Full wwPDB X-ray Structure Validation Report (i)

Aug 9, 2020 – 12:02 AM BST

PDB ID	:	4N62
Title	:	Crystal structure of hemagglutinin from an H7N9 influenza virus in complex with a sulfated receptor analog
Authors	:	Xu, R.; Wilson, I.A.
Deposited on	:	2013-10-11
Resolution	:	2.50 Å(reported)

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

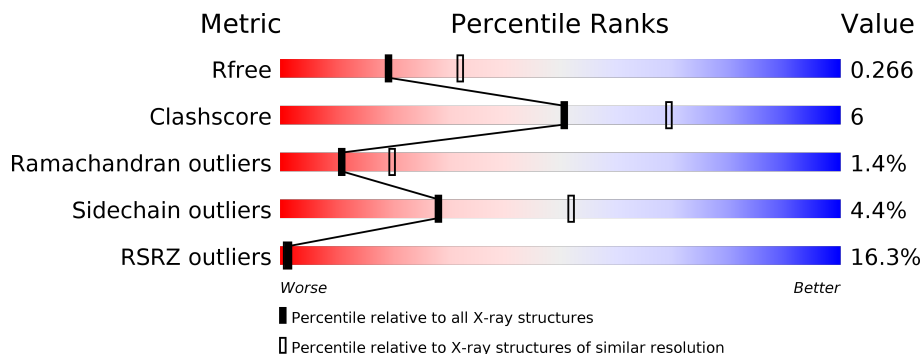|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.13.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.13.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
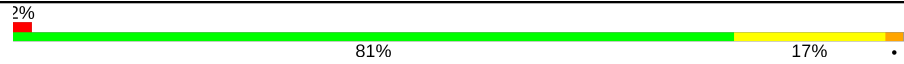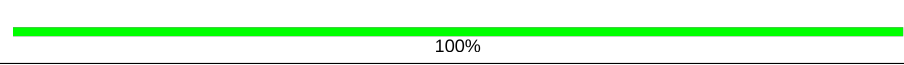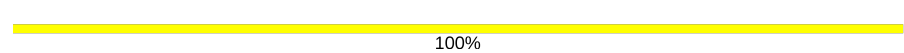*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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		0.266
Clashscore		6
Ramachandran outliers		1.4%
Sidechain outliers		4.4%
RSRZ outliers		16.3%

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}	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 on 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	321	2% / 81% 17% ··
1	C	321	27% / 78% 19% ··
2	B	183	% / 84% 7% · 8%
2	D	183	34% / 83% 8% · 8%
3	E	3	100%
4	F	3	100%

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WORLDWIDE PDB
PROTEIN DATA BANK

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Mol	Chain	Length	Quality of chain
4	G	3	67% 33%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	NGS	G	1	-	-	-	X

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 7839 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 Hemagglutinin HA1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	318	Total 2427	C 1509	N 438	O 465	S 15	0	0	0
1	C	318	Total 2427	C 1509	N 438	O 465	S 15	0	0	0

- Molecule 2 is a protein called Hemagglutinin HA2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	169	Total 1373	C 845	N 241	O 280	S 7	0	0	0
2	D	169	Total 1373	C 845	N 241	O 280	S 7	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	177	SER	-	expression tag	UNP R4NN21
B	178	GLY	-	expression tag	UNP R4NN21
B	179	ARG	-	expression tag	UNP R4NN21
B	180	LEU	-	expression tag	UNP R4NN21
B	181	VAL	-	expression tag	UNP R4NN21
B	182	PRO	-	expression tag	UNP R4NN21
B	183	ARG	-	expression tag	UNP R4NN21
D	177	SER	-	expression tag	UNP R4NN21
D	178	GLY	-	expression tag	UNP R4NN21
D	179	ARG	-	expression tag	UNP R4NN21
D	180	LEU	-	expression tag	UNP R4NN21
D	181	VAL	-	expression tag	UNP R4NN21
D	182	PRO	-	expression tag	UNP R4NN21
D	183	ARG	-	expression tag	UNP R4NN21

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

eta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	3	39	22	2	15	0	0	0

- Molecule 4 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galacto pyranose-(1-4)-2-acetamido-2-deoxy-6-O-sulfo-beta-D-glucopyranose.
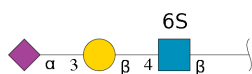
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	F	3	50	25	2	22	1	0	0	0
4	G	3	50	25	2	22	1	0	0	0

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

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

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	41	Total 41	O 41	0	0
6	B	25	Total 25	O 25	0	0
6	C	6	Total 6	O 6	0	0

3 Residue-property plots ⓘ

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

- Molecule 1: Hemagglutinin HA1
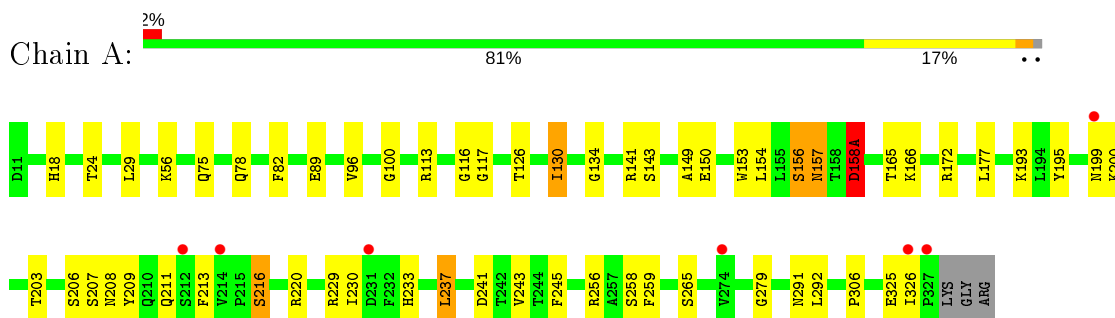
- Molecule 1: Hemagglutinin HA1
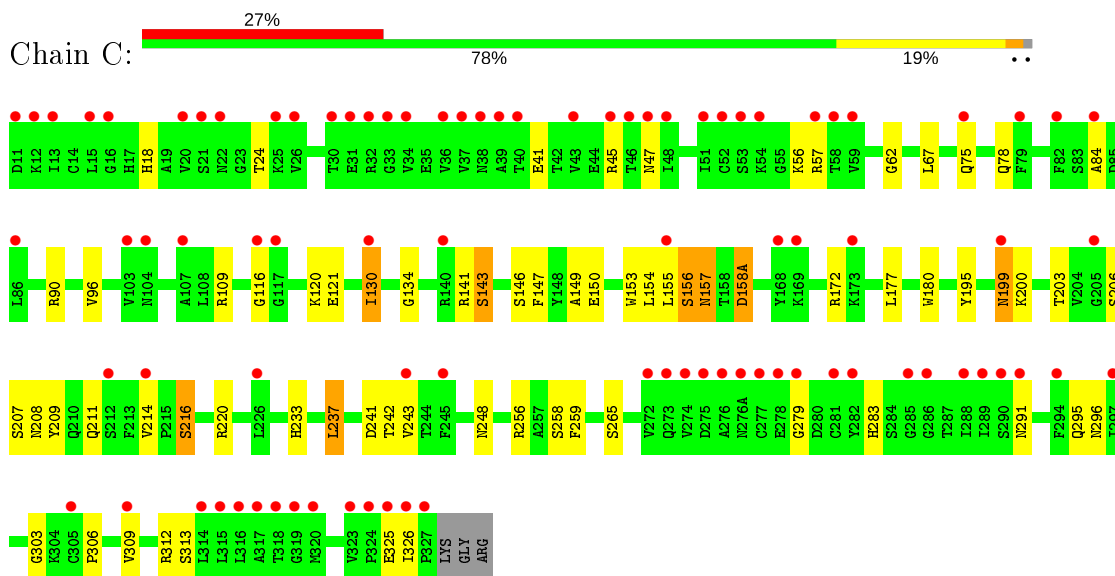
- Molecule 2: Hemagglutinin HA2
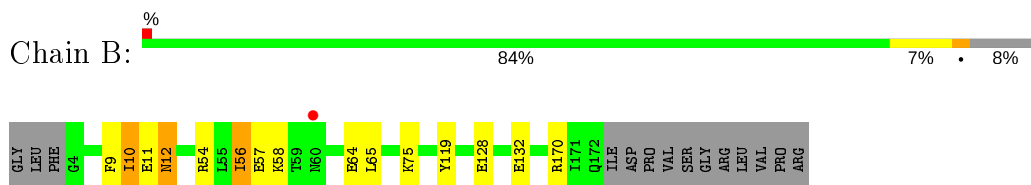
- Molecule 2: Hemagglutinin HA2

Chain D:

34%

83% 8% · 8%
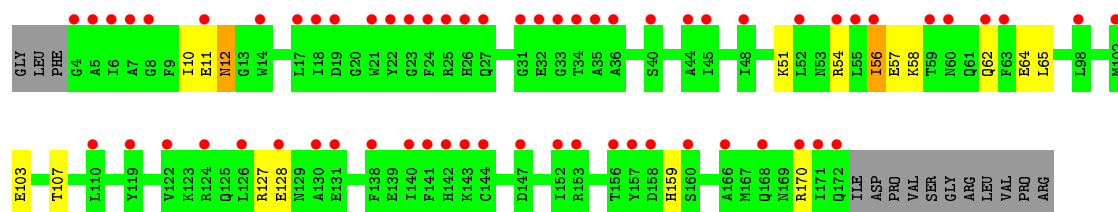
• Molecule 3: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose
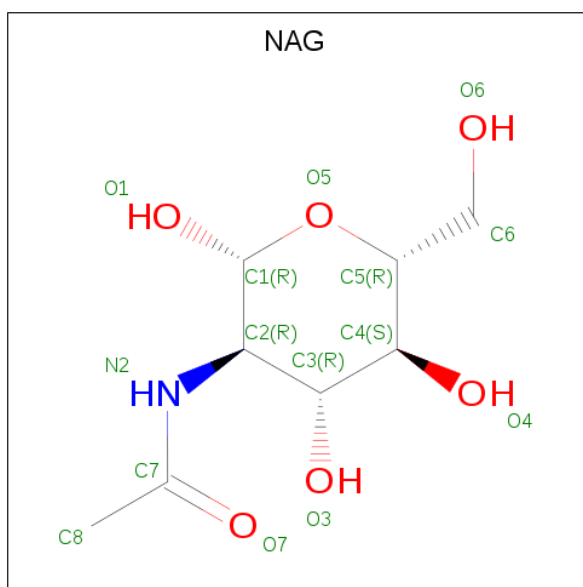
Chain E:

100%

• Molecule 4: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-2-acetamido-2-deoxy-6-O-sulfo-beta-D-glucopyranose

Chain F:

100%

• Molecule 4: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-2-acetamido-2-deoxy-6-O-sulfo-beta-D-glucopyranose

Chain G:

67% 33%

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α, β, γ	153.81Å 153.81Å 153.81Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.64 – 2.50 48.64 – 2.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.64-2.50) 99.7 (48.64-2.50)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.11 (at 2.51Å)	Xtriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.220 , 0.265 0.221 , 0.266	Depositor DCC
R_{free} test set	2121 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	52.9	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 60.6	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.031 for l,-k,h	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7839	wwPDB-VP
Average B, all atoms (Å^2)	104.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.91% 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: GAL, SIA, BMA, NAG, NGS

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	0.29	0/2474	0.48	0/3345
1	C	0.26	0/2474	0.43	0/3345
2	B	0.29	0/1396	0.43	0/1881
2	D	0.23	0/1396	0.39	0/1881
All	All	0.27	0/7740	0.44	0/10452

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	2427	0	2387	32	0
1	C	2427	0	2389	41	0
2	B	1373	0	1273	13	0
2	D	1373	0	1274	13	0
3	E	39	0	34	0	0
4	F	50	0	35	0	0
4	G	50	0	35	1	0
5	A	14	0	13	0	0
5	B	14	0	13	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	41	0	0	2	0
6	B	25	0	0	1	0
6	C	6	0	0	0	0
All	All	7839	0	7453	86	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 6.

All (86) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:291:ASN:OD1	2:D:58:LYS:NZ	1.99	0.94
1:C:56:LYS:NZ	1:C:279:GLY:O	2.03	0.90
1:A:56:LYS:NZ	1:A:279:GLY:O	2.09	0.85
1:A:326:ILE:HG12	2:B:12:ASN:HB3	1.63	0.81
1:C:130:ILE:HD11	1:C:154:LEU:HB3	1.72	0.72
1:A:158(A):ASP:OD2	1:A:193:LYS:NZ	2.23	0.71
2:B:128:GLU:HG3	2:B:170:ARG:HH12	1.55	0.70
2:B:128:GLU:HG3	2:B:170:ARG:NH1	2.12	0.64
1:A:150:GLU:OE1	1:A:256:ARG:HD3	1.98	0.63
1:C:195:TYR:O	1:C:200:LYS:NZ	2.26	0.63
1:A:126:THR:O	1:A:166:LYS:NZ	2.20	0.62
1:C:206:SER:OG	1:C:207:SER:N	2.34	0.60
1:C:206:SER:HB3	1:C:209:TYR:HB3	1.83	0.60
1:A:325:GLU:HA	2:B:12:ASN:HB2	1.83	0.60
1:A:206:SER:HB3	1:A:209:TYR:HB3	1.85	0.59
1:C:150:GLU:OE1	1:C:256:ARG:HD3	2.01	0.59
2:D:128:GLU:HG3	2:D:170:ARG:HH12	1.68	0.58
1:A:206:SER:OG	1:A:207:SER:N	2.37	0.58
1:C:155:LEU:HD21	4:G:3:SIA:H111	1.87	0.57
1:A:291:ASN:OD1	2:B:58:LYS:NZ	2.27	0.57
2:B:12:ASN:ND2	6:B:314:HOH:O	2.37	0.57
1:A:291:ASN:HA	2:B:58:LYS:NZ	2.20	0.56
2:D:51:LYS:NZ	2:D:103:GLU:O	2.38	0.56
1:C:326:ILE:HG12	2:D:12:ASN:HB3	1.87	0.56
1:A:172:ARG:HD3	1:A:259:PHE:CZ	2.41	0.56
1:C:47:ASN:OD1	1:C:283:HIS:NE2	2.36	0.55
1:A:134:GLY:HA3	1:A:153:TRP:HB3	1.89	0.55
1:A:158(A):ASP:N	6:A:517:HOH:O	2.39	0.55
1:C:291:ASN:HB3	2:D:56:ILE:HG13	1.89	0.54
1:C:121:GLU:OE2	1:C:172:ARG:NH1	2.38	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:130:ILE:HD11	1:A:154:LEU:HB3	1.88	0.54
1:C:116:GLY:HA2	1:C:265:SER:HB3	1.90	0.53
1:A:237:LEU:HG	1:A:243:VAL:HG13	1.89	0.53
2:D:128:GLU:O	2:D:170:ARG:NH1	2.34	0.53
1:C:199:ASN:N	1:C:199:ASN:OD1	2.42	0.53
2:D:51:LYS:HZ2	2:D:107:THR:HG1	1.54	0.52
1:C:45:ARG:HD2	1:C:312:ARG:HB2	1.92	0.52
1:A:177:LEU:HB3	1:A:258:SER:HB2	1.92	0.51
1:A:141:ARG:HH12	1:A:149:ALA:HB2	1.77	0.50
2:D:128:GLU:HG3	2:D:170:ARG:NH1	2.25	0.50
1:A:116:GLY:HA2	1:A:265:SER:HB3	1.93	0.50
1:C:146:SER:OG	1:C:147:PHE:N	2.44	0.50
2:B:75:LYS:HD3	5:B:201:NAG:H81	1.94	0.50
1:C:200:LYS:HA	1:C:248:ASN:HD21	1.77	0.49
1:C:295:GLN:HG2	1:C:306:PRO:HG2	1.94	0.49
1:C:172:ARG:HD3	1:C:259:PHE:CZ	2.48	0.48
1:C:134:GLY:HA3	1:C:153:TRP:HB3	1.95	0.48
1:A:291:ASN:HA	2:B:58:LYS:HZ2	1.78	0.48
1:C:303:GLY:HA2	2:D:62:GLN:HG3	1.96	0.48
1:C:237:LEU:HG	1:C:243:VAL:HG13	1.94	0.48
1:C:156:SER:O	1:C:157:ASN:HB2	2.12	0.48
1:C:216:SER:O	1:C:220:ARG:NH2	2.32	0.47
1:A:156:SER:O	1:A:157:ASN:HB2	2.14	0.47
1:A:291:ASN:HB3	2:B:56:ILE:HG13	1.97	0.47
1:C:291:ASN:HA	2:D:58:LYS:NZ	2.30	0.47
1:C:296:ASN:ND2	1:C:309:VAL:O	2.46	0.46
1:C:141:ARG:O	1:C:143:SER:OG	2.31	0.46
1:C:177:LEU:HB3	1:C:258:SER:HB2	1.98	0.45
1:C:130:ILE:HG13	1:C:155:LEU:O	2.17	0.45
1:A:82:PHE:CZ	1:A:117:GLY:HA2	2.51	0.45
1:A:216:SER:O	1:A:220:ARG:NH2	2.34	0.45
2:B:119:TYR:OH	2:B:132:GLU:OE2	2.23	0.44
1:A:237:LEU:HD22	1:A:241:ASP:HB3	2.00	0.44
1:A:292:LEU:O	1:A:306:PRO:HB3	2.18	0.44
1:C:141:ARG:HH12	1:C:149:ALA:HB2	1.83	0.44
1:C:237:LEU:HD23	1:C:237:LEU:HA	1.86	0.44
1:A:325:GLU:HG3	2:B:12:ASN:HD22	1.84	0.43
1:A:195:TYR:O	1:A:200:LYS:NZ	2.32	0.43
1:A:100:GLY:HA3	1:A:230:ILE:O	2.20	0.42
1:C:67:LEU:HD21	1:C:109:ARG:HG2	2.01	0.42
1:C:62:GLY:HA2	1:C:90:ARG:HG3	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:127:ARG:HG3	2:D:159:HIS:CG	2.55	0.42
1:A:89:GLU:OE2	1:A:113:ARG:NE	2.44	0.41
1:C:41:GLU:OE1	1:C:313:SER:OG	2.21	0.41
1:A:213:PHE:CE1	1:A:233:HIS:CD2	3.08	0.41
1:C:146:SER:HG	1:C:147:PHE:H	1.68	0.41
1:A:165:THR:HA	1:A:245:PHE:O	2.21	0.41
1:A:229:ARG:NE	6:A:531:HOH:O	2.28	0.41
2:D:65:LEU:HD12	2:D:65:LEU:HA	1.86	0.41
1:C:200:LYS:O	1:C:214:VAL:HG13	2.21	0.41
2:B:9:PHE:O	2:B:10:ILE:HB	2.21	0.41
1:C:57:ARG:HG2	1:C:84:ALA:HA	2.02	0.41
1:C:241:ASP:OD1	1:C:242:THR:N	2.50	0.40
1:C:180:TRP:CE2	1:C:233:HIS:HB2	2.56	0.40
1:C:120:LYS:NZ	1:C:150:GLU:OE2	2.40	0.40
1:C:325:GLU:HA	2:D:12:ASN:HB2	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	316/321 (98%)	294 (93%)	18 (6%)	4 (1%)	12	21
1	C	316/321 (98%)	294 (93%)	18 (6%)	4 (1%)	12	21
2	B	167/183 (91%)	156 (93%)	8 (5%)	3 (2%)	8	14
2	D	167/183 (91%)	156 (93%)	8 (5%)	3 (2%)	8	14
All	All	966/1008 (96%)	900 (93%)	52 (5%)	14 (1%)	11	20

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	157	ASN
2	B	12	ASN
1	C	157	ASN
2	D	12	ASN
1	A	208	ASN
1	C	208	ASN
1	A	143	SER
1	A	158(A)	ASP
2	B	10	ILE
2	B	57	GLU
1	C	143	SER
1	C	158(A)	ASP
2	D	57	GLU
2	D	10	ILE

5.3.2 Protein sidechains (i)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	267/269 (99%)	253 (95%)	14 (5%)	23	44
1	C	267/269 (99%)	254 (95%)	13 (5%)	25	47
2	B	145/157 (92%)	140 (97%)	5 (3%)	37	63
2	D	145/157 (92%)	141 (97%)	4 (3%)	43	70
All	All	824/852 (97%)	788 (96%)	36 (4%)	28	52

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	HIS
1	A	24	THR
1	A	29	LEU
1	A	75	GLN
1	A	78	GLN
1	A	96	VAL
1	A	130	ILE
1	A	156	SER

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Mol	Chain	Res	Type
1	A	158(A)	ASP
1	A	199	ASN
1	A	203	THR
1	A	211	GLN
1	A	216	SER
1	A	237	LEU
2	B	11	GLU
2	B	54	ARG
2	B	56	ILE
2	B	64	GLU
2	B	65	LEU
1	C	18	HIS
1	C	24	THR
1	C	75	GLN
1	C	78	GLN
1	C	96	VAL
1	C	130	ILE
1	C	156	SER
1	C	158(A)	ASP
1	C	199	ASN
1	C	203	THR
1	C	211	GLN
1	C	216	SER
1	C	237	LEU
2	D	11	GLU
2	D	54	ARG
2	D	56	ILE
2	D	64	GLU

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

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

9 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	#$|Z| > 2$
3	NAG	E	1	1,3	14,14,15	0.54	0	17,19,21	0.47	0
3	NAG	E	2	3	14,14,15	0.23	0	17,19,21	0.69	0
3	BMA	E	3	3	11,11,12	0.86	0	15,15,17	0.92	0
4	NGS	F	1	4	19,19,19	1.55	4 (21%)	26,28,28	1.81	6 (23%)
4	GAL	F	2	4	11,11,12	1.29	1 (9%)	15,15,17	1.24	2 (13%)
4	SIA	F	3	4	17,20,21	0.47	0	21,28,31	1.52	3 (14%)
4	NGS	G	1	4	19,19,19	1.53	3 (15%)	26,28,28	1.73	6 (23%)
4	GAL	G	2	4	11,11,12	1.04	2 (18%)	15,15,17	1.18	1 (6%)
4	SIA	G	3	4	17,20,21	0.43	0	21,28,31	1.45	3 (14%)

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
3	NAG	E	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1
3	BMA	E	3	3	-	0/2/19/22	0/1/1/1
4	NGS	F	1	4	-	4/10/30/30	0/1/1/1
4	GAL	F	2	4	-	2/2/19/22	0/1/1/1
4	SIA	F	3	4	-	4/14/34/38	0/1/1/1
4	NGS	G	1	4	-	4/10/30/30	0/1/1/1
4	GAL	G	2	4	-	2/2/19/22	0/1/1/1
4	SIA	G	3	4	-	5/14/34/38	0/1/1/1

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	1	NGS	C7-N2	3.56	1.46	1.34
4	G	1	NGS	C7-N2	3.50	1.46	1.34
4	F	2	GAL	C2-C3	3.05	1.57	1.52
4	F	1	NGS	C1-C2	-2.69	1.49	1.52
4	G	1	NGS	C1-C2	-2.64	1.49	1.52
4	F	1	NGS	C8-C7	2.52	1.55	1.50
4	G	1	NGS	C8-C7	2.50	1.55	1.50
4	G	2	GAL	C1-C2	2.23	1.57	1.52
4	G	2	GAL	C2-C3	2.07	1.55	1.52
4	F	1	NGS	O5-C5	-2.00	1.39	1.44

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	3	SIA	C6-O6-C2	4.83	121.68	111.34
4	G	3	SIA	C6-O6-C2	4.68	121.35	111.34
4	G	1	NGS	O5-C1-C2	-4.00	105.50	109.52
4	F	1	NGS	C4-C3-C2	3.83	115.95	110.34
4	F	1	NGS	O5-C1-C2	-3.70	105.80	109.52
4	F	1	NGS	O5-C5-C4	3.41	115.89	109.69
4	G	1	NGS	O5-C5-C4	3.38	115.82	109.69
4	G	3	SIA	C3-C2-C1	-3.07	105.23	111.93
4	G	1	NGS	C4-C3-C2	3.03	114.78	110.34
4	G	1	NGS	C3-C4-C5	2.91	115.43	110.24
4	G	3	SIA	C3-C4-C5	-2.89	107.97	111.46
4	F	1	NGS	C3-C4-C5	2.87	115.35	110.24
4	F	1	NGS	O9-S-O7A	-2.76	101.14	112.22
4	G	1	NGS	O9-S-O7A	-2.70	101.38	112.22
4	F	3	SIA	C3-C2-C1	-2.69	106.06	111.93
4	F	1	NGS	C8-C7-N2	2.67	120.62	116.10
4	G	2	GAL	C1-O5-C5	2.67	115.81	112.19
4	F	3	SIA	C3-C4-C5	-2.53	108.40	111.46
4	G	1	NGS	C8-C7-N2	2.45	120.24	116.10
4	F	2	GAL	O3-C3-C4	-2.27	105.11	110.35
4	F	2	GAL	C1-O5-C5	2.03	114.94	112.19

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	G	3	SIA	C6-C7-C8-O8
4	G	3	SIA	O7-C7-C8-O8

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Mol	Chain	Res	Type	Atoms
4	F	3	SIA	C6-C7-C8-O8
4	F	3	SIA	O7-C7-C8-O8
4	F	1	NGS	C4-C5-C6-O6
4	F	1	NGS	O5-C5-C6-O6
4	G	2	GAL	O5-C5-C6-O6
4	F	2	GAL	O5-C5-C6-O6
4	G	2	GAL	C4-C5-C6-O6
3	E	2	NAG	O5-C5-C6-O6
4	G	3	SIA	O7-C7-C8-C9
4	F	3	SIA	O7-C7-C8-C9
4	F	2	GAL	C4-C5-C6-O6
4	G	3	SIA	C6-C7-C8-C9
4	F	3	SIA	C6-C7-C8-C9
4	G	1	NGS	O7-C7-N2-C2
4	G	1	NGS	C8-C7-N2-C2
4	F	1	NGS	O7-C7-N2-C2
4	F	1	NGS	C8-C7-N2-C2
3	E	2	NAG	C4-C5-C6-O6
4	G	1	NGS	O5-C5-C6-O6
4	G	1	NGS	C4-C5-C6-O6
4	G	3	SIA	C6-C5-N5-C10

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	G	3	SIA	1	0

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

Oligosaccharide Chain E

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain F

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain G

Bond lengths

Bond angles

Torsions

Rings
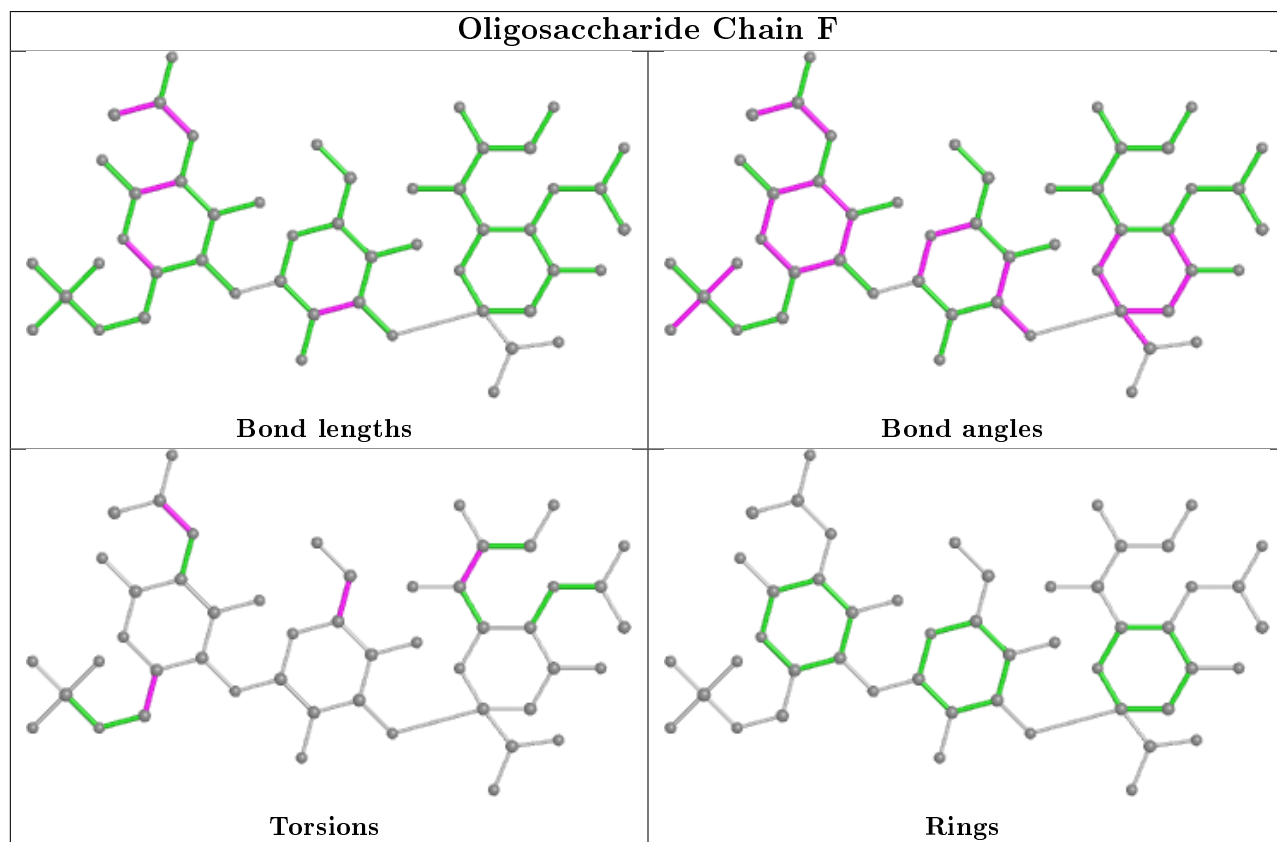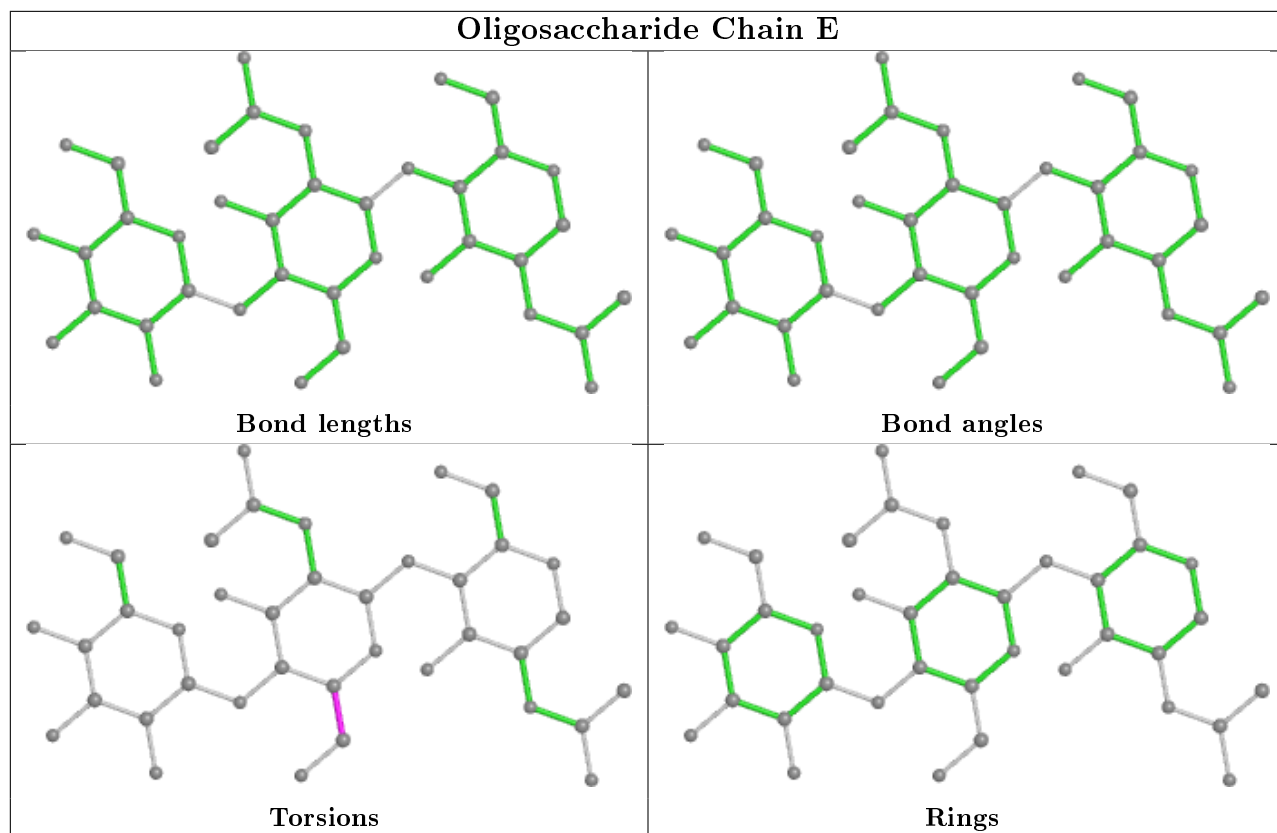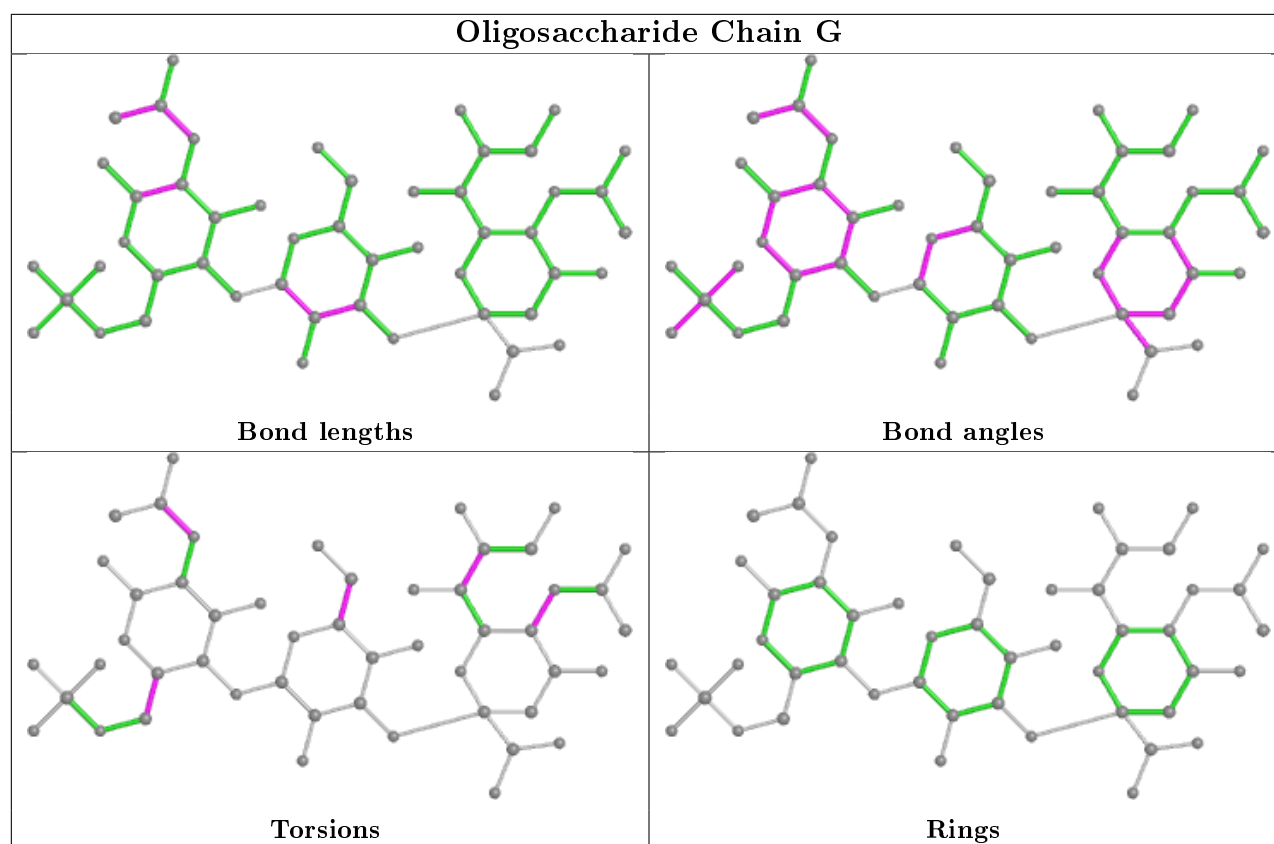
5.6 Ligand geometry (i)

2 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	$\#|Z| > 2$
5	NAG	B	201	2	14,14,15	0.47	0	17,19,21	0.50	0
5	NAG	A	404	1	14,14,15	0.25	0	17,19,21	0.52	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.

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	B	201	2	-	0/6/23/26	0/1/1/1
5	NAG	A	404	1	-	3/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	404	NAG	O5-C5-C6-O6
5	A	404	NAG	C4-C5-C6-O6
5	A	404	NAG	C3-C2-N2-C7

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	201	NAG	1	0

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	318/321 (99%)	0.32	7 (2%)	62	65	50, 69, 98, 142	0
1	C	318/321 (99%)	1.46	88 (27%)	0	0	76, 119, 176, 213	0
2	B	169/183 (92%)	0.33	1 (0%)	89	90	46, 62, 96, 141	0
2	D	169/183 (92%)	2.09	63 (37%)	0	0	92, 160, 188, 232	0
All	All	974/1008 (96%)	1.00	159 (16%)	1	1	46, 93, 176, 232	0

All (159) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	319	GLY	13.0
1	C	327	PRO	11.7
2	D	7	ALA	10.7
2	D	4	GLY	8.7
1	C	58	THR	8.2
2	D	33	GLY	7.7
1	C	289	ILE	7.4
1	C	294	PHE	6.3
2	D	36	ALA	6.2
1	C	288	ILE	6.0
1	C	51	ILE	5.9
2	D	168	GLN	5.7
2	D	140	ILE	5.7
2	D	171	ILE	5.4
1	C	276(A)	ASN	5.4
1	C	323	VAL	5.3
2	D	143	LYS	5.1
2	D	34	THR	5.1
2	D	60	ASN	5.1
2	D	5	ALA	5.0
1	C	86	LEU	4.7

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Mol	Chain	Res	Type	RSRZ
1	C	13	ILE	4.7
2	D	48	ILE	4.7
2	D	172	GLN	4.7
2	D	8	GLY	4.7
1	A	327	PRO	4.7
2	D	131	GLU	4.6
1	C	272	VAL	4.6
2	D	35	ALA	4.5
2	D	166	ALA	4.5
2	D	63	PHE	4.5
2	D	32	GLU	4.5
2	D	23	GLY	4.5
1	C	140	ARG	4.4
2	D	141	PHE	4.4
1	C	279	GLY	4.2
1	C	277	CYS	4.2
2	D	6	ILE	4.2
2	D	59	THR	4.1
1	C	33	GLY	4.1
1	C	38	ASN	4.1
1	C	54	LYS	4.0
1	C	16	GLY	4.0
1	C	282	TYR	3.9
2	D	144	CYS	3.9
2	D	24	PHE	3.9
1	C	12	LYS	3.9
2	D	138	PHE	3.8
2	D	18	ILE	3.8
2	D	52	LEU	3.8
1	C	173	LYS	3.8
2	D	122	VAL	3.8
1	C	45	ARG	3.7
2	D	44	ALA	3.7
2	D	157	TYR	3.6
1	A	214	VAL	3.5
1	C	317	ALA	3.5
2	D	27	GLN	3.5
1	C	281	CYS	3.4
2	D	170	ARG	3.4
1	C	47	ASN	3.4
2	D	152	ILE	3.4
2	B	60	ASN	3.4

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Mol	Chain	Res	Type	RSRZ
1	C	205	GLY	3.3
1	C	326	ILE	3.3
2	D	126	LEU	3.2
1	C	46	THR	3.2
1	C	52	CYS	3.2
2	D	56	ILE	3.2
1	C	305	CYS	3.2
2	D	55	LEU	3.2
1	C	20	VAL	3.1
1	C	82	PHE	3.1
1	C	104	ASN	3.1
1	C	34	VAL	3.1
2	D	128	GLU	3.1
1	C	39	ALA	3.1
1	C	48	ILE	3.0
2	D	130	ALA	3.0
1	C	273	GLN	3.0
1	C	40	THR	3.0
2	D	54	ARG	3.0
1	A	212	SER	3.0
2	D	14	TRP	3.0
1	C	37	VAL	2.9
1	C	325	GLU	2.9
1	C	79	PHE	2.9
1	C	84	ALA	2.9
2	D	21	TRP	2.9
2	D	19	ASP	2.9
1	C	15	LEU	2.9
1	C	278	GLU	2.9
1	C	212	SER	2.9
2	D	142	HIS	2.9
1	C	11	ASP	2.8
1	C	324	PRO	2.8
1	C	199	ASN	2.8
2	D	119	TYR	2.8
1	C	31	GLU	2.8
1	C	155	LEU	2.8
2	D	124	ARG	2.8
1	C	117	GLY	2.8
1	C	22	ASN	2.8
1	C	116	GLY	2.7
2	D	98	LEU	2.7

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Mol	Chain	Res	Type	RSRZ
2	D	11	GLU	2.7
1	C	318	THR	2.7
1	C	43	VAL	2.7
1	C	275	ASP	2.7
1	C	291	ASN	2.7
1	A	199	ASN	2.7
1	C	59	VAL	2.6
1	C	30	THR	2.6
1	C	36	VAL	2.6
2	D	102	MET	2.6
2	D	26	HIS	2.6
2	D	62	GLN	2.6
2	D	147	ASP	2.6
2	D	45	ILE	2.5
1	A	231	ASP	2.5
2	D	31	GLY	2.5
2	D	25	ARG	2.5
1	C	285	GLY	2.5
1	C	290	SER	2.5
1	C	57	ARG	2.5
1	C	168	TYR	2.4
1	A	326	ILE	2.4
1	C	214	VAL	2.4
1	C	32	ARG	2.4
1	C	276	ALA	2.4
1	C	130	ILE	2.4
1	C	21	SER	2.3
2	D	156	THR	2.3
1	C	309	VAL	2.3
1	C	314	LEU	2.3
2	D	110	LEU	2.3
1	C	274	VAL	2.3
2	D	17	LEU	2.3
1	C	103	VAL	2.2
2	D	40	SER	2.2
2	D	160	SER	2.2
1	C	26	VAL	2.2
1	C	169	LYS	2.2
2	D	153	ARG	2.1
1	C	297	ILE	2.1
2	D	158	ASP	2.1
1	C	320	MET	2.1

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Mol	Chain	Res	Type	RSRZ
1	C	226	LEU	2.1
1	A	274	VAL	2.1
1	C	316	LEU	2.1
1	C	53	SER	2.1
2	D	22	TYR	2.1
1	C	315	LEU	2.1
1	C	75	GLN	2.1
1	C	286	GLY	2.0
1	C	25	LYS	2.0
1	C	245	PHE	2.0
1	C	107	ALA	2.0
1	C	243	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(Å^2)	Q<0.9
3	BMA	E	3	11/12	0.42	0.36	175,180,182,182	0
4	NGS	G	1	19/19	0.61	0.47	115,206,210,211	0
4	NGS	F	1	19/19	0.72	0.38	112,158,172,173	0
4	GAL	G	2	11/12	0.75	0.37	151,198,216,220	0
3	NAG	E	2	14/15	0.76	0.40	130,147,156,164	0
4	GAL	F	2	11/12	0.81	0.23	114,175,180,180	0
4	SIA	G	3	20/21	0.84	0.24	95,119,143,146	0
4	SIA	F	3	20/21	0.90	0.18	61,80,101,104	0
3	NAG	E	1	14/15	0.90	0.20	97,115,124,138	0

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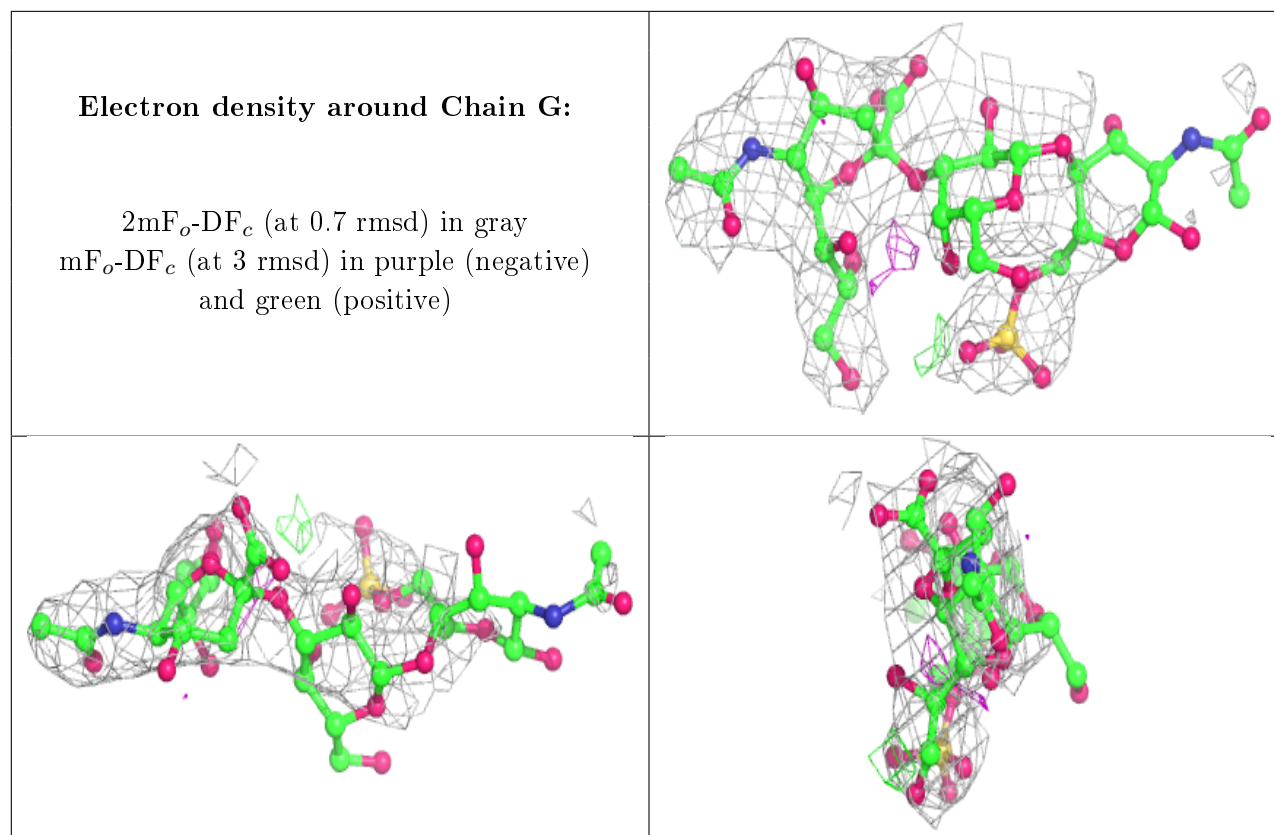
Electron density around Chain E:

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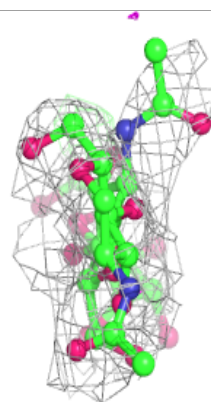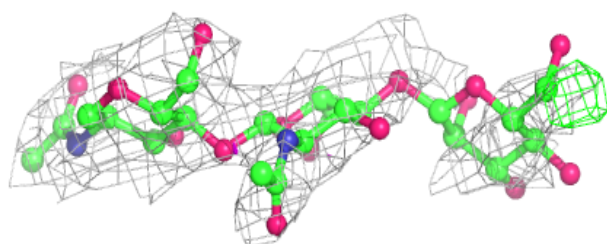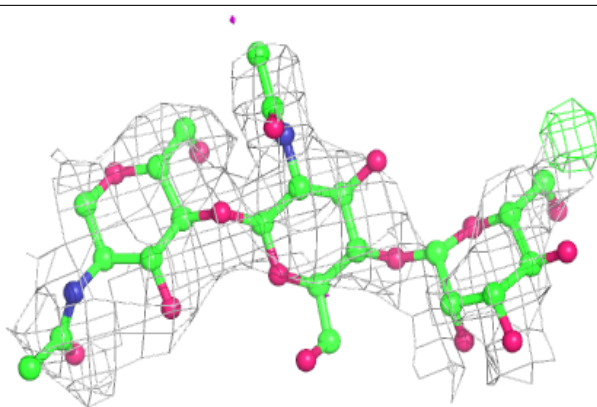
Electron density around Chain F:

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 G:

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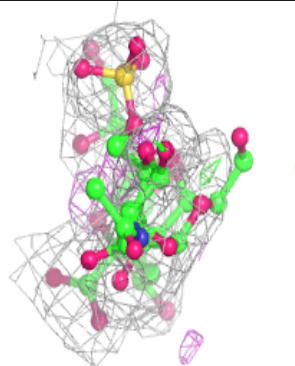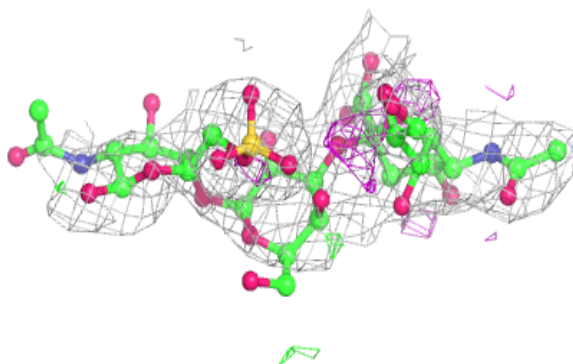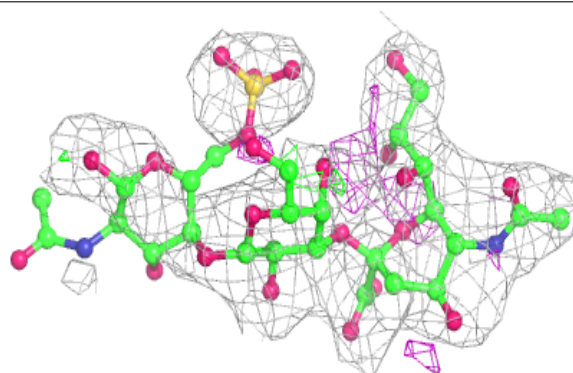
6.4 Ligands (i)

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	NAG	A	404	14/15	0.82	0.18	127,140,146,149	0
5	NAG	B	201	14/15	0.83	0.21	80,92,96,99	0

6.5 Other polymers (i)

There are no such residues in this entry.