



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 11:13 PM UTC

PDB ID : 3TVM / pdb_00003tvm
Title : Structure of the mouse CD1d-SMC124-iNKT TCR complex
Authors : Girardi, E.; Li, Y.; Zajonc, D.M.
Deposited on : 2011-09-20
Resolution : 2.80 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

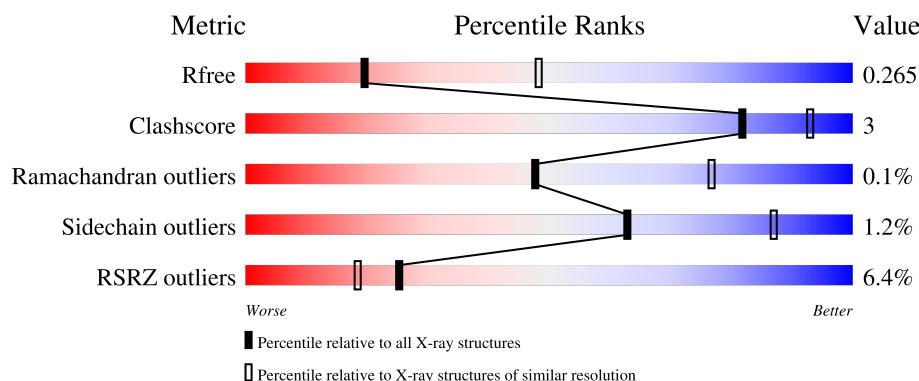
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	285	5% 85% 9% 6%
1	E	285	19% 64% 9% 27%
2	B	99	3% 91% 8% .
2	F	99	3% 94% . .
3	C	209	4% 94% . .

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Mol	Chain	Length	Quality of chain
3	G	209	5% 89% 8%
4	D	241	% 95% 5%
4	H	241	2% 96%
5	I	2	50% 50%
5	K	2	100%
6	J	3	33% 67%
6	L	3	100%

2 Entry composition

There are 11 unique types of molecules in this entry. The entry contains 12264 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 Antigen-presenting glycoprotein CD1d1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	268	Total	C	N	O	S	0	0	0
			2075	1326	353	383	13			
1	E	209	Total	C	N	O	S	0	1	0
			1590	1019	268	294	9			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	201	HIS	ASP	variant	UNP P11609
A	280	HIS	-	expression tag	UNP P11609
A	281	HIS	-	expression tag	UNP P11609
A	282	HIS	-	expression tag	UNP P11609
A	283	HIS	-	expression tag	UNP P11609
A	284	HIS	-	expression tag	UNP P11609
A	285	HIS	-	expression tag	UNP P11609
E	201	HIS	ASP	variant	UNP P11609
E	280	HIS	-	expression tag	UNP P11609
E	281	HIS	-	expression tag	UNP P11609
E	282	HIS	-	expression tag	UNP P11609
E	283	HIS	-	expression tag	UNP P11609
E	284	HIS	-	expression tag	UNP P11609
E	285	HIS	-	expression tag	UNP P11609

- Molecule 2 is a protein called beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	98	Total	C	N	O	S	0	0	0
			781	499	133	142	7			
2	F	97	Total	C	N	O	S	0	0	0
			740	473	126	135	6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	85	ALA	ASP	variant	UNP P01887
F	85	ALA	ASP	variant	UNP P01887

- Molecule 3 is a protein called Valpha14 (mouse variable domain, human constant domain).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	200	Total	C	N	O	S	0	1	0
			1504	937	259	300	8			
3	G	203	Total	C	N	O	S	0	0	0
			1518	947	258	305	8			

- Molecule 4 is a protein called Vbeta8.2 (mouse variable domain, human constant domain).

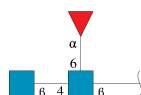
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	239	Total	C	N	O	S	0	0	0
			1851	1164	329	352	6			
4	H	240	Total	C	N	O	S	0	0	0
			1850	1164	326	354	6			

- Molecule 5 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
5	I	2	Total	C	N	O	0	0	0
			28	16	2	10			
5	K	2	Total	C	N	O	0	0	0
			28	16	2	10			

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
6	J	3	Total	C	N	O	0	0	0
			38	22	2	14			

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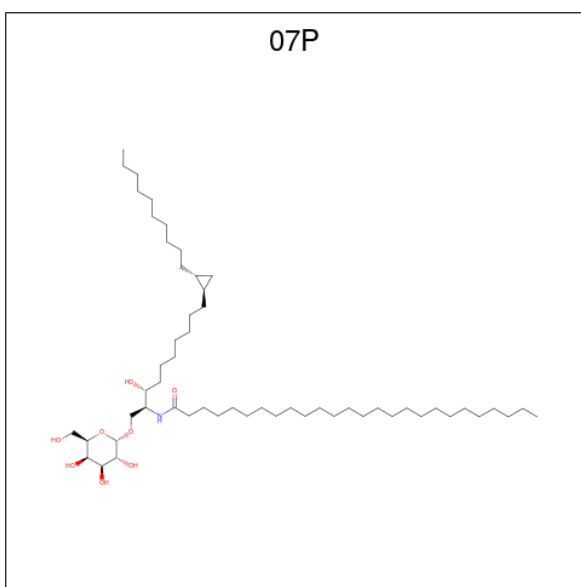
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
6	L	3	Total	C	N	O	0	0	0
			38	22	2	14			

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 8 is N-[(2S,3R)-10-[(1R,2R)-2-decylcyclopropyl]-1-(alpha-D-galactopyranosyloxy)-3-hydroxydecan-2-yl]hexacosanamide (CCD ID: 07P) (formula: $C_{55}H_{107}NO_8$).

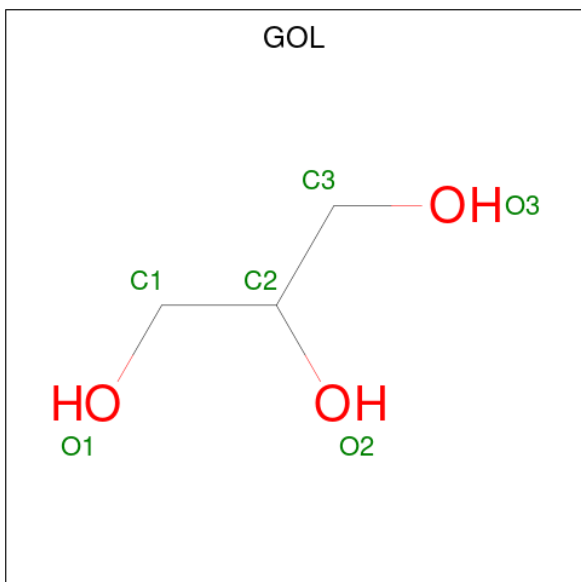


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	N	O	0	0
			64	55	1	8		
8	E	1	Total	C	N	O	0	0
			64	55	1	8		

- Molecule 9 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	D	1	Total	Cl	0	0
			1	1		

- Molecule 10 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	E	1	Total	C	O	0	0
			6	3	3		

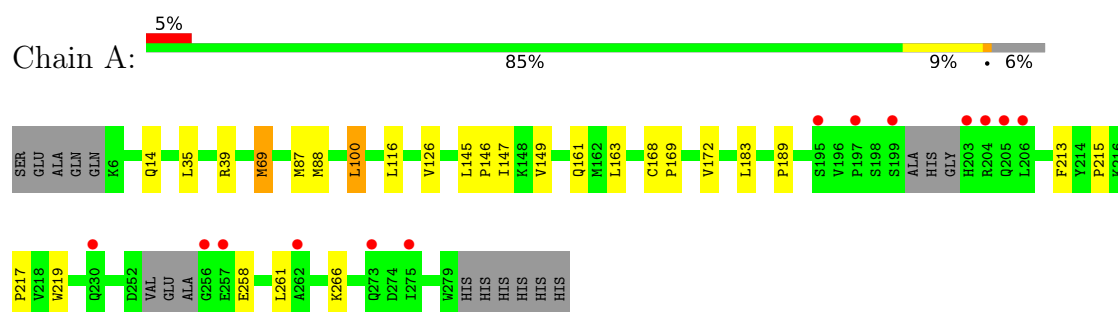
- Molecule 11 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
11	A	9	Total	O	0	0
			9	9		
11	B	6	Total	O	0	0
			6	6		
11	C	10	Total	O	0	0
			10	10		
11	D	12	Total	O	0	0
			12	12		
11	E	3	Total	O	0	0
			3	3		
11	F	5	Total	O	0	0
			5	5		
11	G	7	Total	O	0	0
			7	7		
11	H	8	Total	O	0	0
			8	8		

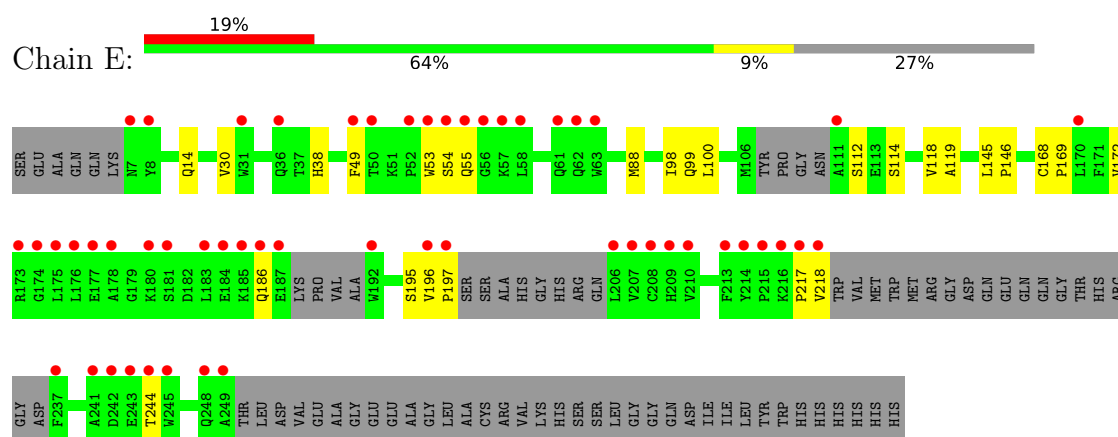
3 Residue-property plots [i](#)

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

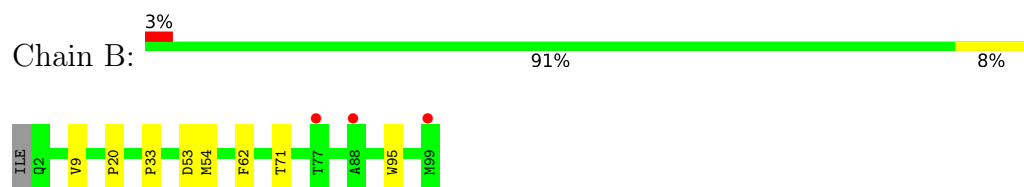
- Molecule 1: Antigen-presenting glycoprotein CD1d1



- Molecule 1: Antigen-presenting glycoprotein CD1d1



- Molecule 2: beta-2-microglobulin



- Molecule 2: beta-2-microglobulin

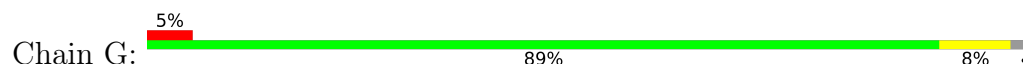




- Molecule 3: Valpha14 (mouse variable domain, human constant domain)



- Molecule 3: Valpha14 (mouse variable domain, human constant domain)



- Molecule 4: Vbeta8.2 (mouse variable domain, human constant domain)



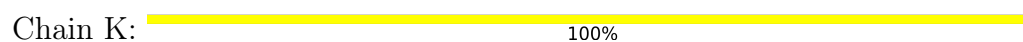
- Molecule 4: Vbeta8.2 (mouse variable domain, human constant domain)



- Molecule 5: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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

Chain J:  33% 67%

MAG1
MAG2
FUC3

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

Chain L:  100%

MAG1
MAG2
FUC3

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	78.97Å 150.57Å 101.96Å 90.00° 96.35° 90.00°	Depositor
Resolution (Å)	75.29 – 2.80 75.29 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (75.29-2.80) 99.9 (75.29-2.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.24 (at 2.82Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.224 , 0.273 0.221 , 0.265	Depositor DCC
R_{free} test set	2948 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	52.3	Xtriage
Anisotropy	0.024	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 41.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	12264	wwPDB-VP
Average B, all atoms (Å ²)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.76% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, NAG, CL, 07P, FUC

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.39	0/2136	0.71	0/2914
1	E	0.42	0/1635	0.75	0/2234
2	B	0.43	0/807	0.67	0/1102
2	F	0.45	0/766	0.76	0/1053
3	C	0.42	0/1532	0.67	0/2089
3	G	0.40	0/1546	0.71	0/2107
4	D	0.40	0/1902	0.71	0/2596
4	H	0.40	0/1901	0.70	0/2596
All	All	0.41	0/12225	0.71	0/16691

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2075	0	1901	19	0
1	E	1590	0	1398	16	0
2	B	781	0	727	5	0
2	F	740	0	647	2	0
3	C	1504	0	1402	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	G	1518	0	1421	8	0
4	D	1851	0	1739	7	0
4	H	1850	0	1731	4	0
5	I	28	0	25	0	0
5	K	28	0	25	0	0
6	J	38	0	34	1	0
6	L	38	0	34	0	0
7	A	14	0	13	0	0
7	E	14	0	13	0	0
8	A	64	0	107	0	0
8	E	64	0	107	2	0
9	D	1	0	0	0	0
10	E	6	0	8	1	0
11	A	9	0	0	0	0
11	B	6	0	0	0	0
11	C	10	0	0	0	0
11	D	12	0	0	0	0
11	E	3	0	0	1	0
11	F	5	0	0	0	0
11	G	7	0	0	0	0
11	H	8	0	0	0	0
All	All	12264	0	11332	59	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (59) 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:E:195:SER:N	11:E:289:HOH:O	2.16	0.78
1:A:87:MET:HE3	1:A:145:LEU:HG	1.65	0.77
1:A:219:TRP:HB3	1:A:266:LYS:HB2	1.71	0.73
1:A:87:MET:HE1	1:A:149:VAL:HG21	1.69	0.73
1:E:55[A]:GLN:O	1:E:55[A]:GLN:OE1	2.08	0.72
1:E:168:CYS:HB3	1:E:169:PRO:HD3	1.73	0.71
4:D:124:LEU:HD11	4:D:140:LEU:HD23	1.75	0.69
1:A:69:MET:HE1	1:A:163:LEU:HD11	1.75	0.69
1:A:87:MET:HG2	1:A:88:MET:HE2	1.77	0.65
1:E:55[A]:GLN:OE1	1:E:55[A]:GLN:C	2.41	0.64
3:G:21:GLN:OE1	3:G:74:THR:HG22	1.98	0.62
1:E:30:VAL:HG21	8:E:286:07P:H87	1.82	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:88:MET:HE1	1:A:145:LEU:HD23	1.82	0.61
3:C:168:MET:HE1	4:D:137:LYS:HD3	1.84	0.60
1:A:88:MET:HE3	1:A:146:PRO:HD3	1.85	0.57
1:A:215:PRO:HB2	1:A:217:PRO:HD2	1.88	0.56
2:B:20:PRO:HA	2:B:71:THR:HG22	1.88	0.55
4:D:150:ASP:HB2	4:D:173:PRO:HG2	1.90	0.53
1:E:88:MET:HE1	1:E:145:LEU:HD23	1.92	0.51
3:G:153:SER:HA	3:G:160:ILE:HD12	1.92	0.51
1:E:118:VAL:HG11	8:E:286:07P:H22	1.92	0.51
2:F:5:PRO:HB3	2:F:30:PHE:HB3	1.94	0.50
1:A:168:CYS:O	1:A:172:VAL:HG23	2.12	0.49
4:D:214:LEU:HD13	4:D:227:PRO:HG2	1.93	0.49
3:C:177:SER:OG	4:D:190:ARG:HD3	2.13	0.49
4:H:119:PRO:HD3	4:H:227:PRO:HB3	1.96	0.48
1:E:30:VAL:HB	1:E:38:HIS:HB2	1.95	0.48
1:A:189:PRO:HB3	1:A:213:PHE:HB3	1.96	0.47
1:A:14:GLN:HB3	1:A:100:LEU:HB3	1.96	0.47
1:A:100:LEU:HD11	1:A:116:LEU:HD21	1.95	0.47
3:G:55:LYS:HG2	3:G:65:THR:HG22	1.97	0.47
1:A:87:MET:CE	1:A:145:LEU:HG	2.39	0.47
1:E:169:PRO:HA	1:E:172:VAL:HG12	1.97	0.47
3:G:138:VAL:HG12	3:G:181:TRP:HB3	1.95	0.46
1:A:168:CYS:HB3	1:A:169:PRO:HD3	1.97	0.46
4:H:199:GLN:HA	4:H:239:ARG:O	2.15	0.46
1:E:14:GLN:HB3	1:E:100:LEU:HB3	1.97	0.45
1:E:145:LEU:HB3	1:E:146:PRO:HD3	1.97	0.45
3:G:60:ARG:NH2	3:G:84:ASP:OD2	2.49	0.45
1:A:126:VAL:HG21	1:A:147:ILE:HD11	1.99	0.45
4:D:199:GLN:HA	4:D:239:ARG:O	2.17	0.44
1:E:99:GLN:HB2	1:E:119:ALA:HB3	2.00	0.44
1:A:145:LEU:HB3	1:A:146:PRO:HD3	1.99	0.44
1:A:39:ARG:HD3	2:B:53:ASP:OD2	2.18	0.43
1:A:35:LEU:HD12	1:A:183:LEU:HD23	1.99	0.43
4:H:127:PRO:HD2	4:H:198:TRP:CZ2	2.53	0.43
3:G:35:PHE:CD1	3:G:43:LEU:HB3	2.55	0.41
2:B:9:VAL:HG11	2:B:95:TRP:HB2	2.02	0.41
2:B:33:PRO:HA	2:B:54:MET:HE1	2.02	0.41
2:F:70:PHE:CE2	2:F:72:PRO:HG3	2.55	0.41
1:A:161:GLN:HB3	6:J:1:NAG:H82	2.03	0.41
3:C:168:MET:CE	4:D:137:LYS:HD3	2.48	0.41
1:E:53:TRP:C	1:E:55[B]:GLN:H	2.29	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:G:161:THR:HG21	4:H:188:SER:HB3	2.02	0.41
1:E:49:PHE:HD1	10:E:287:GOL:H32	1.86	0.41
2:B:54:MET:HE3	2:B:62:PHE:HB3	2.04	0.40
1:E:55[A]:GLN:C	1:E:55[A]:GLN:CD	2.88	0.40
1:E:196:VAL:HA	1:E:197:PRO:HD3	1.94	0.40
3:G:33:ARG:HB3	3:G:91:VAL:HG13	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	262/285 (92%)	253 (97%)	9 (3%)	0	100	100
1	E	200/285 (70%)	188 (94%)	10 (5%)	2 (1%)	12	38
2	B	96/99 (97%)	95 (99%)	1 (1%)	0	100	100
2	F	95/99 (96%)	92 (97%)	3 (3%)	0	100	100
3	C	197/209 (94%)	188 (95%)	9 (5%)	0	100	100
3	G	201/209 (96%)	194 (96%)	7 (4%)	0	100	100
4	D	237/241 (98%)	234 (99%)	3 (1%)	0	100	100
4	H	238/241 (99%)	232 (98%)	6 (2%)	0	100	100
All	All	1526/1668 (92%)	1476 (97%)	48 (3%)	2 (0%)	48	77

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	54	SER
1	E	217	PRO

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	212/249 (85%)	208 (98%)	4 (2%)	50	81
1	E	155/249 (62%)	149 (96%)	6 (4%)	28	64
2	B	85/93 (91%)	85 (100%)	0	100	100
2	F	75/93 (81%)	75 (100%)	0	100	100
3	C	164/188 (87%)	162 (99%)	2 (1%)	63	87
3	G	165/188 (88%)	164 (99%)	1 (1%)	78	92
4	D	196/208 (94%)	195 (100%)	1 (0%)	81	93
4	H	195/208 (94%)	194 (100%)	1 (0%)	81	93
All	All	1247/1476 (84%)	1232 (99%)	15 (1%)	63	87

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	69	MET
1	A	100	LEU
1	A	258	GLU
1	A	261	LEU
3	C	14	GLN
3	C	82	LEU
4	D	168	CYS
1	E	98	ILE
1	E	112	SER
1	E	114	SER
1	E	186	GLN
1	E	218	VAL
1	E	244	THR
3	G	50	VAL
4	H	216	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	14	GLN
1	A	110	ASN
1	A	186	GLN
2	B	8	GLN
2	B	24	ASN
3	C	14	GLN
3	C	30	ASN
3	C	37	GLN
3	C	105	HIS
3	C	183	ASN
4	D	24	ASN
4	D	37	GLN
4	D	41	HIS
4	D	73	ASN
4	D	164	HIS
1	E	67	GLN
1	E	186	GLN
2	F	29	GLN
3	G	30	ASN
3	G	127	GLN
4	H	24	ASN
4	H	73	ASN

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 ⓘ

10 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
5	NAG	I	1	5,1	14,14,15	0.53	0	17,19,21	0.83	0
5	NAG	I	2	5	14,14,15	0.49	0	17,19,21	0.98	1 (5%)
6	NAG	J	1	6,1	14,14,15	0.52	0	17,19,21	0.78	0
6	NAG	J	2	6	14,14,15	0.50	0	17,19,21	0.99	1 (5%)
6	FUC	J	3	6	10,10,11	0.56	0	14,14,16	0.59	0
5	NAG	K	1	5,1	14,14,15	0.50	0	17,19,21	0.97	1 (5%)
5	NAG	K	2	5	14,14,15	0.54	0	17,19,21	0.95	1 (5%)
6	NAG	L	1	6,1	14,14,15	0.54	0	17,19,21	0.79	0
6	NAG	L	2	6	14,14,15	0.53	0	17,19,21	0.90	0
6	FUC	L	3	6	10,10,11	0.61	0	14,14,16	0.82	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
5	NAG	I	1	5,1	-	1/6/23/26	0/1/1/1
5	NAG	I	2	5	-	2/6/23/26	0/1/1/1
6	NAG	J	1	6,1	-	1/6/23/26	0/1/1/1
6	NAG	J	2	6	-	2/6/23/26	0/1/1/1
6	FUC	J	3	6	-	-	0/1/1/1
5	NAG	K	1	5,1	-	2/6/23/26	0/1/1/1
5	NAG	K	2	5	-	1/6/23/26	0/1/1/1
6	NAG	L	1	6,1	-	1/6/23/26	0/1/1/1
6	NAG	L	2	6	-	0/6/23/26	0/1/1/1
6	FUC	L	3	6	-	-	0/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	J	2	NAG	C1-O5-C5	3.62	117.04	112.19
5	K	1	NAG	C1-O5-C5	3.12	116.37	112.19
5	I	2	NAG	C1-O5-C5	2.60	115.67	112.19
5	K	2	NAG	C4-C3-C2	2.27	114.35	111.02

There are no chirality outliers.

All (10) torsion outliers are listed below:

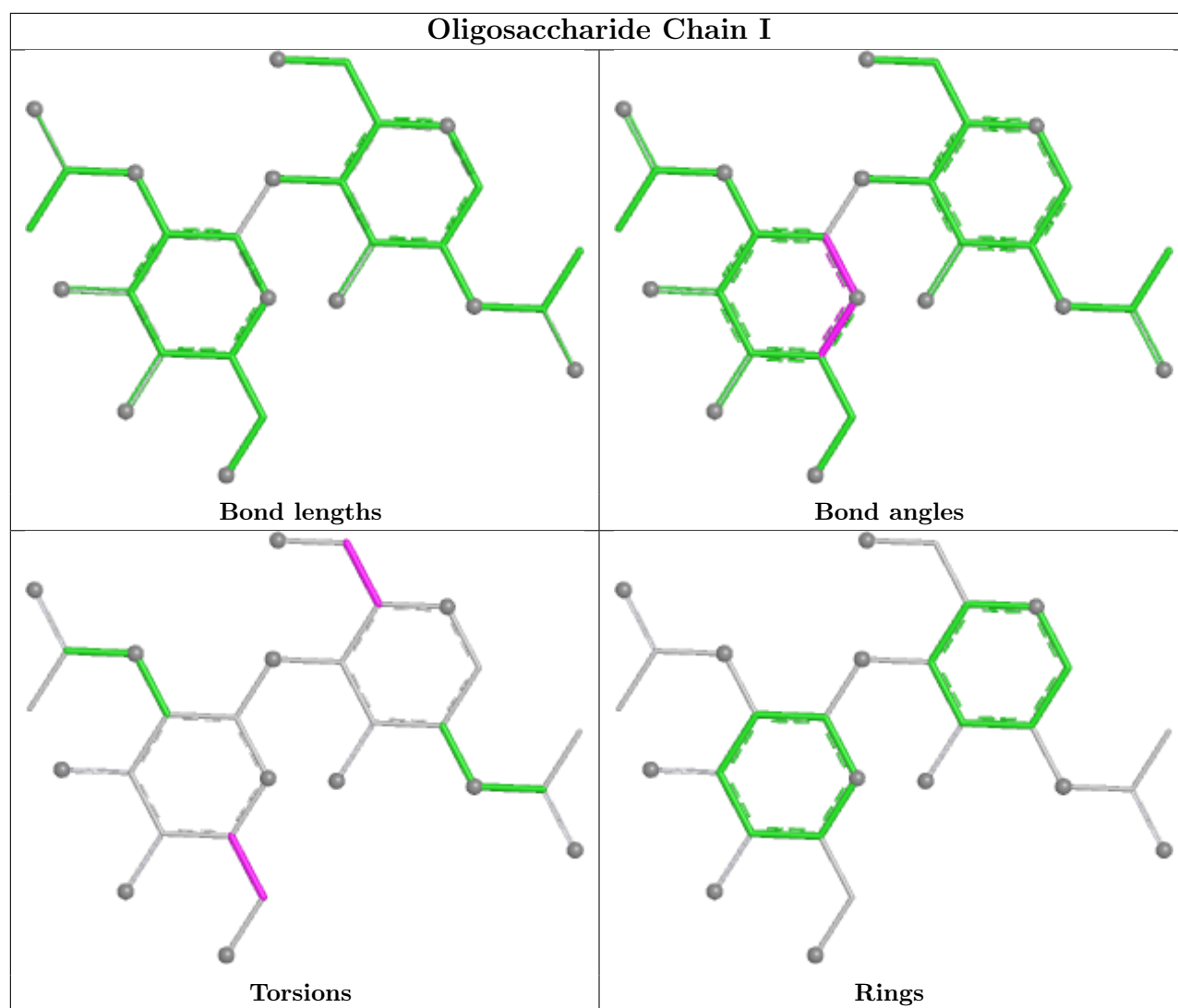
Mol	Chain	Res	Type	Atoms
5	I	2	NAG	O5-C5-C6-O6
5	I	2	NAG	C4-C5-C6-O6
6	J	2	NAG	C4-C5-C6-O6
6	J	2	NAG	O5-C5-C6-O6
5	K	1	NAG	C4-C5-C6-O6
5	K	1	NAG	O5-C5-C6-O6
5	K	2	NAG	O5-C5-C6-O6
6	J	1	NAG	O5-C5-C6-O6
5	I	1	NAG	C4-C5-C6-O6
6	L	1	NAG	O5-C5-C6-O6

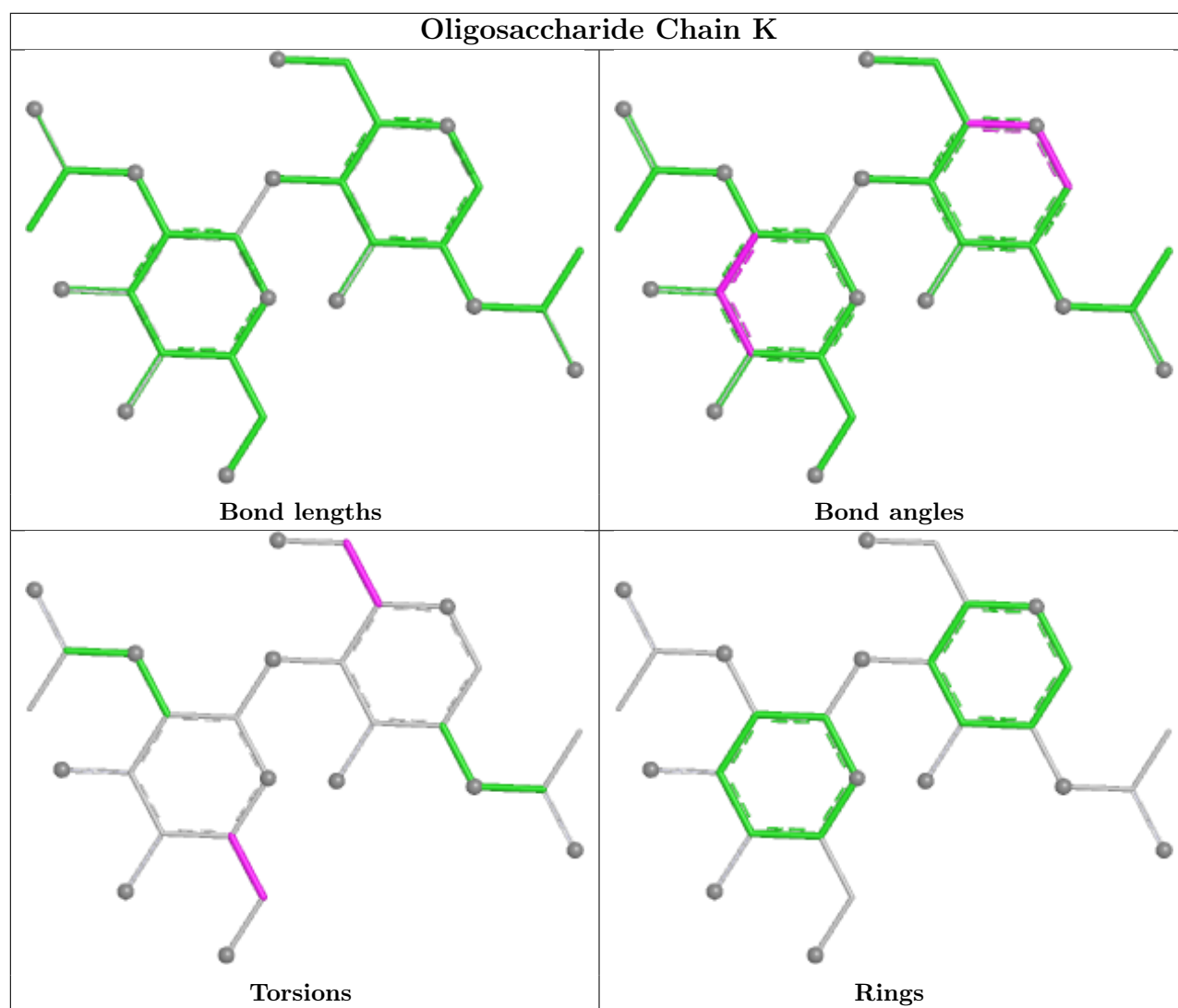
There are no ring outliers.

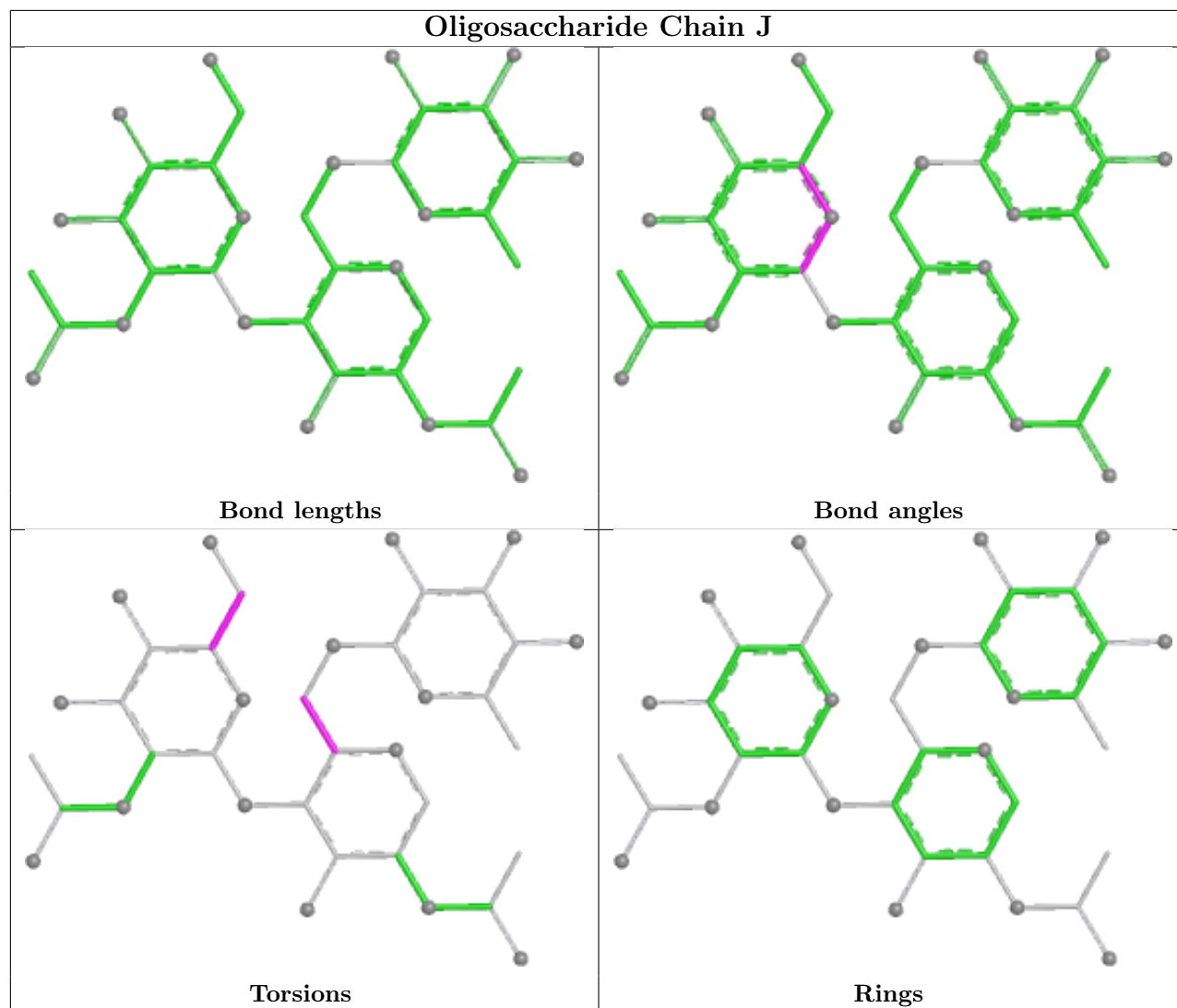
1 monomer is involved in 1 short contact:

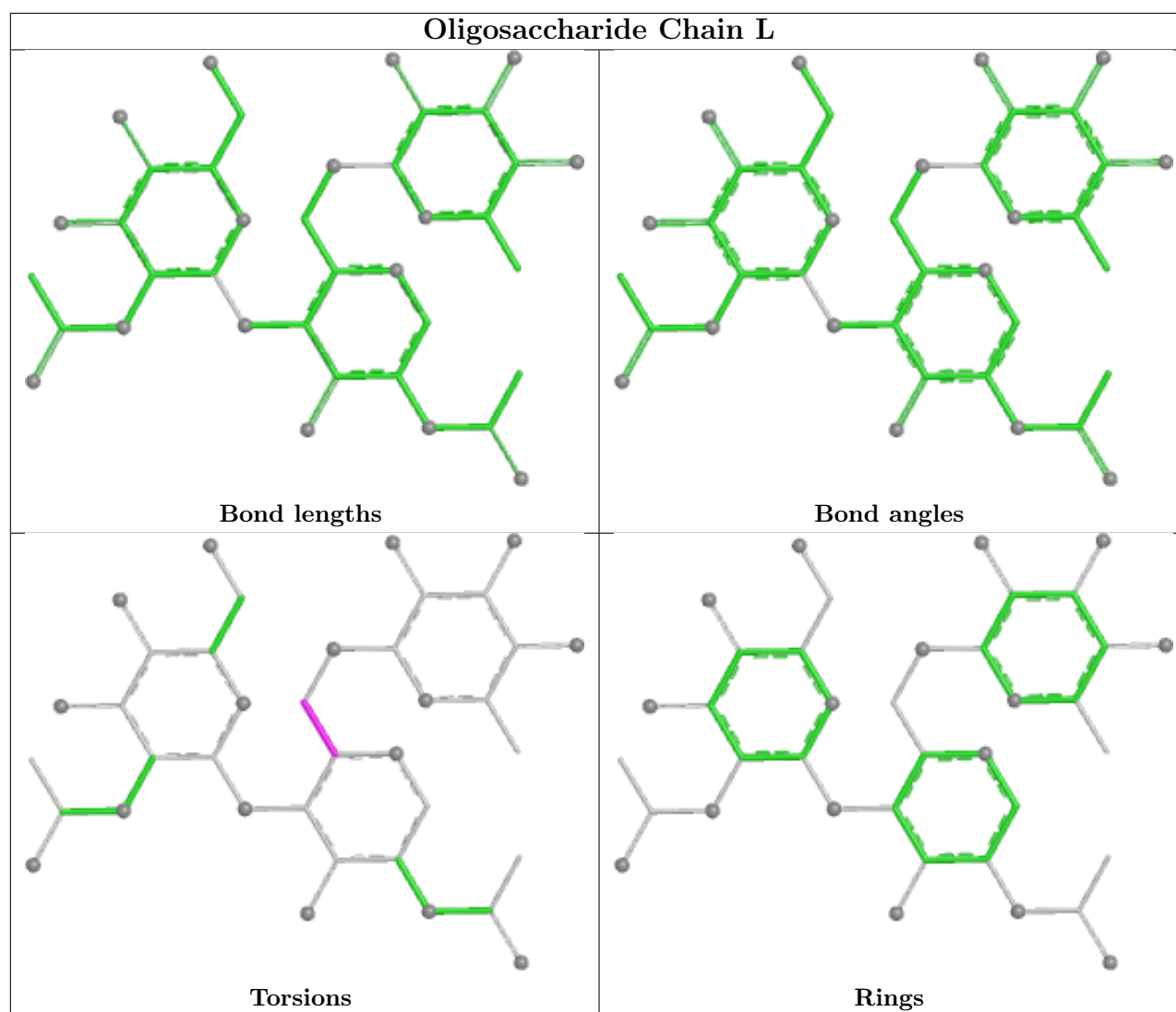
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	J	1	NAG	1	0

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









5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 1 is monoatomic - leaving 5 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	$\# Z > 2$
10	GOL	E	287	-	5,5,5	0.43	0	5,5,5	0.28	0
8	07P	E	286	-	65,65,65	0.51	0	71,76,76	0.87	2 (2%)
7	NAG	A	508	1	14,14,15	0.55	0	17,19,21	0.83	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	NAG	E	514	1	14,14,15	0.45	0	17,19,21	0.63	0
8	07P	A	286	-	65,65,65	0.44	0	71,76,76	0.95	3 (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
10	GOL	E	287	-	-	3/4/4/4	-
8	07P	E	286	-	-	32/60/85/85	0/2/2/2
7	NAG	A	508	1	-	0/6/23/26	0/1/1/1
7	NAG	E	514	1	-	0/6/23/26	0/1/1/1
8	07P	A	286	-	-	31/60/85/85	0/2/2/2

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	E	286	07P	CCA-CBZ-CBY	-3.54	114.23	120.62
8	A	286	07P	CCA-CBZ-CBY	-2.85	115.47	120.62
8	A	286	07P	CAH-CBY-CBZ	-2.84	105.39	115.11
8	A	286	07P	CAE-CAD-CAC	-2.58	109.88	114.11
8	E	286	07P	CCA-CCB-CCC	-2.07	116.88	120.62

There are no chirality outliers.

All (66) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	A	286	07P	CCA-CCB-CCC-CCD
8	A	286	07P	OAG-CAC-CAD-CAE
8	E	286	07P	CCA-CCB-CCC-CCD
8	E	286	07P	OAG-CAC-CAD-CAE
8	E	286	07P	CAB-CAC-CAD-CAE
8	A	286	07P	O5-C5-C6-O6
8	E	286	07P	C4-C5-C6-O6
8	E	286	07P	CAX-CAZ-CBA-CBB
8	E	286	07P	O5-C5-C6-O6
8	A	286	07P	C4-C5-C6-O6
8	A	286	07P	CAD-CAE-CAF-CAJ

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Mol	Chain	Res	Type	Atoms
8	E	286	07P	CBQ-CBR-CBS-CBT
8	A	286	07P	CAB-CAC-CAD-CAE
8	A	286	07P	CCE-CCF-CCG-CCH
8	E	286	07P	CBL-CBM-CBN-CBO
8	E	286	07P	CAZ-CBA-CBB-CBC
8	A	286	07P	CCB-CCC-CCD-CCE
8	A	286	07P	CBI-CBJ-CBK-CBL
8	E	286	07P	CCH-CCI-CCJ-CCK
8	E	286	07P	CBK-CBL-CBM-CBN
8	A	286	07P	CBP-CBQ-CBR-CBS
8	A	286	07P	CBO-CBP-CBQ-CBR
8	A	286	07P	CBL-CBM-CBN-CBO
8	E	286	07P	CBF-CBG-CBH-CBI
8	A	286	07P	CBF-CBG-CBH-CBI
8	A	286	07P	CCF-CCG-CCH-CCI
8	A	286	07P	CCD-CCE-CCF-CCG
8	A	286	07P	CBG-CBH-CBI-CBJ
8	E	286	07P	CBS-CBT-CBU-CBV
8	E	286	07P	CBN-CBO-CBP-CBQ
8	E	286	07P	CBA-CBB-CBC-CBD
8	A	286	07P	CBQ-CBR-CBS-CBT
8	E	286	07P	CBH-CBI-CBJ-CBK
8	E	286	07P	CBD-CBE-CBF-CBG
8	E	286	07P	CBB-CBC-CBD-CBE
8	E	286	07P	CCI-CCJ-CCK-CCL
10	E	287	GOL	O1-C1-C2-O2
8	E	286	07P	CBU-CBV-CBW-CBX
8	A	286	07P	CCI-CCJ-CCK-CCL
8	A	286	07P	CBJ-CBK-CBL-CBM
8	A	286	07P	CAH-CAI-CAJ-CAF
8	A	286	07P	CBR-CBS-CBT-CBU
10	E	287	GOL	O1-C1-C2-C3
8	E	286	07P	CBJ-CBK-CBL-CBM
8	A	286	07P	CBZ-CCB-CCC-CCD
8	A	286	07P	CCC-CCD-CCE-CCF
8	E	286	07P	CCG-CCH-CCI-CCJ
8	A	286	07P	CBD-CBE-CBF-CBG
8	E	286	07P	CAH-CAI-CAJ-CAF
8	A	286	07P	CAE-CAF-CAJ-CAI
8	A	286	07P	CBU-CBV-CBW-CBX
8	E	286	07P	CAA-CAB-CAC-CAD
8	E	286	07P	CAI-CAH-CBY-CBZ

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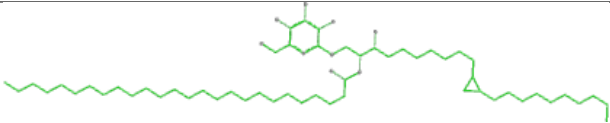
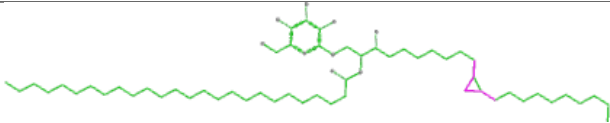
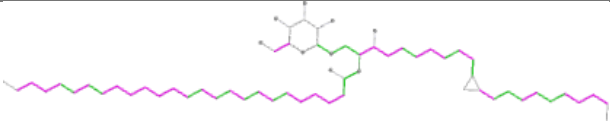
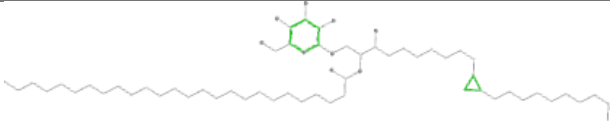
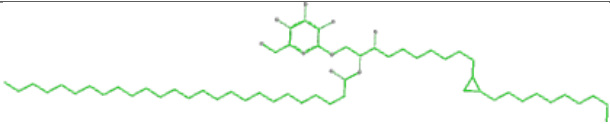
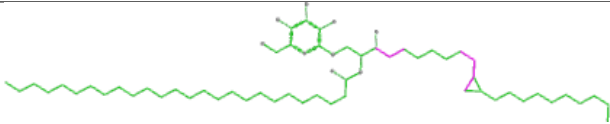
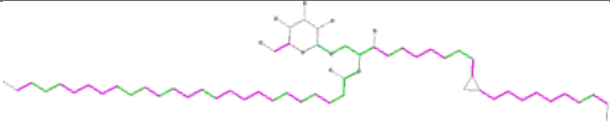
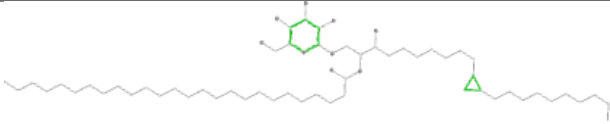
Mol	Chain	Res	Type	Atoms
8	E	286	07P	CCD-CCE-CCF-CCG
8	E	286	07P	CBT-CBU-CBV-CBW
8	E	286	07P	CBO-CBP-CBQ-CBR
8	A	286	07P	CCG-CCH-CCI-CCJ
8	E	286	07P	CBM-CBN-CBO-CBP
8	A	286	07P	CBE-CBF-CBG-CBH
8	A	286	07P	CAZ-CBA-CBB-CBC
8	E	286	07P	CAA-CAB-CAC-OAG
10	E	287	GOL	O2-C2-C3-O3
8	A	286	07P	CBB-CBC-CBD-CBE
8	E	286	07P	CAC-CAD-CAE-CAF
8	E	286	07P	CAE-CAF-CAJ-CAI
8	A	286	07P	CAH-CBY-CBZ-CCB

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	E	287	GOL	1	0
8	E	286	07P	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 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.

Ligand 07P E 286	
 Bond lengths	 Bond angles
 Torsions	 Rings
Ligand 07P A 286	
 Bond lengths	 Bond angles
 Torsions	 Rings

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 ⓘ

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	268/285 (94%)	0.27	13 (4%) 35 27	28, 52, 93, 129	0
1	E	209/285 (73%)	1.06	53 (25%) 1 1	31, 64, 148, 191	1 (0%)
2	B	98/99 (98%)	0.45	3 (3%) 51 41	41, 62, 85, 91	0
2	F	97/99 (97%)	0.53	3 (3%) 51 41	47, 66, 119, 135	0
3	C	200/209 (95%)	0.09	8 (4%) 42 33	18, 43, 87, 101	1 (0%)
3	G	203/209 (97%)	0.14	10 (4%) 35 27	27, 42, 86, 99	0
4	D	239/241 (99%)	-0.13	3 (1%) 75 66	26, 43, 69, 87	0
4	H	240/241 (99%)	0.04	6 (2%) 58 48	29, 43, 70, 97	0
All	All	1554/1668 (93%)	0.27	99 (6%) 25 18	18, 49, 104, 191	2 (0%)

All (99) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	249	ALA	6.0
1	E	52	PRO	5.6
1	A	256	GLY	5.4
1	E	58	LEU	5.3
1	E	54	SER	5.0
3	C	206	SER	4.7
1	E	53	TRP	4.6
1	E	192	TRP	4.4
1	E	55[A]	GLN	4.3
1	A	203	HIS	4.2
4	H	181	ASN	4.0
1	E	218	VAL	3.9
1	E	8	TYR	3.7
1	E	183	LEU	3.7
1	E	245	TRP	3.6
4	H	223	ASP	3.6

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Mol	Chain	Res	Type	RSRZ
1	E	214	TYR	3.5
1	E	206	LEU	3.4
1	E	197	PRO	3.4
1	E	237	PHE	3.4
3	C	185	SER	3.4
3	G	206	SER	3.3
1	E	56	GLY	3.3
1	E	180	LYS	3.2
1	E	177	GLU	3.2
1	E	49	PHE	3.1
1	E	216	LYS	3.1
1	E	217	PRO	3.1
4	D	2	ALA	3.1
1	A	275	ILE	2.9
4	H	182	ASP	2.9
2	F	75	THR	2.9
1	E	178	ALA	2.9
3	C	147	GLN	2.9
4	H	217	ASN	2.9
1	E	170	LEU	2.9
4	H	1	GLU	2.8
1	A	204	ARG	2.8
1	A	206	LEU	2.8
1	A	197	PRO	2.8
1	E	209	HIS	2.8
1	A	230	GLN	2.8
3	G	195	ASN	2.8
1	E	248	GLN	2.7
3	C	200	GLU	2.7
1	E	50	THR	2.7
1	E	210	VAL	2.7
3	G	197	ILE	2.7
1	E	174	GLY	2.7
3	C	145	ASP	2.7
2	F	97	ARG	2.7
1	E	184	GLU	2.7
1	E	181	SER	2.7
3	G	186	ASP	2.7
2	B	77	THR	2.6
2	F	71	THR	2.6
1	E	175	LEU	2.6
1	E	213	PHE	2.6

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Mol	Chain	Res	Type	RSRZ
1	E	57	LYS	2.6
1	E	244	THR	2.6
1	E	7	ASN	2.6
1	A	262	ALA	2.6
1	E	186	GLN	2.6
1	E	208	CYS	2.5
4	D	181	ASN	2.5
1	A	257	GLU	2.5
1	A	199	SER	2.5
2	B	88	ALA	2.5
3	G	154	LYS	2.5
1	E	242	ASP	2.5
1	E	215	PRO	2.4
3	G	185	SER	2.4
3	G	200	GLU	2.4
1	E	176	LEU	2.4
1	E	185	LYS	2.3
1	E	243	GLU	2.3
2	B	99	MET	2.3
1	E	111	ALA	2.3
1	A	273	GLN	2.3
3	G	183	ASN	2.2
3	G	191	ASN	2.2
1	E	61	GLN	2.2
1	E	173	ARG	2.2
3	C	117	ASP	2.2
1	E	187	GLU	2.2
1	E	62	GLN	2.1
1	E	241	ALA	2.1
1	E	196	VAL	2.1
1	E	36	GLN	2.1
4	D	223	ASP	2.1
1	E	63	TRP	2.1
1	A	195	SER	2.0
4	H	224	ARG	2.0
1	E	31	TRP	2.0
1	A	205	GLN	2.0
3	C	39	THR	2.0
3	G	190	ALA	2.0
3	C	155	ASP	2.0
1	E	207	VAL	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](#)

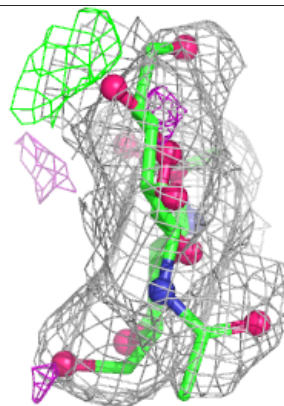
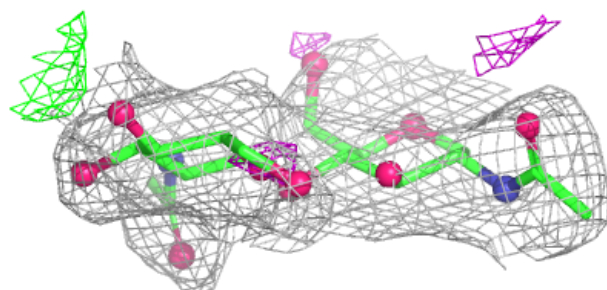
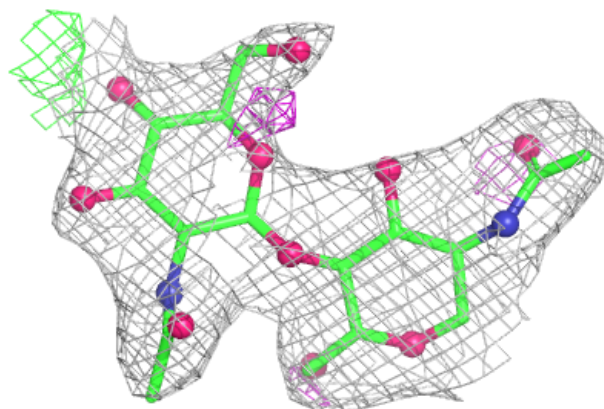
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	NAG	K	2	14/15	0.65	0.15	64,74,83,86	0
6	FUC	L	3	10/11	0.75	0.14	62,70,77,82	0
5	NAG	I	2	14/15	0.78	0.12	50,59,65,66	0
6	FUC	J	3	10/11	0.84	0.13	45,50,53,56	0
6	NAG	L	2	14/15	0.85	0.13	72,79,85,87	0
6	NAG	J	2	14/15	0.87	0.11	54,58,61,64	0
5	NAG	I	1	14/15	0.91	0.09	46,50,54,55	0
5	NAG	K	1	14/15	0.93	0.10	58,62,66,69	0
6	NAG	L	1	14/15	0.93	0.09	73,75,77,81	0
6	NAG	J	1	14/15	0.95	0.07	49,51,54,54	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.

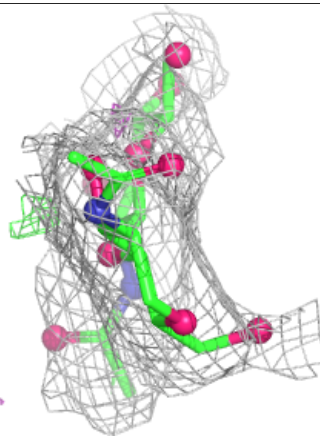
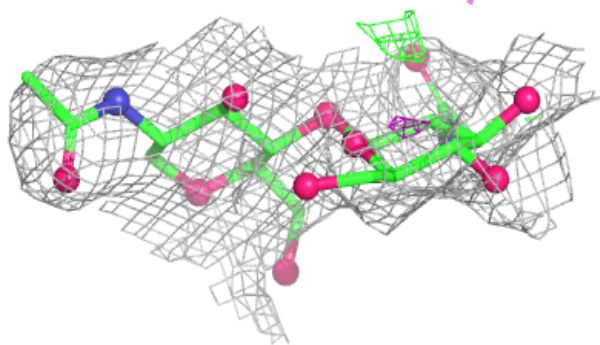
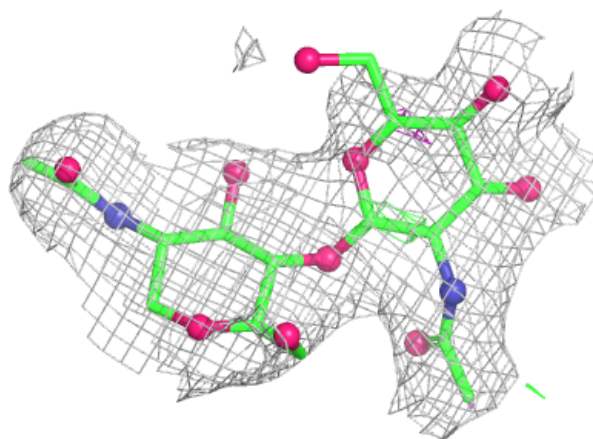
Electron density around Chain I:

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



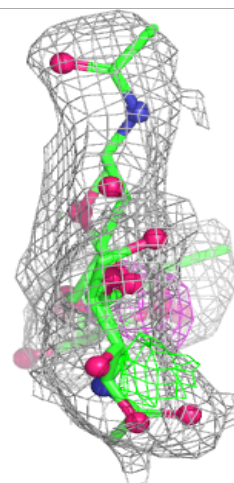
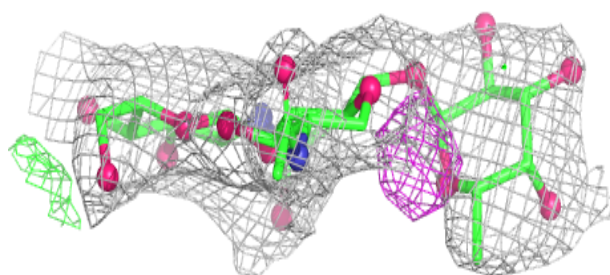
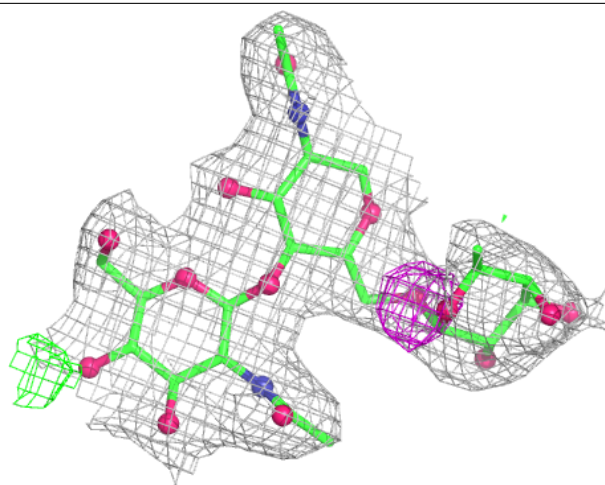
Electron density around Chain K:

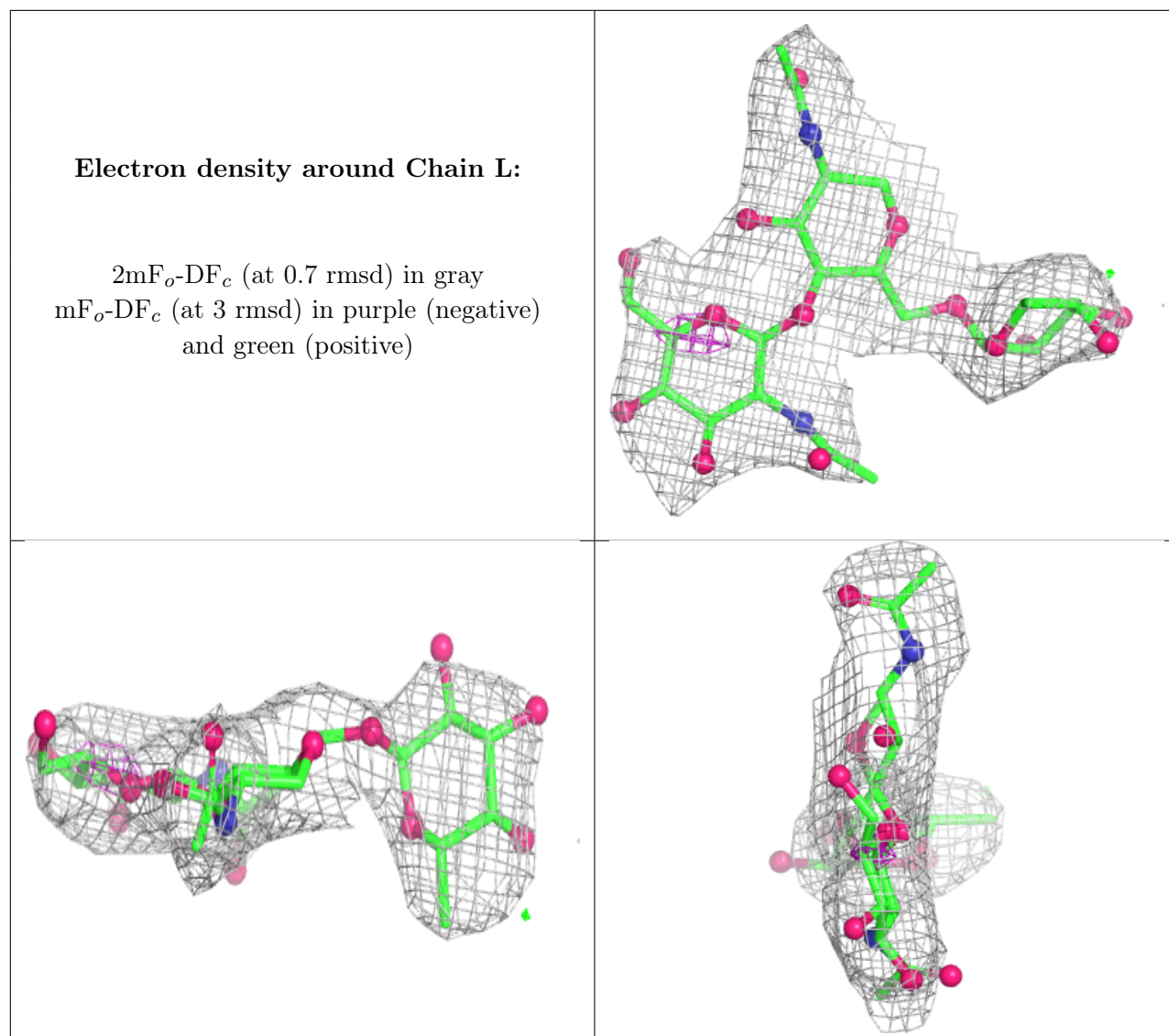
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain J:

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





6.4 Ligands [i](#)

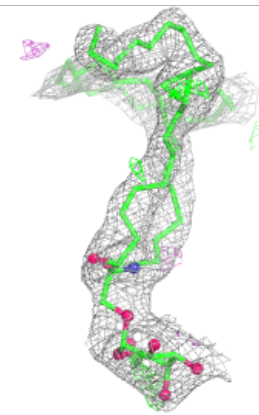
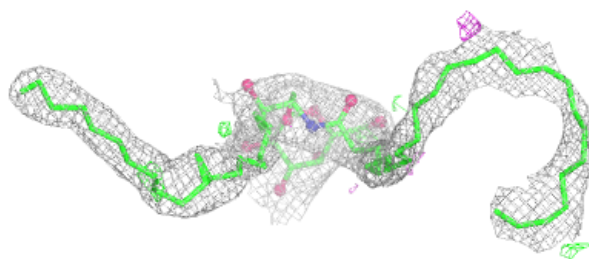
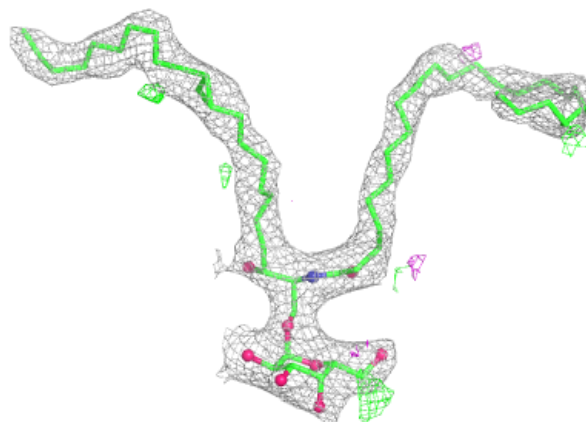
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	NAG	E	514	14/15	0.70	0.15	64,71,77,78	0
7	NAG	A	508	14/15	0.76	0.15	67,74,77,81	0
10	GOL	E	287	6/6	0.91	0.11	42,42,43,43	0
8	07P	E	286	64/64	0.92	0.14	37,48,73,75	0
8	07P	A	286	64/64	0.95	0.11	32,35,41,42	0
9	CL	D	241	1/1	0.96	0.05	50,50,50,50	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.

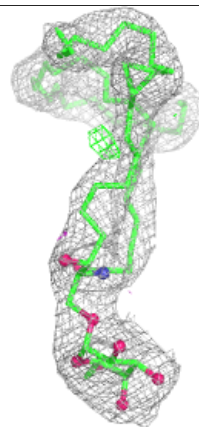
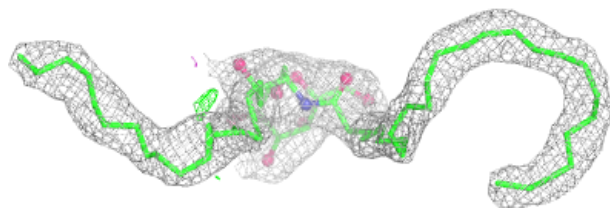
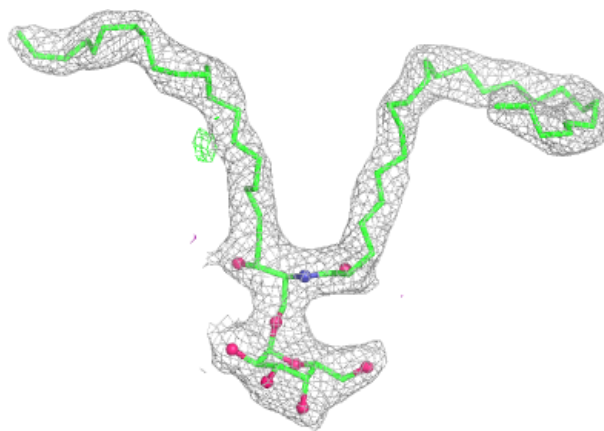
Electron density around 07P E 286:

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



Electron density around 07P A 286:

$2mF_o-DF_c$ (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.