



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 02:55 PM UTC

PDB ID : 5HBC / pdb_00005hbc
Title : Intermediate structure of iron-saturated C-lobe of bovine lactoferrin at 2.79 Angstrom resolution indicates the softening of iron coordination
Authors : Singh, A.; Rastogi, N.; Singh, P.K.; Tyagi, T.K.; Kaur, P.; Sharma, S.; Singh, T.P.
Deposited on : 2015-12-31
Resolution : 2.79 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
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

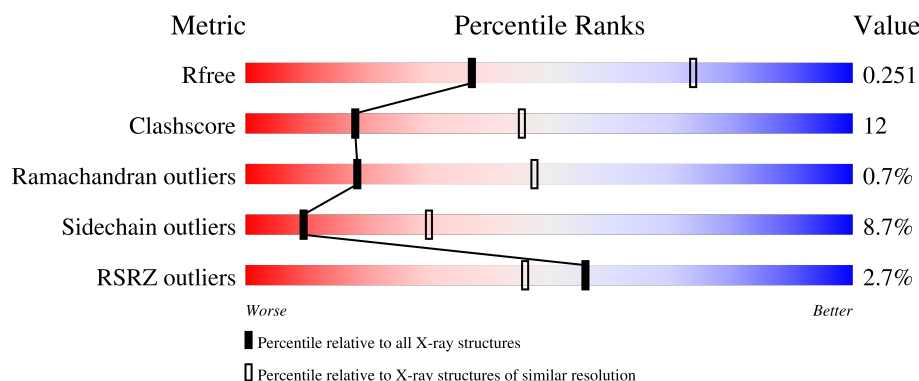
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.79 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	348	2% 61% 33% 5%
1	B	348	3% 73% 23% .
2	C	3	67% 33%
2	D	3	100%
2	E	3	100%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5542 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.

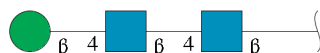
- Molecule 1 is a protein called Lactotransferrin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	348	Total	C	N	O	S	0	0	0
			2658	1656	464	517	21			
1	B	348	Total	C	N	O	S	0	0	0
			2658	1656	464	517	21			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	565	LYS	ASN	See sequence details	UNP P24627
A	608	GLU	LYS	See sequence details	UNP P24627
B	565	LYS	ASN	See sequence details	UNP P24627
B	608	GLU	LYS	See sequence details	UNP P24627

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

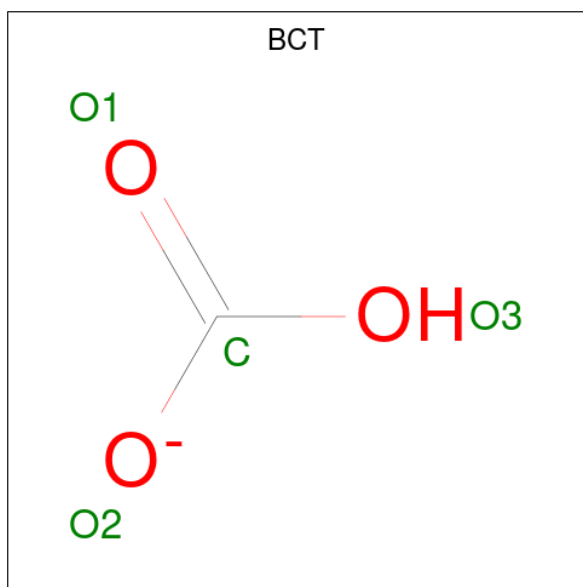


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	3	Total	C	N	O	0	0	0
			39	22	2	15			
2	D	3	Total	C	N	O	0	0	0
			39	22	2	15			
2	E	3	Total	C	N	O	0	0	0
			39	22	2	15			

- Molecule 3 is FE (III) ION (CCD ID: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Fe	0	0
			1	1		
3	B	1	Total	Fe	0	0
			1	1		

- Molecule 4 is BICARBONATE ION (CCD ID: BCT) (formula: CHO_3).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			4	1	3		
4	B	1	Total	C	O	0	0
			4	1	3		

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $\text{C}_8\text{H}_{15}\text{NO}_6$).



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

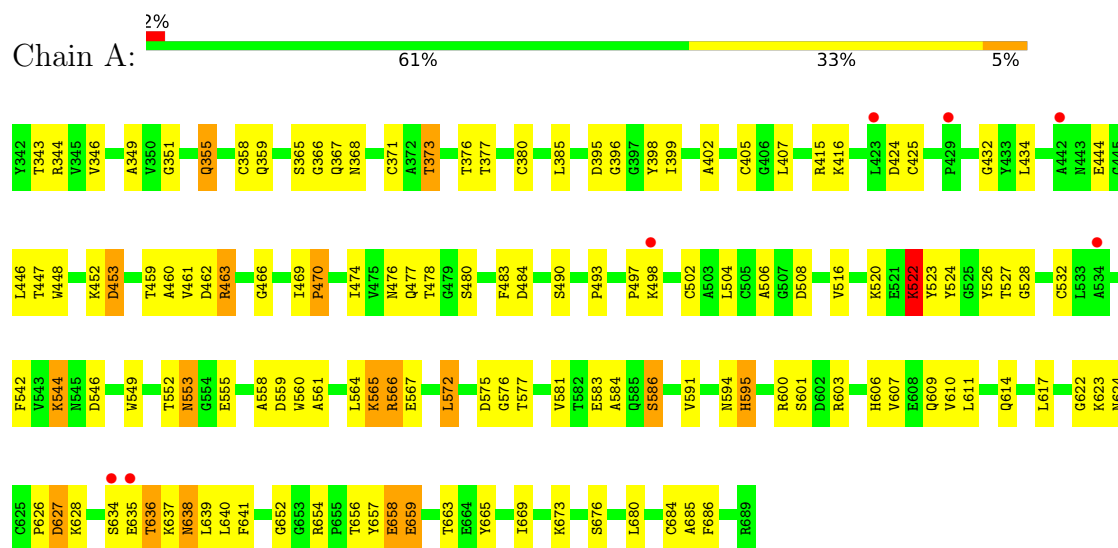
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	43	Total	O	0	0
			43	43		
6	B	28	Total	O	0	0
			28	28		

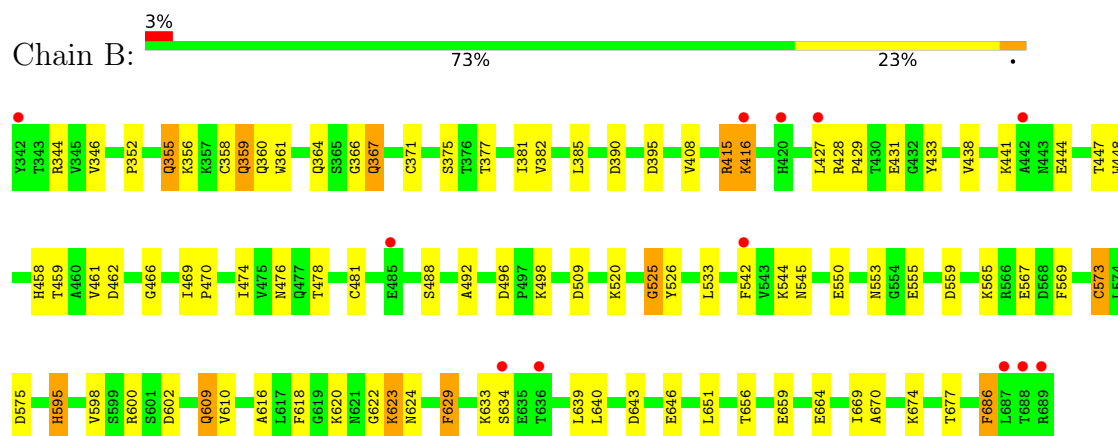
3 Residue-property plots

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.

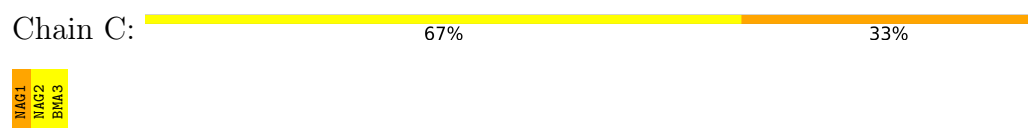
• Molecule 1: Lactotransferrin



• Molecule 1: Lactotransferrin



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



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

Chain D:  100%

MAG1
MAG2
BMA3

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

Chain E:  100%

MAG1
MAG2
BMA3

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	159.65Å 82.58Å 107.69Å 90.00° 128.08° 90.00°	Depositor
Resolution (Å)	39.45 – 2.79 39.45 – 2.79	Depositor EDS
% Data completeness (in resolution range)	98.5 (39.45-2.79) 98.7 (39.45-2.79)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.13 (at 2.77Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.206 , 0.273 (Not available) , 0.251	Depositor DCC
R_{free} test set	1370 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	60.0	Xtriage
Anisotropy	0.403	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 28.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5542	wwPDB-VP
Average B, all atoms (Å ²)	68.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.15% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BMA, NAG, BCT, FE

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	1.22	1/2708 (0.0%)	1.17	15/3670 (0.4%)
1	B	1.14	3/2708 (0.1%)	1.11	15/3670 (0.4%)
All	All	1.18	4/5416 (0.1%)	1.14	30/7340 (0.4%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	433	TYR	CA-CB	-7.78	1.41	1.53
1	B	525	GLY	C-N	-5.88	1.26	1.33
1	A	609	GLN	C-O	-5.60	1.17	1.24
1	B	429	PRO	N-CD	5.15	1.54	1.47

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	433	TYR	N-CA-CB	7.96	122.97	110.56
1	B	526	TYR	O-C-N	7.27	129.86	122.08
1	B	525	GLY	CA-C-N	7.18	130.77	120.79
1	B	525	GLY	C-N-CA	7.18	130.77	120.79
1	A	658	GLU	N-CA-C	7.04	118.75	111.14
1	A	686	PHE	N-CA-C	6.66	119.37	111.71
1	B	664	GLU	N-CA-C	6.65	118.32	111.14
1	B	600	ARG	N-CA-C	-6.41	102.04	110.43
1	B	525	GLY	O-C-N	-6.31	116.77	122.77
1	A	346	VAL	CB-CA-C	-6.31	103.70	111.08
1	A	611	LEU	N-CA-C	6.13	118.04	111.36
1	A	555	GLU	N-CA-C	5.87	117.47	111.14
1	A	576	GLY	N-CA-C	-5.77	107.10	114.37
1	A	686	PHE	CA-C-N	5.70	128.49	120.28
1	A	686	PHE	C-N-CA	5.70	128.49	120.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	476	ASN	N-CA-C	5.58	117.17	111.14
1	B	609	GLN	N-CA-C	-5.54	104.93	110.97
1	A	638	ASN	N-CA-C	5.52	119.20	111.74
1	A	351	GLY	CA-C-N	5.52	124.86	118.85
1	A	351	GLY	C-N-CA	5.52	124.86	118.85
1	B	629	PHE	N-CA-C	5.39	117.96	108.75
1	A	522	LYS	N-CA-C	-5.33	105.47	111.28
1	B	616	ALA	N-CA-C	-5.30	105.61	111.71
1	A	617	LEU	N-CA-C	5.29	117.12	111.36
1	B	595	HIS	CA-C-N	-5.18	113.38	121.87
1	B	595	HIS	C-N-CA	-5.18	113.38	121.87
1	B	371	CYS	N-CA-C	5.15	117.29	108.90
1	A	659	GLU	N-CA-C	-5.14	105.67	111.28
1	B	488	SER	N-CA-C	-5.09	105.73	111.28
1	A	627	ASP	N-CA-C	-5.07	105.75	111.28

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	2658	0	2582	86	0
1	B	2658	0	2580	44	0
2	C	39	0	34	1	0
2	D	39	0	34	0	0
2	E	39	0	34	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	4	0	0	0	0
4	B	4	0	0	0	0
5	B	28	0	26	2	0
6	A	43	0	0	3	0
6	B	28	0	0	1	0
All	All	5542	0	5290	131	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 12.

All (131) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:395:ASP:HA	1:B:595:HIS:CD2	2.10	0.86
1:A:575:ASP:HB2	1:A:577:THR:HG22	1.58	0.84
5:B:705:NAG:O7	5:B:705:NAG:O3	1.97	0.81
1:A:344:ARG:O	1:A:344:ARG:HD3	1.88	0.73
1:B:355:GLN:O	1:B:359:GLN:HG2	1.93	0.69
1:A:355:GLN:O	1:A:359:GLN:HG3	1.93	0.68
1:A:552:THR:HB	1:A:553:ASN:ND2	2.10	0.67
1:A:634:SER:O	1:A:637:LYS:HG3	1.96	0.66
1:A:459:THR:OG1	1:A:466:GLY:HA3	1.96	0.65
1:A:474:ILE:O	1:A:478:THR:HG23	1.95	0.65
1:A:606:HIS:O	1:A:610:VAL:HG23	1.97	0.65
1:A:395:ASP:HA	1:A:595:HIS:CD2	2.32	0.64
1:B:550:GLU:O	1:B:555:GLU:HB3	1.98	0.64
1:A:553:ASN:HD22	1:A:553:ASN:N	1.96	0.64
1:A:565:LYS:HD3	1:A:567:GLU:H	1.63	0.63
1:A:624:ASN:HB3	1:A:628:LYS:HB2	1.80	0.63
1:A:575:ASP:CB	1:A:577:THR:HG22	2.29	0.62
1:A:377:THR:HG21	1:A:398:TYR:CD2	2.35	0.62
1:B:555:GLU:HA	1:B:555:GLU:OE1	2.00	0.62
1:B:496:ASP:OD1	1:B:498:LYS:HG2	2.00	0.61
1:A:603:ARG:O	1:A:607:VAL:HG23	2.00	0.61
1:B:459:THR:OG1	1:B:466:GLY:HA3	2.00	0.60
1:A:516:VAL:HG23	1:A:516:VAL:O	2.01	0.60
1:A:349:ALA:O	1:A:373:THR:HG22	2.02	0.59
1:A:385:LEU:HD21	1:A:405:CYS:HB3	1.83	0.59
1:A:434:LEU:O	1:A:544:LYS:HA	2.03	0.59
1:A:358:CYS:C	1:A:371:CYS:SG	2.86	0.58
1:A:396:GLY:HA2	1:A:399:ILE:HD12	1.84	0.58
1:A:626:PRO:O	1:A:627:ASP:C	2.43	0.58
5:B:705:NAG:HO3	5:B:705:NAG:C7	2.06	0.58
1:A:424:ASP:OD1	1:A:425:CYS:N	2.37	0.57
1:A:639:LEU:O	1:A:641:PHE:N	2.30	0.57
1:B:366:GLY:O	1:B:367:GLN:HB2	2.04	0.57
1:A:553:ASN:ND2	1:A:553:ASN:N	2.51	0.57
1:A:600:ARG:HD3	6:A:828:HOH:O	2.06	0.56
1:A:583:GLU:O	1:A:586:SER:N	2.37	0.55
1:A:622:GLY:O	1:A:623:LYS:C	2.48	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:573:CYS:HB2	1:B:575:ASP:OD1	2.06	0.55
1:A:665:TYR:CE2	1:A:669:ILE:HD11	2.42	0.54
1:A:565:LYS:HD2	1:A:567:GLU:HG2	1.89	0.54
1:B:474:ILE:O	1:B:478:THR:HG23	2.08	0.54
1:B:620:LYS:HD2	1:B:646:GLU:HG3	1.91	0.53
1:A:553:ASN:HD21	1:A:566:ARG:H	1.57	0.53
1:B:622:GLY:O	1:B:623:LYS:C	2.53	0.52
1:B:656:THR:OG1	1:B:659:GLU:HG3	2.09	0.52
1:A:526:TYR:CZ	1:A:544:LYS:HE3	2.45	0.52
1:A:452:LYS:O	1:A:453:ASP:HB2	2.10	0.52
1:B:567:GLU:C	1:B:569:PHE:H	2.19	0.51
1:A:402:ALA:HB1	1:A:407:LEU:HD12	1.92	0.51
1:A:673:LYS:HA	6:A:803:HOH:O	2.10	0.50
1:A:544:LYS:HD2	1:A:546:ASP:HB2	1.94	0.50
1:B:356:LYS:O	1:B:360:GLN:HG3	2.11	0.50
1:B:428:ARG:HH12	1:B:646:GLU:CD	2.19	0.50
1:A:549:TRP:CE3	1:A:566:ARG:NH1	2.79	0.50
1:A:447:THR:O	1:A:448:TRP:C	2.52	0.50
1:B:618:PHE:CD1	1:B:629:PHE:HB3	2.46	0.49
1:B:669:ILE:O	1:B:670:ALA:C	2.55	0.49
1:A:639:LEU:C	1:A:641:PHE:H	2.17	0.49
1:B:609:GLN:O	1:B:610:VAL:C	2.54	0.49
1:B:634:SER:OG	1:B:639:LEU:HG	2.12	0.49
1:A:665:TYR:CZ	1:A:669:ILE:HD11	2.47	0.49
1:A:484:ASP:N	1:A:484:ASP:OD1	2.46	0.49
1:A:610:VAL:O	1:A:614:GLN:HG2	2.13	0.49
1:B:358:CYS:O	1:B:361:TRP:HB3	2.12	0.48
1:B:346:VAL:O	1:B:390:ASP:HB2	2.14	0.48
1:B:544:LYS:O	1:B:545:ASN:C	2.55	0.48
1:B:550:GLU:C	1:B:555:GLU:HB3	2.38	0.48
1:A:460:ALA:O	1:A:463:ARG:HG3	2.14	0.48
1:A:583:GLU:O	1:A:584:ALA:C	2.56	0.47
1:A:490:SER:O	1:A:504:LEU:HB2	2.15	0.47
1:A:349:ALA:HB3	1:A:373:THR:HG23	1.97	0.47
1:A:656:THR:O	1:A:657:TYR:C	2.57	0.47
1:B:377:THR:O	1:B:381:ILE:HG13	2.14	0.47
1:A:477:GLN:O	1:A:478:THR:C	2.54	0.47
1:A:365:SER:HA	2:C:1:NAG:H81	1.96	0.46
1:A:565:LYS:O	1:A:566:ARG:C	2.58	0.46
1:A:469:ILE:HB	1:A:470:PRO:CD	2.45	0.46
1:A:594:ASN:O	1:A:595:HIS:C	2.59	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:461:VAL:O	1:B:462:ASP:HB2	2.16	0.46
1:A:446:LEU:C	1:A:447:THR:CG2	2.89	0.46
1:A:483:PHE:C	1:A:483:PHE:CD1	2.94	0.45
1:A:639:LEU:C	1:A:641:PHE:N	2.75	0.45
1:A:624:ASN:O	1:A:628:LYS:N	2.32	0.45
1:B:438:VAL:HG12	1:B:533:LEU:CD2	2.46	0.45
1:A:415:ARG:NH1	1:A:432:GLY:O	2.49	0.45
1:A:572:LEU:HD23	1:A:572:LEU:N	2.31	0.45
1:B:416:LYS:HA	1:B:646:GLU:OE1	2.16	0.45
1:B:633:LYS:HD3	1:B:633:LYS:HA	1.76	0.45
1:A:561:ALA:HA	1:A:564:LEU:HD12	1.99	0.45
1:A:463:ARG:HE	1:A:463:ARG:HB3	1.62	0.45
1:A:497:PRO:HA	1:A:502:CYS:SG	2.57	0.45
1:A:542:PHE:CD1	1:A:542:PHE:N	2.85	0.45
1:B:469:ILE:HB	1:B:470:PRO:CD	2.47	0.45
1:B:633:LYS:NZ	1:B:643:ASP:O	2.50	0.44
1:B:364:GLN:HB3	1:B:618:PHE:CZ	2.52	0.44
1:A:565:LYS:HD2	1:A:567:GLU:CG	2.46	0.44
1:A:634:SER:OG	1:A:638:ASN:N	2.51	0.44
1:B:622:GLY:O	1:B:624:ASN:N	2.51	0.44
1:A:523:TYR:CG	1:A:532:CYS:HB2	2.53	0.44
1:A:639:LEU:O	1:A:640:LEU:HB2	2.18	0.44
1:A:676:SER:N	6:A:803:HOH:O	2.51	0.44
1:B:415:ARG:O	1:B:416:LYS:C	2.59	0.43
1:A:558:ALA:O	1:A:559:ASP:C	2.61	0.43
1:B:352:PRO:HA	1:B:355:GLN:HB2	1.99	0.43
1:A:355:GLN:HB2	1:A:373:THR:CG2	2.47	0.43
1:A:565:LYS:CD	1:A:567:GLU:HG2	2.48	0.43
1:B:408:VAL:O	1:B:598:VAL:HA	2.19	0.43
1:B:470:PRO:HB3	1:B:542:PHE:CD2	2.54	0.43
1:A:349:ALA:O	1:A:373:THR:HA	2.19	0.43
1:A:355:GLN:HB2	1:A:373:THR:HG23	2.01	0.43
1:A:446:LEU:C	1:A:447:THR:HG23	2.44	0.42
1:A:523:TYR:C	1:A:528:GLY:HA3	2.43	0.42
1:B:686:PHE:CD1	1:B:686:PHE:N	2.87	0.42
1:A:684:CYS:O	1:A:685:ALA:C	2.61	0.42
1:B:447:THR:O	1:B:448:TRP:C	2.61	0.42
1:A:516:VAL:O	1:A:516:VAL:CG2	2.67	0.42
1:A:560:TRP:CE3	1:A:561:ALA:HB2	2.55	0.42
1:B:459:THR:HG22	1:B:525:GLY:C	2.45	0.41
1:A:461:VAL:O	1:A:462:ASP:HB2	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:458:HIS:HB2	1:B:492:ALA:HA	2.02	0.41
1:A:368:ASN:OD1	1:B:674:LYS:NZ	2.53	0.41
1:A:524:TYR:CD2	1:A:524:TYR:C	2.98	0.41
1:B:639:LEU:O	1:B:640:LEU:HB2	2.19	0.41
1:A:460:ALA:HA	1:A:493:PRO:HD2	2.03	0.41
1:A:476:ASN:ND2	1:A:476:ASN:O	2.54	0.41
1:A:635:GLU:C	1:A:636:THR:OG1	2.63	0.41
1:B:382:VAL:O	1:B:385:LEU:HB2	2.21	0.41
1:A:366:GLY:O	1:A:367:GLN:HB2	2.21	0.40
1:A:506:ALA:HB3	1:A:522:LYS:HB3	2.04	0.40
1:A:508:ASP:OD1	1:A:508:ASP:C	2.64	0.40
1:B:544:LYS:NZ	6:B:803:HOH:O	2.55	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	346/348 (99%)	313 (90%)	28 (8%)	5 (1%)	9	30
1	B	346/348 (99%)	313 (90%)	33 (10%)	0	100	100
All	All	692/696 (99%)	626 (90%)	61 (9%)	5 (1%)	18	47

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	416	LYS
1	A	566	ARG
1	A	595	HIS
1	A	652	GLY
1	A	470	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	289/289 (100%)	262 (91%)	27 (9%)	8	27
1	B	289/289 (100%)	266 (92%)	23 (8%)	11	34
All	All	578/578 (100%)	528 (91%)	50 (9%)	9	30

All (50) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	343	THR
1	A	355	GLN
1	A	373	THR
1	A	376	THR
1	A	380	CYS
1	A	444	GLU
1	A	453	ASP
1	A	463	ARG
1	A	480	SER
1	A	498	LYS
1	A	520	LYS
1	A	522	LYS
1	A	527	THR
1	A	544	LYS
1	A	553	ASN
1	A	565	LYS
1	A	572	LEU
1	A	581	VAL
1	A	586	SER
1	A	591	VAL
1	A	601	SER
1	A	636	THR
1	A	654	ARG
1	A	658	GLU
1	A	659	GLU
1	A	663	THR
1	A	680	LEU

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Mol	Chain	Res	Type
1	B	344	ARG
1	B	355	GLN
1	B	359	GLN
1	B	367	GLN
1	B	375	SER
1	B	415	ARG
1	B	416	LYS
1	B	427	LEU
1	B	431	GLU
1	B	441	LYS
1	B	444	GLU
1	B	481	CYS
1	B	509	ASP
1	B	520	LYS
1	B	553	ASN
1	B	559	ASP
1	B	565	LYS
1	B	573	CYS
1	B	602	ASP
1	B	623	LYS
1	B	651	LEU
1	B	677	THR
1	B	686	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	355	GLN
1	A	367	GLN
1	A	393	ASN
1	A	468	ASN
1	A	476	ASN
1	A	510	GLN
1	A	553	ASN
1	A	595	HIS
1	B	393	ASN
1	B	585	GLN
1	B	624	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 ⓘ

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$
2	NAG	C	1	1,2	14,14,15	0.67	0	17,19,21	2.39	6 (35%)
2	NAG	C	2	2	14,14,15	0.81	0	17,19,21	2.35	6 (35%)
2	BMA	C	3	2	11,11,12	0.54	0	15,15,17	1.53	2 (13%)
2	NAG	D	1	1,2	14,14,15	0.63	0	17,19,21	1.32	2 (11%)
2	NAG	D	2	2	14,14,15	0.52	0	17,19,21	1.70	2 (11%)
2	BMA	D	3	2	11,11,12	0.68	0	15,15,17	1.09	1 (6%)
2	NAG	E	1	1,2	14,14,15	0.72	0	17,19,21	1.95	3 (17%)
2	NAG	E	2	2	14,14,15	0.53	0	17,19,21	2.18	5 (29%)
2	BMA	E	3	2	11,11,12	0.85	0	15,15,17	1.24	3 (20%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	C	1	1,2	-	2/6/23/26	0/1/1/1
2	NAG	C	2	2	-	2/6/23/26	0/1/1/1
2	BMA	C	3	2	-	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	D	1	1,2	-	2/6/23/26	0/1/1/1
2	NAG	D	2	2	-	2/6/23/26	0/1/1/1
2	BMA	D	3	2	-	0/2/19/22	0/1/1/1
2	NAG	E	1	1,2	-	2/6/23/26	0/1/1/1
2	NAG	E	2	2	-	2/6/23/26	0/1/1/1
2	BMA	E	3	2	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	NAG	C1-O5-C5	6.83	121.34	112.19
2	C	2	NAG	O4-C4-C5	5.44	122.73	109.32
2	E	1	NAG	C1-O5-C5	5.36	119.37	112.19
2	D	2	NAG	C1-C2-N2	5.13	118.52	110.43
2	E	2	NAG	C1-C2-N2	5.10	118.48	110.43
2	C	2	NAG	C1-O5-C5	4.75	118.55	112.19
2	E	2	NAG	C1-O5-C5	4.66	118.44	112.19
2	D	1	NAG	C1-O5-C5	4.08	117.66	112.19
2	C	3	BMA	C1-O5-C5	3.68	117.11	112.19
2	C	1	NAG	O6-C6-C5	-3.66	98.87	111.33
2	E	1	NAG	O5-C1-C2	-3.58	105.76	111.29
2	C	1	NAG	O5-C5-C4	3.43	119.18	110.83
2	C	2	NAG	C3-C4-C5	-2.92	104.93	110.23
2	E	2	NAG	C6-C5-C4	-2.81	106.13	113.02
2	E	1	NAG	C4-C3-C2	2.69	114.96	111.02
2	C	2	NAG	O7-C7-C8	-2.67	117.30	122.05
2	C	1	NAG	O5-C5-C6	-2.66	102.48	107.66
2	E	3	BMA	O3-C3-C2	2.59	115.33	110.05
2	E	3	BMA	C1-O5-C5	2.49	115.53	112.19
2	C	3	BMA	C6-C5-C4	-2.48	106.94	113.02
2	E	2	NAG	O7-C7-C8	-2.43	117.72	122.05
2	C	1	NAG	C4-C3-C2	2.35	114.46	111.02
2	E	2	NAG	O5-C5-C6	2.28	112.09	107.66
2	C	1	NAG	O5-C1-C2	-2.22	107.85	111.29
2	C	2	NAG	C4-C3-C2	-2.20	107.80	111.02
2	C	2	NAG	C8-C7-N2	2.19	119.75	116.12
2	D	3	BMA	O3-C3-C2	2.19	114.52	110.05
2	D	2	NAG	C1-O5-C5	2.07	114.96	112.19
2	D	1	NAG	C1-C2-N2	-2.01	107.27	110.43
2	E	3	BMA	C1-C2-C3	2.01	112.57	109.64

There are no chirality outliers.

All (12) torsion outliers are listed below:

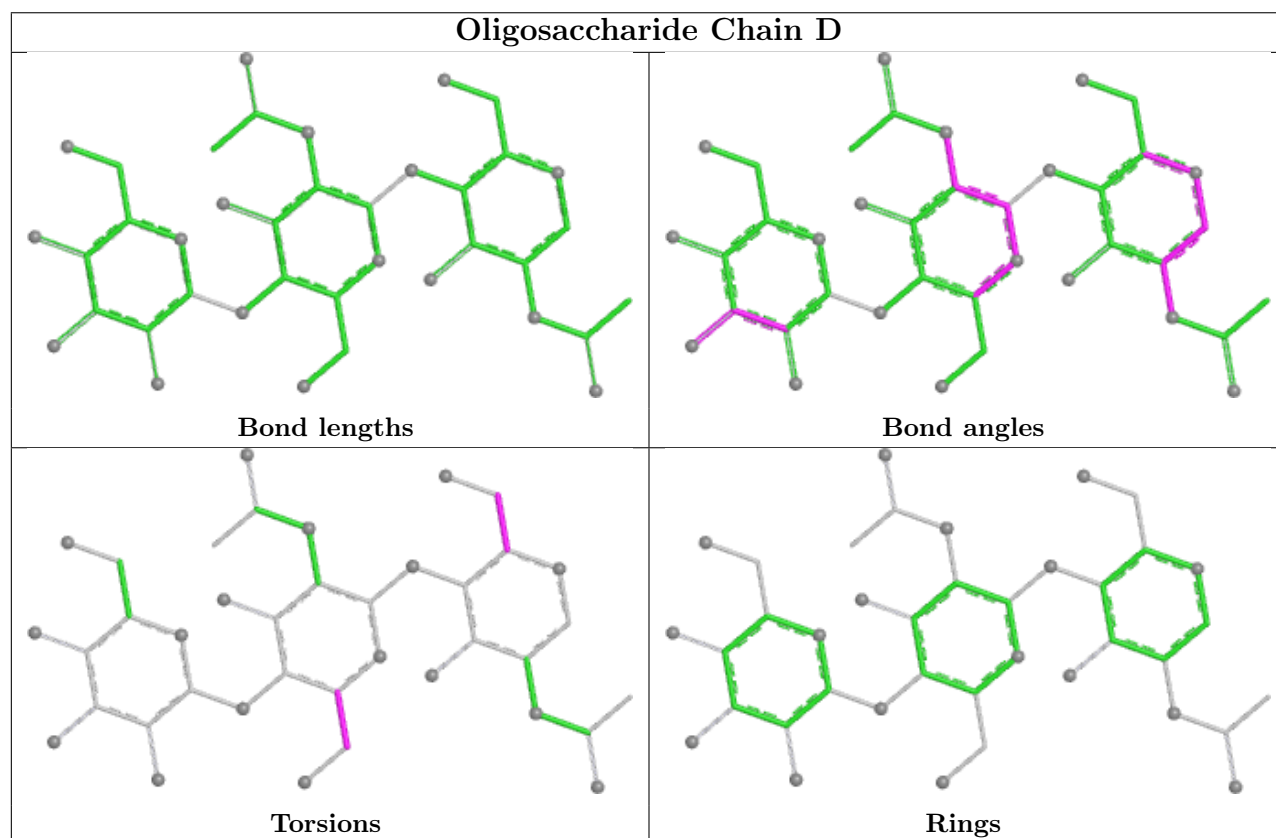
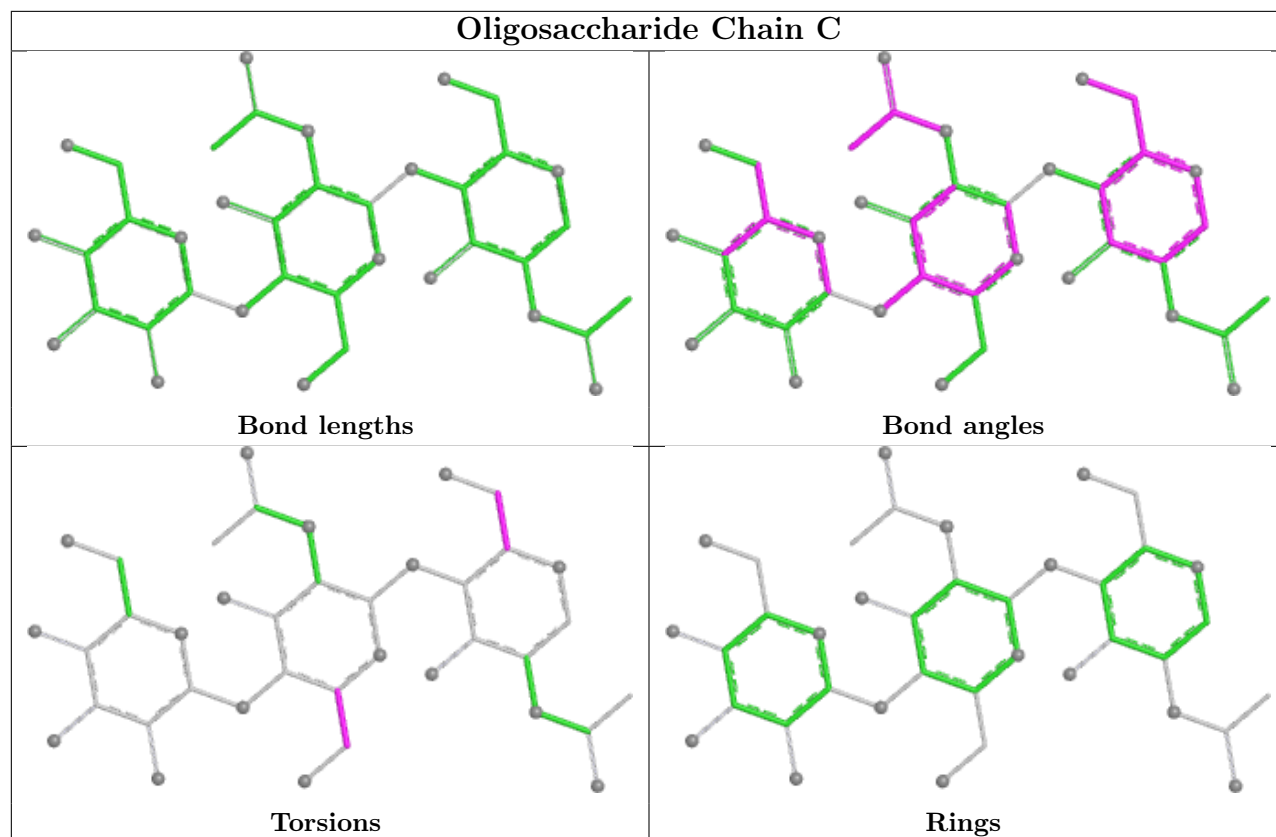
Mol	Chain	Res	Type	Atoms
2	C	1	NAG	C4-C5-C6-O6
2	C	1	NAG	O5-C5-C6-O6
2	E	2	NAG	O5-C5-C6-O6
2	D	2	NAG	O5-C5-C6-O6
2	C	2	NAG	C4-C5-C6-O6
2	E	1	NAG	C4-C5-C6-O6
2	E	1	NAG	O5-C5-C6-O6
2	C	2	NAG	O5-C5-C6-O6
2	D	1	NAG	C4-C5-C6-O6
2	D	1	NAG	O5-C5-C6-O6
2	E	2	NAG	C4-C5-C6-O6
2	D	2	NAG	C4-C5-C6-O6

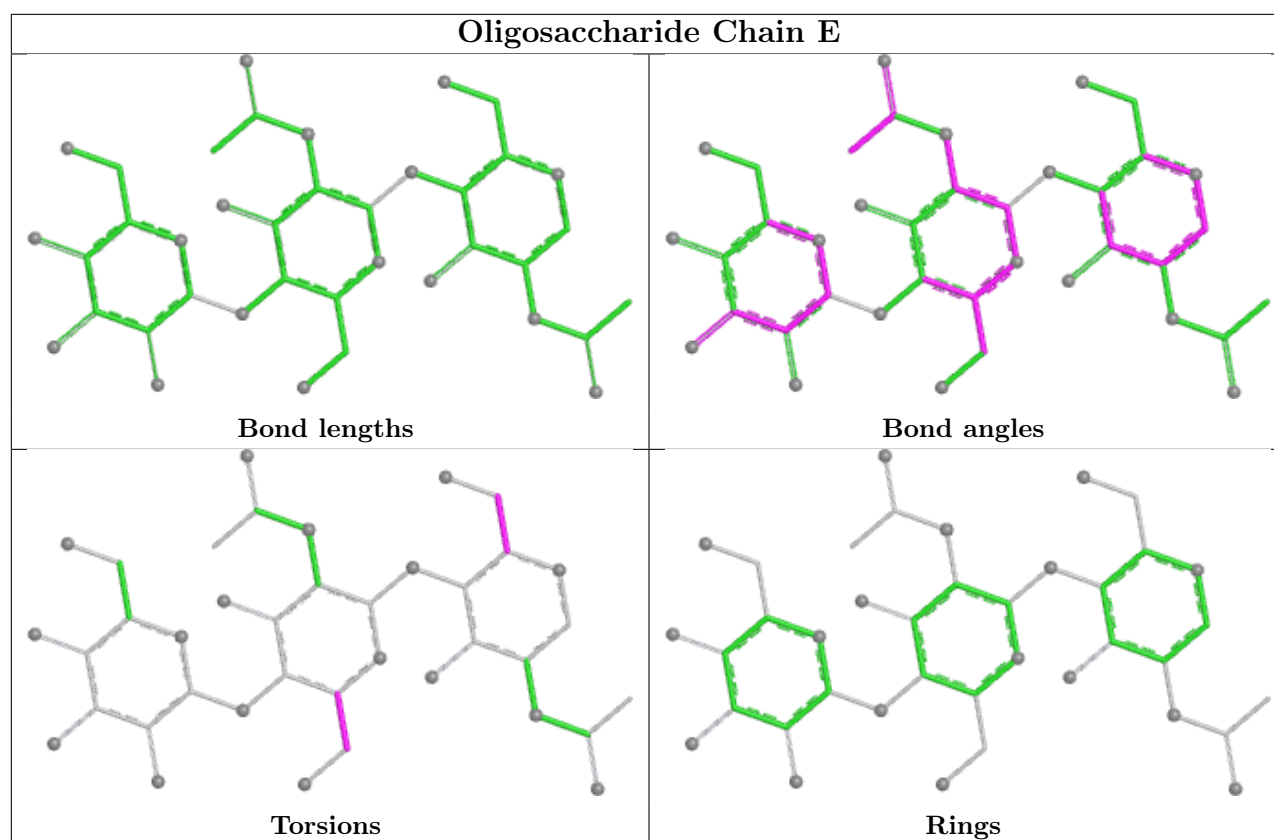
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	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, 2 are monoatomic - leaving 4 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	$\# Z > 2$
4	BCT	A	705	3	3,3,3	1.77	1 (33%)	2,3,3	0.36	0
5	NAG	B	704	1	14,14,15	0.71	0	17,19,21	2.20	3 (17%)
4	BCT	B	707	3	3,3,3	1.78	1 (33%)	2,3,3	0.34	0
5	NAG	B	705	1	14,14,15	0.59	0	17,19,21	1.22	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	B	704	1	-	2/6/23/26	0/1/1/1
5	NAG	B	705	1	-	1/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	707	BCT	O1-C	2.95	1.35	1.25
4	A	705	BCT	O1-C	2.82	1.35	1.25

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	704	NAG	C1-O5-C5	6.92	121.46	112.19
5	B	704	NAG	O5-C5-C4	2.75	117.52	110.83
5	B	704	NAG	O4-C4-C5	2.50	115.49	109.32
5	B	705	NAG	C4-C3-C2	2.20	114.24	111.02
5	B	705	NAG	O3-C3-C2	-2.18	104.87	109.40
5	B	705	NAG	C6-C5-C4	-2.05	108.00	113.02

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	704	NAG	O5-C5-C6-O6
5	B	704	NAG	C4-C5-C6-O6
5	B	705	NAG	C3-C2-N2-C7

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	705	NAG	2	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data [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	348/348 (100%)	0.25	7 (2%) 65 56	36, 63, 99, 163	0
1	B	348/348 (100%)	0.22	12 (3%) 48 39	38, 64, 100, 156	0
All	All	696/696 (100%)	0.24	19 (2%) 56 46	36, 64, 100, 163	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	442	ALA	4.1
1	B	342	TYR	3.5
1	B	636	THR	3.4
1	B	634	SER	3.1
1	A	498	LYS	3.0
1	A	634	SER	2.9
1	A	534	ALA	2.9
1	A	635	GLU	2.8
1	B	442	ALA	2.8
1	B	416	LYS	2.6
1	B	688	THR	2.4
1	B	687	LEU	2.2
1	A	423	LEU	2.1
1	B	689	ARG	2.1
1	B	427	LEU	2.1
1	B	485	GLU	2.1
1	B	542	PHE	2.0
1	A	429	PRO	2.0
1	B	420	HIS	2.0

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

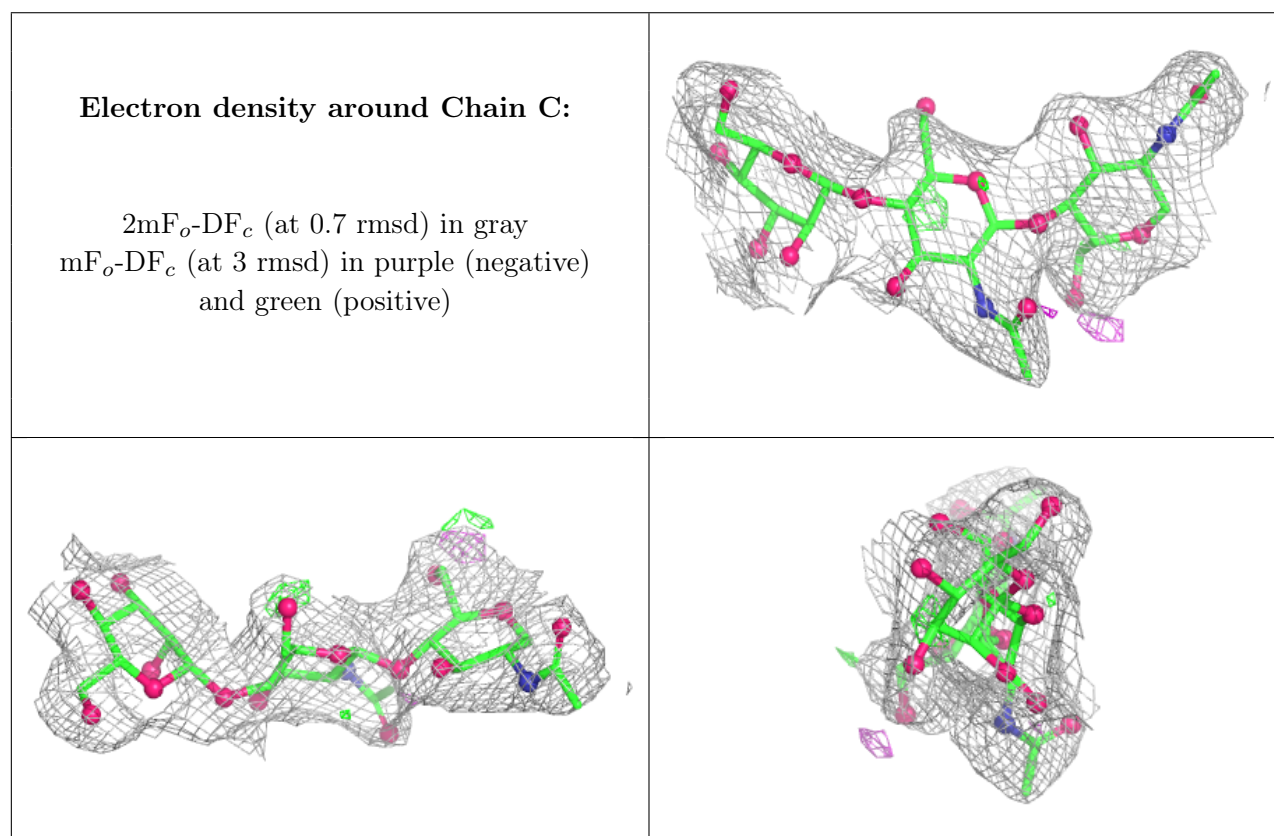
There are no non-standard protein/DNA/RNA residues in this entry.

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.

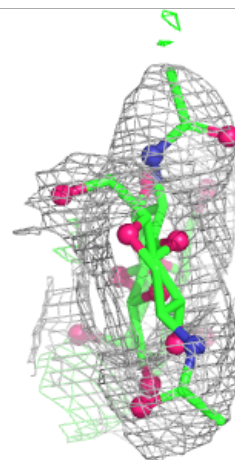
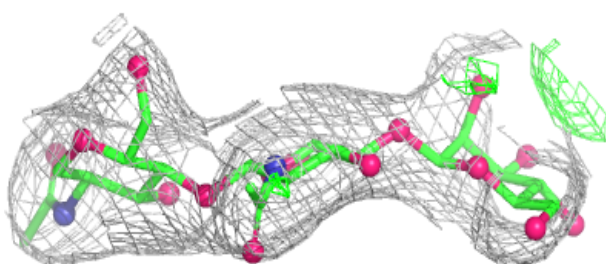
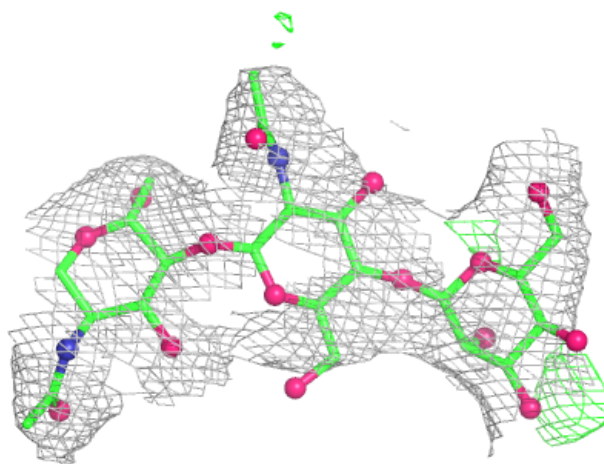
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	BMA	D	3	11/12	0.60	0.14	88,113,122,129	0
2	BMA	C	3	11/12	0.62	0.10	101,112,124,126	0
2	BMA	E	3	11/12	0.72	0.13	75,107,118,120	0
2	NAG	C	2	14/15	0.75	0.12	73,94,111,120	0
2	NAG	D	2	14/15	0.84	0.12	77,93,111,120	0
2	NAG	E	2	14/15	0.88	0.11	71,76,93,93	0
2	NAG	E	1	14/15	0.89	0.11	66,75,83,84	0
2	NAG	C	1	14/15	0.90	0.09	60,69,74,77	0
2	NAG	D	1	14/15	0.95	0.07	71,81,86,86	0

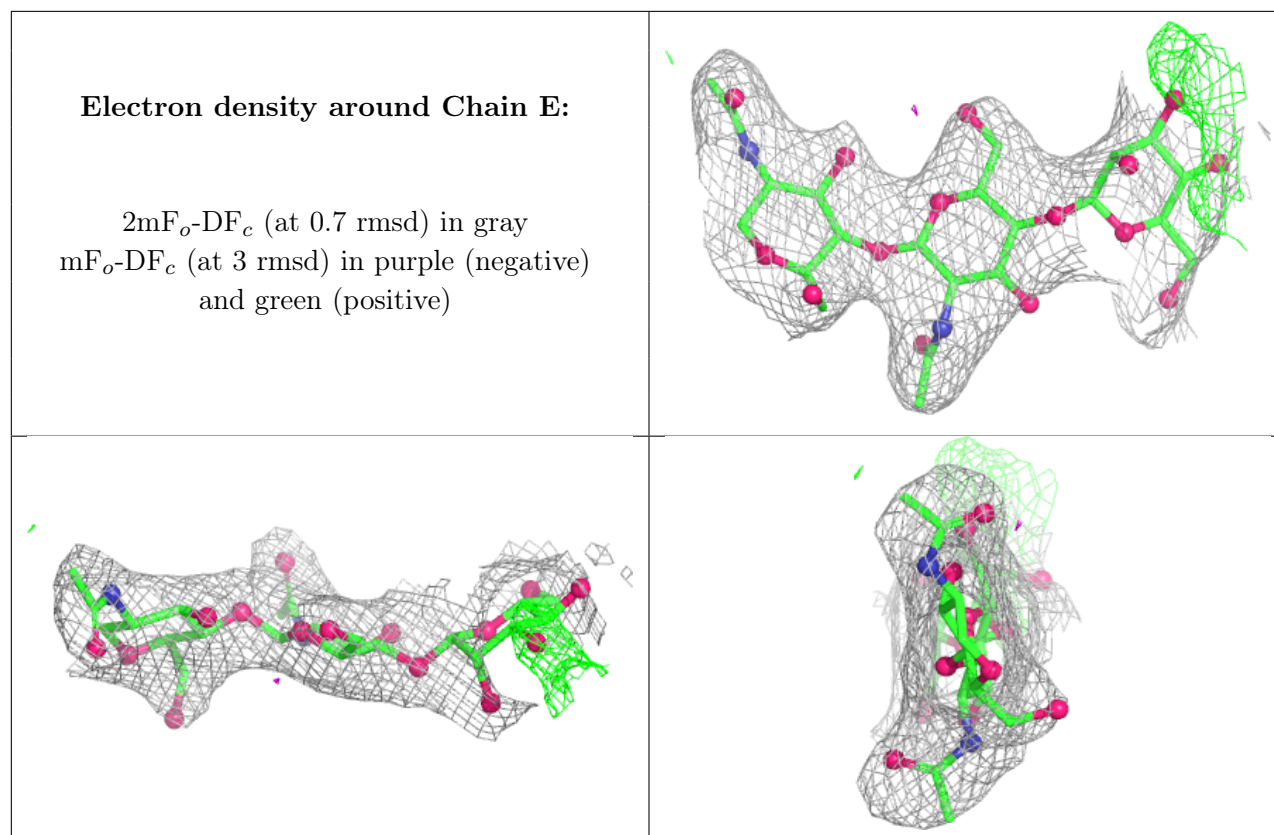
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



Electron density around Chain D:

$2mF_o-DF_c$ (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	B	705	14/15	0.68	0.16	78,87,91,100	0
5	NAG	B	704	14/15	0.82	0.12	69,77,86,90	0
4	BCT	A	705	4/4	0.93	0.11	49,54,57,58	0
4	BCT	B	707	4/4	0.94	0.08	42,42,46,47	0
3	FE	B	706	1/1	0.95	0.06	65,65,65,65	0
3	FE	A	704	1/1	0.96	0.06	86,86,86,86	0

6.5 Other polymers [i](#)

There are no such residues in this entry.