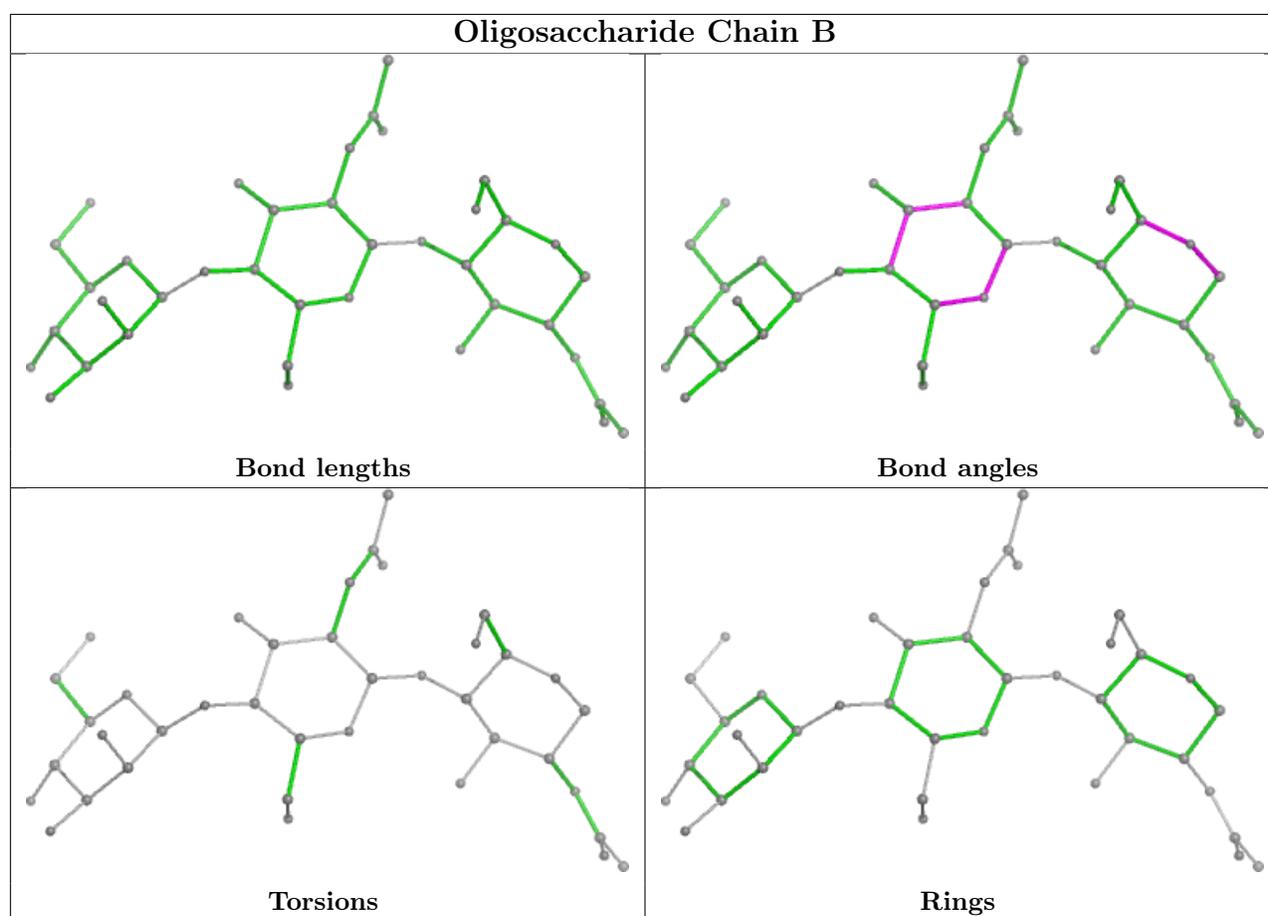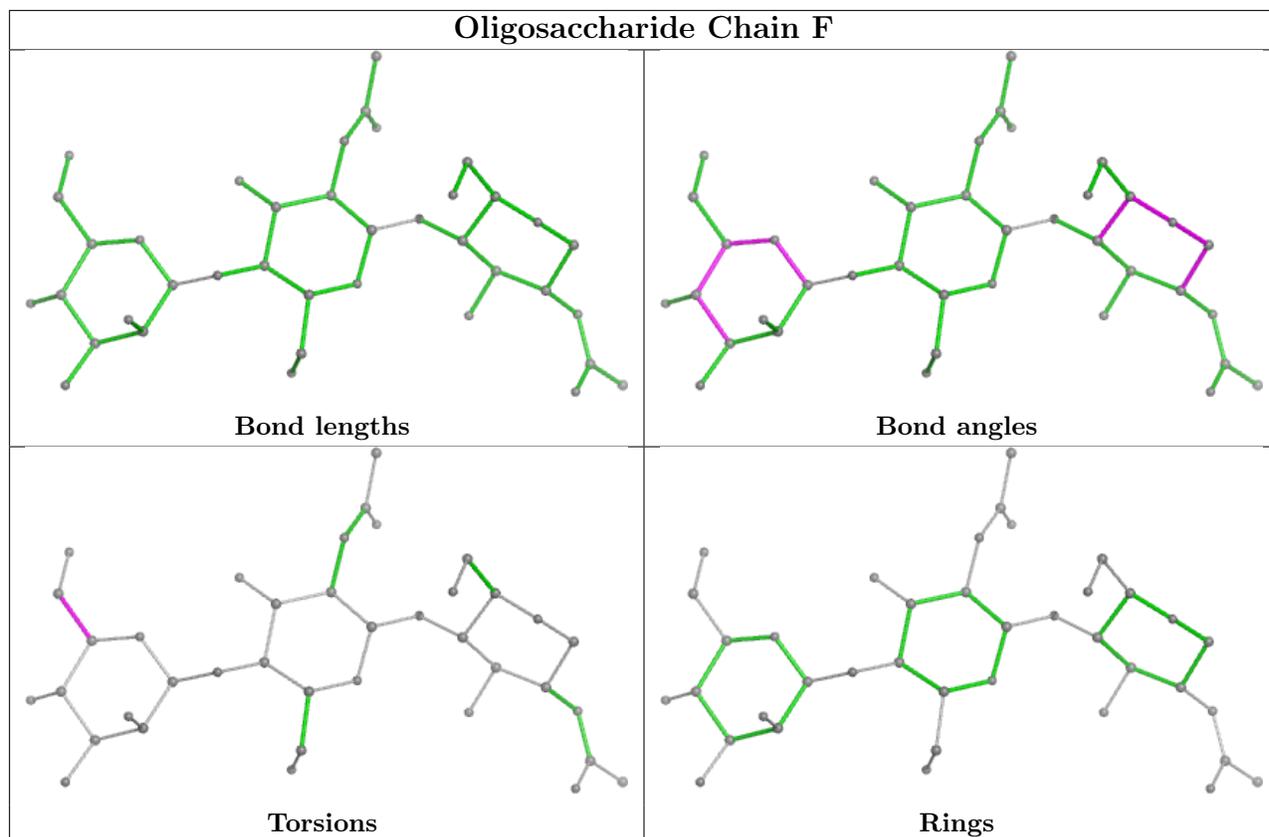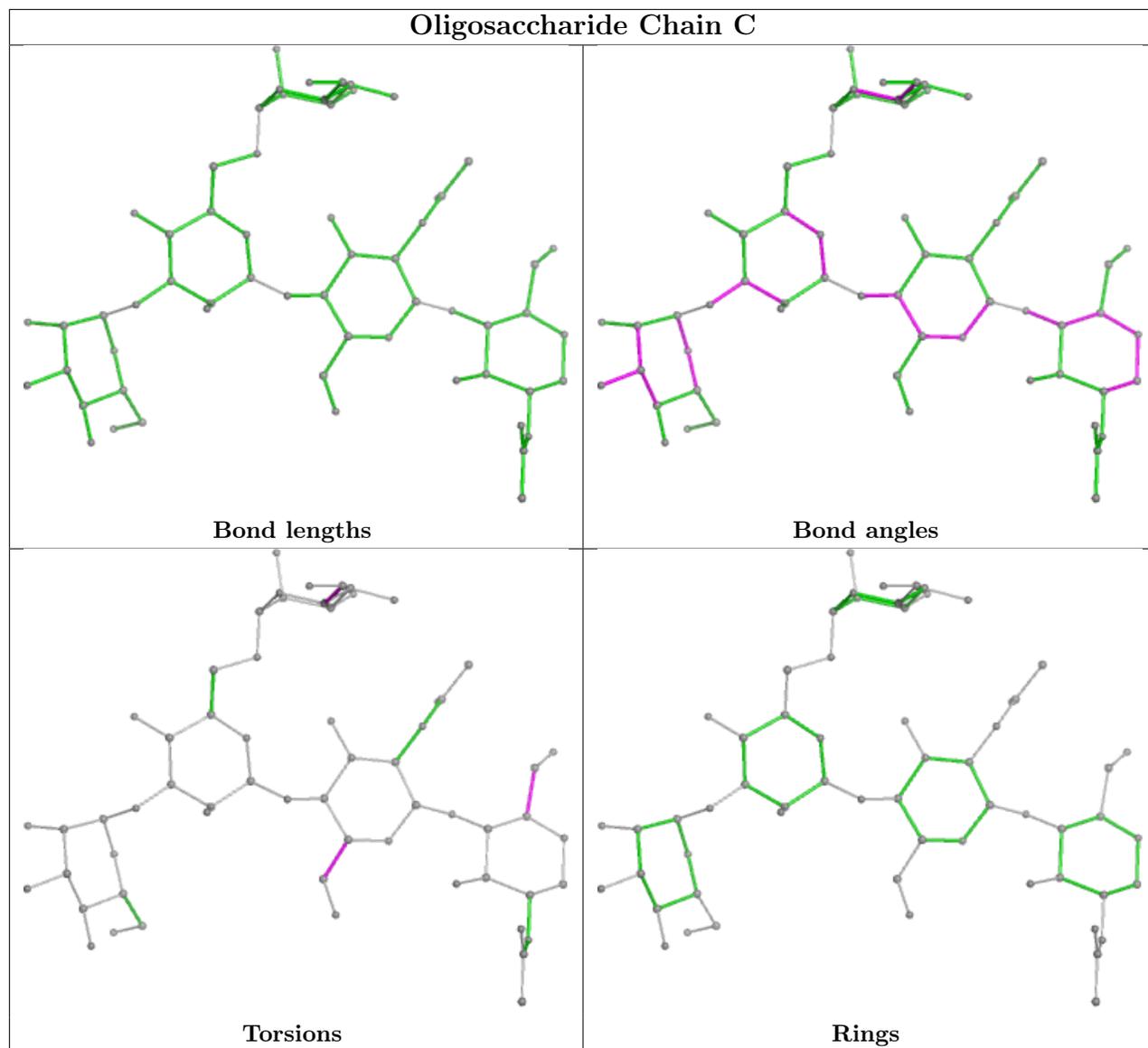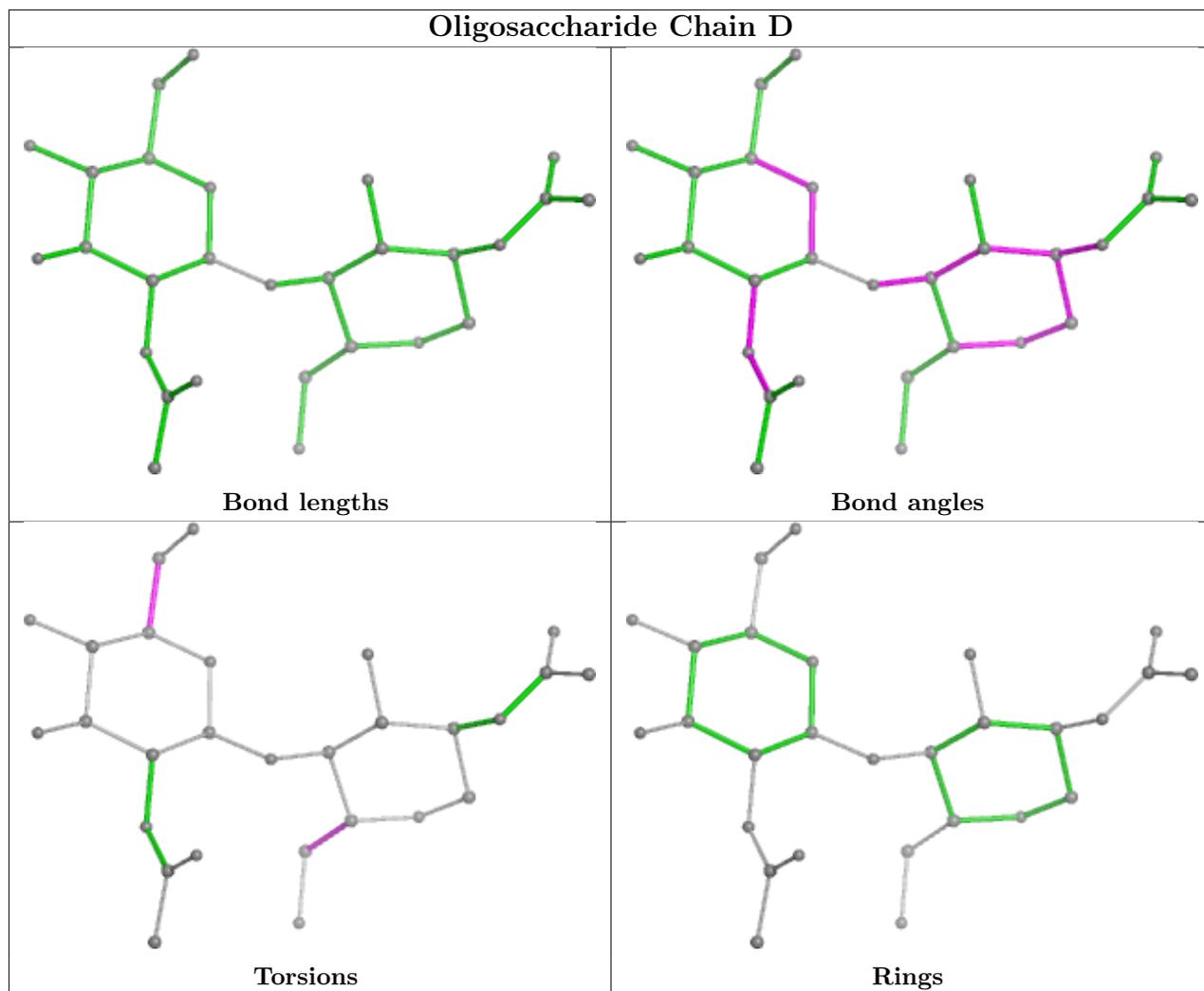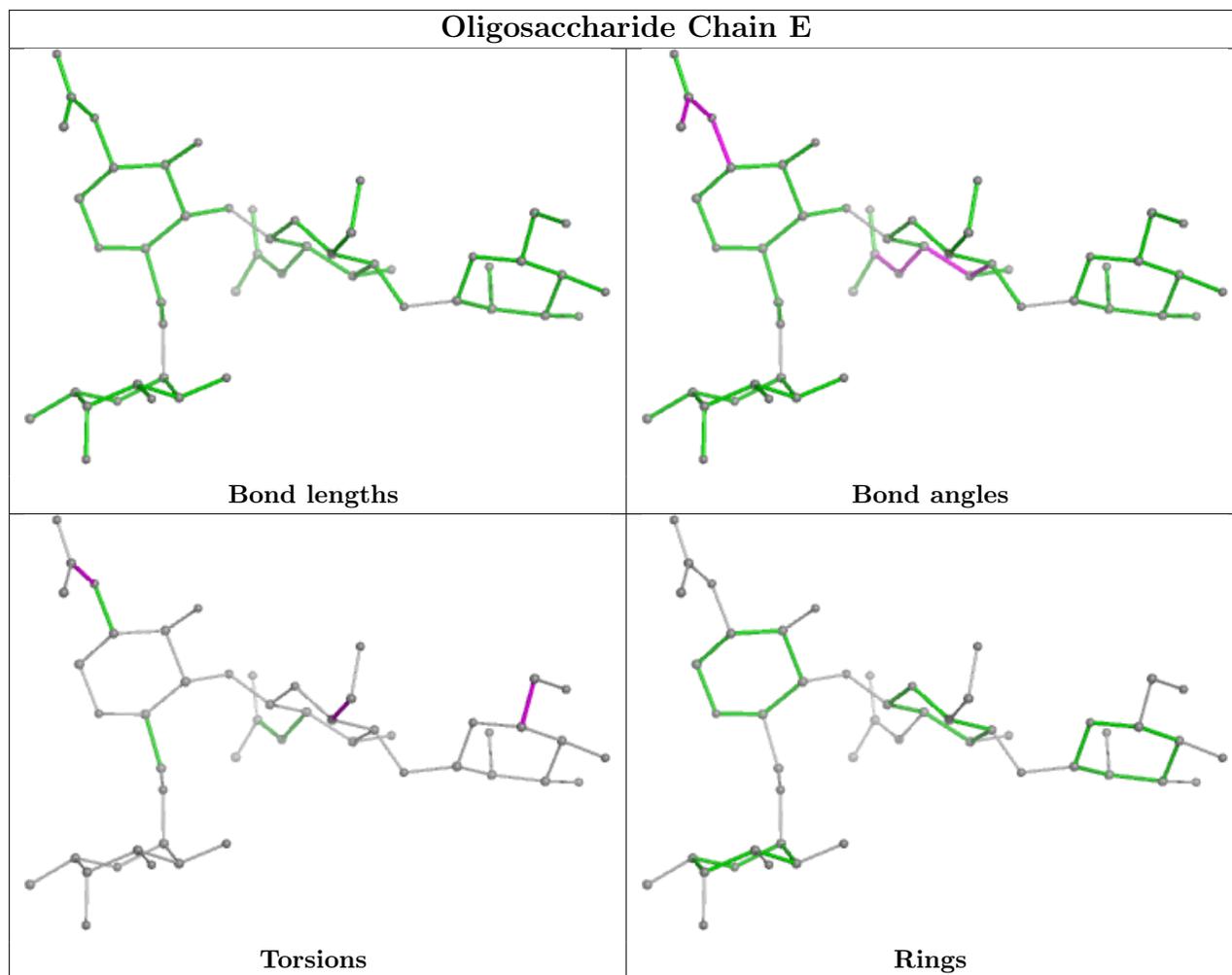
5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 5 are monoatomic - leaving 3 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#$|Z| > 2$	Counts	RMSZ	#$|Z| > 2$
11	A1J0C	A	808	6	74,74,74	0.64	0	94,96,96	1.14	6 (6%)
9	NAG	A	806	1	14,14,15	0.84	0	17,19,21	1.47	3 (17%)
9	NAG	A	805	1	14,14,15	0.93	1 (7%)	17,19,21	2.02	3 (17%)

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
11	A1J0C	A	808	6	-	13/88/88/88	1/3/3/3
9	NAG	A	806	1	-	0/6/23/26	0/1/1/1
9	NAG	A	805	1	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	A	805	NAG	O5-C1	2.11	1.47	1.43

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	805	NAG	O5-C5-C6	5.27	115.47	107.20
9	A	805	NAG	C1-O5-C5	5.02	118.99	112.19
11	A	808	A1J0C	C37-N7-C34	4.14	121.28	111.44
11	A	808	A1J0C	C36-C35-N7	-3.25	103.03	113.63
9	A	806	NAG	C1-O5-C5	3.16	116.47	112.19
11	A	808	A1J0C	C31-C32-N6	2.79	119.83	113.36
9	A	806	NAG	O4-C4-C5	2.26	114.91	109.30
9	A	806	NAG	O3-C3-C4	-2.18	105.31	110.35
11	A	808	A1J0C	C41-N9-C40	2.14	116.54	111.44
11	A	808	A1J0C	C46-C45-N8	2.14	120.62	113.63
11	A	808	A1J0C	C33-C34-N7	2.13	118.17	113.02
9	A	805	NAG	C2-N2-C7	2.11	125.90	122.90

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
11	A	808	A1J0C	C40-C39-N8-C38
11	A	808	A1J0C	C33-C34-N7-C35
11	A	808	A1J0C	C38-C37-N7-C34
9	A	805	NAG	C4-C5-C6-O6
9	A	805	NAG	O5-C5-C6-O6
11	A	808	A1J0C	N4-C23-C24-C25
11	A	808	A1J0C	C33-C34-N7-C37
11	A	808	A1J0C	C38-C37-N7-C35

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Mol	Chain	Res	Type	Atoms
11	A	808	A1J0C	C42-C41-N9-C43
11	A	808	A1J0C	N4-C23-C24-C29
11	A	808	A1J0C	C36-C35-N7-C37
11	A	808	A1J0C	O7-C23-C24-C25
11	A	808	A1J0C	C42-C41-N9-C40
11	A	808	A1J0C	O7-C23-C24-C29
11	A	808	A1J0C	C24-C23-N4-C13

All (1) ring outliers are listed below:

Mol	Chain	Res	Type	Atoms
11	A	808	A1J0C	C33-C34-C37-C38-C39-C40-C41-C42-N6-N7-N8-N9

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	806	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 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 A1J0C A 808

Bond lengths

Bond angles

Torsions

Rings
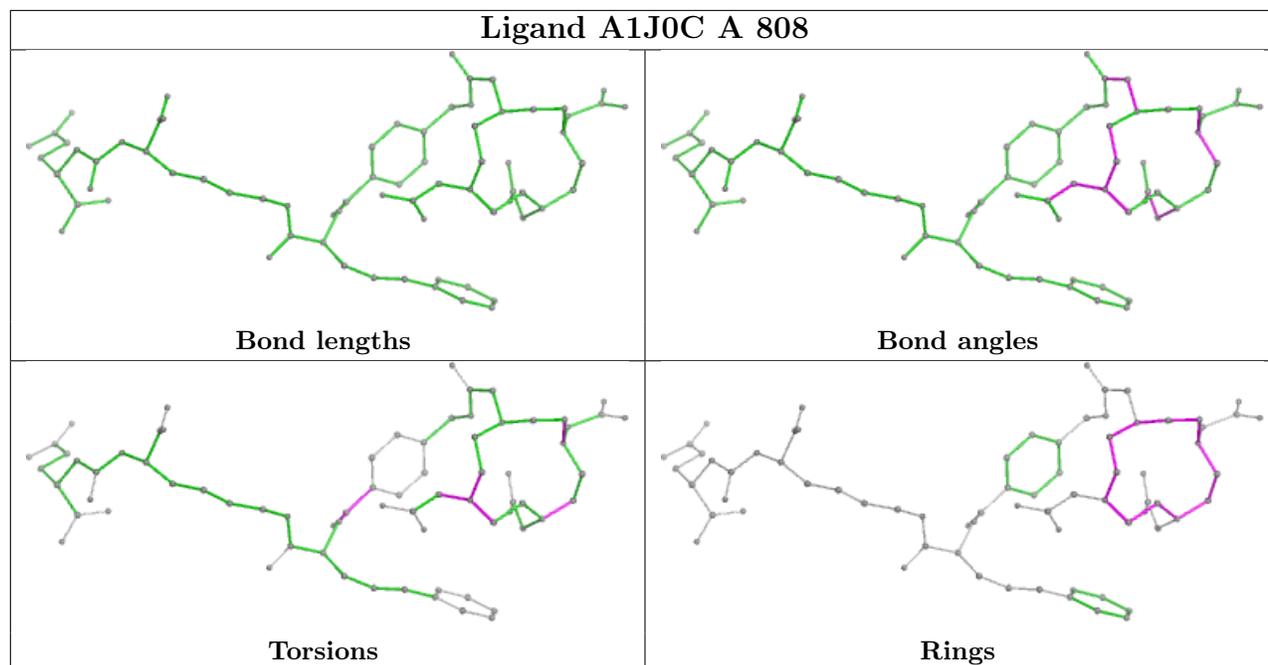
5.7 Other polymers ⓘ

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	693/707 (98%)	0.17	21 (3%)	52	60	8, 25, 46, 70	54 (7%)

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	653	PHE	5.1
1	A	656[A]	SER	4.7
1	A	124	HIS	3.8
1	A	506	PHE	3.1
1	A	651	GLN	2.8
1	A	545	LYS	2.7
1	A	652	ASP	2.6
1	A	131[A]	ILE	2.4
1	A	136	ASN	2.3
1	A	154	VAL	2.3
1	A	334	THR	2.3
1	A	138	ILE	2.3
1	A	487	GLY	2.2
1	A	546	PHE	2.2
1	A	155	SER	2.2
1	A	56	HIS	2.1
1	A	335	GLY	2.1
1	A	153	ASN	2.1
1	A	338	SER	2.0
1	A	337	PHE	2.0
1	A	325	VAL	2.0

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 (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
5	BMA	E	3	11/12	0.42	0.17	108,116,120,122	0
2	BMA	B	3	11/12	0.50	0.17	89,95,100,100	0
4	NAG	D	2	14/15	0.60	0.16	82,91,98,106	0
4	NAG	D	1	14/15	0.62	0.23	53,63,85,89	0
2	BMA	F	3	11/12	0.64	0.15	60,65,74,82	0
3	MAN	C	5	11/12	0.73	0.17	72,80,85,85	0
5	FUC	E	4	10/11	0.79	0.20	71,81,84,85	0
5	NAG	E	2	14/15	0.82	0.14	54,65,77,97	0
2	NAG	B	2	14/15	0.86	0.12	41,57,68,79	0
3	NAG	C	2	14/15	0.87	0.14	41,44,53,66	0
3	MAN	C	4	11/12	0.87	0.13	47,50,53,53	0
3	BMA	C	3	11/12	0.88	0.12	42,48,59,62	0
5	NAG	E	1	14/15	0.89	0.12	40,46,55,55	0
2	NAG	F	2	14/15	0.92	0.09	34,42,49,56	0
3	NAG	C	1	14/15	0.92	0.09	24,31,40,53	0
2	NAG	F	1	14/15	0.94	0.08	30,31,35,38	0
2	NAG	B	1	14/15	0.94	0.08	35,41,46,49	0

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

Electron density around Chain B:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
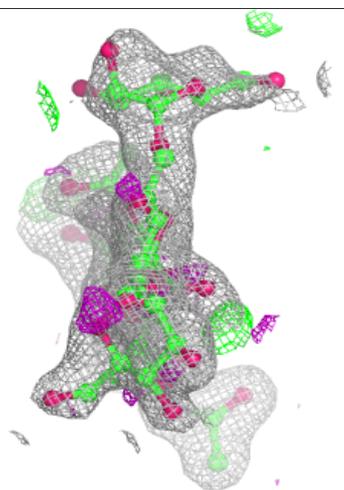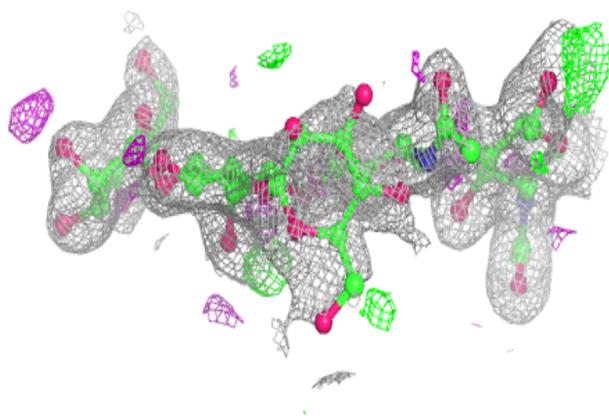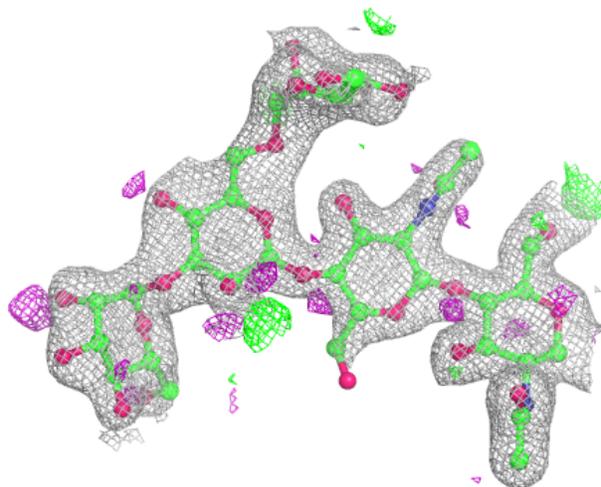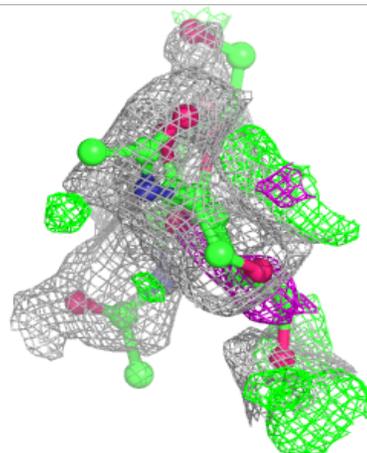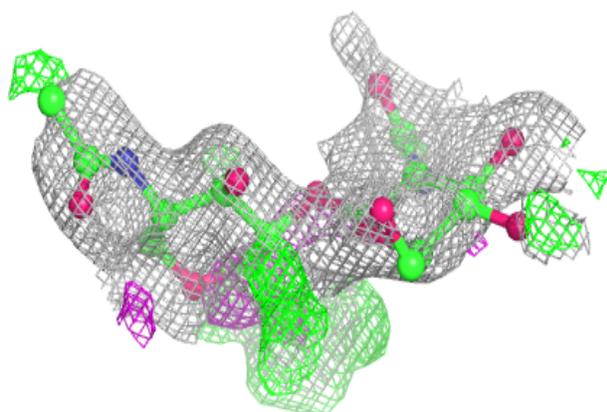and green (positive)
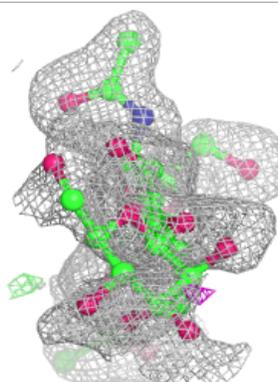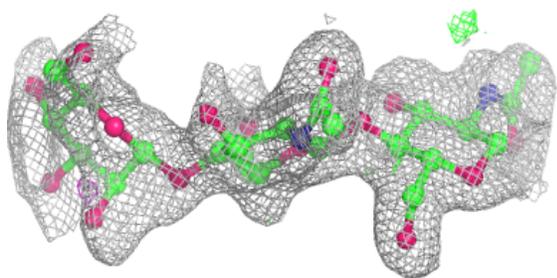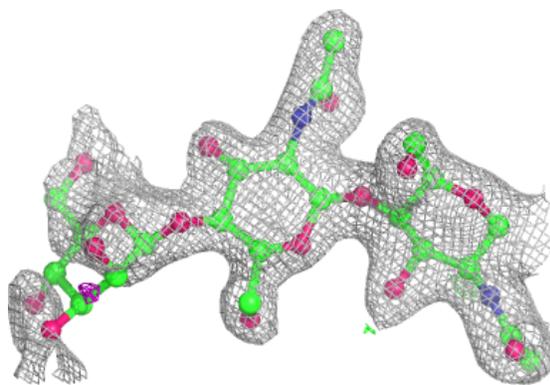
Electron density around Chain F:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
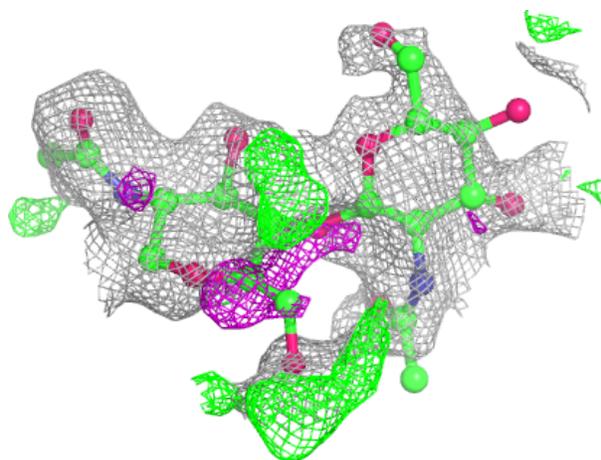mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
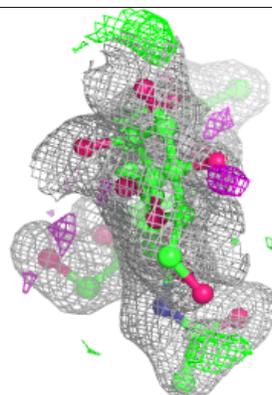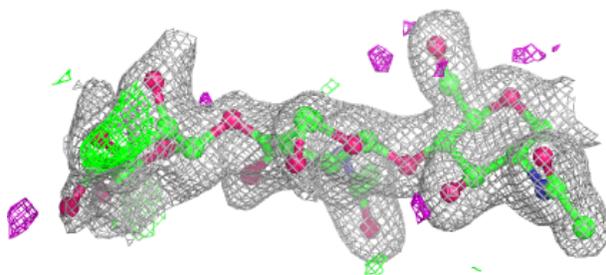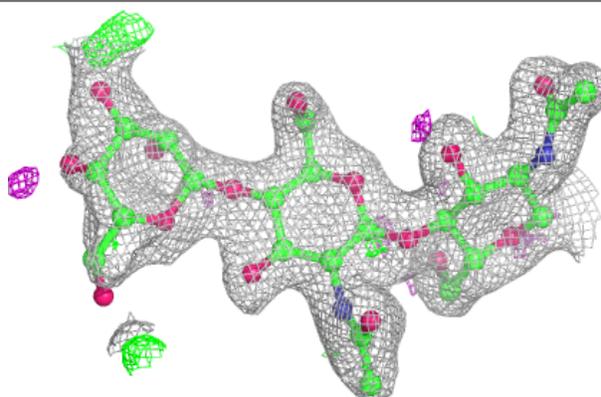
Electron density around Chain C:

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

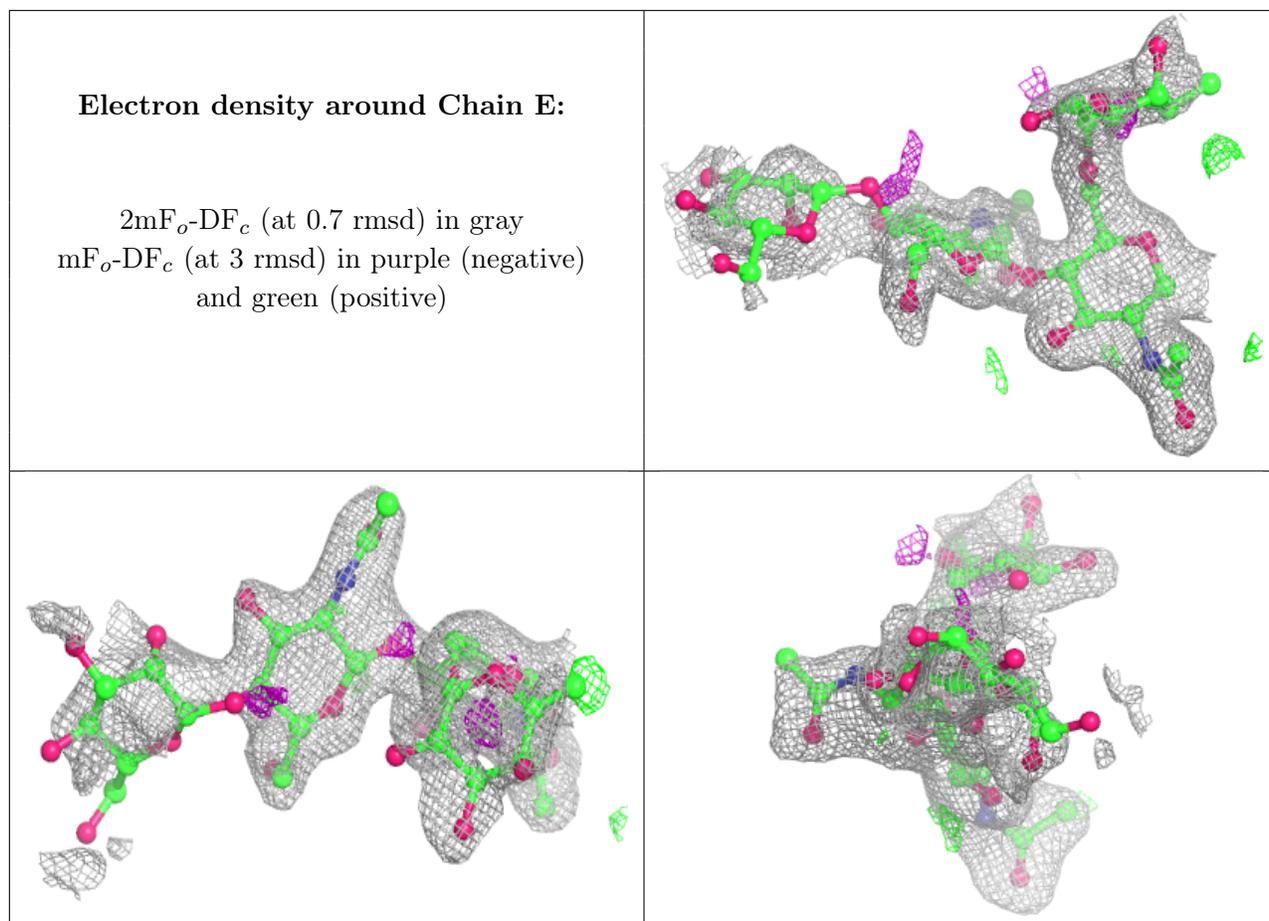**Electron density around Chain D:**

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around Chain E:

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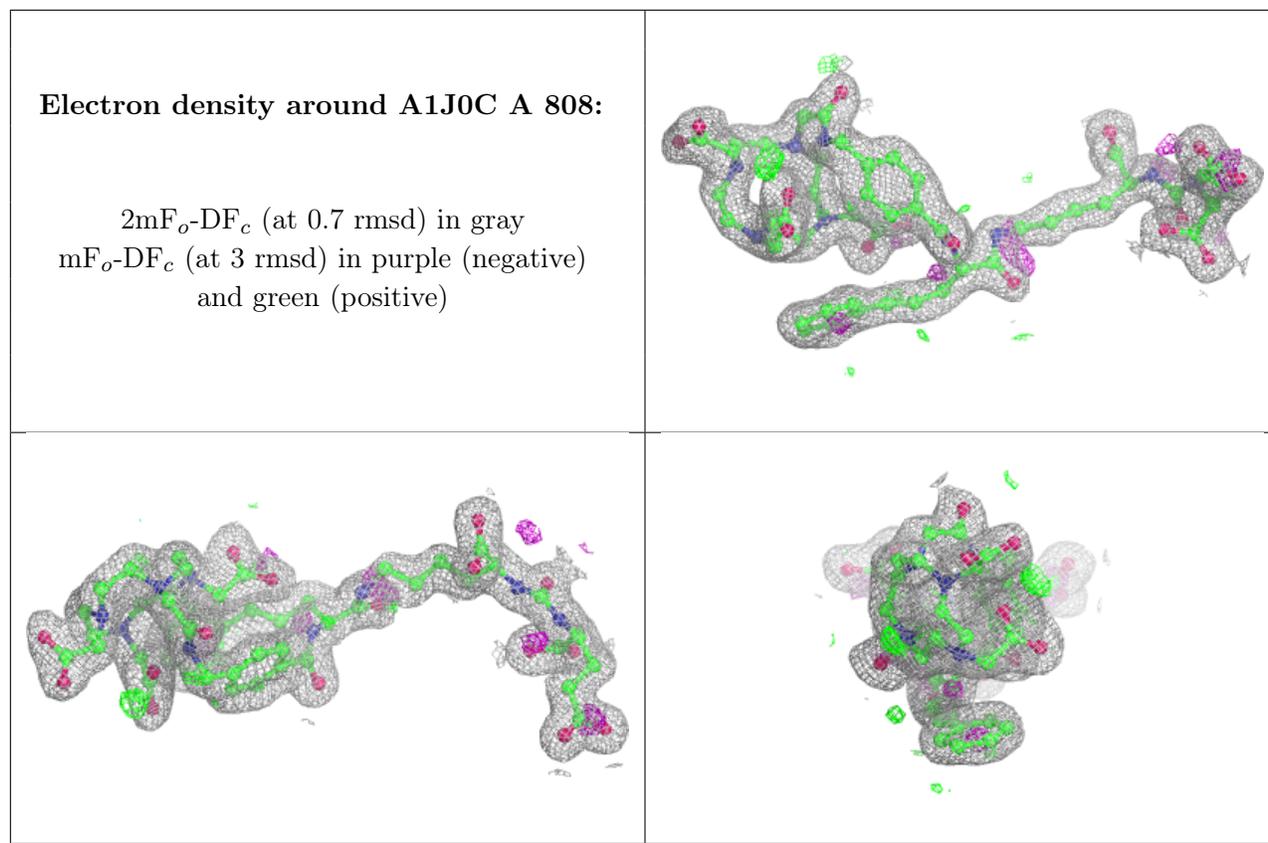mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

6.4 Ligands ⓘ

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(Å²)	Q<0.9
9	NAG	A	805	14/15	0.74	0.15	67,75,81,81	0
10	NA	A	807	1/1	0.88	0.26	54,54,54,54	0
9	NAG	A	806	14/15	0.91	0.09	29,39,45,47	0
11	A1J0C	A	808	72/72	0.95	0.10	17,36,48,55	0
6	ZN	A	801	1/1	1.00	0.02	19,19,19,19	0
6	ZN	A	802	1/1	1.00	0.03	19,19,19,19	0
7	CA	A	803	1/1	1.00	0.02	20,20,20,20	0
8	CL	A	804	1/1	1.00	0.04	21,21,21,21	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 A1J0C A 808:

$2mF_o$-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 ⓘ

There are no such residues in this entry.