



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 03:42 PM UTC

PDB ID : 6TY1 / pdb_00006ty1
Title : Crystal structure of the haemagglutinin mutant (Gln226Leu, Gly228Ser) from an H10N7 seal influenza virus isolated in Germany in complex with human receptor analogue 6'-SLN
Authors : Zhang, J.; Xiong, X.; Purkiss, A.; Walker, P.; Gamblin, S.; Skehel, J.J.
Deposited on : 2020-01-15
Resolution : 3.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

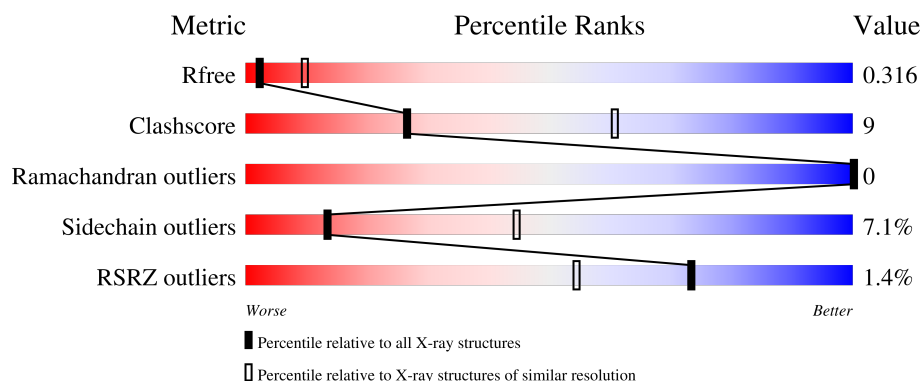
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	325	2% 78% 19% ..
1	C	325	2% 79% 18% ..
1	E	325	2% 75% 22% ..
1	G	325	0% 80% 18% ..

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Mol	Chain	Length	Quality of chain
1	I	325	
1	K	325	
2	B	177	
2	D	177	
2	F	177	
2	H	177	
2	J	177	
2	L	177	
3	M	3	
3	P	3	
4	N	2	
4	O	2	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 23049 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.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	320	Total	C	N	O	S	0	0	0
			2443	1515	442	470	16			
1	C	320	Total	C	N	O	S	0	0	0
			2439	1512	441	470	16			
1	E	320	Total	C	N	O	S	0	0	0
			2402	1491	433	462	16			
1	G	320	Total	C	N	O	S	0	0	0
			2423	1504	436	467	16			
1	I	320	Total	C	N	O	S	0	0	0
			2412	1492	438	466	16			
1	K	320	Total	C	N	O	S	0	0	0
			2420	1504	435	465	16			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	ASP	-	expression tag	UNP A0A0A7HR51
A	0	PRO	-	expression tag	UNP A0A0A7HR51
A	221	SER	GLY	engineered mutation	UNP A0A0A7HR51
C	-1	ASP	-	expression tag	UNP A0A0A7HR51
C	0	PRO	-	expression tag	UNP A0A0A7HR51
C	221	SER	GLY	engineered mutation	UNP A0A0A7HR51
E	-1	ASP	-	expression tag	UNP A0A0A7HR51
E	0	PRO	-	expression tag	UNP A0A0A7HR51
E	221	SER	GLY	engineered mutation	UNP A0A0A7HR51
G	-1	ASP	-	expression tag	UNP A0A0A7HR51
G	0	PRO	-	expression tag	UNP A0A0A7HR51
G	221	SER	GLY	engineered mutation	UNP A0A0A7HR51
I	-1	ASP	-	expression tag	UNP A0A0A7HR51
I	0	PRO	-	expression tag	UNP A0A0A7HR51
I	221	SER	GLY	engineered mutation	UNP A0A0A7HR51
K	-1	ASP	-	expression tag	UNP A0A0A7HR51
K	0	PRO	-	expression tag	UNP A0A0A7HR51

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Chain	Residue	Modelled	Actual	Comment	Reference
K	221	SER	GLY	engineered mutation	UNP A0A0A7HR51

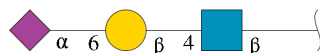
- Molecule 2 is a protein called Hemagglutinin HA2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	172	Total	C	N	O	S	0	0	0
			1374	850	238	278	8			
2	D	172	Total	C	N	O	S	0	0	0
			1366	846	239	273	8			
2	F	172	Total	C	N	O	S	0	0	0
			1373	849	238	278	8			
2	H	172	Total	C	N	O	S	0	0	0
			1369	847	236	278	8			
2	J	172	Total	C	N	O	S	0	0	0
			1364	842	240	274	8			
2	L	172	Total	C	N	O	S	0	0	0
			1366	845	238	275	8			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	177	LYS	-	expression tag	UNP A0A0A7HR51
D	177	LYS	-	expression tag	UNP A0A0A7HR51
F	177	LYS	-	expression tag	UNP A0A0A7HR51
H	177	LYS	-	expression tag	UNP A0A0A7HR51
J	177	LYS	-	expression tag	UNP A0A0A7HR51
L	177	LYS	-	expression tag	UNP A0A0A7HR51

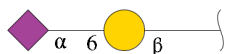
- Molecule 3 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-6)-beta-D-galactopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	M	3	Total	C	N	O		0	0	0
			46	25	2	19				
3	P	3	Total	C	N	O		0	0	0
			46	25	2	19				

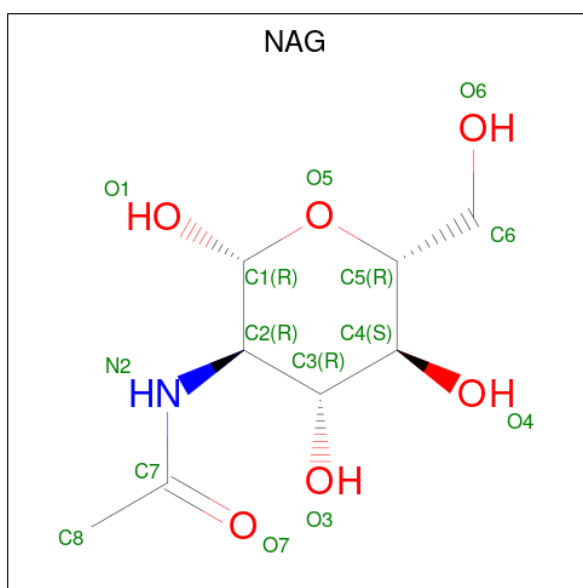
- Molecule 4 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-6)-beta-D-galacto

pyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	N	2	Total	C	N	O	0	0	0
			32	17	1	14			
4	O	2	Total	C	N	O	0	0	0
			32	17	1	14			

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



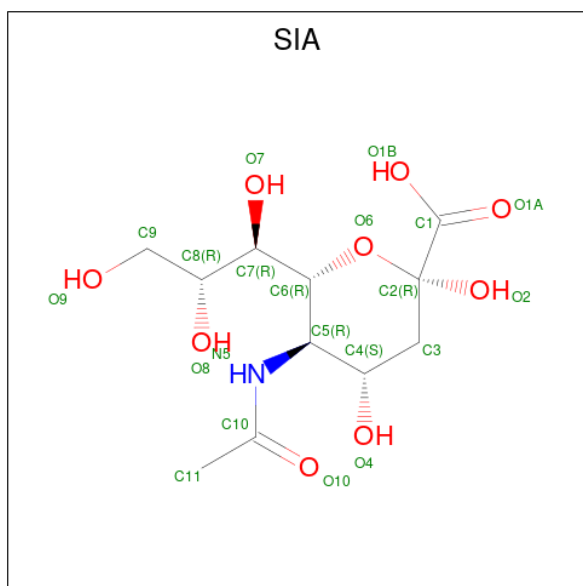
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	D	1	Total	C	N	O	0	0
			14	8	1	5		
5	F	1	Total	C	N	O	0	0
			14	8	1	5		
5	H	1	Total	C	N	O	0	0
			14	8	1	5		
5	I	1	Total	C	N	O	0	0
			14	8	1	5		
5	J	1	Total	C	N	O	0	0
			14	8	1	5		
5	K	1	Total	C	N	O	0	0
			14	8	1	5		

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

- Molecule 6 is N-acetyl-alpha-neuraminic acid (CCD ID: SIA) (formula: $C_{11}H_{19}NO_9$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	I	1	Total	C	N	O	0	0
			21	11	1	9		
6	K	1	Total	C	N	O	0	0
			21	11	1	9		

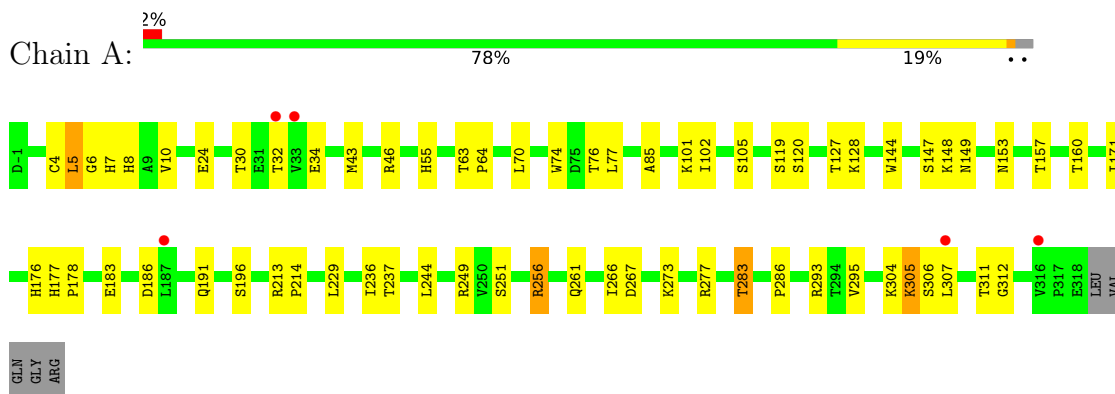
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total O	0	0
			1 1		
7	I	1	Total O	0	0
			1 1		

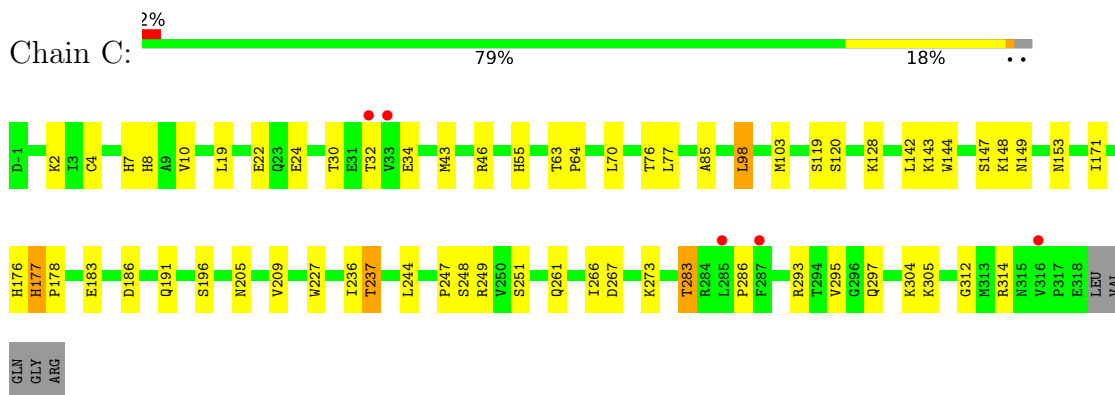
3 Residue-property plots [i](#)

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.

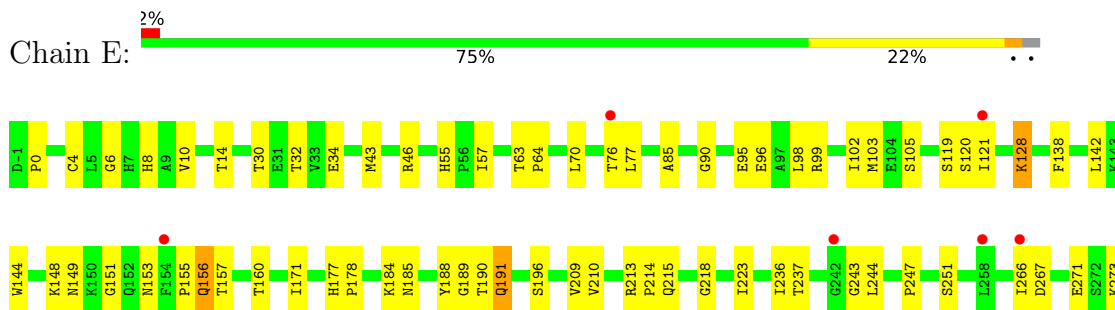
• Molecule 1: Hemagglutinin



• Molecule 1: Hemagglutinin

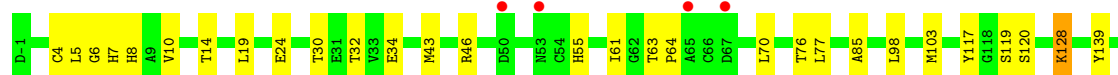
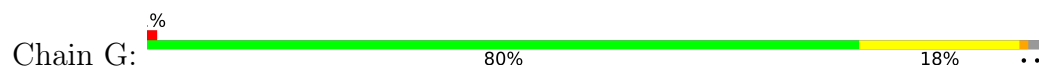


• Molecule 1: Hemagglutinin

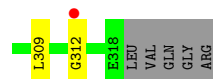
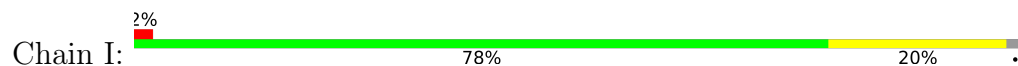




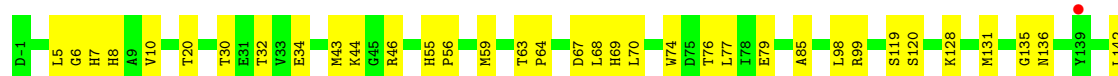
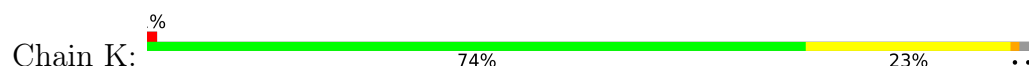
• Molecule 1: Hemagglutinin



• Molecule 1: Hemagglutinin

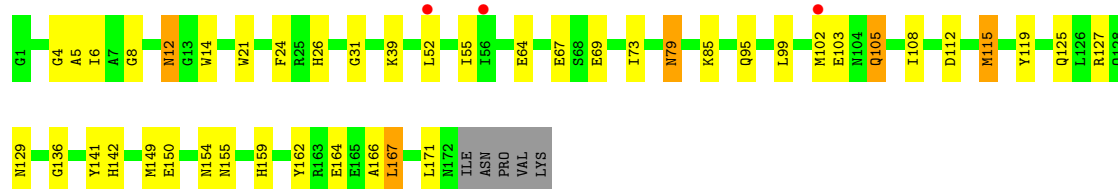


• Molecule 1: Hemagglutinin

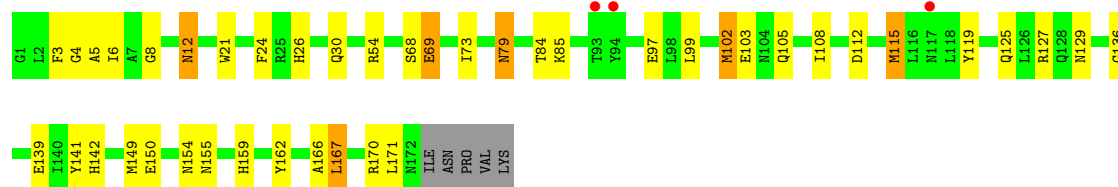
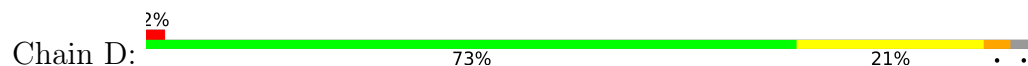


• Molecule 2: Hemagglutinin HA2

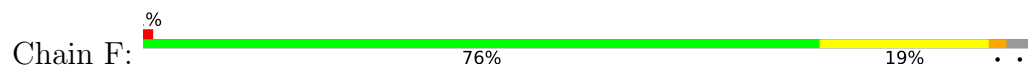




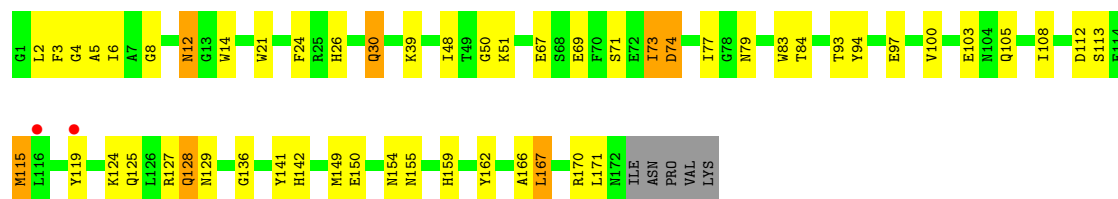
• Molecule 2: Hemagglutinin HA2



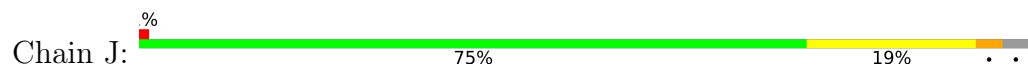
• Molecule 2: Hemagglutinin HA2



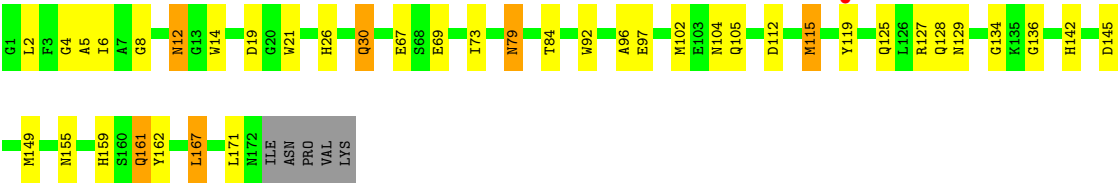
• Molecule 2: Hemagglutinin HA2



• Molecule 2: Hemagglutinin HA2



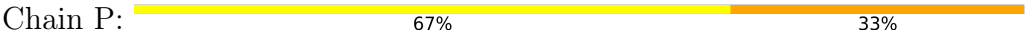
• Molecule 2: Hemagglutinin HA2



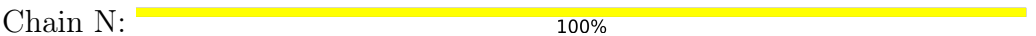
● Molecule 3: N-acetyl-alpha-neuraminic acid-(2-6)-beta-D-galactopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



● Molecule 4: N-acetyl-alpha-neuraminic acid-(2-6)-beta-D-galactopyranose



● Molecule 4: N-acetyl-alpha-neuraminic acid-(2-6)-beta-D-galactopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	68.99Å 212.67Å 154.90Å 90.00° 101.58° 90.00°	Depositor
Resolution (Å)	87.08 – 3.20 87.08 – 3.20	Depositor EDS
% Data completeness (in resolution range)	99.9 (87.08-3.20) 99.9 (87.08-3.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.85 (at 3.19Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.272 , 0.336 0.257 , 0.316	Depositor DCC
R_{free} test set	3549 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	77.7	Xtriage
Anisotropy	0.712	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 77.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.014 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	23049	wwPDB-VP
Average B, all atoms (Å ²)	121.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 29.41 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.5567e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: SIA, GAL, NAG

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	1.06	1/2493 (0.0%)	1.40	0/3379
1	C	1.07	1/2489 (0.0%)	1.39	2/3375 (0.1%)
1	E	1.12	0/2451	1.43	1/3328 (0.0%)
1	G	1.08	0/2473	1.39	1/3356 (0.0%)
1	I	1.08	0/2460	1.38	1/3337 (0.0%)
1	K	1.08	0/2470	1.41	2/3351 (0.1%)
2	B	1.04	0/1399	1.59	1/1889 (0.1%)
2	D	1.04	0/1391	1.56	1/1879 (0.1%)
2	F	1.04	0/1398	1.57	0/1887
2	H	1.04	0/1394	1.57	0/1882
2	J	1.06	1/1388 (0.1%)	1.58	2/1873 (0.1%)
2	L	1.04	0/1390	1.59	2/1876 (0.1%)
All	All	1.07	3/23196 (0.0%)	1.46	13/31412 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	249	ARG	C-O	6.10	1.30	1.23
2	J	139	GLU	C-O	-5.22	1.18	1.24
1	C	249	ARG	C-O	5.21	1.29	1.23

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	L	161	GLN	CB-CG-CD	-6.30	101.88	112.60
1	E	90	GLY	CA-C-O	-6.23	117.05	122.16
1	C	237	THR	CA-CB-OG1	-6.03	100.56	109.60
2	B	31	GLY	CA-C-O	-5.65	117.53	122.16
2	D	69	GLU	CB-CG-CD	5.50	121.94	112.60

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	2443	0	2399	45	0
1	C	2439	0	2388	37	0
1	E	2402	0	2337	59	0
1	G	2423	0	2360	41	0
1	I	2412	0	2349	39	0
1	K	2420	0	2364	64	0
2	B	1374	0	1269	37	0
2	D	1366	0	1262	42	0
2	F	1373	0	1267	26	0
2	H	1369	0	1259	46	0
2	J	1364	0	1261	35	0
2	L	1366	0	1263	36	0
3	M	46	0	40	3	0
3	P	46	0	40	7	0
4	N	32	0	28	0	0
4	O	32	0	28	2	0
5	D	14	0	13	3	0
5	F	14	0	13	1	0
5	H	14	0	13	0	0
5	I	14	0	13	0	0
5	J	14	0	13	3	0
5	K	14	0	13	0	0
5	L	14	0	13	0	0
6	I	21	0	18	1	0
6	K	21	0	18	0	0
7	B	1	0	0	1	0
7	I	1	0	0	0	0
All	All	23049	0	22041	421	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 9.

The worst 5 of 421 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:156:GLN:HE21	1:E:156:GLN:HA	1.13	1.06
1:K:131:MET:HG2	1:K:136:ASN:HA	1.50	0.93
2:B:105:GLN:HE21	2:B:105:GLN:HA	1.40	0.86
2:D:99:LEU:HD22	2:H:94:TYR:OH	1.77	0.85
2:D:79:ASN:ND2	5:D:201:NAG:H81	1.92	0.85

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	318/325 (98%)	310 (98%)	8 (2%)	0	100	100
1	C	318/325 (98%)	310 (98%)	8 (2%)	0	100	100
1	E	318/325 (98%)	311 (98%)	7 (2%)	0	100	100
1	G	318/325 (98%)	310 (98%)	8 (2%)	0	100	100
1	I	318/325 (98%)	309 (97%)	9 (3%)	0	100	100
1	K	318/325 (98%)	310 (98%)	8 (2%)	0	100	100
2	B	170/177 (96%)	158 (93%)	12 (7%)	0	100	100
2	D	170/177 (96%)	156 (92%)	14 (8%)	0	100	100
2	F	170/177 (96%)	158 (93%)	12 (7%)	0	100	100
2	H	170/177 (96%)	157 (92%)	13 (8%)	0	100	100
2	J	170/177 (96%)	158 (93%)	12 (7%)	0	100	100
2	L	170/177 (96%)	159 (94%)	11 (6%)	0	100	100
All	All	2928/3012 (97%)	2806 (96%)	122 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	271/276 (98%)	252 (93%)	19 (7%)	14	45
1	C	270/276 (98%)	248 (92%)	22 (8%)	11	39
1	E	262/276 (95%)	242 (92%)	20 (8%)	12	42
1	G	266/276 (96%)	248 (93%)	18 (7%)	14	46
1	I	265/276 (96%)	246 (93%)	19 (7%)	13	44
1	K	266/276 (96%)	244 (92%)	22 (8%)	10	38
2	B	143/151 (95%)	132 (92%)	11 (8%)	12	41
2	D	141/151 (93%)	134 (95%)	7 (5%)	22	55
2	F	143/151 (95%)	137 (96%)	6 (4%)	26	60
2	H	142/151 (94%)	129 (91%)	13 (9%)	8	33
2	J	141/151 (93%)	133 (94%)	8 (6%)	18	51
2	L	141/151 (93%)	132 (94%)	9 (6%)	16	48
All	All	2451/2562 (96%)	2277 (93%)	174 (7%)	13	44

5 of 174 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	H	167	LEU
1	K	8	HIS
1	I	61	ILE
1	I	241	ASN
1	K	120	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 65 such sidechains are listed below:

Mol	Chain	Res	Type
1	K	133	ASN
1	K	205	ASN
1	E	191	GLN
1	E	156	GLN

Continued on next page...

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Mol	Chain	Res	Type
2	L	12	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$
3	NAG	M	1	3	15,15,15	0.58	0	21,21,21	1.90	5 (23%)
3	GAL	M	2	3	11,11,12	0.57	0	15,15,17	1.77	4 (26%)
3	SIA	M	3	3	20,20,21	1.24	1 (5%)	21,28,31	2.42	11 (52%)
4	GAL	N	1	4	12,12,12	0.79	0	17,17,17	1.72	6 (35%)
4	SIA	N	2	4	20,20,21	1.02	1 (5%)	21,28,31	2.09	6 (28%)
4	GAL	O	1	4	12,12,12	0.58	0	17,17,17	1.28	2 (11%)
4	SIA	O	2	4	20,20,21	0.68	0	21,28,31	1.25	2 (9%)
3	NAG	P	1	3	15,15,15	0.78	0	21,21,21	1.75	5 (23%)
3	GAL	P	2	3	11,11,12	0.76	0	15,15,17	1.54	2 (13%)
3	SIA	P	3	3	20,20,21	0.72	0	21,28,31	1.71	4 (19%)

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	M	1	3	-	2/6/26/26	0/1/1/1
3	GAL	M	2	3	-	0/2/19/22	0/1/1/1
3	SIA	M	3	3	-	8/18/34/38	0/1/1/1
4	GAL	N	1	4	-	0/2/22/22	0/1/1/1
4	SIA	N	2	4	-	6/18/34/38	0/1/1/1
4	GAL	O	1	4	-	0/2/22/22	0/1/1/1
4	SIA	O	2	4	-	0/18/34/38	0/1/1/1
3	NAG	P	1	3	-	0/6/26/26	0/1/1/1
3	GAL	P	2	3	-	0/2/19/22	0/1/1/1
3	SIA	P	3	3	-	8/18/34/38	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	M	3	SIA	C8-C7	4.02	1.60	1.53
4	N	2	SIA	C2-C1	-2.57	1.49	1.52

The worst 5 of 47 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	N	2	SIA	C6-C5-N5	-5.26	102.51	110.91
3	P	2	GAL	C1-O5-C5	4.30	117.95	112.19
3	M	3	SIA	O7-C7-C8	4.07	118.18	108.93
3	M	1	NAG	C1-C2-C3	-3.89	105.24	110.54
3	P	3	SIA	C6-C5-N5	-3.89	104.70	110.91

There are no chirality outliers.

5 of 24 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	M	3	SIA	O6-C6-C7-O7
3	M	3	SIA	C6-C7-C8-C9
3	M	3	SIA	C6-C7-C8-O8
3	M	3	SIA	O7-C7-C8-C9
3	M	3	SIA	O7-C7-C8-O8

There are no ring outliers.

5 monomers are involved in 12 short contacts:

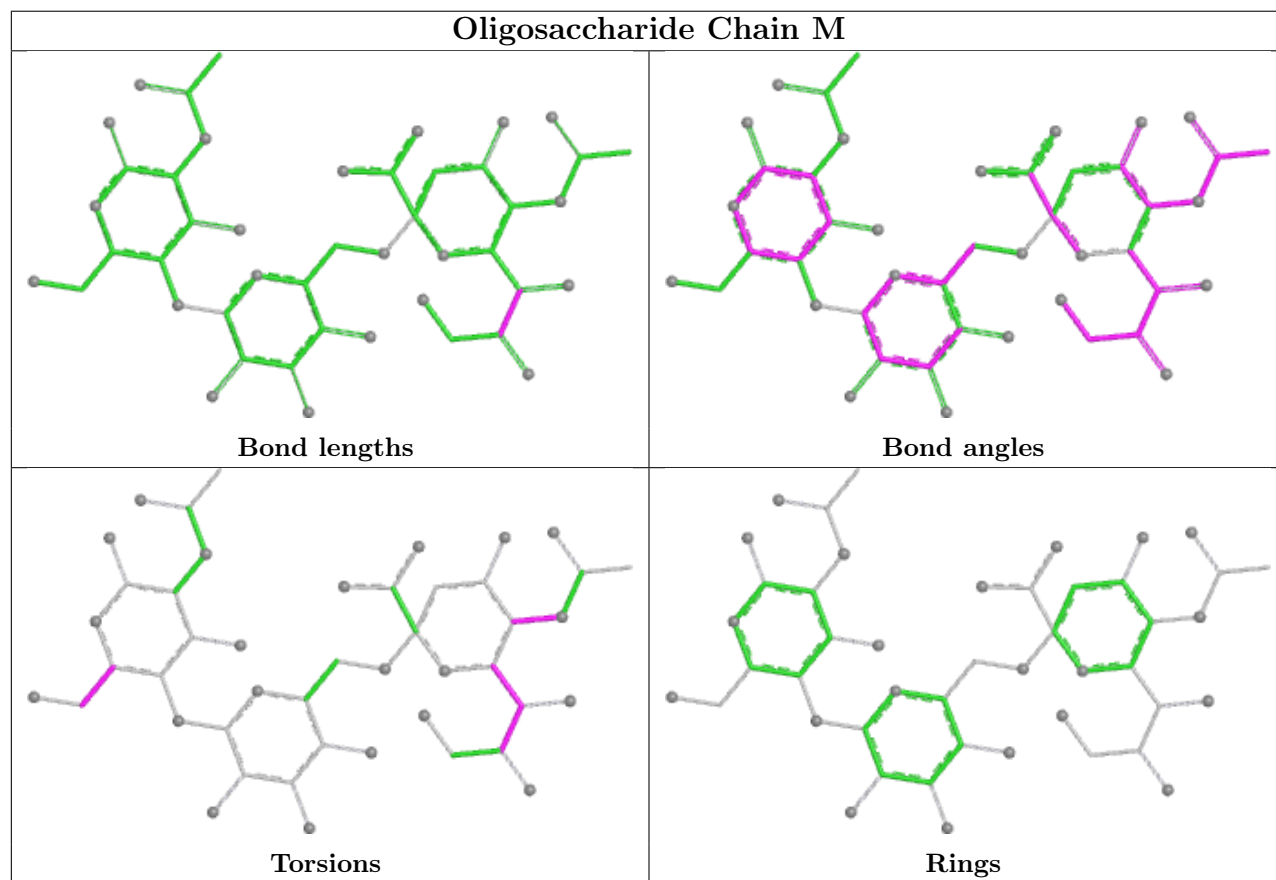
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	O	2	SIA	2	0

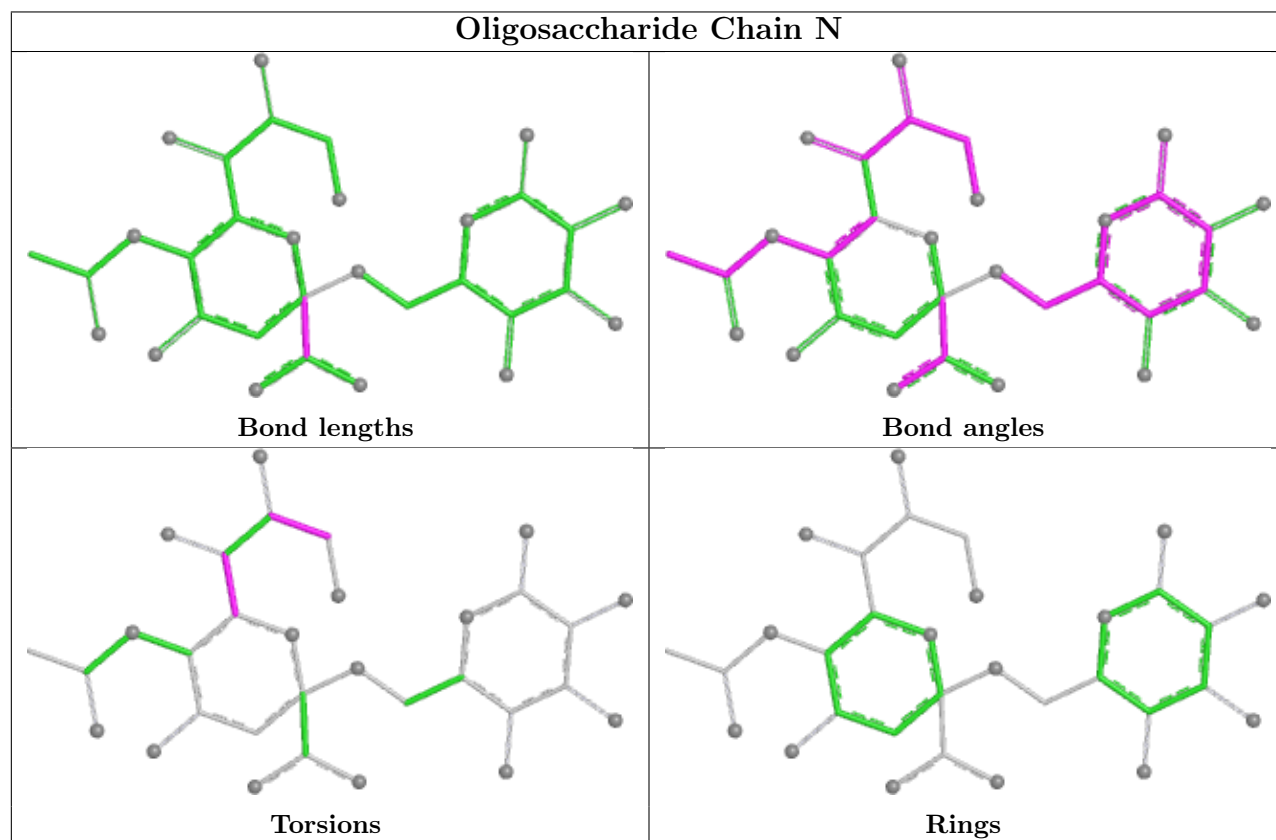
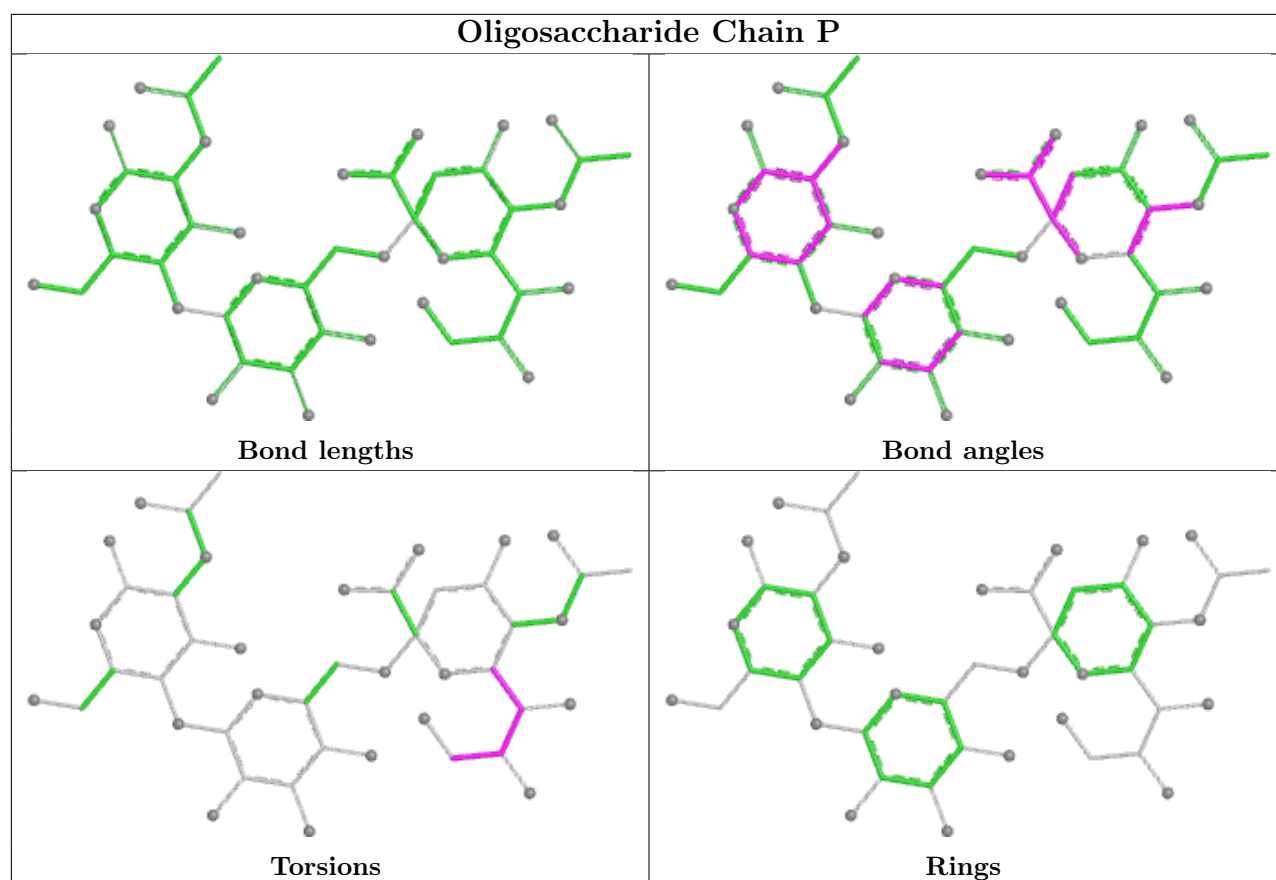
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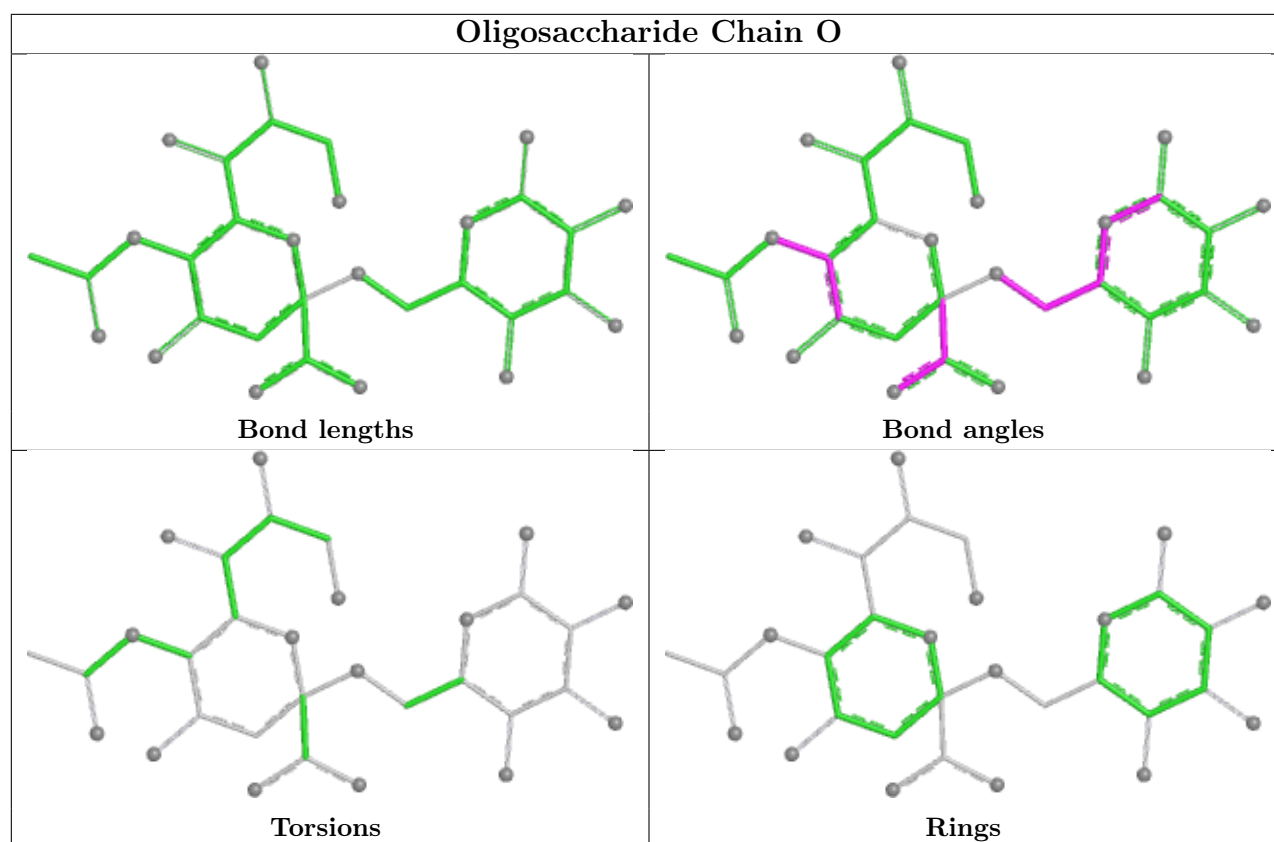
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	M	2	GAL	1	0
3	P	3	SIA	7	0
3	M	1	NAG	1	0
3	M	3	SIA	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for 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	$\# Z > 2$
5	NAG	L	201	2	14,14,15	0.71	0	17,19,21	1.71	5 (29%)
5	NAG	D	201	2	14,14,15	1.01	0	17,19,21	2.17	5 (29%)
6	SIA	K	402	-	21,21,21	1.37	2 (9%)	24,31,31	1.65	6 (25%)
5	NAG	H	201	2	14,14,15	1.31	1 (7%)	17,19,21	3.13	7 (41%)
5	NAG	K	401	1	14,14,15	1.08	1 (7%)	17,19,21	1.47	3 (17%)
5	NAG	F	201	2	14,14,15	1.80	3 (21%)	17,19,21	3.15	9 (52%)
5	NAG	J	201	2	14,14,15	1.05	1 (7%)	17,19,21	2.68	8 (47%)
6	SIA	I	402	-	21,21,21	1.50	2 (9%)	24,31,31	2.16	9 (37%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	I	401	1	14,14,15	0.81	1 (7%)	17,19,21	1.44	3 (17%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	L	201	2	-	0/6/23/26	0/1/1/1
5	NAG	D	201	2	-	1/6/23/26	0/1/1/1
6	SIA	K	402	-	-	11/20/38/38	0/1/1/1
5	NAG	H	201	2	-	2/6/23/26	0/1/1/1
5	NAG	K	401	1	-	0/6/23/26	0/1/1/1
5	NAG	F	201	2	-	1/6/23/26	0/1/1/1
5	NAG	J	201	2	-	2/6/23/26	0/1/1/1
6	SIA	I	402	-	-	6/20/38/38	0/1/1/1
5	NAG	I	401	1	-	0/6/23/26	0/1/1/1

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	K	402	SIA	O2-C2	4.65	1.46	1.39
6	I	402	SIA	O2-C2	4.42	1.45	1.39
5	F	201	NAG	C1-C2	3.62	1.57	1.52
5	F	201	NAG	O5-C5	3.36	1.50	1.43
6	I	402	SIA	O6-C2	3.02	1.46	1.43

The worst 5 of 55 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	F	201	NAG	C1-C2-N2	7.66	122.50	110.43
5	H	201	NAG	C1-O5-C5	7.51	122.25	112.19
5	F	201	NAG	O5-C5-C6	6.46	120.24	107.66
5	H	201	NAG	C8-C7-N2	-5.22	107.46	116.12
5	J	201	NAG	C8-C7-N2	-5.19	107.51	116.12

There are no chirality outliers.

5 of 23 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	I	402	SIA	O8-C8-C9-O9
6	K	402	SIA	O1A-C1-C2-O2
6	K	402	SIA	O1B-C1-C2-O2
6	K	402	SIA	O1B-C1-C2-O6
6	K	402	SIA	C5-C6-C7-O7

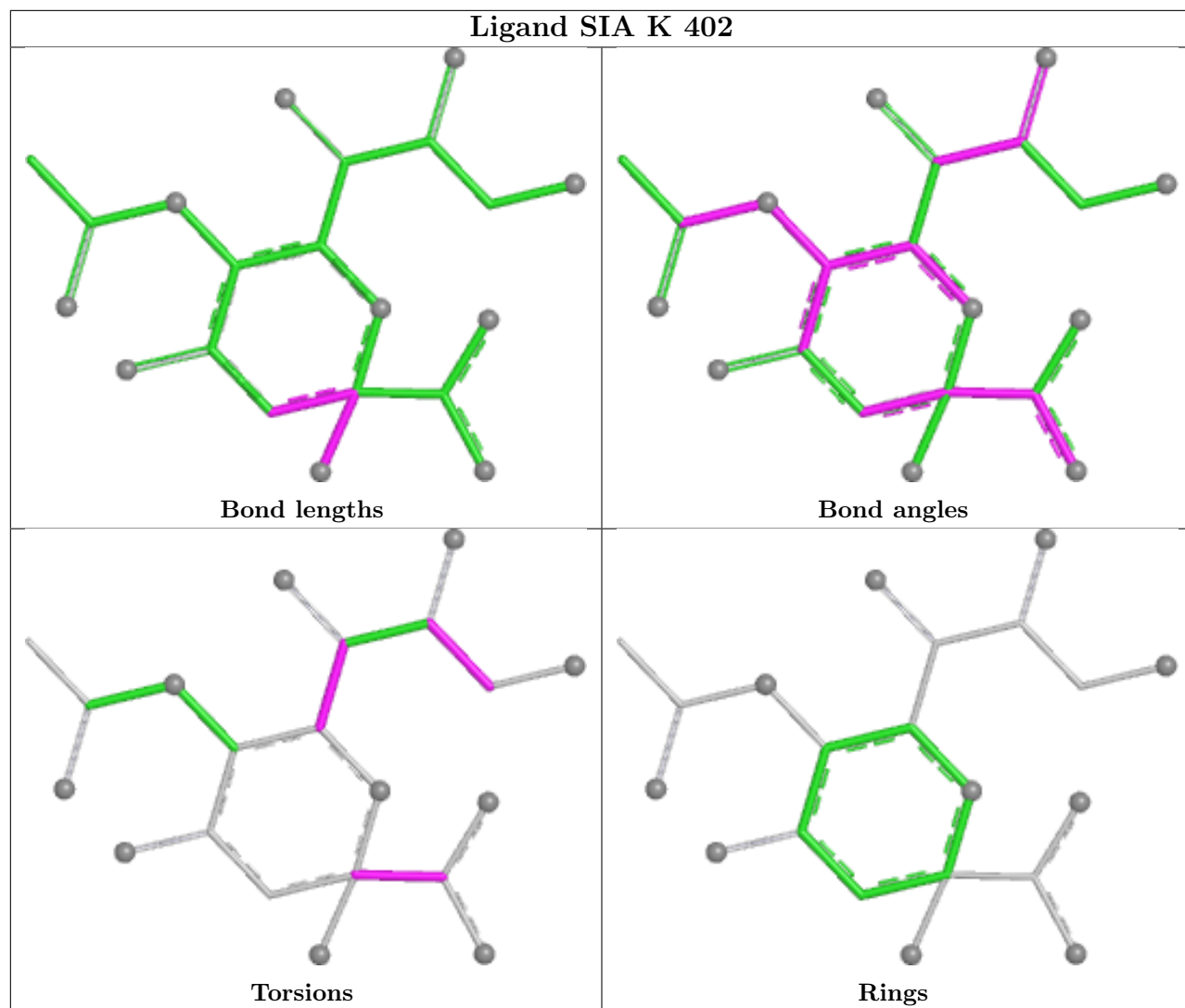
There are no ring outliers.

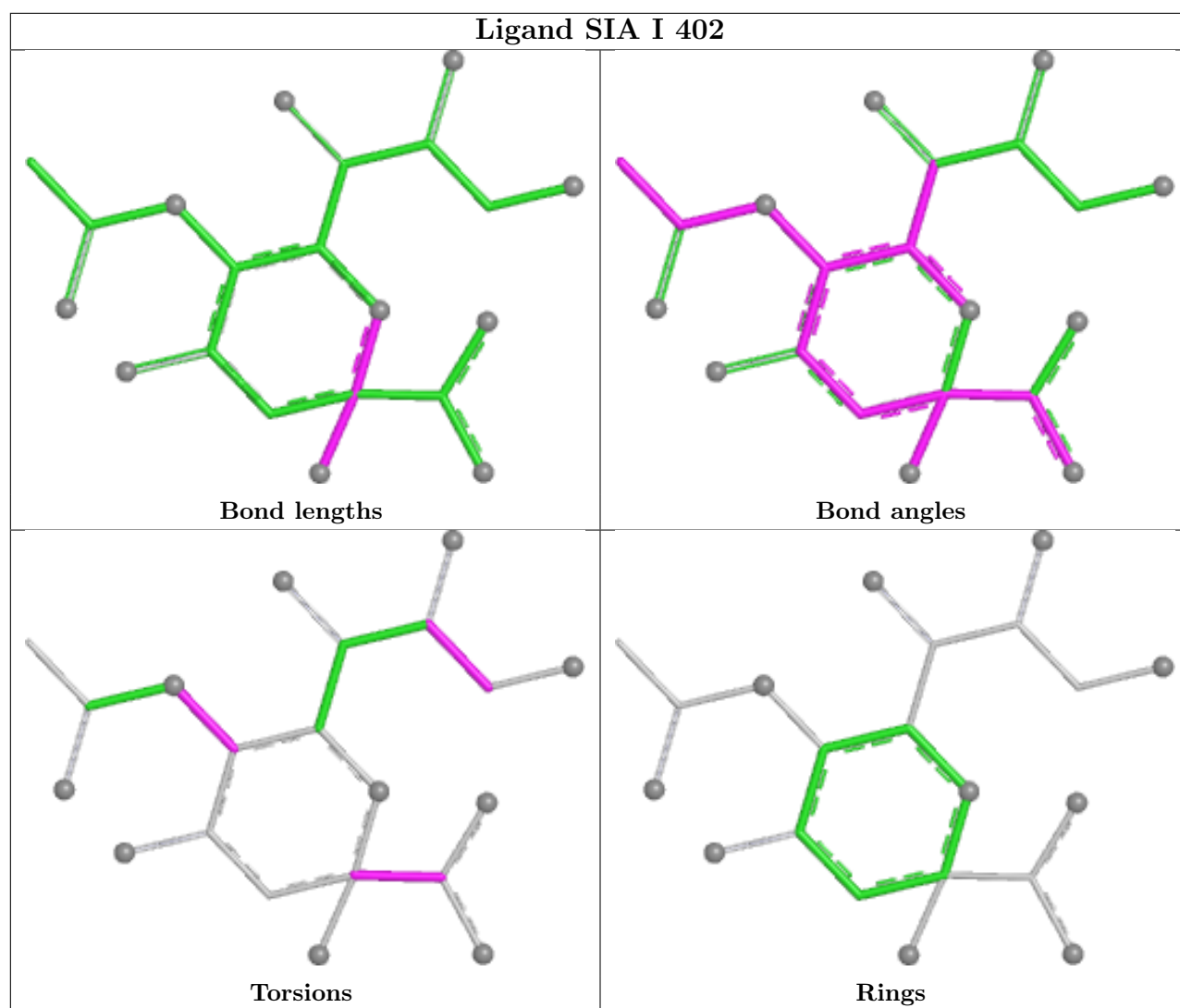
4 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	201	NAG	3	0
5	F	201	NAG	1	0
5	J	201	NAG	3	0
6	I	402	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 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 SIA K 402





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	320/325 (98%)	-0.17	5 (1%) 70 51	66, 108, 154, 190	0
1	C	320/325 (98%)	-0.14	5 (1%) 70 51	66, 103, 151, 179	0
1	E	320/325 (98%)	0.03	6 (1%) 66 46	70, 125, 201, 246	0
1	G	320/325 (98%)	-0.07	4 (1%) 75 55	68, 126, 176, 211	0
1	I	320/325 (98%)	0.01	6 (1%) 66 46	82, 139, 192, 235	0
1	K	320/325 (98%)	-0.12	3 (0%) 81 64	84, 150, 204, 253	0
2	B	172/177 (97%)	-0.12	3 (1%) 69 49	61, 102, 144, 165	0
2	D	172/177 (97%)	-0.08	3 (1%) 69 49	58, 100, 134, 164	0
2	F	172/177 (97%)	-0.32	1 (0%) 85 73	62, 106, 135, 154	0
2	H	172/177 (97%)	-0.29	2 (1%) 76 58	63, 103, 127, 145	0
2	J	172/177 (97%)	-0.15	2 (1%) 76 58	72, 117, 152, 180	0
2	L	172/177 (97%)	-0.25	1 (0%) 85 73	71, 113, 154, 175	0
All	All	2952/3012 (98%)	-0.12	41 (1%) 73 54	58, 116, 179, 253	0

The worst 5 of 41 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	I	56	PRO	5.2
1	I	88	TYR	4.9
1	C	32	THR	4.7
1	E	242	GLY	4.6
2	H	119	TYR	3.6

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

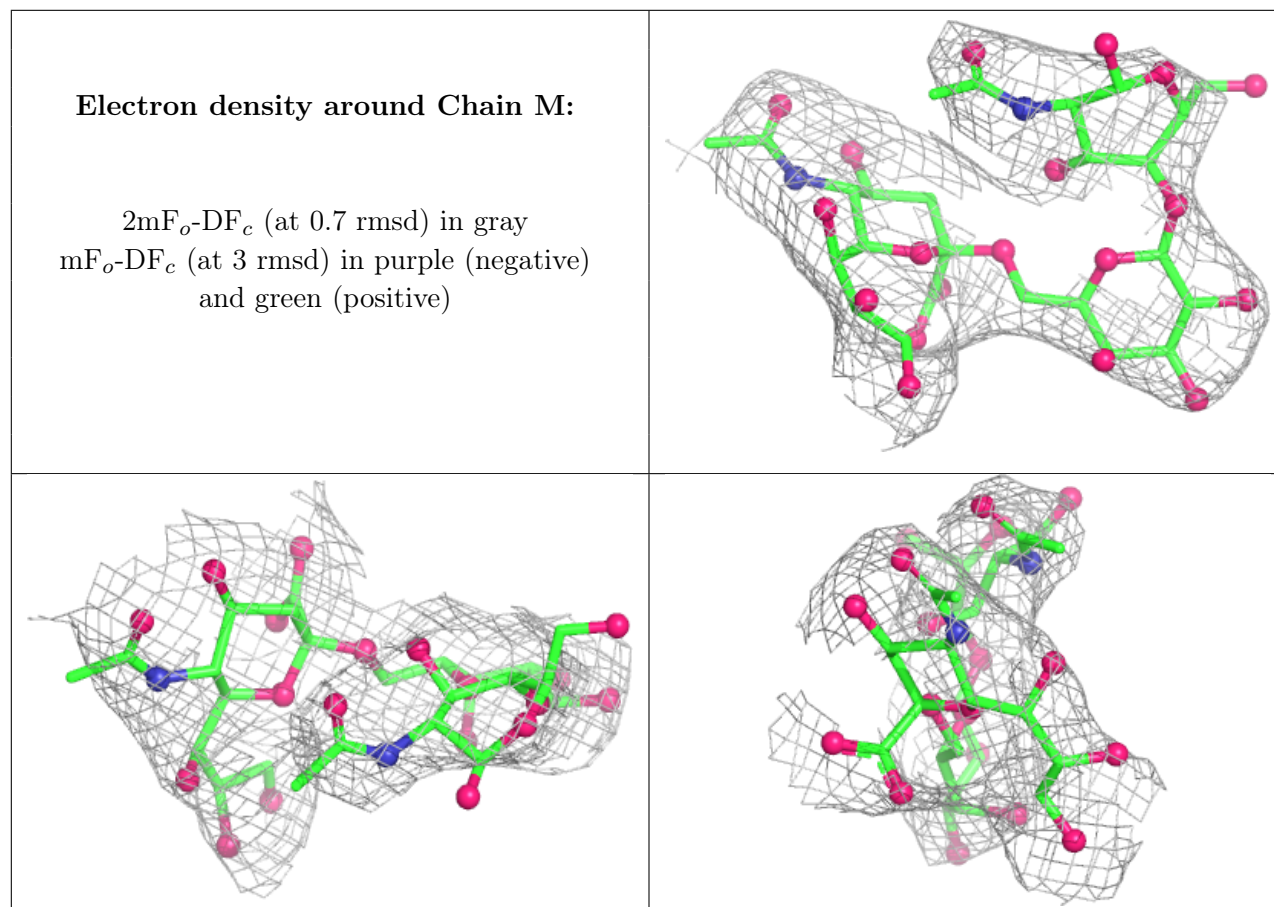
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

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

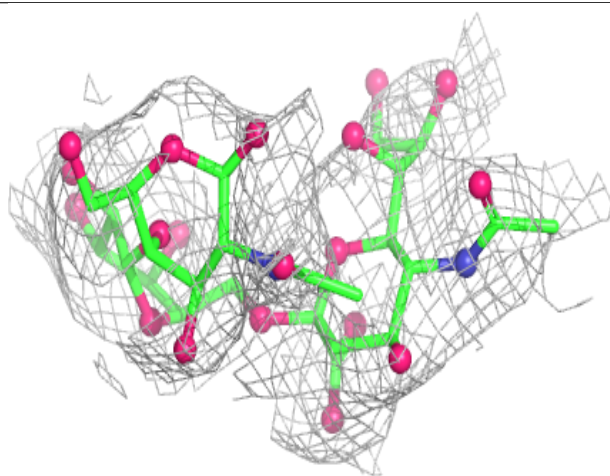
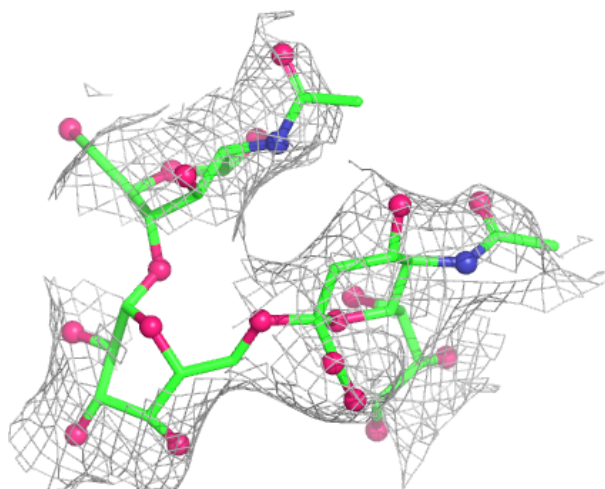
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	NAG	M	1	15/15	0.62	0.09	133,176,188,205	0
4	GAL	O	1	12/12	0.66	0.08	117,146,156,158	0
3	GAL	P	2	11/12	0.68	0.07	135,159,172,177	0
3	NAG	P	1	15/15	0.73	0.08	123,157,169,182	0
3	GAL	M	2	11/12	0.76	0.07	142,155,165,165	0
4	GAL	N	1	12/12	0.87	0.05	100,127,139,149	0
3	SIA	P	3	20/21	0.91	0.07	109,127,171,186	0
4	SIA	O	2	20/21	0.91	0.07	120,137,153,154	0
3	SIA	M	3	20/21	0.95	0.06	81,107,135,138	0
4	SIA	N	2	20/21	0.96	0.05	63,92,148,161	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.



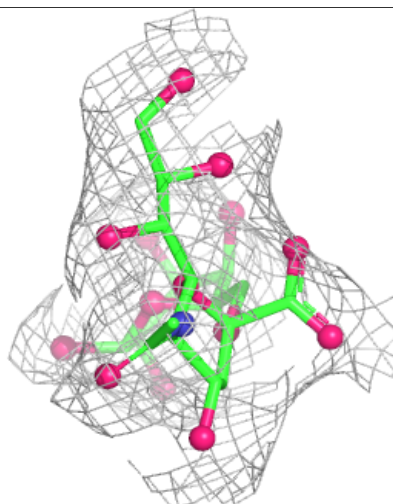
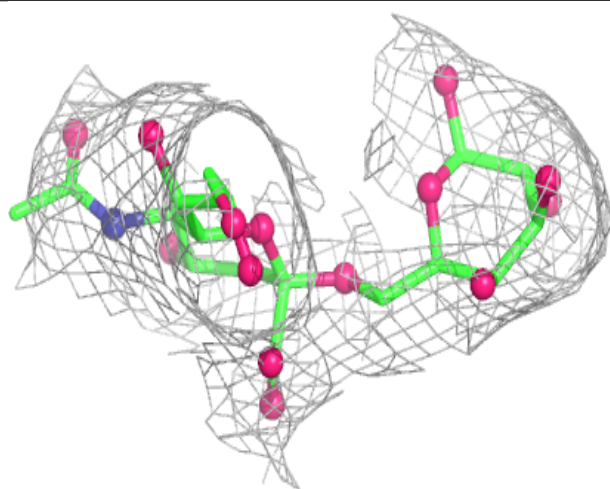
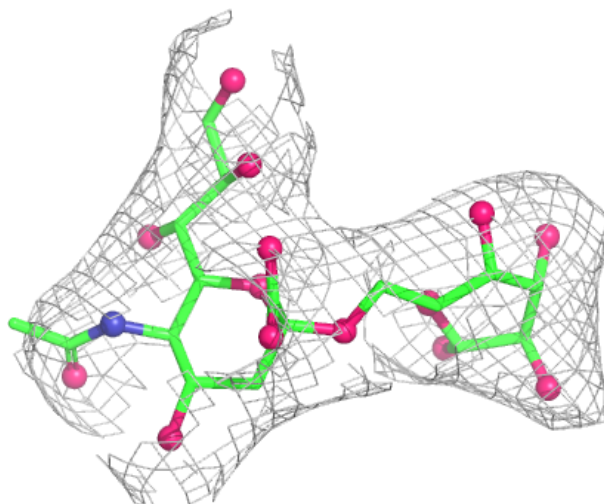
Electron density around Chain P:

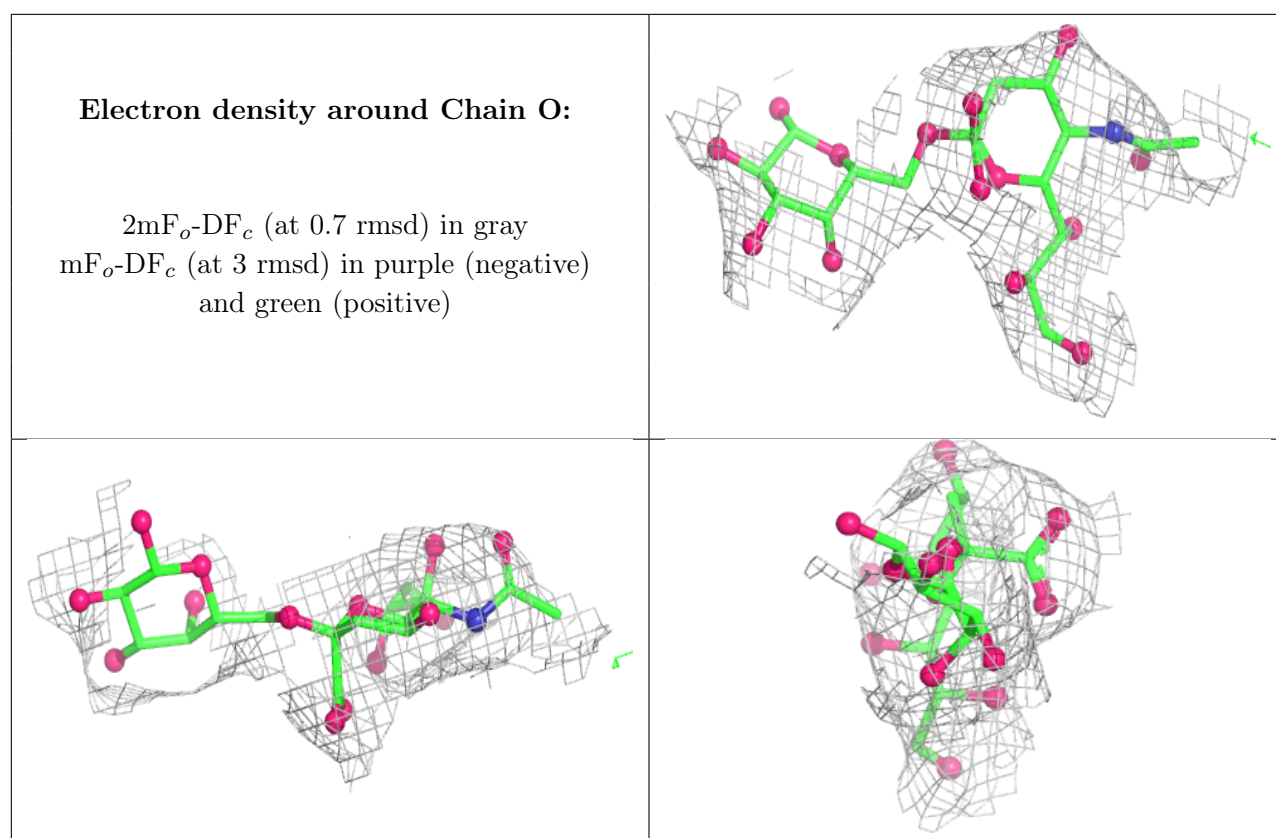
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain N:

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





6.4 Ligands [i](#)

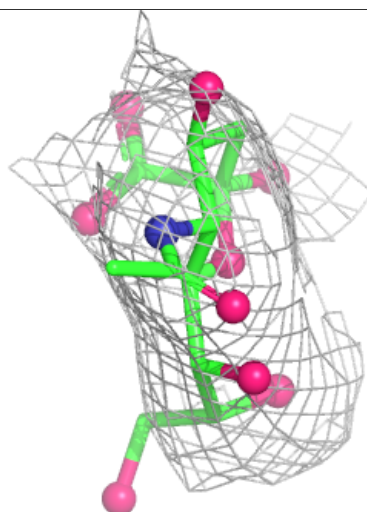
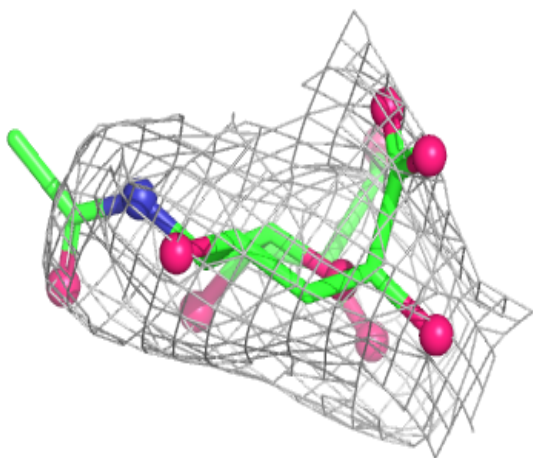
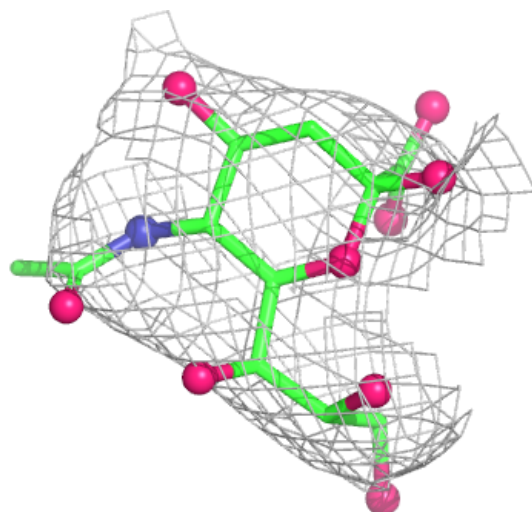
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q < 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	NAG	K	401	14/15	0.70	0.09	131,162,179,182	0
5	NAG	D	201	14/15	0.73	0.08	124,155,166,167	0
6	SIA	K	402	21/21	0.73	0.07	112,151,180,211	0
6	SIA	I	402	21/21	0.75	0.11	124,153,186,205	0
5	NAG	J	201	14/15	0.75	0.08	92,124,130,131	0
5	NAG	L	201	14/15	0.79	0.08	100,136,151,155	0
5	NAG	F	201	14/15	0.80	0.10	82,100,142,145	0
5	NAG	I	401	14/15	0.83	0.09	123,184,208,208	0
5	NAG	H	201	14/15	0.83	0.07	88,108,126,127	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.

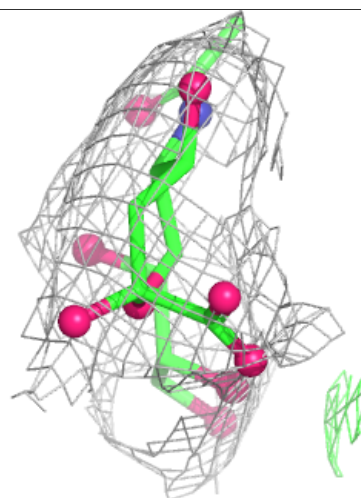
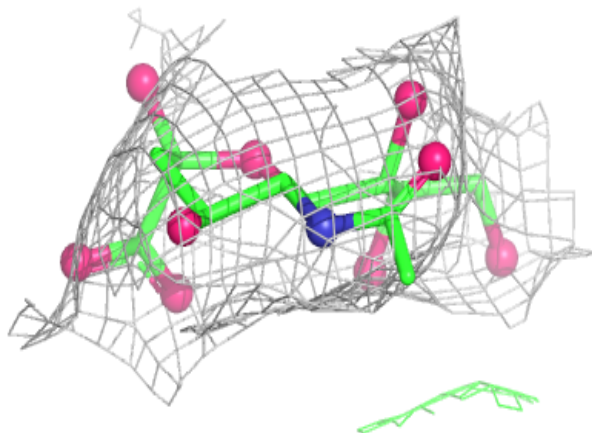
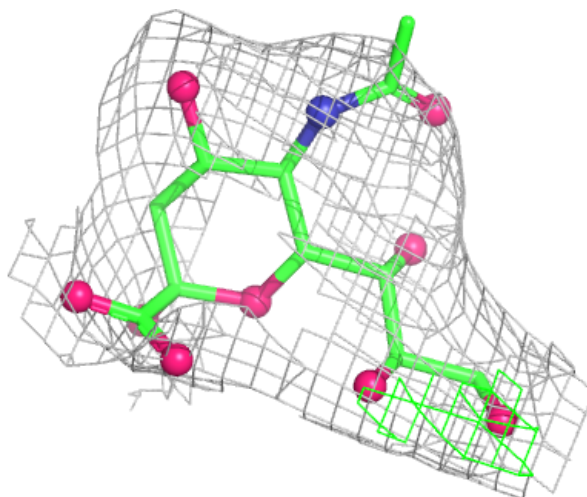
Electron density around SIA K 402:

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



Electron density around SIA I 402:

$2mF_o-DF_c$ (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.