



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 11:48 PM UTC

PDB ID : 3W2T / pdb_00003w2t
Title : Crystal structure of human deipeptidyl peptidase IV (DPP-4) in complex with vildagliptin
Authors : Kishida, H.; Nabeno, M.; Miyaguchi, I.; Tanaka, Y.; Katou, R.; Akahoshi, F.
Deposited on : 2012-12-04
Resolution : 2.36 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

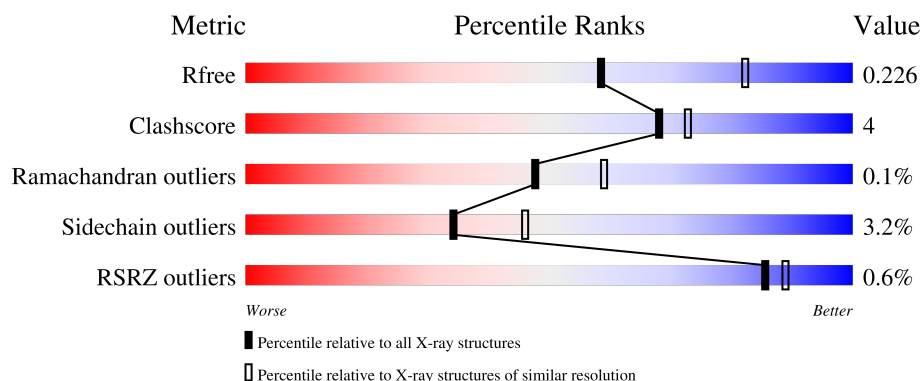
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.36 Å.

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



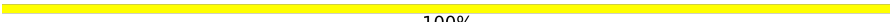
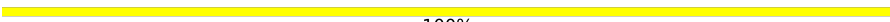
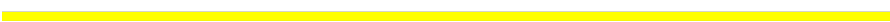
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	740	% 89% 9% ..
1	B	740	% 87% 10% ..
2	C	2	50% 50%
2	G	2	50% 50%
3	D	2	50% 50%

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Mol	Chain	Length	Quality of chain
3	E	2	 100%
3	F	2	 100%
3	H	2	 100%
3	I	2	 100%
3	J	2	 100%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 13311 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 Dipeptidyl peptidase 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	729	Total	C	N	O	S	0	0	0
			5971	3831	983	1131	26			
1	B	729	Total	C	N	O	S	0	0	0
			5971	3831	983	1131	26			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	767	HIS	-	expression tag	UNP P27487
A	768	HIS	-	expression tag	UNP P27487
A	769	HIS	-	expression tag	UNP P27487
A	770	HIS	-	expression tag	UNP P27487
A	771	HIS	-	expression tag	UNP P27487
A	772	HIS	-	expression tag	UNP P27487
B	767	HIS	-	expression tag	UNP P27487
B	768	HIS	-	expression tag	UNP P27487
B	769	HIS	-	expression tag	UNP P27487
B	770	HIS	-	expression tag	UNP P27487
B	771	HIS	-	expression tag	UNP P27487
B	772	HIS	-	expression tag	UNP P27487

- Molecule 2 is an oligosaccharide called beta-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.



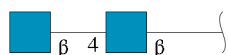
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	2	Total	C	N	O	0	0	0
			24	14	1	9			

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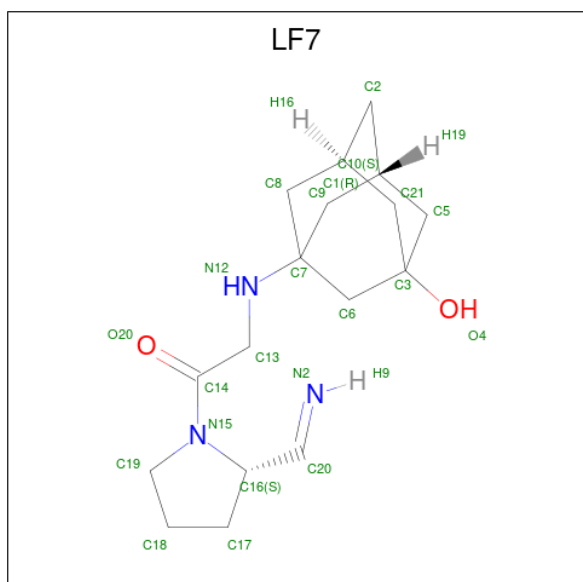
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	G	2	Total	C	N	O	0	0	0
			24	14	1	9			

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



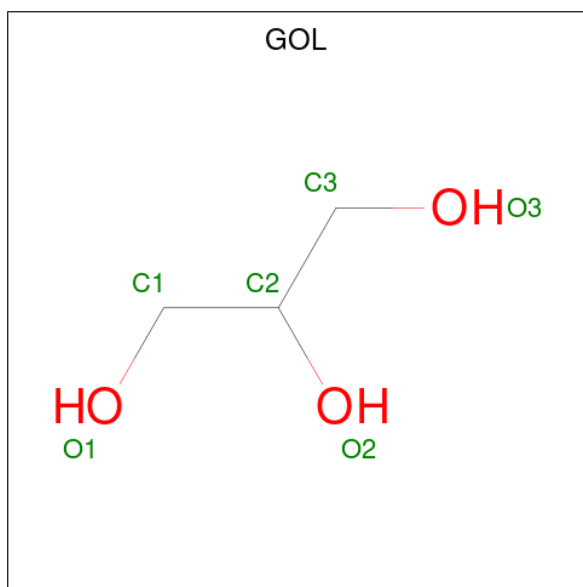
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	D	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	E	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	F	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	H	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	I	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	J	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is 2-{[(1r,3s,5R,7S)-3-hydroxytricyclo[3.3.1.1^{3,7}]decan-1-yl]amino}-1-{(2S)-2-[(E)-iminomethyl]pyrrolidin-1-yl}ethan-1-one (CCD ID: LF7) (formula: C₁₇H₂₇N₃O₂).



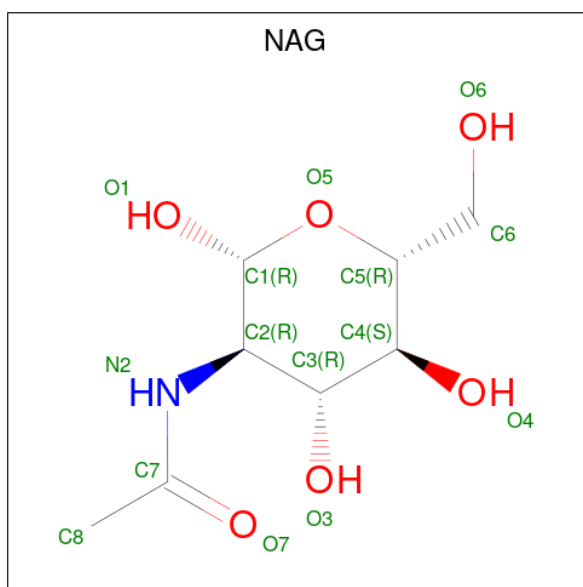
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			22	17	3	2		
4	B	1	Total	C	N	O	0	0
			22	17	3	2		

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



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

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

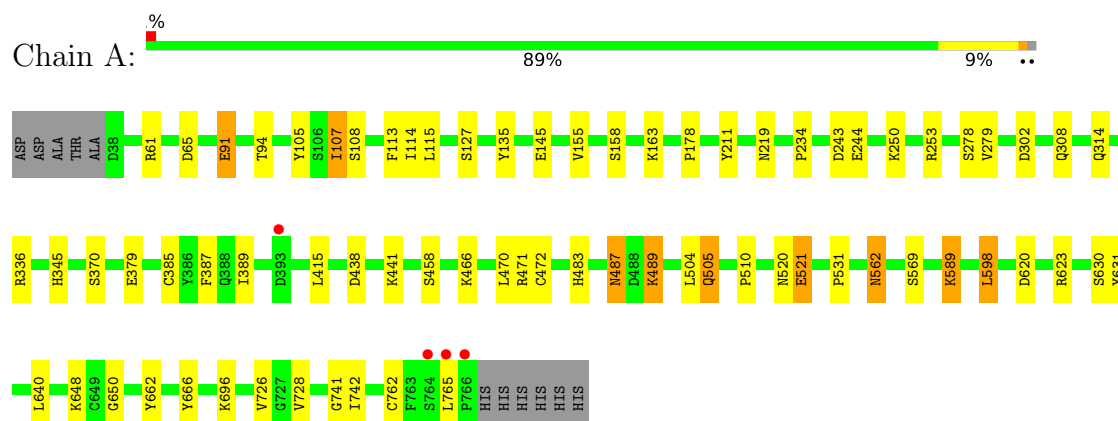
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	482	Total	O	0	0
			482	482		
7	B	545	Total	O	0	0
			545	545		

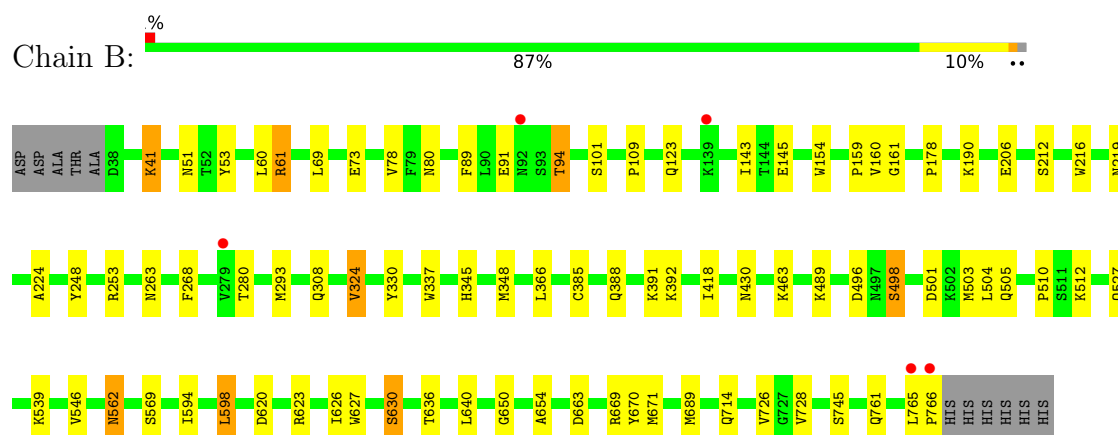
3 Residue-property plots

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: Dipeptidyl peptidase 4



- Molecule 1: Dipeptidyl peptidase 4



- Molecule 2: beta-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 2: beta-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose





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

Chain D: 50% 50%



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

Chain E: 100%



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

Chain F: 100%



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

Chain H: 100%



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

Chain I: 100%



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

Chain J: 100%



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	118.22Å 126.24Å 137.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.36 30.00 – 2.36	Depositor EDS
% Data completeness (in resolution range)	97.3 (30.00-2.36) 97.2 (30.00-2.36)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.30 (at 2.37Å)	Xtriage
Refinement program	REFMAC 5.5.0110	Depositor
R, R_{free}	0.180 , 0.231 0.178 , 0.226	Depositor DCC
R_{free} test set	4103 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å ²)	32.7	Xtriage
Anisotropy	0.469	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 35.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	13311	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.31% 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: LF7, GOL, NAG, FUL

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	0.66	2/6143 (0.0%)	0.81	2/8355 (0.0%)
1	B	0.66	2/6143 (0.0%)	0.81	1/8355 (0.0%)
All	All	0.66	4/12286 (0.0%)	0.81	3/16710 (0.0%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	630	SER	N-CA	-7.05	1.37	1.46
1	B	123	GLN	CA-C	5.89	1.55	1.52
1	A	531	PRO	CA-C	5.28	1.54	1.51
1	A	630	SER	CA-CB	-5.07	1.45	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	589	LYS	N-CA-C	-5.12	105.70	111.28
1	B	463	LYS	N-CA-C	5.10	117.50	111.33
1	A	765	LEU	N-CA-C	5.08	116.07	109.72

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	5971	0	5681	40	0
1	B	5971	0	5682	47	0
2	C	24	0	22	0	0
2	G	24	0	22	3	0
3	D	28	0	25	0	0
3	E	28	0	25	0	0
3	F	28	0	25	0	0
3	H	28	0	25	0	0
3	I	28	0	25	0	0
3	J	28	0	25	0	0
4	A	22	0	25	2	0
4	B	22	0	25	0	0
5	A	6	0	8	0	0
5	B	6	0	8	0	0
6	A	42	0	39	1	0
6	B	28	0	26	0	0
7	A	482	0	0	2	0
7	B	545	0	0	4	0
All	All	13311	0	11688	87	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 4.

All (87) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:61:ARG:HG3	1:B:61:ARG:HH11	1.20	1.03
1:A:253:ARG:HH21	1:B:253:ARG:HH21	1.20	0.86
6:A:809:NAG:H81	7:A:2067:HOH:O	1.86	0.74
1:A:114:ILE:HG23	1:A:135:TYR:HB3	1.70	0.73
1:B:293:MET:HE3	1:B:324:VAL:HG12	1.70	0.73
1:A:505:GLN:HA	1:A:505:GLN:HE21	1.53	0.73
1:B:61:ARG:HH11	1:B:61:ARG:CG	1.99	0.72
1:B:80:ASN:HB2	2:G:1:NAG:H82	1.72	0.71
1:B:726:VAL:HG23	1:B:728:VAL:HG23	1.73	0.71
1:B:539:LYS:HE3	1:B:620:ASP:HA	1.74	0.67
1:B:41:LYS:HE3	1:B:53:TYR:OH	1.97	0.64
1:A:91:GLU:O	1:A:94:THR:HG23	2.00	0.61
1:A:640:LEU:HD11	1:A:650:GLY:HA3	1.83	0.60
1:B:345:HIS:HD2	7:B:1025:HOH:O	1.84	0.60
1:B:61:ARG:HG3	1:B:61:ARG:NH1	1.99	0.60
1:A:219:ASN:H	1:A:308:GLN:HE22	1.50	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:620:ASP:OD2	1:A:623:ARG:HD3	2.03	0.59
1:A:520:ASN:C	1:A:521:GLU:HG2	2.28	0.58
1:B:503:MET:HA	1:B:503:MET:HE2	1.84	0.58
1:B:293:MET:CE	1:B:324:VAL:HG12	2.35	0.56
1:B:219:ASN:H	1:B:308:GLN:HE22	1.53	0.55
1:A:696:LYS:HG3	1:A:728:VAL:HG22	1.89	0.55
1:B:143:ILE:CD1	1:B:178:PRO:HB2	2.36	0.55
1:A:741:GLY:O	1:A:742:ILE:C	2.50	0.54
1:B:91:GLU:O	1:B:94:THR:HG22	2.07	0.54
1:B:78:VAL:HG23	1:B:89:PHE:HB2	1.90	0.53
1:A:105:TYR:HB2	1:A:114:ILE:HD11	1.89	0.53
1:B:69:LEU:HD23	1:B:78:VAL:HG22	1.90	0.53
1:B:598:LEU:HD22	1:B:671:MET:HG2	1.92	0.51
1:A:345:HIS:HE1	1:A:389:ILE:O	1.94	0.51
1:B:562:ASN:C	1:B:562:ASN:HD22	2.17	0.51
1:B:219:ASN:N	1:B:308:GLN:HE22	2.09	0.50
1:B:505:GLN:HE21	1:B:505:GLN:HA	1.77	0.50
1:B:512:LYS:HE3	1:B:527:GLN:CD	2.36	0.50
1:A:510:PRO:HD3	1:A:569:SER:HB2	1.94	0.48
1:B:154:TRP:CE2	1:B:212:SER:HB3	2.48	0.48
1:B:501:ASP:O	1:B:505:GLN:HG2	2.13	0.48
1:A:107:ILE:HG22	1:A:108:SER:O	2.14	0.48
1:B:620:ASP:OD1	1:B:623:ARG:HD3	2.14	0.47
1:A:562:ASN:HD22	1:A:562:ASN:C	2.23	0.47
1:A:438:ASP:OD2	1:A:441:LYS:HD3	2.14	0.47
1:A:105:TYR:HA	1:A:115:LEU:O	2.15	0.46
7:B:1056:HOH:O	2:G:1:NAG:C8	2.63	0.46
1:A:219:ASN:N	1:A:308:GLN:HE22	2.14	0.46
1:B:330:TYR:HB2	1:B:337:TRP:CH2	2.51	0.46
1:B:512:LYS:HE3	1:B:527:GLN:OE1	2.17	0.45
1:A:666:TYR:CZ	4:A:801:LF7:H1	2.51	0.45
1:A:415:LEU:HD23	1:A:415:LEU:C	2.41	0.45
1:B:489:LYS:HE3	1:B:489:LYS:HB2	1.63	0.45
1:B:206:GLU:OE1	1:B:663:ASP:OD1	2.35	0.44
1:A:234:PRO:HB2	1:B:248:TYR:CZ	2.53	0.44
1:A:487:ASN:HD22	1:A:487:ASN:C	2.25	0.44
7:B:1056:HOH:O	2:G:1:NAG:H83	2.17	0.44
1:A:65:ASP:OD2	1:A:466:LYS:HB2	2.17	0.44
1:A:487:ASN:ND2	1:A:489:LYS:H	2.15	0.44
1:A:219:ASN:OD1	1:A:219:ASN:C	2.60	0.44
1:A:127:SER:HB3	1:A:211:TYR:CD1	2.53	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:726:VAL:HG23	1:A:728:VAL:HG23	1.99	0.44
1:A:370:SER:HB2	1:A:387:PHE:O	2.18	0.43
1:B:496:ASP:OD1	1:B:498:SER:HB2	2.18	0.43
1:B:510:PRO:HD3	1:B:569:SER:HB2	1.99	0.43
1:B:630:SER:HA	1:B:654:ALA:O	2.17	0.43
1:A:662:TYR:CE1	4:A:801:LF7:H2	2.54	0.43
1:A:458:SER:OG	1:A:471:ARG:NH1	2.52	0.43
1:B:61:ARG:CG	1:B:61:ARG:NH1	2.69	0.43
1:B:224:ALA:HB1	1:B:268:PHE:CZ	2.54	0.43
1:A:244:GLU:HG3	1:B:689:MET:HE3	2.00	0.42
1:B:109:PRO:HD2	1:B:161:GLY:O	2.20	0.42
1:B:418:ILE:HA	1:B:430:ASN:O	2.19	0.42
1:B:546:VAL:HG12	1:B:627:TRP:O	2.18	0.42
1:A:113:PHE:CE2	1:A:178:PRO:HG2	2.54	0.42
1:A:648:LYS:HE2	1:A:762:CYS:O	2.20	0.42
1:B:51:ASN:HB3	7:B:1038:HOH:O	2.20	0.42
1:B:626:ILE:HG23	1:B:636:THR:HG23	2.01	0.42
1:B:765:LEU:HA	1:B:766:PRO:HD2	1.70	0.42
1:A:243:ASP:HB3	7:A:2479:HOH:O	2.20	0.41
1:B:159:PRO:HD3	1:B:216:TRP:CB	2.50	0.41
1:B:640:LEU:HD11	1:B:650:GLY:HA3	2.02	0.41
1:B:669:ARG:HD2	1:B:670:TYR:CZ	2.55	0.41
1:A:345:HIS:CE1	1:A:389:ILE:O	2.73	0.41
1:A:158:SER:OG	1:A:163:LYS:HB2	2.21	0.41
1:B:388:GLN:HB2	1:B:391:LYS:HB2	2.02	0.41
1:A:470:LEU:HD12	1:A:483:HIS:NE2	2.36	0.41
1:A:113:PHE:CZ	1:A:178:PRO:HG2	2.56	0.40
1:A:302:ASP:HB3	1:A:314:GLN:HB2	2.03	0.40
1:A:598:LEU:HG	1:A:631:TYR:OH	2.21	0.40
1:B:60:LEU:HD12	1:B:60:LEU:C	2.46	0.40

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	727/740 (98%)	697 (96%)	30 (4%)	0	100	100
1	B	727/740 (98%)	698 (96%)	28 (4%)	1 (0%)	48	59
All	All	1454/1480 (98%)	1395 (96%)	58 (4%)	1 (0%)	48	59

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	714	GLN

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	654/663 (99%)	634 (97%)	20 (3%)	35	47
1	B	654/663 (99%)	632 (97%)	22 (3%)	32	43
All	All	1308/1326 (99%)	1266 (97%)	42 (3%)	34	46

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	61	ARG
1	A	91	GLU
1	A	107	ILE
1	A	145	GLU
1	A	155	VAL
1	A	250	LYS
1	A	278	SER
1	A	279	VAL
1	A	336	ARG
1	A	379	GLU
1	A	385	CYS
1	A	472	CYS

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Mol	Chain	Res	Type
1	A	487	ASN
1	A	489	LYS
1	A	504	LEU
1	A	505	GLN
1	A	521	GLU
1	A	562	ASN
1	A	589	LYS
1	A	598	LEU
1	B	41	LYS
1	B	61	ARG
1	B	73	GLU
1	B	94	THR
1	B	101	SER
1	B	145	GLU
1	B	160	VAL
1	B	190	LYS
1	B	263	ASN
1	B	280	THR
1	B	324	VAL
1	B	348	MET
1	B	366	LEU
1	B	385	CYS
1	B	392	LYS
1	B	498	SER
1	B	504	LEU
1	B	562	ASN
1	B	594	ILE
1	B	598	LEU
1	B	745	SER
1	B	761	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (33) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	112	GLN
1	A	141	GLN
1	A	169	ASN
1	A	227	GLN
1	A	263	ASN
1	A	286	GLN
1	A	308	GLN
1	A	314	GLN

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Mol	Chain	Res	Type
1	A	345	HIS
1	A	430	ASN
1	A	435	GLN
1	A	487	ASN
1	A	505	GLN
1	A	562	ASN
1	A	572	ASN
1	A	679	ASN
1	A	694	ASN
1	B	112	GLN
1	B	138	ASN
1	B	169	ASN
1	B	263	ASN
1	B	286	GLN
1	B	308	GLN
1	B	345	HIS
1	B	430	ASN
1	B	435	GLN
1	B	505	GLN
1	B	508	GLN
1	B	562	ASN
1	B	595	ASN
1	B	606	GLN
1	B	679	ASN
1	B	694	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

16 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	2,1	14,14,15	0.47	0	17,19,21	1.48	1 (5%)
2	FUL	C	2	2	10,10,11	0.71	0	14,14,16	0.78	0
3	NAG	D	1	3,1	14,14,15	0.55	0	17,19,21	1.02	0
3	NAG	D	2	3	14,14,15	0.61	0	17,19,21	1.30	1 (5%)
3	NAG	E	1	3,1	14,14,15	0.68	0	17,19,21	1.13	2 (11%)
3	NAG	E	2	3	14,14,15	0.37	0	17,19,21	1.06	1 (5%)
3	NAG	F	1	3,1	14,14,15	0.51	0	17,19,21	1.67	2 (11%)
3	NAG	F	2	3	14,14,15	0.53	0	17,19,21	1.23	2 (11%)
2	NAG	G	1	2,1	14,14,15	0.56	0	17,19,21	3.49	7 (41%)
2	FUL	G	2	2	10,10,11	0.80	0	14,14,16	1.07	0
3	NAG	H	1	3,1	14,14,15	0.57	0	17,19,21	0.89	1 (5%)
3	NAG	H	2	3	14,14,15	0.49	0	17,19,21	1.21	2 (11%)
3	NAG	I	1	3,1	14,14,15	0.57	0	17,19,21	1.18	1 (5%)
3	NAG	I	2	3	14,14,15	0.48	0	17,19,21	1.12	1 (5%)
3	NAG	J	1	3,1	14,14,15	0.52	0	17,19,21	1.22	2 (11%)
3	NAG	J	2	3	14,14,15	0.51	0	17,19,21	1.07	1 (5%)

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	C	1	2,1	-	2/6/23/26	0/1/1/1
2	FUL	C	2	2	-	-	0/1/1/1
3	NAG	D	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	2/6/23/26	0/1/1/1
3	NAG	E	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1
3	NAG	F	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	F	2	3	-	2/6/23/26	0/1/1/1
2	NAG	G	1	2,1	-	5/6/23/26	0/1/1/1
2	FUL	G	2	2	-	-	0/1/1/1
3	NAG	H	1	3,1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	H	2	3	-	0/6/23/26	0/1/1/1
3	NAG	I	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	I	2	3	-	2/6/23/26	0/1/1/1
3	NAG	J	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	J	2	3	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	1	NAG	C2-N2-C7	8.87	134.79	122.90
2	G	1	NAG	C1-O5-C5	8.51	123.59	112.19
2	C	1	NAG	C1-O5-C5	4.91	118.76	112.19
3	F	1	NAG	C1-O5-C5	4.44	118.14	112.19
2	G	1	NAG	C4-C3-C2	-4.32	104.68	111.02
3	D	2	NAG	C1-O5-C5	4.07	117.64	112.19
3	I	2	NAG	C1-O5-C5	3.83	117.32	112.19
3	F	1	NAG	C2-N2-C7	-3.78	117.83	122.90
3	E	2	NAG	C1-O5-C5	3.54	116.93	112.19
3	J	2	NAG	C1-O5-C5	3.54	116.93	112.19
3	E	1	NAG	C1-O5-C5	3.31	116.62	112.19
3	I	1	NAG	C1-O5-C5	3.26	116.56	112.19
3	F	2	NAG	C1-O5-C5	3.26	116.55	112.19
3	J	1	NAG	C1-O5-C5	3.00	116.21	112.19
2	G	1	NAG	O5-C5-C6	-2.74	102.32	107.66
2	G	1	NAG	C8-C7-N2	2.60	120.43	116.12
2	G	1	NAG	C1-C2-N2	2.41	114.23	110.43
2	G	1	NAG	O5-C5-C4	2.28	116.36	110.83
3	J	1	NAG	C2-N2-C7	-2.27	119.85	122.90
3	F	2	NAG	C2-N2-C7	2.27	125.94	122.90
3	H	2	NAG	C3-C4-C5	-2.26	106.14	110.23
3	H	1	NAG	C1-O5-C5	-2.21	109.22	112.19
3	E	1	NAG	O5-C1-C2	-2.09	108.06	111.29
3	H	2	NAG	O7-C7-N2	2.02	125.55	121.98

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	1	NAG	O5-C5-C6-O6
2	G	1	NAG	C4-C5-C6-O6

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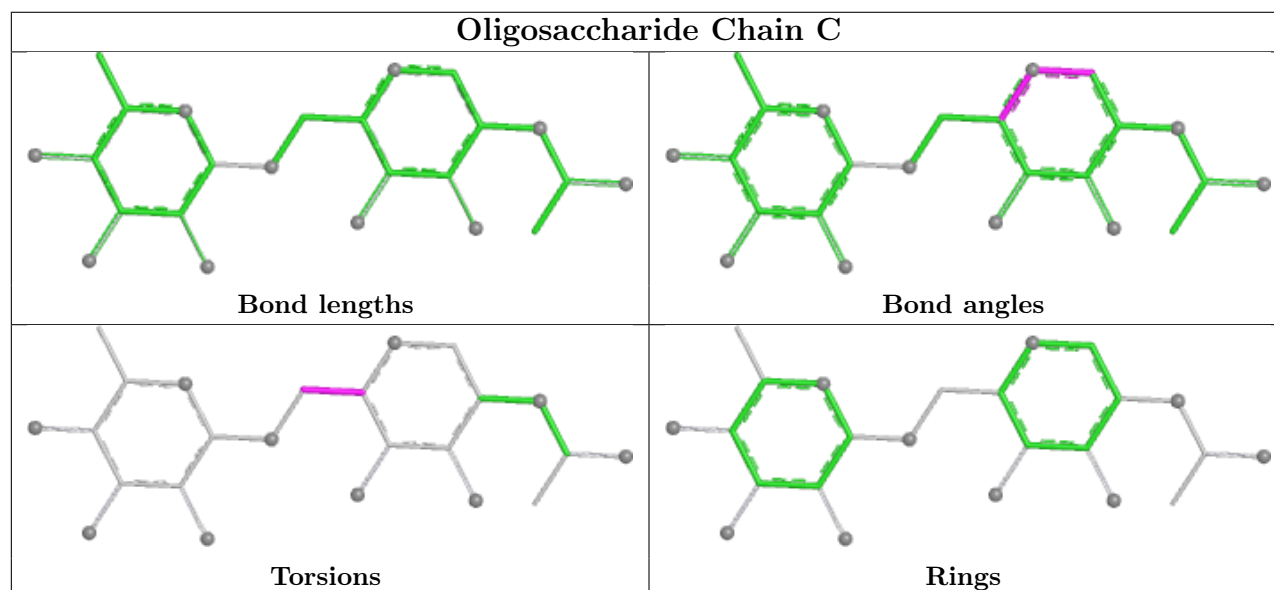
Mol	Chain	Res	Type	Atoms
3	D	2	NAG	C4-C5-C6-O6
2	G	1	NAG	O5-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6
3	D	2	NAG	O5-C5-C6-O6
2	G	1	NAG	C8-C7-N2-C2
2	G	1	NAG	O7-C7-N2-C2
3	F	2	NAG	C8-C7-N2-C2
3	F	2	NAG	O7-C7-N2-C2
3	E	2	NAG	O5-C5-C6-O6
3	E	2	NAG	C4-C5-C6-O6
3	I	2	NAG	C4-C5-C6-O6
3	J	2	NAG	C4-C5-C6-O6
3	I	2	NAG	O5-C5-C6-O6
2	G	1	NAG	C3-C2-N2-C7
3	J	2	NAG	O5-C5-C6-O6

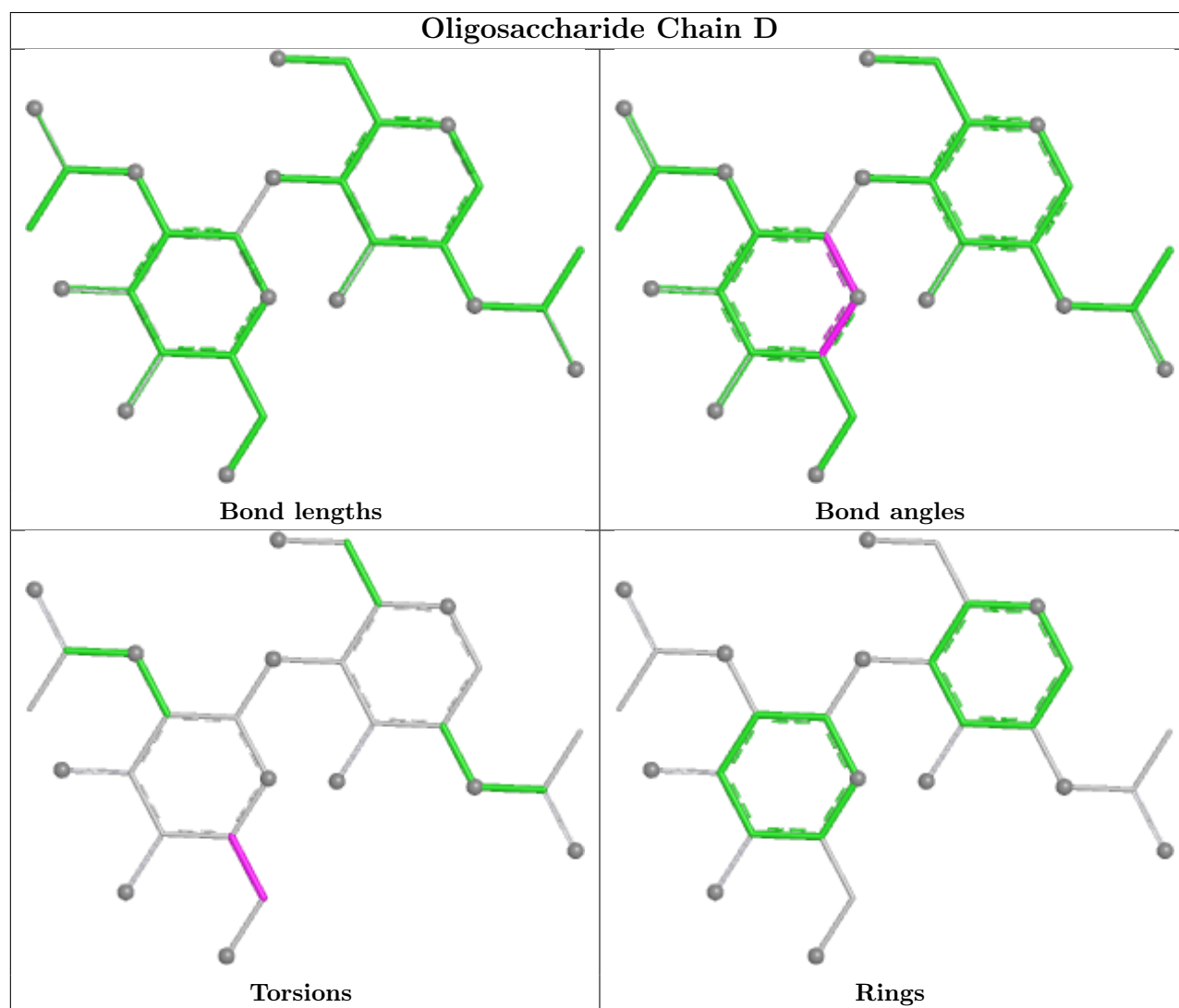
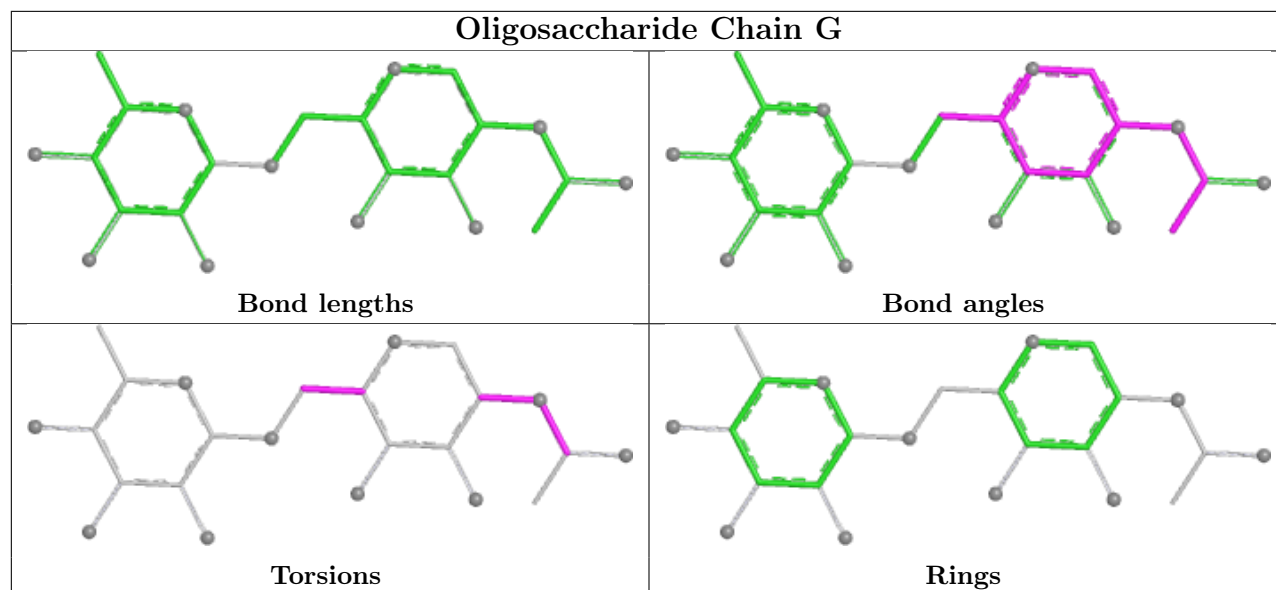
There are no ring outliers.

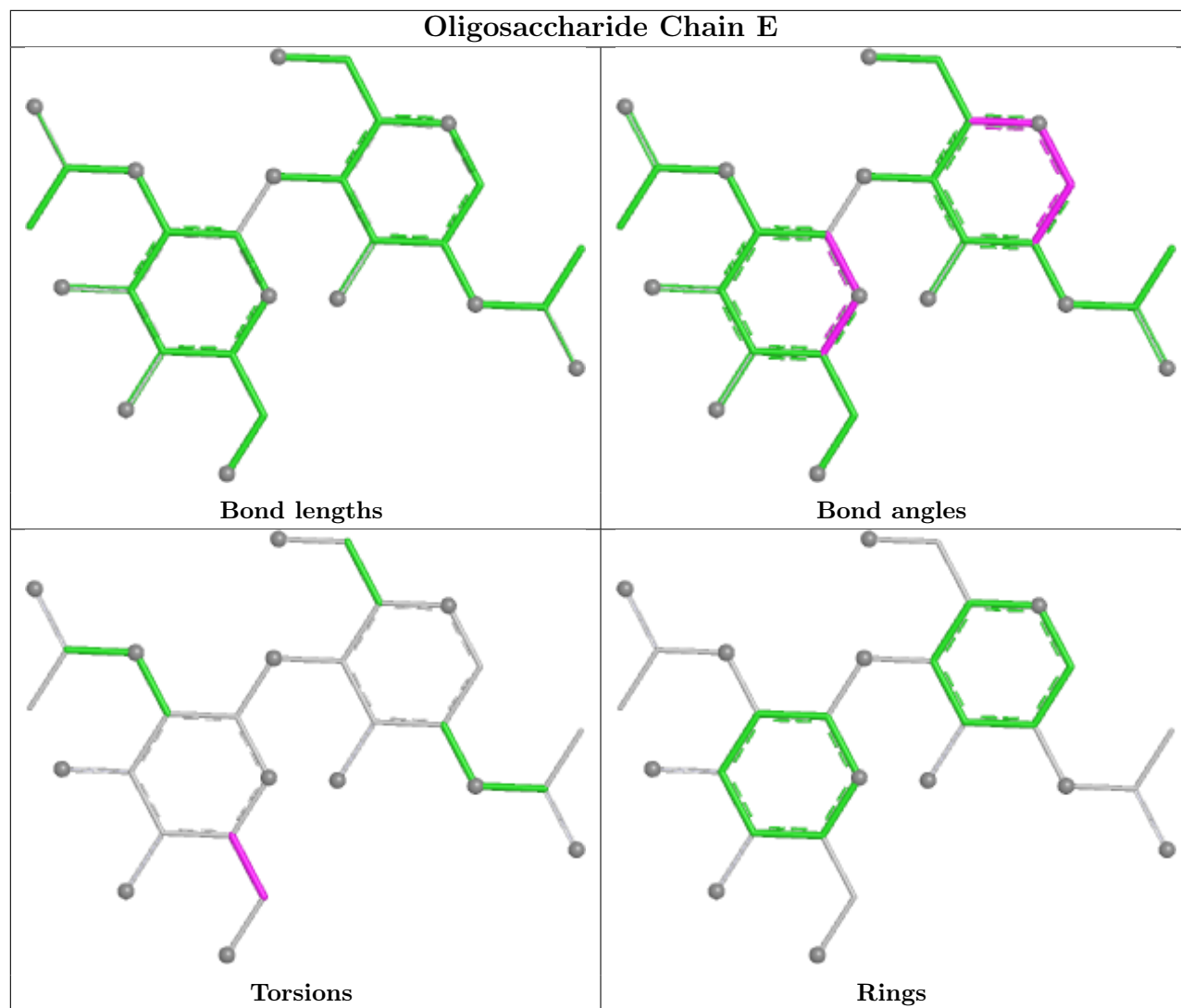
1 monomer is involved in 3 short contacts:

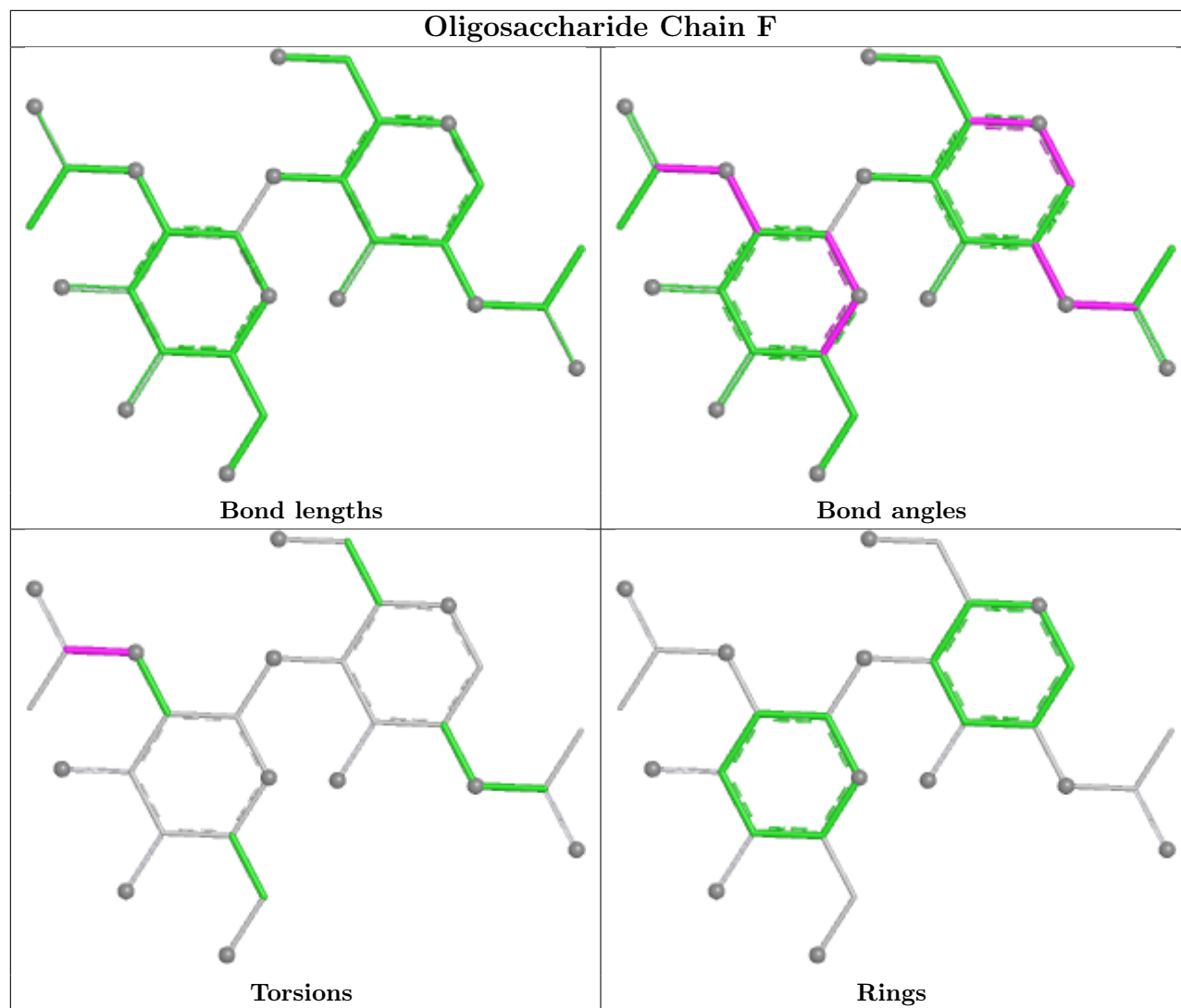
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	G	1	NAG	3	0

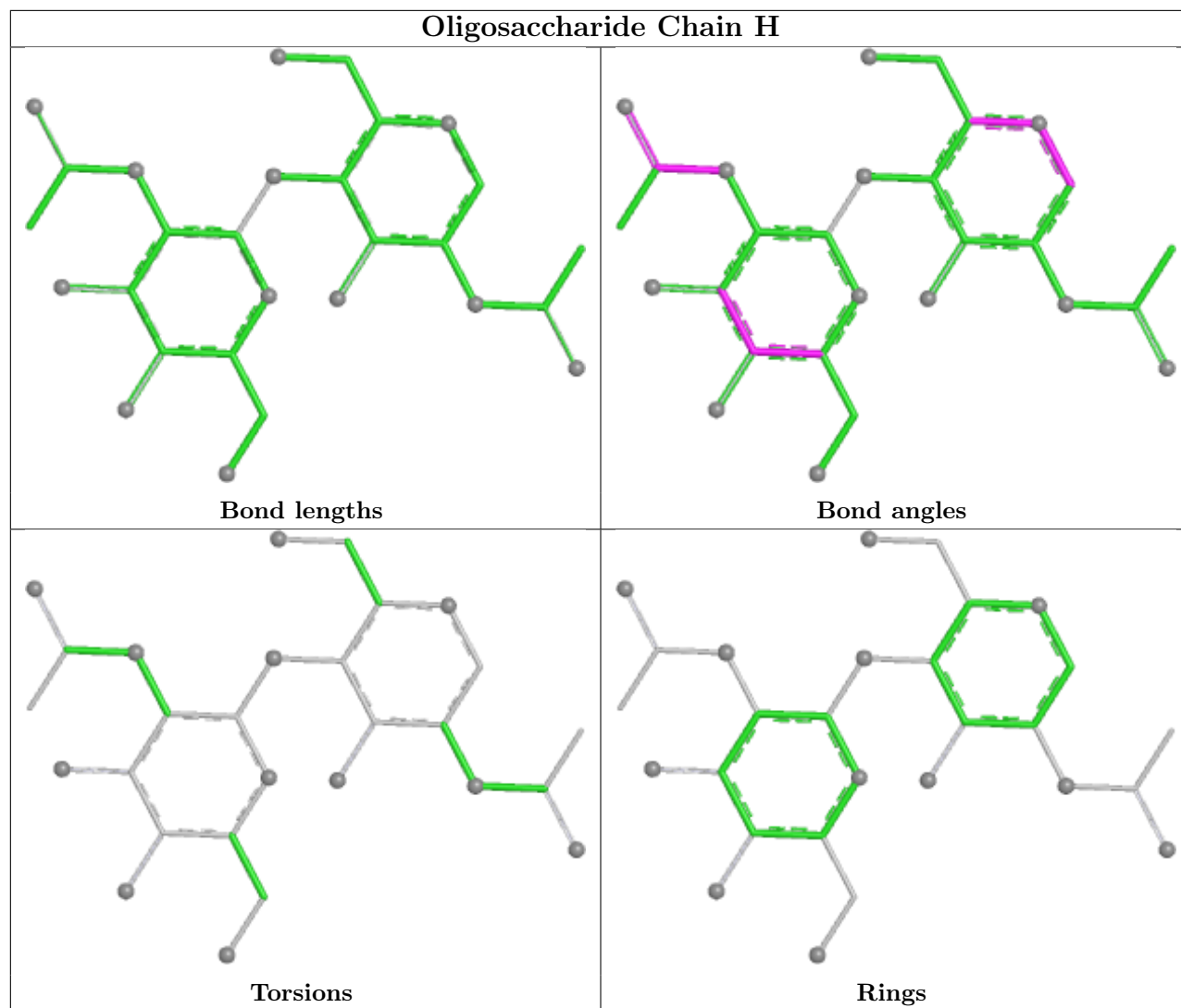
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

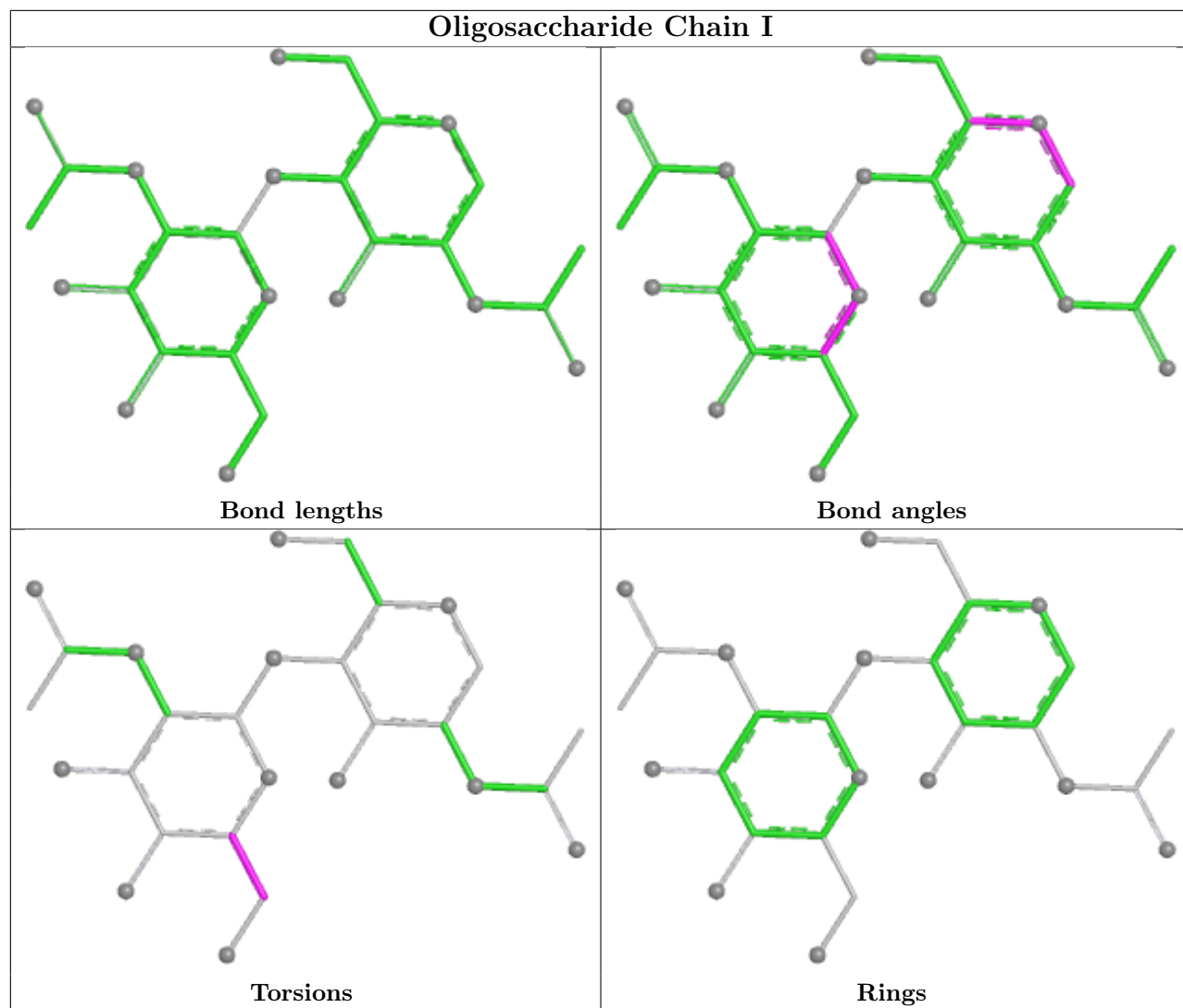


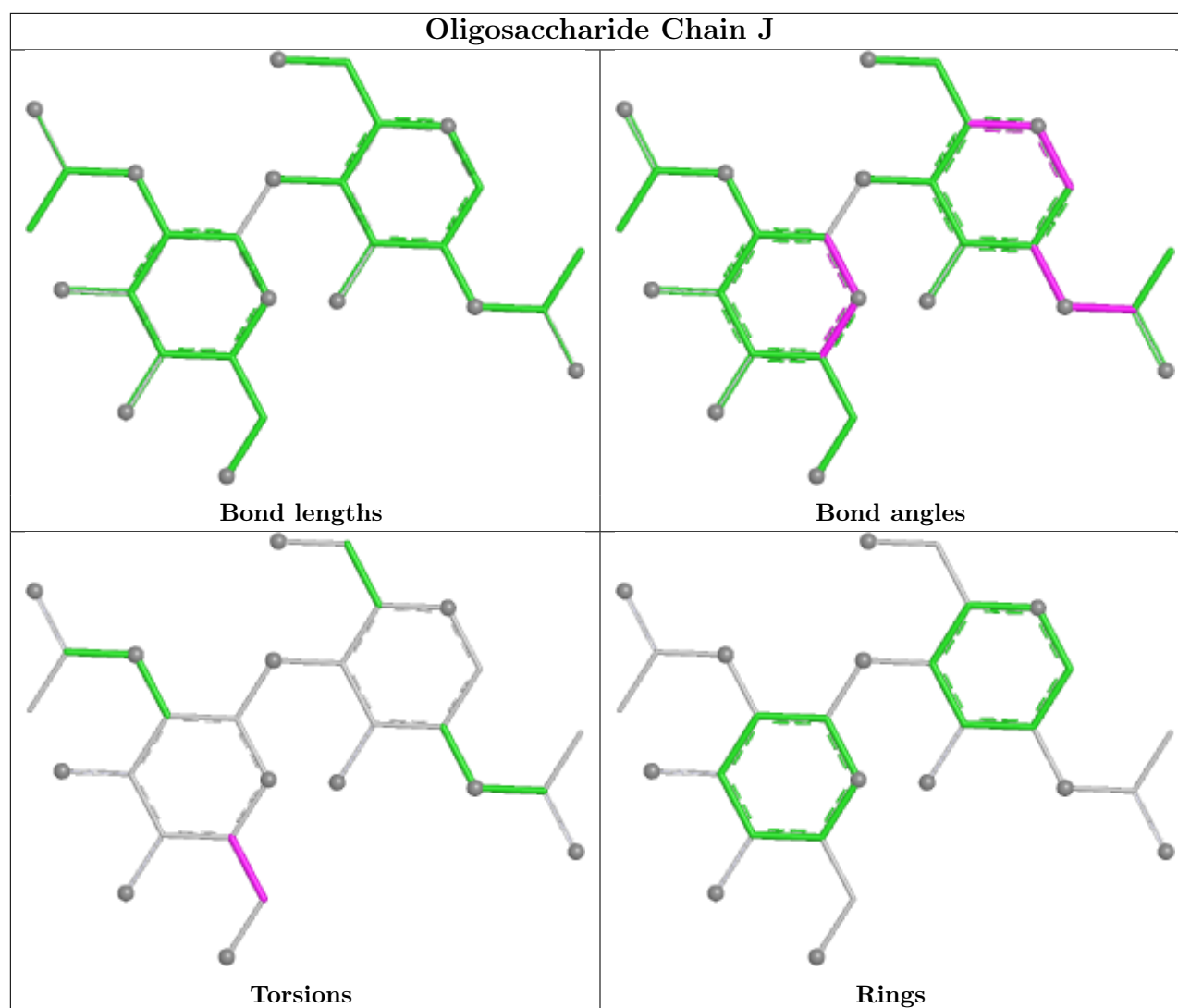












5.6 Ligand geometry [i](#)

9 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
6	NAG	A	805	1	14,14,15	0.57	0	17,19,21	1.53	1 (5%)
6	NAG	B	810	1	14,14,15	0.56	0	17,19,21	1.38	2 (11%)
4	LF7	A	801	1	23,25,25	0.53	0	33,39,39	1.06	2 (6%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	GOL	A	802	-	5,5,5	0.40	0	5,5,5	0.26	0
4	LF7	B	801	1	23,25,25	0.57	0	33,39,39	0.83	1 (3%)
6	NAG	A	806	1	14,14,15	0.47	0	17,19,21	2.15	2 (11%)
6	NAG	A	809	1	14,14,15	0.50	0	17,19,21	1.44	2 (11%)
6	NAG	B	805	1	14,14,15	0.53	0	17,19,21	1.34	1 (5%)
5	GOL	B	802	-	5,5,5	0.45	0	5,5,5	0.36	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	NAG	A	805	1	-	0/6/23/26	0/1/1/1
6	NAG	B	810	1	-	2/6/23/26	0/1/1/1
4	LF7	A	801	1	-	5/10/52/52	0/5/4/4
5	GOL	A	802	-	-	2/4/4/4	-
4	LF7	B	801	1	-	3/10/52/52	0/5/4/4
6	NAG	A	806	1	-	0/6/23/26	0/1/1/1
6	NAG	A	809	1	-	2/6/23/26	0/1/1/1
6	NAG	B	805	1	-	0/6/23/26	0/1/1/1
5	GOL	B	802	-	-	2/4/4/4	-

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	806	NAG	C1-O5-C5	7.85	122.71	112.19
6	A	805	NAG	C1-O5-C5	4.59	118.34	112.19
6	B	805	NAG	C1-O5-C5	4.29	117.93	112.19
6	B	810	NAG	C1-O5-C5	3.97	117.50	112.19
4	A	801	LF7	C19-N15-C14	-3.48	115.92	126.08
6	A	809	NAG	O5-C1-C2	-3.36	106.09	111.29
6	A	809	NAG	C1-C2-N2	3.35	115.71	110.43
4	B	801	LF7	C19-N15-C14	-2.81	117.89	126.08
6	B	810	NAG	O5-C5-C6	2.39	112.32	107.66
4	A	801	LF7	C21-C1-C8	-2.35	106.61	109.41
6	A	806	NAG	O5-C1-C2	2.28	114.83	111.29

There are no chirality outliers.

All (16) torsion outliers are listed below:

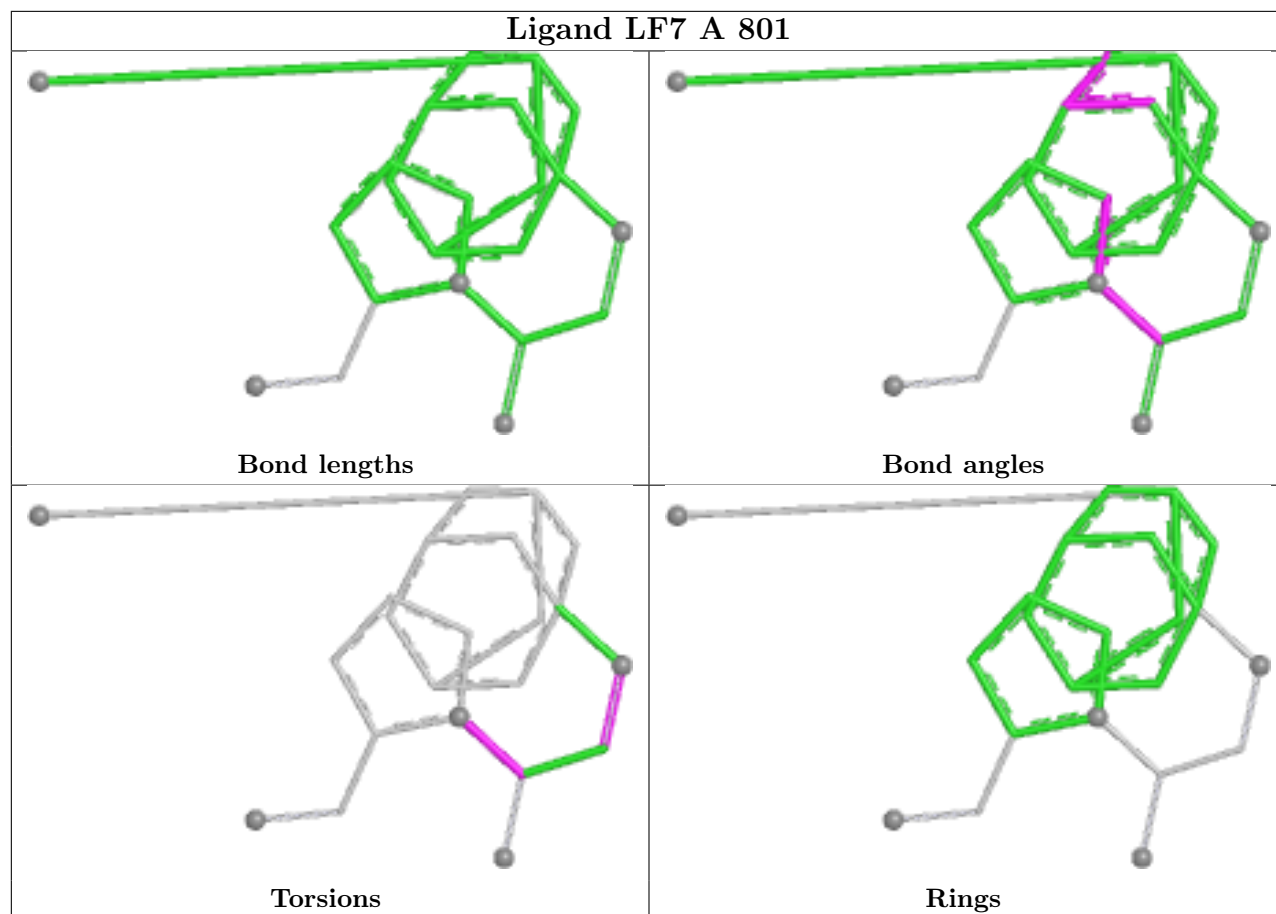
Mol	Chain	Res	Type	Atoms
5	B	802	GOL	O1-C1-C2-C3
6	A	809	NAG	C8-C7-N2-C2
6	A	809	NAG	O7-C7-N2-C2
5	B	802	GOL	O1-C1-C2-O2
6	B	810	NAG	C4-C5-C6-O6
5	A	802	GOL	C1-C2-C3-O3
6	B	810	NAG	O5-C5-C6-O6
4	B	801	LF7	O20-C14-N15-C16
4	B	801	LF7	C13-C14-N15-C16
4	A	801	LF7	O20-C14-N15-C19
4	A	801	LF7	C14-C13-N12-C7
4	B	801	LF7	C14-C13-N12-C7
4	A	801	LF7	O20-C14-N15-C16
4	A	801	LF7	C13-C14-N15-C19
4	A	801	LF7	C13-C14-N15-C16
5	A	802	GOL	O2-C2-C3-O3

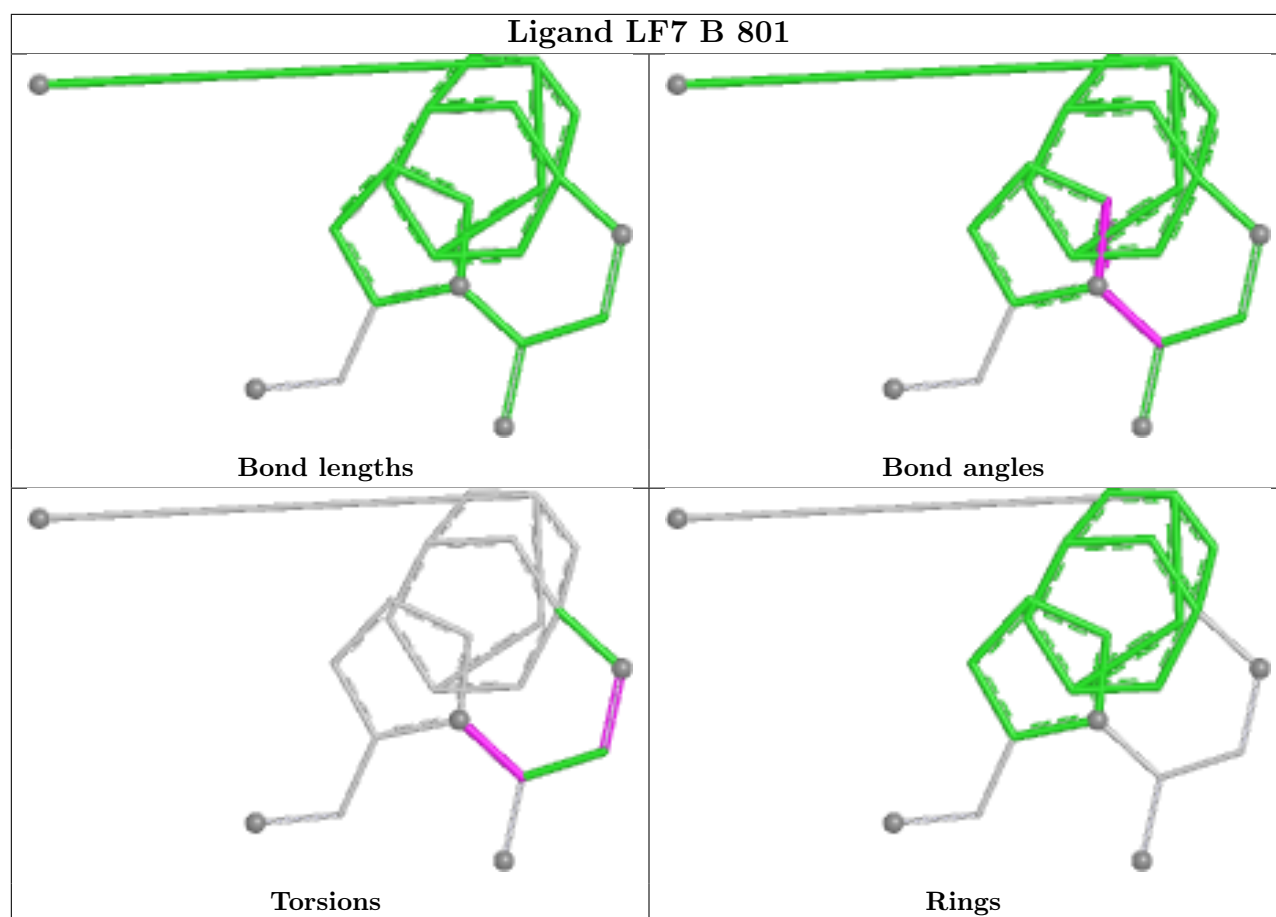
There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	801	LF7	2	0
6	A	809	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 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	729/740 (98%)	-0.32	4 (0%)	87 90	20, 30, 52, 69	0
1	B	729/740 (98%)	-0.36	5 (0%)	84 87	19, 29, 50, 63	0
All	All	1458/1480 (98%)	-0.34	9 (0%)	85 89	19, 30, 51, 69	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	766	PRO	5.5
1	B	766	PRO	3.7
1	A	765	LEU	3.6
1	B	765	LEU	2.7
1	A	764	SER	2.6
1	A	393	ASP	2.1
1	B	92	ASN	2.1
1	B	279	VAL	2.1
1	B	139	LYS	2.0

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.

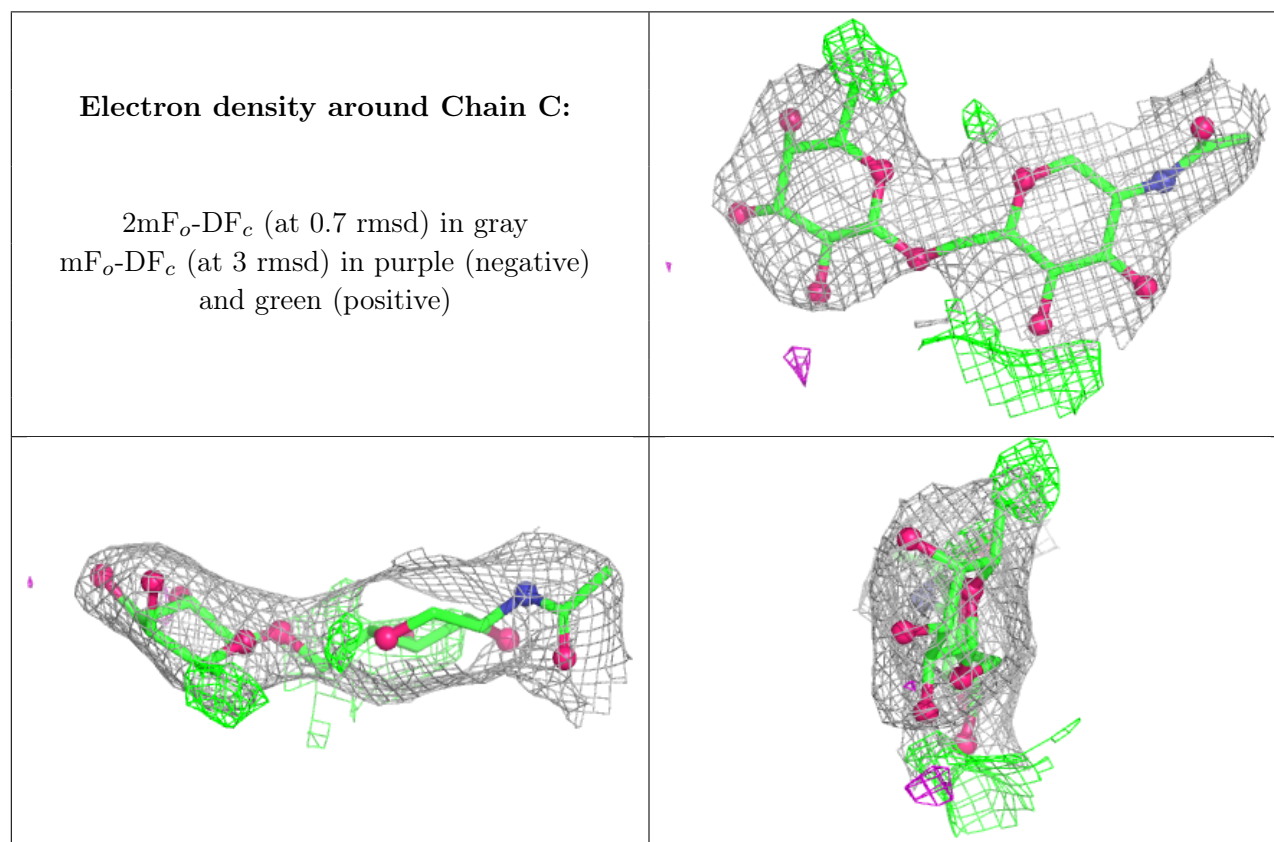
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	NAG	F	2	14/15	0.66	0.14	61,64,66,66	0

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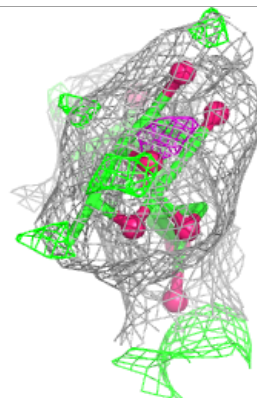
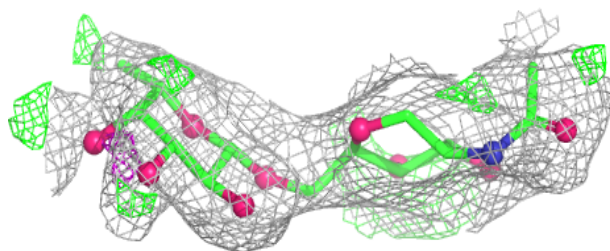
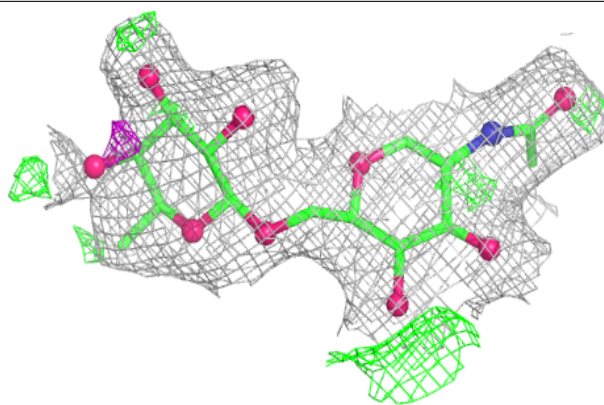
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	FUL	G	2	10/11	0.75	0.15	63,65,66,68	0
2	FUL	C	2	10/11	0.76	0.16	69,70,70,70	0
3	NAG	I	2	14/15	0.77	0.13	59,62,65,66	0
3	NAG	J	2	14/15	0.77	0.13	63,66,68,68	0
3	NAG	H	2	14/15	0.81	0.12	59,63,66,66	0
2	NAG	G	1	14/15	0.84	0.12	54,57,62,64	0
2	NAG	C	1	14/15	0.85	0.12	60,62,66,69	0
3	NAG	E	2	14/15	0.86	0.11	38,43,45,45	0
3	NAG	D	2	14/15	0.87	0.09	53,56,59,59	0
3	NAG	H	1	14/15	0.90	0.08	47,53,56,57	0
3	NAG	J	1	14/15	0.90	0.09	48,54,56,60	0
3	NAG	F	1	14/15	0.90	0.09	46,51,54,57	0
3	NAG	D	1	14/15	0.93	0.07	38,47,53,53	0
3	NAG	I	1	14/15	0.94	0.07	41,46,51,54	0
3	NAG	E	1	14/15	0.95	0.07	29,33,37,37	0

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

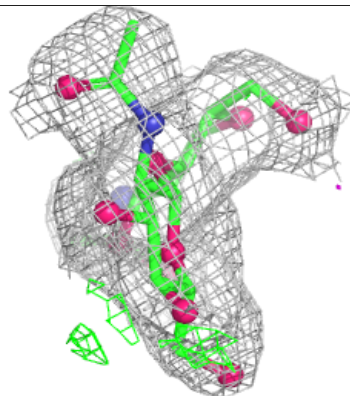
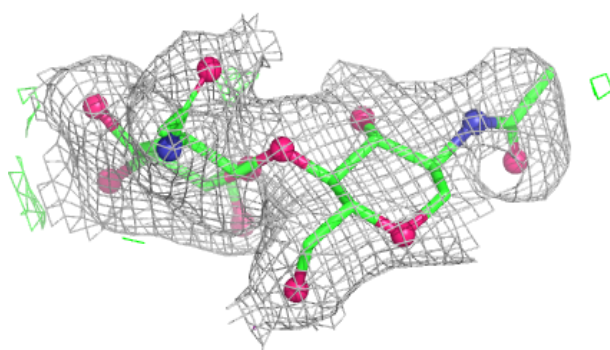
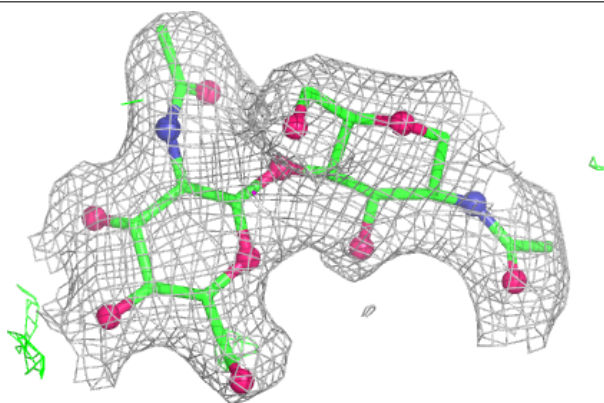


Electron density around Chain G:

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

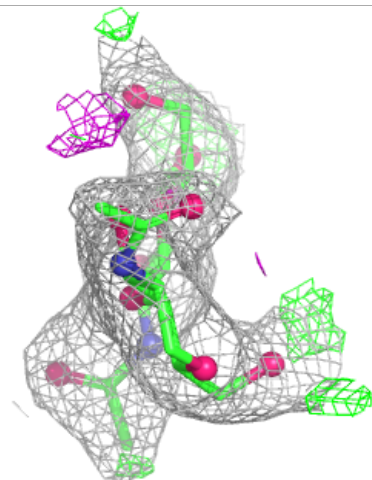
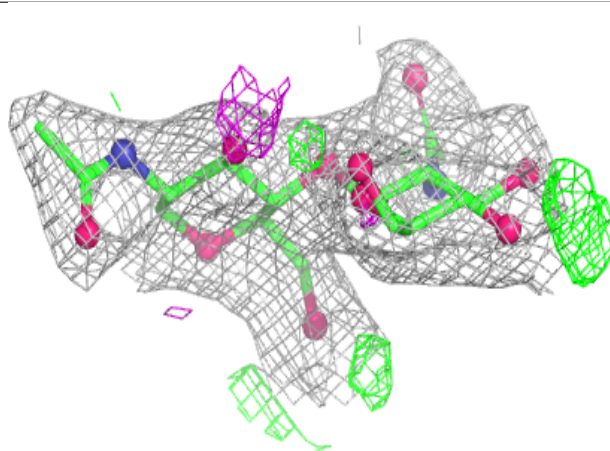
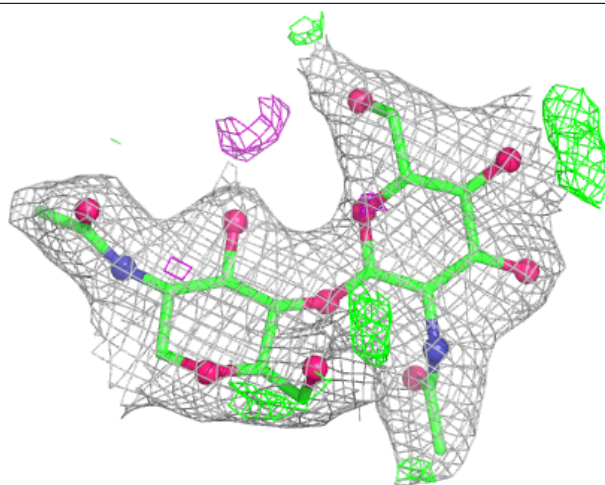
**Electron density around Chain D:**

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



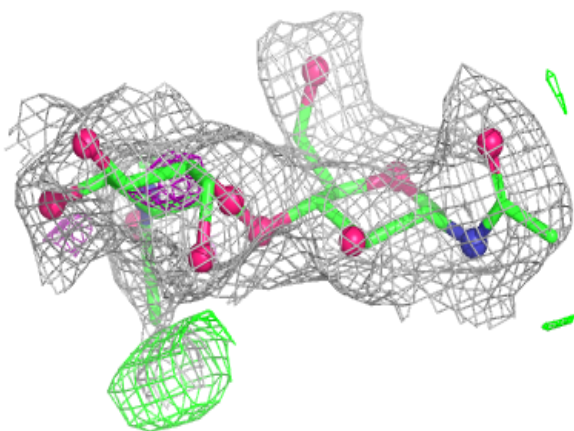
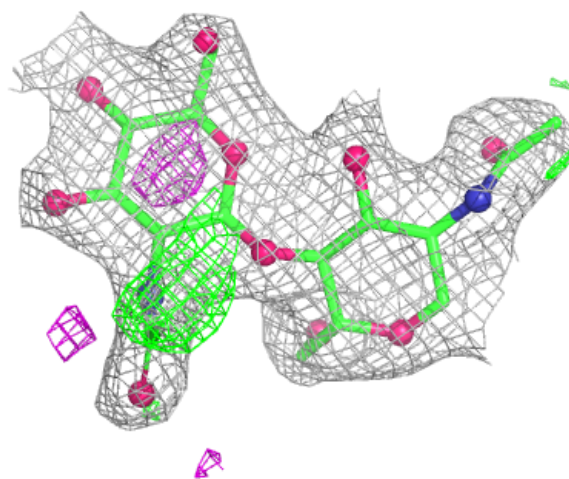
Electron density around Chain E:

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



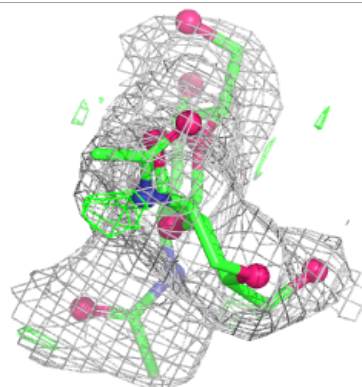
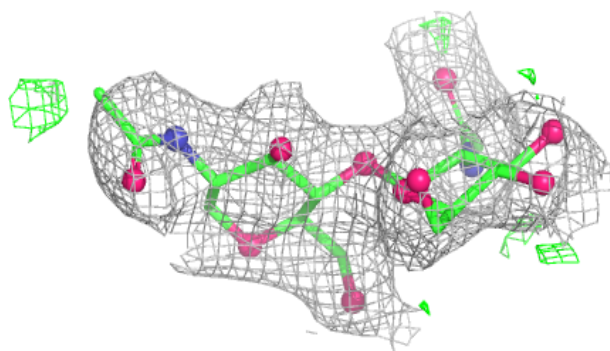
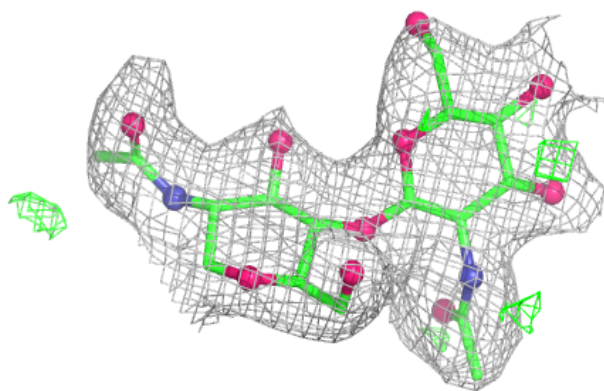
Electron density around Chain F:

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



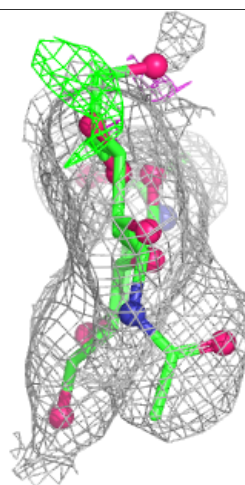
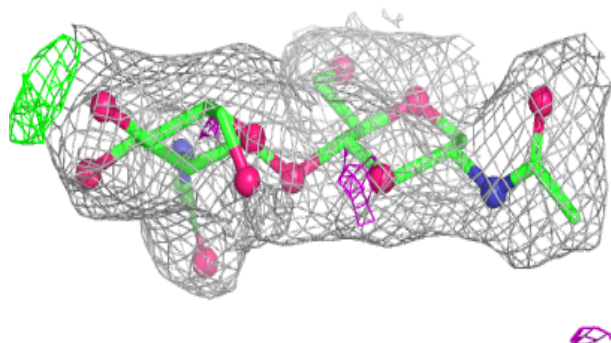
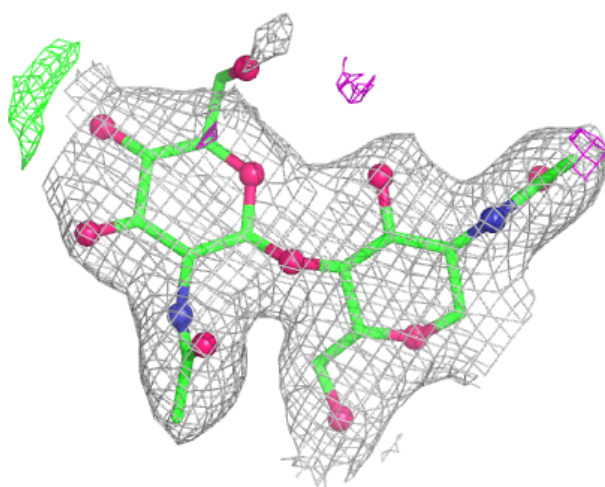
Electron density around Chain H:

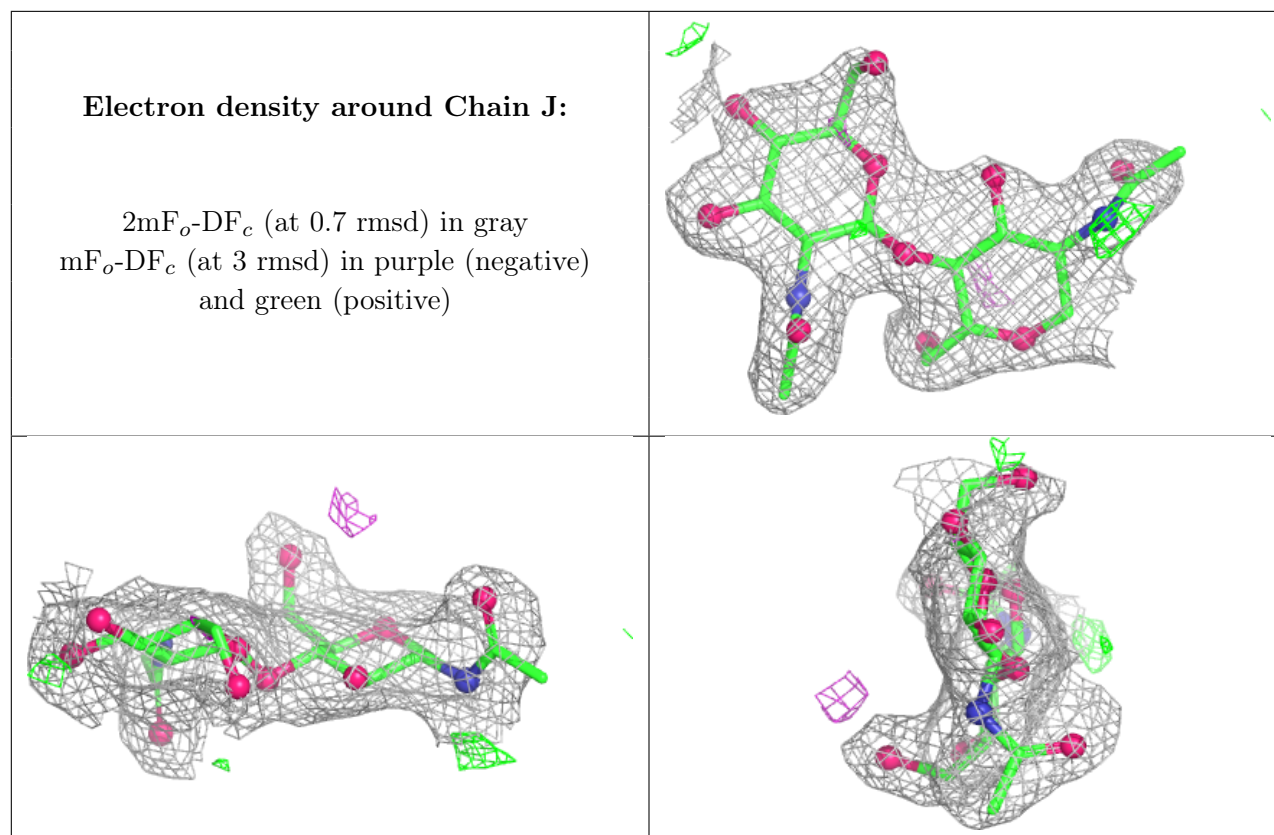
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



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)





6.4 Ligands ⓘ

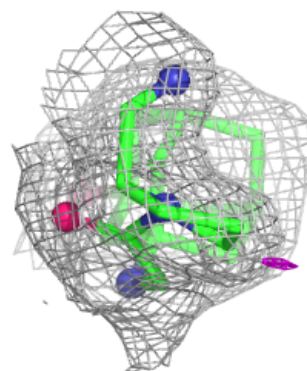
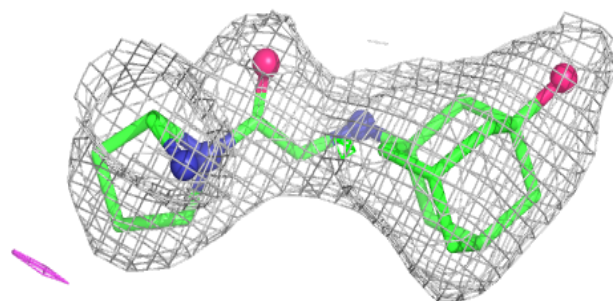
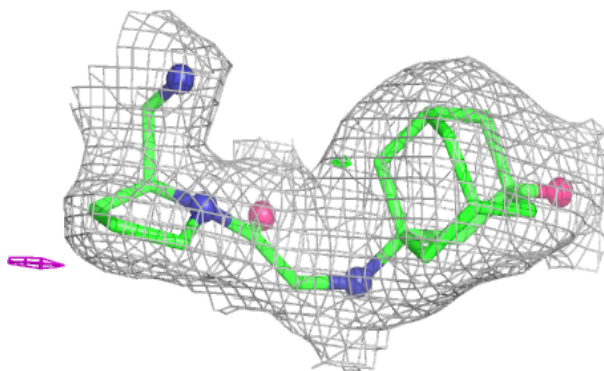
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	NAG	A	805	14/15	0.69	0.14	75,77,78,78	0
6	NAG	A	806	14/15	0.71	0.14	58,63,64,64	0
6	NAG	B	805	14/15	0.74	0.12	53,56,59,60	0
6	NAG	B	810	14/15	0.87	0.10	55,57,58,59	0
6	NAG	A	809	14/15	0.88	0.09	34,37,41,45	0
5	GOL	A	802	6/6	0.92	0.13	61,62,62,62	0
5	GOL	B	802	6/6	0.93	0.11	48,50,52,52	0
4	LF7	B	801	22/22	0.96	0.06	20,22,23,24	0
4	LF7	A	801	22/22	0.97	0.06	22,25,27,28	0

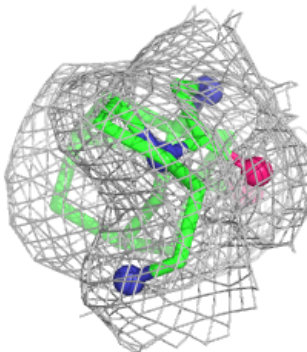
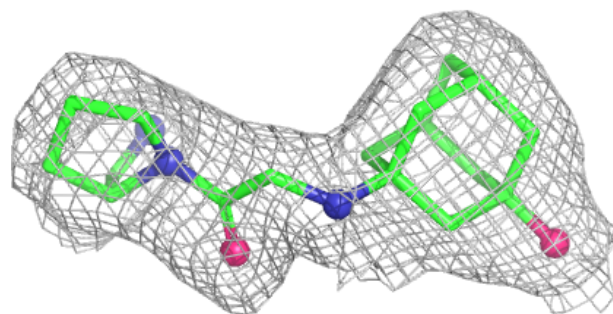
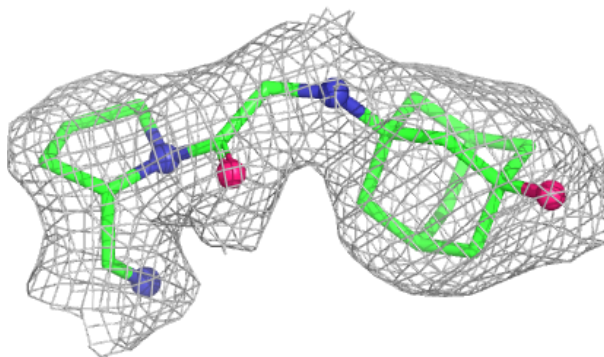
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around LF7 B 801:

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

**Electron density around LF7 A 801:**

$2mF_o-DF_c$ (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.