



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:52 PM UTC

PDB ID : 2XMC / pdb_00002xmc
Title : G117H mutant of human butyrylcholinesterase in complex with fluoride anion
Authors : Nachon, F.; Carletti, E.; Wandhammer, M.; Nicolet, Y.; Schopfer, L.M.; Masson, P.; Lockridge, O.
Deposited on : 2010-07-27
Resolution : 2.40 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

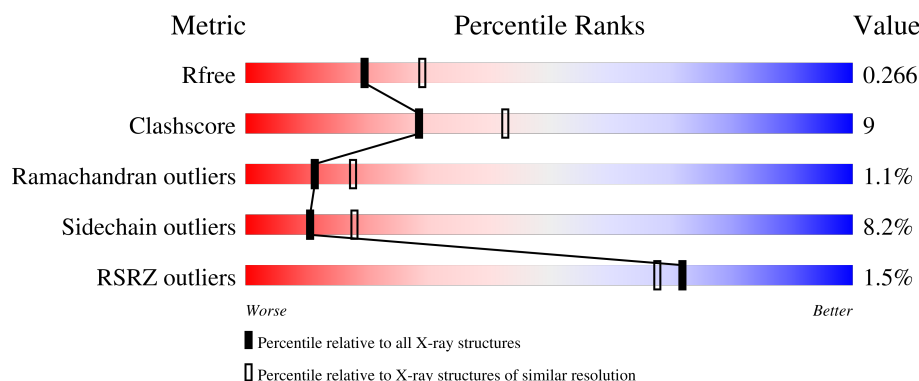
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	529	2% 79% 16% ..
2	B	3	100%
2	D	3	67% 33%
3	C	2	100%

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
2	FUC	B	3	X	-	-	-
2	FUC	D	3	X	-	-	-
3	FUC	C	2	X	-	-	-
9	NAG	A	1561	X	-	-	-

2 Entry composition

There are 10 unique types of molecules in this entry. The entry contains 4616 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.

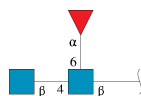
- Molecule 1 is a protein called CHOLINESTERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	527	4216	2721	710	770	15	0	1	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	17	GLN	ASN	engineered mutation	UNP P06276
A	117	HIS	GLY	engineered mutation	UNP P06276
A	455	GLN	ASN	engineered mutation	UNP P06276
A	481	GLN	ASN	engineered mutation	UNP P06276
A	486	GLN	ASN	engineered mutation	UNP P06276

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



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

- Molecule 3 is an oligosaccharide called alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.



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

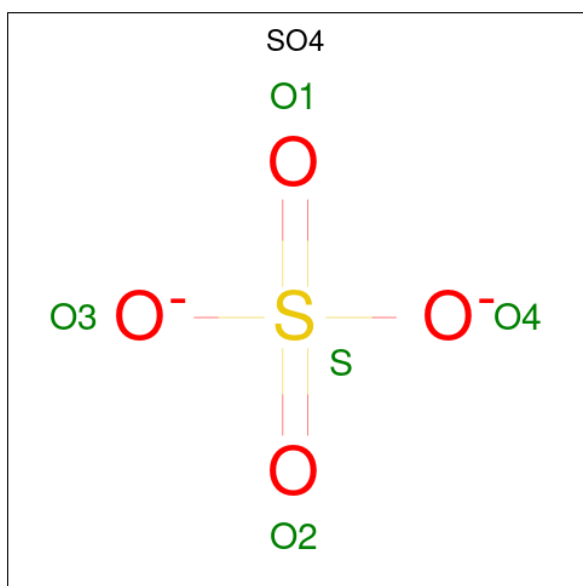
- Molecule 4 is UNKNOWN ATOM OR ION (CCD ID: UNX) (formula: X).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	17	Total	X	0	0
			17	17		

- Molecule 5 is FLUORIDE ION (CCD ID: F) (formula: F).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	F	0	0
			1	1		

- Molecule 6 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	O	S	0	0
			5	4	1		

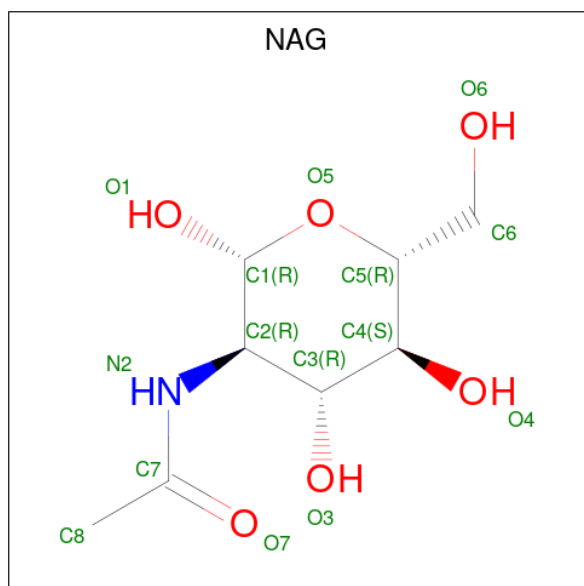
- Molecule 7 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	5	Total	Cl	0	0
			5	5		

- Molecule 8 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total K 1 1	0	0

- Molecule 9 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



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

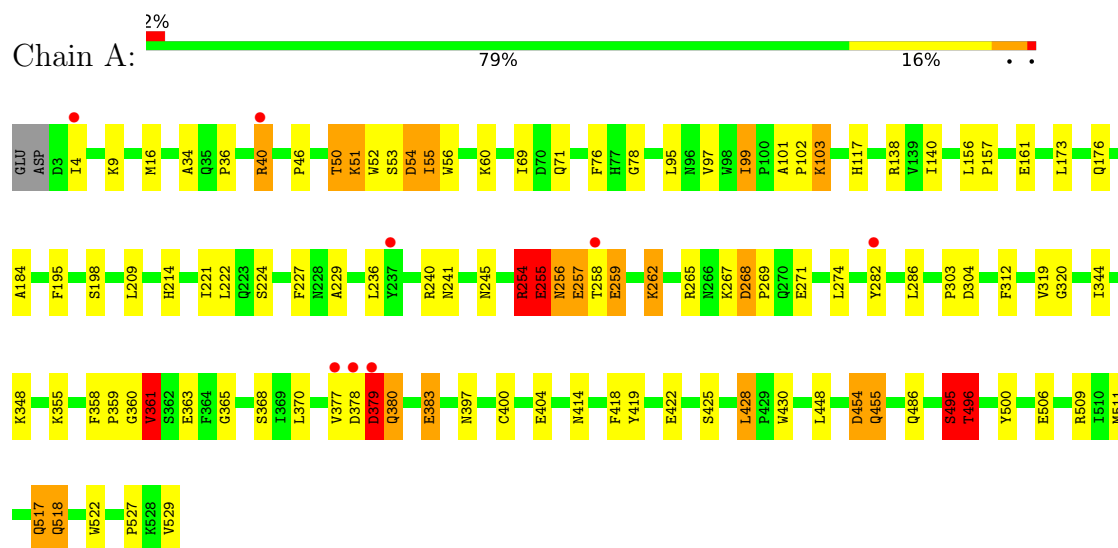
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	229	Total O 229 229	0	0

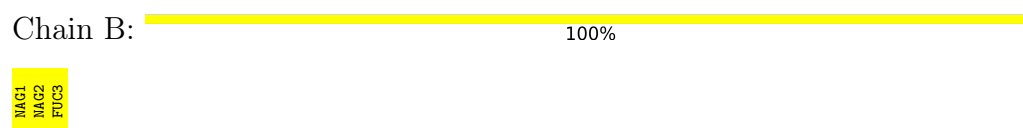
3 Residue-property plots

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.

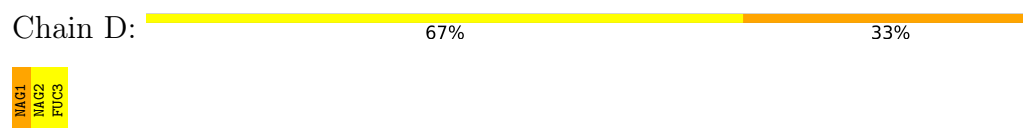
• Molecule 1: CHOLINESTERASE



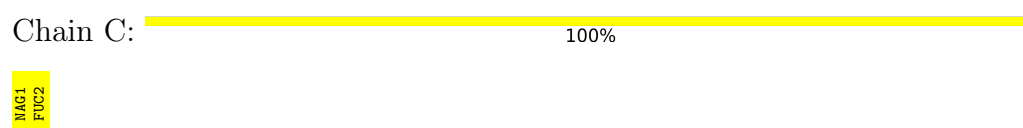
• Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



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



• Molecule 3: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, α , β , γ	155.59Å 155.59Å 127.99Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	109.76 – 2.40 109.76 – 2.40	Depositor EDS
% Data completeness (in resolution range)	96.7 (109.76-2.40) 96.7 (109.76-2.40)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.57 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.192 , 0.253 0.208 , 0.266	Depositor DCC
R_{free} test set	980 reflections (3.17%)	wwPDB-VP
Wilson B-factor (Å ²)	42.8	Xtriage
Anisotropy	0.255	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 43.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4616	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.99% 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: K, UNX, CL, FUC, SO4, F, 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	1.20	4/4340 (0.1%)	1.16	14/5892 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	5

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	36	PRO	CA-C	9.21	1.60	1.52
1	A	496	THR	CA-CB	6.49	1.64	1.53
1	A	344	ILE	CA-CB	5.69	1.60	1.53
1	A	140	ILE	CA-CB	-5.54	1.47	1.54

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	361	VAL	N-CA-C	7.63	125.21	109.34
1	A	495	SER	N-CA-C	-7.44	100.71	110.53
1	A	99	ILE	CA-C-N	-6.84	113.75	120.52
1	A	99	ILE	C-N-CA	-6.84	113.75	120.52
1	A	454	ASP	N-CA-C	6.65	121.10	112.92
1	A	268	ASP	CB-CA-C	5.44	117.23	108.91
1	A	397	ASN	N-CA-C	5.37	118.99	112.23
1	A	400	CYS	CA-C-N	-5.26	113.50	119.28
1	A	400	CYS	C-N-CA	-5.26	113.50	119.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	229	ALA	CA-C-N	-5.19	114.73	119.82
1	A	229	ALA	C-N-CA	-5.19	114.73	119.82
1	A	256	ASN	N-CA-C	-5.15	97.58	107.57
1	A	358	PHE	CA-C-N	5.02	125.04	119.32
1	A	358	PHE	C-N-CA	5.02	125.04	119.32

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	254	ARG	Peptide
1	A	255	GLU	Peptide
1	A	360	GLY	Peptide
1	A	380	GLN	Peptide
1	A	53	SER	Peptide

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	4216	0	4111	74	0
2	B	38	0	34	0	0
2	D	38	0	34	4	0
3	C	24	0	22	0	0
4	A	17	0	0	2	0
5	A	1	0	0	0	0
6	A	5	0	0	0	0
7	A	5	0	0	0	0
8	A	1	0	0	0	0
9	A	42	0	39	0	0
10	A	229	0	0	15	0
All	All	4616	0	4240	76	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.

All (76) 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:A:40:ARG:HG2	1:A:40:ARG:HH11	1.08	1.09
1:A:518:GLN:HE21	1:A:518:GLN:H	1.20	0.89
1:A:71:GLN:HG2	10:A:2034:HOH:O	1.73	0.88
1:A:117:HIS:HD2	10:A:2120:HOH:O	1.59	0.84
1:A:40:ARG:HG2	1:A:40:ARG:NH1	1.83	0.81
1:A:454:ASP:O	1:A:455:GLN:HB2	1.83	0.79
1:A:320:GLY:HA3	1:A:419:TYR:CE1	2.22	0.75
1:A:161:GLU:HG3	1:A:258:THR:HG23	1.71	0.71
1:A:267:LYS:HE3	10:A:2116:HOH:O	1.90	0.69
1:A:320:GLY:HA3	1:A:419:TYR:CZ	2.27	0.69
1:A:404:GLU:HG2	10:A:2107:HOH:O	1.94	0.67
1:A:227:PHE:CD2	1:A:227:PHE:C	2.73	0.66
1:A:157:PRO:O	10:A:2090:HOH:O	2.12	0.66
1:A:50:THR:HG22	1:A:51:LYS:HE3	1.76	0.66
1:A:241:ASN:HD22	2:D:1:NAG:H83	1.59	0.66
1:A:348:LYS:NZ	10:A:2147:HOH:O	2.30	0.65
1:A:454:ASP:O	1:A:455:GLN:CB	2.44	0.64
1:A:209:LEU:HD22	1:A:312:PHE:HB3	1.80	0.64
1:A:227:PHE:CE2	1:A:303:PRO:HB2	2.35	0.62
1:A:256:ASN:O	1:A:259:GLU:N	2.31	0.61
1:A:378:ASP:O	1:A:380:GLN:NE2	2.33	0.61
1:A:51:LYS:HD3	1:A:51:LYS:H	1.66	0.61
1:A:268:ASP:HB2	1:A:269:PRO:CD	2.31	0.60
1:A:101:ALA:HA	1:A:102:PRO:C	2.26	0.60
1:A:117:HIS:CD2	10:A:2120:HOH:O	2.42	0.59
1:A:268:ASP:HB2	1:A:269:PRO:HD3	1.84	0.58
1:A:222:LEU:HD12	1:A:222:LEU:N	2.19	0.58
1:A:518:GLN:H	1:A:518:GLN:NE2	1.96	0.58
1:A:378:ASP:O	1:A:380:GLN:N	2.37	0.58
1:A:254:ARG:O	1:A:255:GLU:HB3	2.05	0.56
1:A:209:LEU:CD2	1:A:312:PHE:HB3	2.36	0.55
1:A:422:GLU:OE2	1:A:509:ARG:NH2	2.39	0.55
1:A:522:TRP:O	1:A:527:PRO:HD3	2.07	0.54
1:A:282:TYR:CD2	1:A:359:PRO:HB2	2.42	0.53
1:A:40:ARG:HH11	1:A:40:ARG:CG	1.96	0.53
1:A:256:ASN:O	1:A:258:THR:N	2.42	0.53
1:A:377:VAL:HA	1:A:378:ASP:HB2	1.92	0.52
1:A:425:SER:HB3	1:A:428:LEU:HD23	1.91	0.52
1:A:245:ASN:HD21	2:D:1:NAG:H62	1.75	0.51
1:A:214[A]:HIS:HE1	10:A:2132:HOH:O	1.93	0.51
4:A:1531:UNX:UNK	4:A:1532:UNX:UNK	1.54	0.51
1:A:241:ASN:HD22	2:D:1:NAG:C8	2.23	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:198:SER:HA	1:A:224:SER:O	2.11	0.50
1:A:257:GLU:HG2	10:A:2110:HOH:O	2.10	0.50
1:A:267:LYS:CE	10:A:2116:HOH:O	2.53	0.50
1:A:255:GLU:N	1:A:255:GLU:OE1	2.45	0.50
1:A:319:VAL:O	1:A:418:PHE:HA	2.12	0.49
1:A:383:GLU:CD	1:A:383:GLU:H	2.20	0.49
1:A:56:TRP:CD1	1:A:56:TRP:C	2.91	0.48
1:A:267:LYS:HD2	1:A:271:GLU:OE1	2.12	0.48
1:A:509:ARG:HD3	10:A:2206:HOH:O	2.12	0.48
1:A:40:ARG:NH1	10:A:2015:HOH:O	2.47	0.47
1:A:55:ILE:HD11	10:A:2003:HOH:O	2.14	0.46
1:A:221:ILE:C	1:A:222:LEU:HD12	2.41	0.45
1:A:495:SER:O	1:A:496:THR:OG1	2.29	0.45
4:A:1536:UNX:UNK	4:A:1537:UNX:UNK	1.61	0.45
1:A:500:TYR:CZ	1:A:511:MET:HB2	2.53	0.44
1:A:236:LEU:HD12	1:A:236:LEU:HA	1.79	0.44
1:A:95:LEU:HD12	1:A:95:LEU:C	2.43	0.43
1:A:256:ASN:O	1:A:257:GLU:C	2.61	0.43
1:A:379:ASP:OD2	1:A:379:ASP:N	2.52	0.43
1:A:241:ASN:HD22	2:D:1:NAG:C7	2.29	0.43
1:A:414:ASN:OD1	10:A:2165:HOH:O	2.21	0.43
1:A:52:TRP:HD1	1:A:54:ASP:HB2	1.85	0.42
1:A:428:LEU:HD12	1:A:430:TRP:HB2	2.01	0.42
1:A:262:LYS:HG2	1:A:265:ARG:NH2	2.35	0.42
1:A:76:PHE:CE2	1:A:78:GLY:HA3	2.54	0.42
1:A:265:ARG:NE	10:A:2112:HOH:O	2.27	0.42
1:A:365:GLY:O	1:A:368:SER:HB2	2.20	0.41
1:A:34:ALA:HB2	1:A:173:LEU:HD23	2.02	0.41
1:A:517:GLN:HE21	1:A:517:GLN:HB3	1.72	0.41
1:A:103:LYS:NZ	1:A:184:ALA:O	2.53	0.41
1:A:46:PRO:HB2	1:A:173:LEU:HD22	2.03	0.41
1:A:97:VAL:HG12	1:A:99:ILE:HG23	2.02	0.41
1:A:268:ASP:CB	1:A:269:PRO:CD	2.99	0.40
1:A:320:GLY:HA3	1:A:419:TYR:CD1	2.56	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	526/529 (99%)	492 (94%)	28 (5%)	6 (1%)	11 18

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	54	ASP
1	A	255	GLU
1	A	361	VAL
1	A	379	ASP
1	A	496	THR
1	A	257	GLU

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	454/455 (100%)	417 (92%)	37 (8%)	11 18

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	ILE
1	A	9	LYS
1	A	16	MET
1	A	40	ARG
1	A	50	THR

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Mol	Chain	Res	Type
1	A	51	LYS
1	A	55	ILE
1	A	60	LYS
1	A	69	ILE
1	A	103	LYS
1	A	138	ARG
1	A	156	LEU
1	A	176	GLN
1	A	195	PHE
1	A	240	ARG
1	A	254	ARG
1	A	255	GLU
1	A	259	GLU
1	A	262	LYS
1	A	274	LEU
1	A	286	LEU
1	A	304	ASP
1	A	355	LYS
1	A	361	VAL
1	A	363	GLU
1	A	370	LEU
1	A	379	ASP
1	A	383	GLU
1	A	428	LEU
1	A	448	LEU
1	A	455	GLN
1	A	486	GLN
1	A	495	SER
1	A	506	GLU
1	A	517	GLN
1	A	518	GLN
1	A	529	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	126	HIS
1	A	245	ASN
1	A	275	ASN
1	A	380	GLN
1	A	414	ASN
1	A	517	GLN

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Mol	Chain	Res	Type
1	A	518	GLN

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 ⓘ

8 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	B	1	1,2	14,14,15	0.87	0	17,19,21	2.64	9 (52%)
2	NAG	B	2	2	14,14,15	0.86	0	17,19,21	2.11	7 (41%)
2	FUC	B	3	2	10,10,11	1.23	1 (10%)	14,14,16	2.78	7 (50%)
3	NAG	C	1	3,1	14,14,15	1.21	1 (7%)	17,19,21	1.71	6 (35%)
3	FUC	C	2	3	10,10,11	1.12	1 (10%)	14,14,16	2.01	4 (28%)
2	NAG	D	1	1,2	14,14,15	1.04	1 (7%)	17,19,21	2.93	8 (47%)
2	NAG	D	2	2	14,14,15	1.31	1 (7%)	17,19,21	2.53	7 (41%)
2	FUC	D	3	2	10,10,11	0.87	0	14,14,16	2.17	6 (42%)

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	B	1	1,2	-	4/6/23/26	0/1/1/1
2	NAG	B	2	2	-	2/6/23/26	0/1/1/1
2	FUC	B	3	2	1/1/4/5	-	0/1/1/1
3	NAG	C	1	3,1	-	4/6/23/26	0/1/1/1
3	FUC	C	2	3	1/1/4/5	-	0/1/1/1
2	NAG	D	1	1,2	-	4/6/23/26	0/1/1/1
2	NAG	D	2	2	-	0/6/23/26	0/1/1/1
2	FUC	D	3	2	1/1/4/5	-	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	2	NAG	C1-C2	4.37	1.58	1.52
3	C	1	NAG	C1-C2	3.04	1.56	1.52
3	C	2	FUC	C2-C3	2.30	1.56	1.52
2	D	1	NAG	C2-N2	2.24	1.50	1.46
2	B	3	FUC	C4-C5	2.21	1.57	1.52

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	NAG	C1-O5-C5	7.74	122.56	112.19
2	B	3	FUC	C1-C2-C3	-6.63	99.99	109.64
2	D	2	NAG	C1-C2-N2	5.56	119.20	110.43
2	B	1	NAG	C1-C2-N2	-4.96	102.62	110.43
2	B	1	NAG	C2-N2-C7	4.87	129.43	122.90
2	B	2	NAG	C2-N2-C7	4.69	129.19	122.90
2	B	3	FUC	C3-C4-C5	4.63	116.86	109.81
2	D	2	NAG	C3-C4-C5	-4.60	101.90	110.23
2	D	1	NAG	O7-C7-C8	-4.36	114.30	122.05
2	D	3	FUC	C3-C4-C5	4.11	116.06	109.81
2	B	1	NAG	C3-C4-C5	-4.07	102.84	110.23
2	D	1	NAG	C1-C2-N2	3.88	116.55	110.43
2	B	2	NAG	C3-C4-C5	-3.79	103.36	110.23
2	D	3	FUC	C1-C2-C3	-3.79	104.13	109.64
2	B	3	FUC	C1-O5-C5	-3.70	104.23	112.97
2	D	2	NAG	C1-O5-C5	3.61	117.03	112.19
3	C	2	FUC	O3-C3-C2	3.53	117.25	110.05
3	C	1	NAG	O4-C4-C5	3.50	117.94	109.32
2	D	3	FUC	O2-C2-C1	3.49	117.22	109.22
2	D	1	NAG	O3-C3-C2	3.36	116.37	109.40
2	B	1	NAG	C8-C7-N2	3.24	121.49	116.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	2	FUC	C1-C2-C3	-3.21	104.97	109.64
3	C	2	FUC	C3-C4-C5	3.19	114.66	109.81
2	D	2	NAG	C2-N2-C7	3.17	127.15	122.90
2	D	2	NAG	O5-C5-C6	3.14	113.77	107.66
2	D	1	NAG	C8-C7-N2	3.03	121.15	116.12
2	B	1	NAG	O6-C6-C5	3.02	121.60	111.33
3	C	2	FUC	C2-C3-C4	-2.93	105.72	110.86
3	C	1	NAG	C8-C7-N2	2.87	120.89	116.12
2	D	1	NAG	O5-C5-C4	2.87	117.82	110.83
2	D	1	NAG	C4-C3-C2	-2.87	106.81	111.02
2	B	2	NAG	O5-C5-C4	-2.83	103.94	110.83
2	D	3	FUC	C1-O5-C5	-2.68	106.65	112.97
2	B	1	NAG	O7-C7-C8	-2.65	117.34	122.05
2	D	2	NAG	O3-C3-C2	2.61	114.83	109.40
2	D	2	NAG	O4-C4-C5	2.61	115.75	109.32
2	B	2	NAG	O5-C5-C6	2.61	112.74	107.66
2	B	3	FUC	O5-C1-C2	-2.57	104.67	110.79
2	D	3	FUC	O5-C1-C2	-2.50	104.83	110.79
2	B	1	NAG	C6-C5-C4	2.48	119.10	113.02
2	B	1	NAG	O5-C1-C2	-2.43	107.54	111.29
2	B	3	FUC	O2-C2-C3	2.41	115.14	110.15
2	D	1	NAG	C2-N2-C7	2.40	126.11	122.90
3	C	1	NAG	C3-C4-C5	-2.34	105.98	110.23
2	B	2	NAG	C1-O5-C5	-2.33	109.07	112.19
3	C	1	NAG	O5-C5-C6	2.31	112.16	107.66
3	C	1	NAG	C2-N2-C7	2.29	125.97	122.90
2	B	3	FUC	C6-C5-C4	2.25	117.20	113.08
3	C	1	NAG	O7-C7-C8	-2.23	118.09	122.05
2	B	1	NAG	O5-C5-C6	2.20	111.95	107.66
2	B	3	FUC	C2-C3-C4	2.07	114.50	110.86
2	B	2	NAG	C4-C3-C2	2.03	113.99	111.02
2	B	2	NAG	C6-C5-C4	2.02	117.99	113.02
2	D	3	FUC	O3-C3-C4	2.00	115.10	110.38

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	B	3	FUC	C1
2	D	3	FUC	C1
3	C	2	FUC	C1

All (14) torsion outliers are listed below:

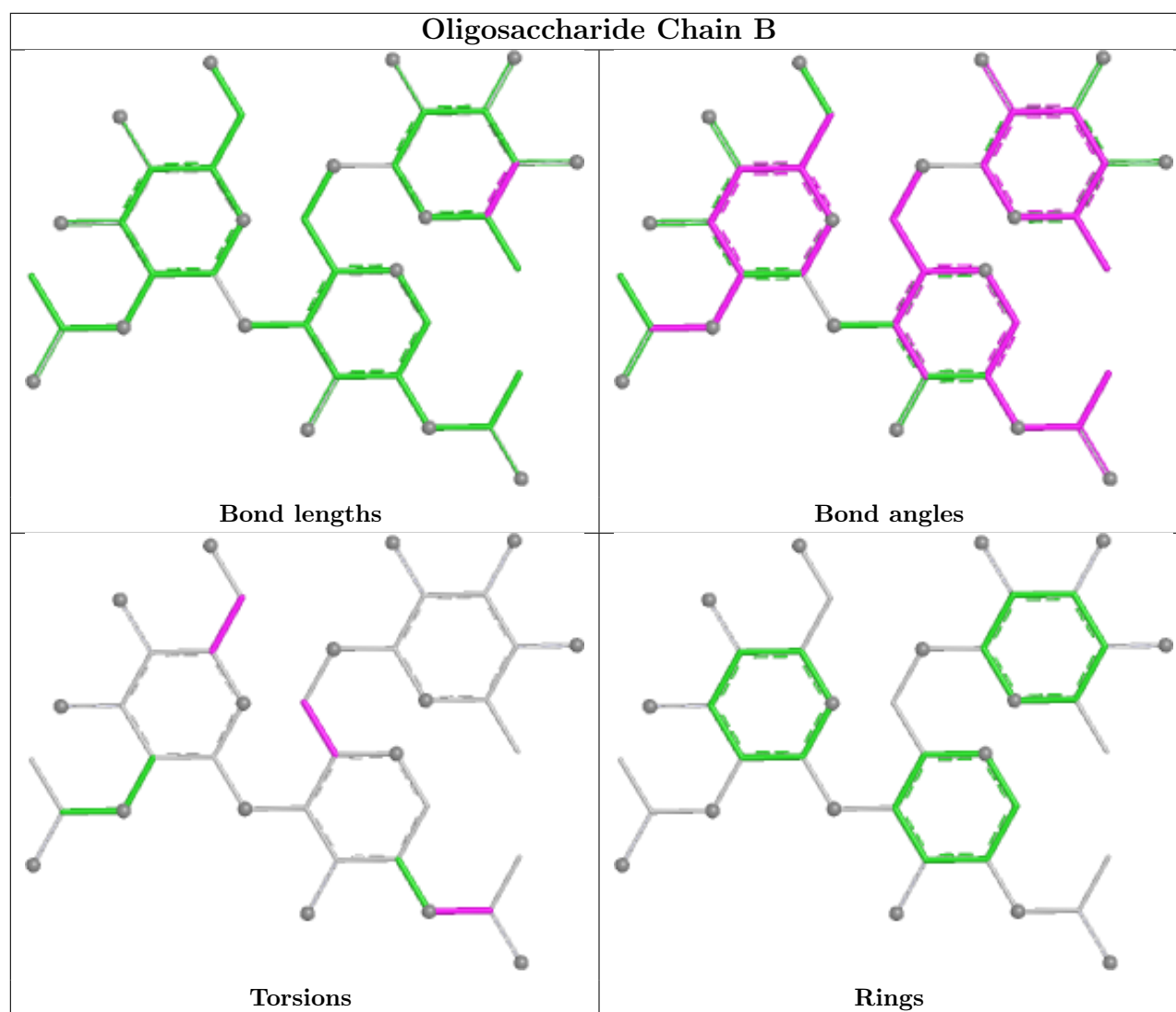
Mol	Chain	Res	Type	Atoms
3	C	1	NAG	O5-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
2	B	1	NAG	C8-C7-N2-C2
2	B	1	NAG	O7-C7-N2-C2
2	D	1	NAG	C8-C7-N2-C2
2	D	1	NAG	O7-C7-N2-C2
3	C	1	NAG	C8-C7-N2-C2
3	C	1	NAG	O7-C7-N2-C2
2	D	1	NAG	O5-C5-C6-O6
2	D	1	NAG	C4-C5-C6-O6
2	B	2	NAG	O5-C5-C6-O6
2	B	1	NAG	O5-C5-C6-O6
2	B	1	NAG	C4-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6

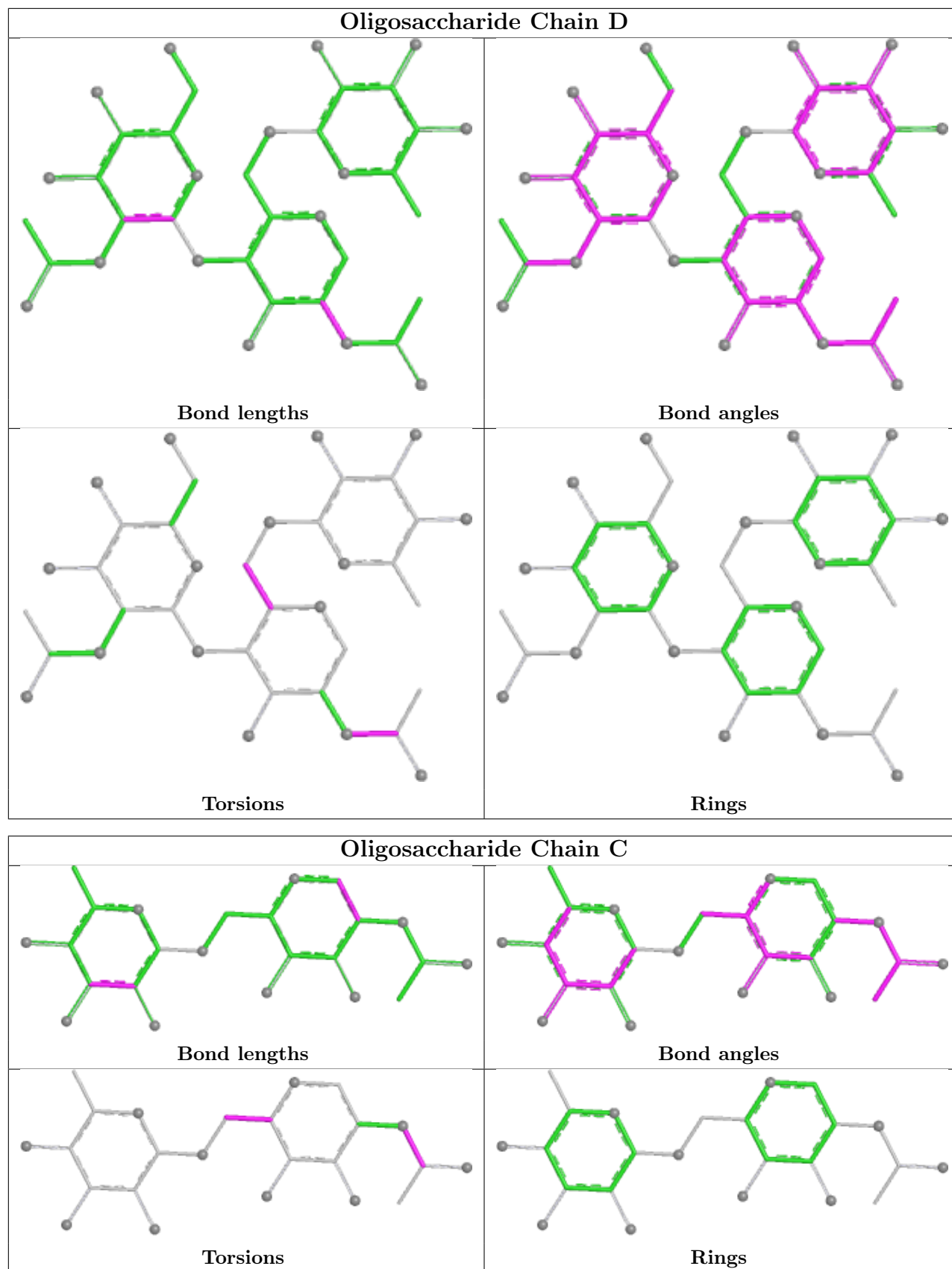
There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	1	NAG	4	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

Of 28 ligands modelled in this entry, 17 are unknown and 7 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	$\# Z > 2$
9	NAG	A	1559	1	14,14,15	0.76	0	17,19,21	2.55	5 (29%)
9	NAG	A	1561	1	14,14,15	0.95	0	17,19,21	2.76	7 (41%)
6	SO4	A	1548	-	4,4,4	0.48	0	6,6,6	0.43	0
9	NAG	A	1560	1	14,14,15	0.76	0	17,19,21	2.49	5 (29%)

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
9	NAG	A	1559	1	-	4/6/23/26	0/1/1/1
9	NAG	A	1561	1	1/1/5/7	4/6/23/26	0/1/1/1
9	NAG	A	1560	1	-	1/6/23/26	0/1/1/1

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	1561	NAG	C2-N2-C7	7.64	133.13	122.90
9	A	1559	NAG	C1-O5-C5	7.56	122.32	112.19
9	A	1560	NAG	C1-O5-C5	6.88	121.40	112.19
9	A	1561	NAG	C1-O5-C5	5.82	119.99	112.19
9	A	1559	NAG	C4-C3-C2	-4.74	104.07	111.02
9	A	1560	NAG	C4-C3-C2	-4.01	105.14	111.02
9	A	1561	NAG	C4-C3-C2	3.51	116.16	111.02
9	A	1560	NAG	O5-C5-C6	3.35	114.18	107.66
9	A	1560	NAG	O4-C4-C3	2.89	117.19	110.38
9	A	1559	NAG	O3-C3-C4	2.67	116.68	110.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	1559	NAG	O4-C4-C3	2.45	116.16	110.38
9	A	1561	NAG	O4-C4-C5	2.45	115.36	109.32
9	A	1561	NAG	O5-C1-C2	2.31	114.86	111.29
9	A	1559	NAG	C8-C7-N2	2.21	119.79	116.12
9	A	1561	NAG	O7-C7-N2	2.12	125.73	121.98
9	A	1561	NAG	O7-C7-C8	-2.11	118.29	122.05
9	A	1560	NAG	C6-C5-C4	-2.00	108.10	113.02

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
9	A	1561	NAG	C1

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	1559	NAG	O5-C5-C6-O6
9	A	1559	NAG	C4-C5-C6-O6
9	A	1559	NAG	C8-C7-N2-C2
9	A	1559	NAG	O7-C7-N2-C2
9	A	1561	NAG	C4-C5-C6-O6
9	A	1561	NAG	O5-C5-C6-O6
9	A	1560	NAG	C4-C5-C6-O6
9	A	1561	NAG	C1-C2-N2-C7
9	A	1561	NAG	C3-C2-N2-C7

There are no ring outliers.

No monomer is involved in short contacts.

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	527/529 (99%)	-0.18	8 (1%) 72 68	21, 42, 73, 108	10 (1%)

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	379	ASP	4.6
1	A	258	THR	4.5
1	A	237	TYR	4.1
1	A	377	VAL	3.7
1	A	282	TYR	3.3
1	A	378	ASP	2.7
1	A	4	ILE	2.1
1	A	40	ARG	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.

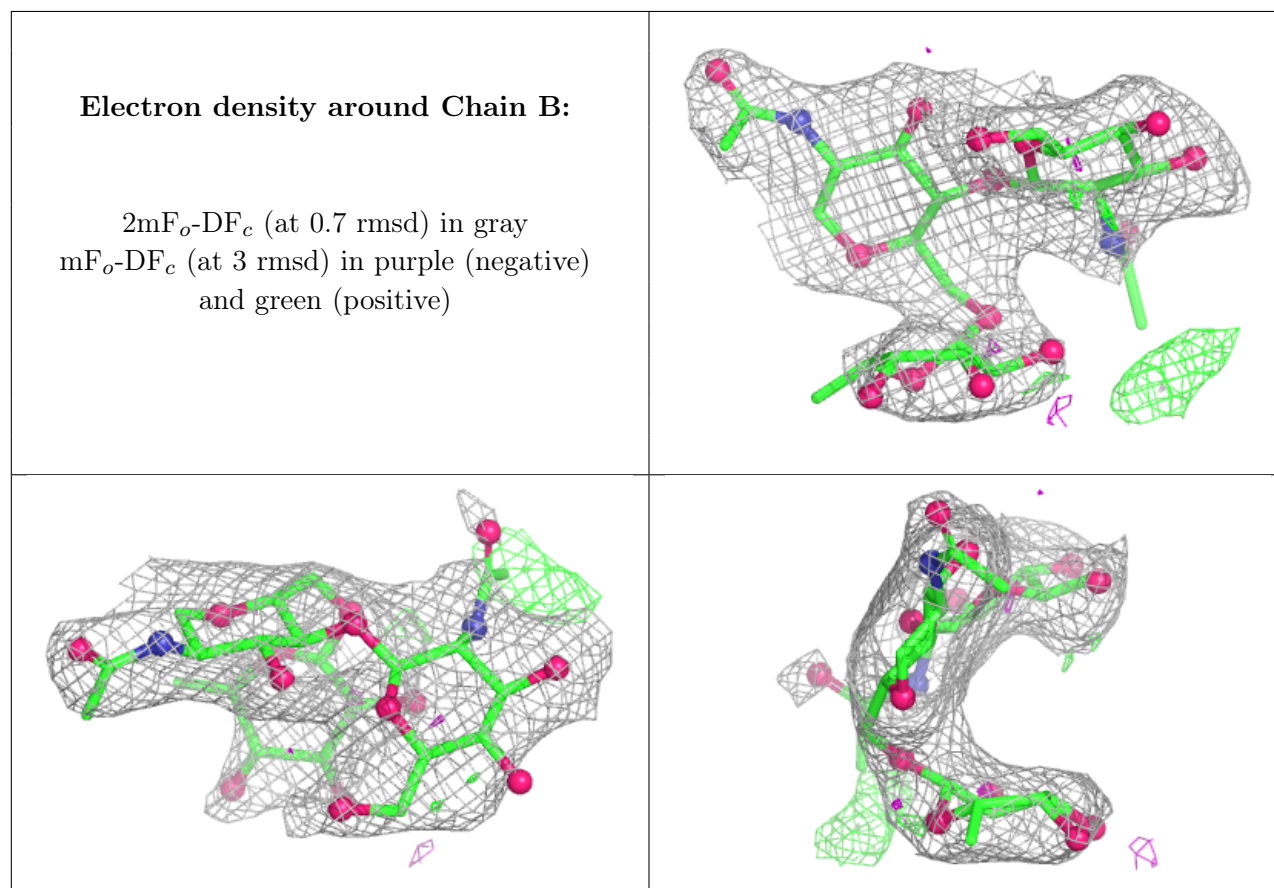
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	B	2	14/15	0.65	0.18	76,83,87,88	0
2	NAG	D	1	14/15	0.68	0.17	75,87,92,93	0
2	NAG	D	2	14/15	0.71	0.16	88,96,98,99	0
2	FUC	B	3	10/11	0.76	0.19	84,86,88,88	0

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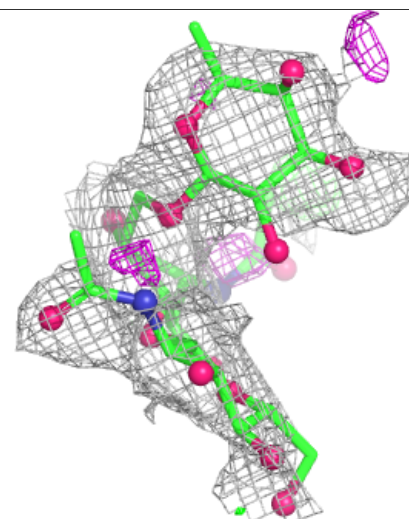
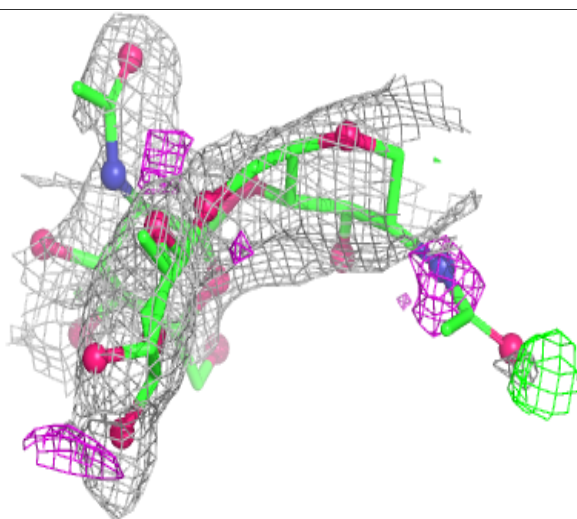
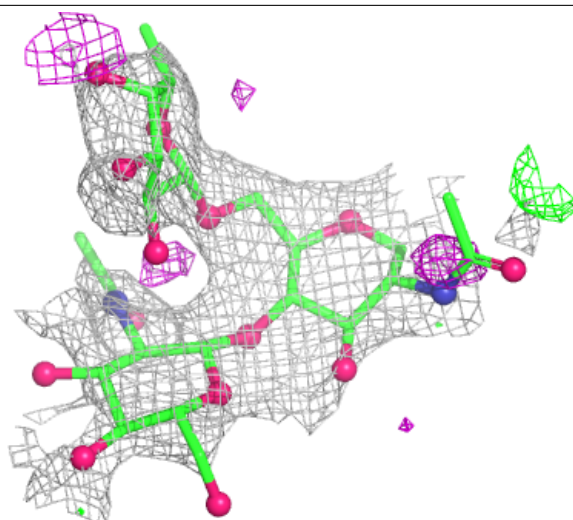
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NAG	C	1	14/15	0.77	0.12	56,64,68,68	0
3	FUC	C	2	10/11	0.81	0.17	66,70,73,73	0
2	FUC	D	3	10/11	0.87	0.14	89,91,92,93	0
2	NAG	B	1	14/15	0.93	0.10	46,56,70,78	0

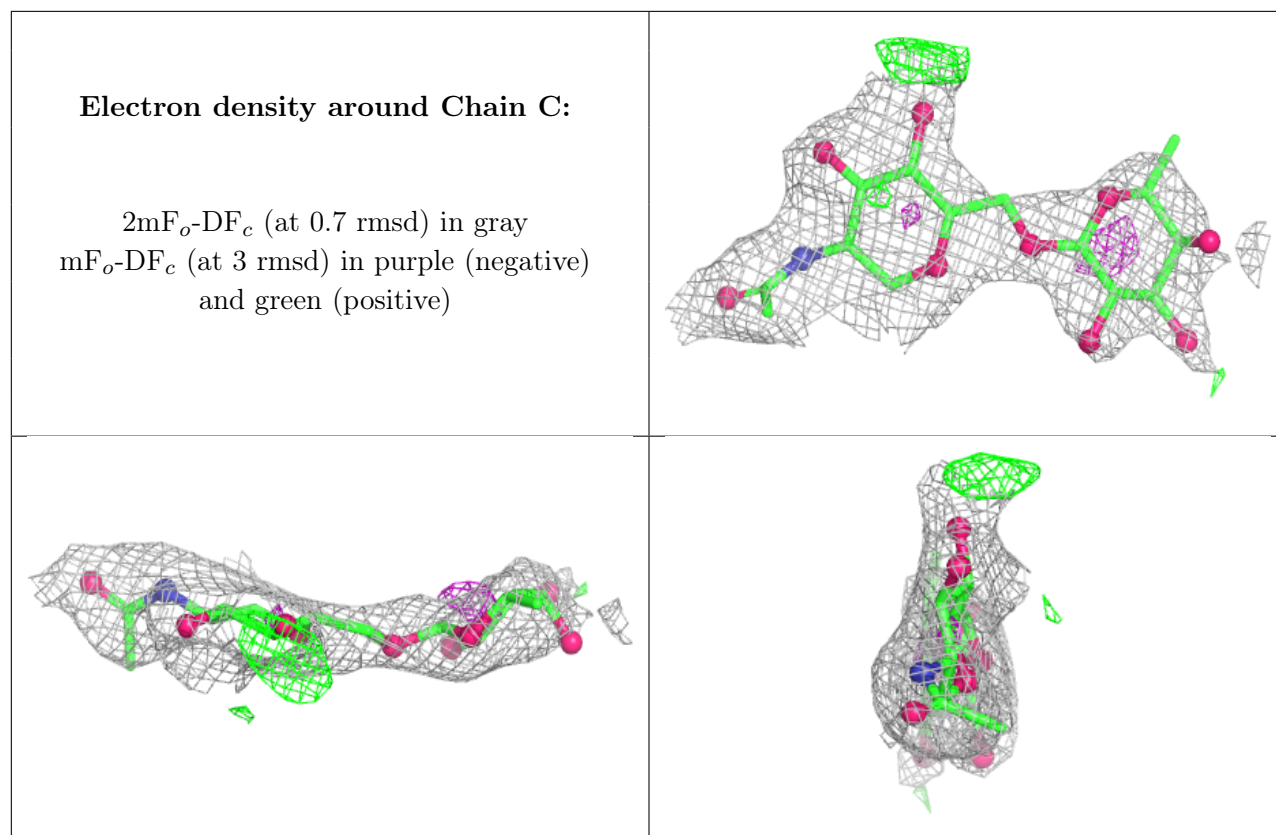
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



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 ⓘ

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
9	NAG	A	1561	14/15	0.37	0.21	80,90,95,95	0
9	NAG	A	1559	14/15	0.49	0.18	72,81,83,85	0
4	UNX	A	1545	1/1	0.65	0.23	59,59,59,59	0
9	NAG	A	1560	14/15	0.71	0.17	69,77,83,85	0
7	CL	A	1565	1/1	0.81	0.20	71,71,71,71	0
8	K	A	1553	1/1	0.87	0.12	79,79,79,79	0
7	CL	A	1549	1/1	0.87	0.09	91,91,91,91	0
7	CL	A	1550	1/1	0.87	0.18	72,72,72,72	0
4	UNX	A	1546	1/1	0.87	0.19	43,43,43,43	0
6	SO4	A	1548	5/5	0.88	0.21	68,68,69,71	0
4	UNX	A	1536	1/1	0.89	0.14	51,51,51,51	0
4	UNX	A	1532	1/1	0.90	0.15	38,38,38,38	0
4	UNX	A	1531	1/1	0.90	0.14	33,33,33,33	0
4	UNX	A	1535	1/1	0.91	0.14	35,35,35,35	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	UNX	A	1542	1/1	0.91	0.12	13,13,13,13	0
7	CL	A	1551	1/1	0.91	0.24	77,77,77,77	0
4	UNX	A	1544	1/1	0.91	0.06	12,12,12,12	0
4	UNX	A	1540	1/1	0.92	0.08	16,16,16,16	0
5	F	A	1530	1/1	0.93	0.08	34,34,34,34	0
4	UNX	A	1534	1/1	0.93	0.11	24,24,24,24	0
4	UNX	A	1539	1/1	0.93	0.07	22,22,22,22	0
4	UNX	A	1543	1/1	0.93	0.11	23,23,23,23	0
4	UNX	A	1547	1/1	0.93	0.10	28,28,28,28	0
7	CL	A	1552	1/1	0.95	0.15	63,63,63,63	0
4	UNX	A	1533	1/1	0.95	0.18	23,23,23,23	0
4	UNX	A	1538	1/1	0.96	0.06	33,33,33,33	0
4	UNX	A	1537	1/1	0.96	0.06	28,28,28,28	0
4	UNX	A	1541	1/1	0.98	0.05	34,34,34,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.