



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:24 PM UTC

PDB ID : 7G5O / pdb_00007g5o
Title : Crystal Structure of rat Autotaxin in complex with (3,5-dichlorophenyl)methyl rac-(3aR,6aS)-2,3,3a,4,6,6a-hexahydro-1H-pyrrolo[3,4-c]pyrrole-5-carboxylate
Authors : Stihle, M.; Benz, J.; Hunziker, D.; Rudolph, M.G.
Deposited on : 2023-06-05
Resolution : 1.74 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

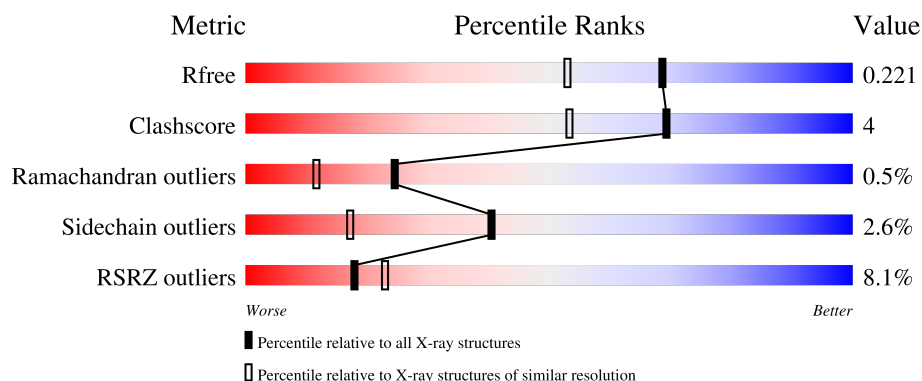
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

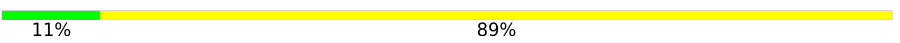
The reported resolution of this entry is 1.74 Å.

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	1187 (1.74-1.74)
Clashscore	190562	1207 (1.74-1.74)
Ramachandran outliers	187476	1200 (1.74-1.74)
Sidechain outliers	187428	1200 (1.74-1.74)
RSRZ outliers	180081	1188 (1.74-1.74)

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	846	
2	B	9	

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 7341 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.

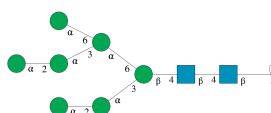
- Molecule 1 is a protein called Isoform 2 of Ectonucleotide pyrophosphatase/phosphodiesterase family member 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	806	Total	C	N	O	S	0	18	0
			6642	4223	1143	1226	50			

There are 14 discrepancies between the modelled and reference sequences:

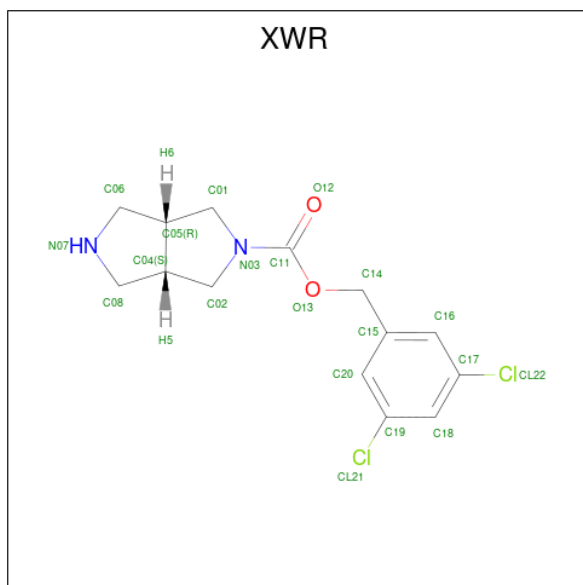
Chain	Residue	Modelled	Actual	Comment	Reference
A	53	ALA	ASN	engineered mutation	UNP Q64610
A	410	ALA	ASN	engineered mutation	UNP Q64610
A	591	THR	ARG	engineered mutation	UNP Q64610
A	863	GLY	-	expression tag	UNP Q64610
A	864	GLY	-	expression tag	UNP Q64610
A	865	ARG	-	expression tag	UNP Q64610
A	866	HIS	-	expression tag	UNP Q64610
A	867	HIS	-	expression tag	UNP Q64610
A	868	HIS	-	expression tag	UNP Q64610
A	869	HIS	-	expression tag	UNP Q64610
A	870	HIS	-	expression tag	UNP Q64610
A	871	HIS	-	expression tag	UNP Q64610
A	872	HIS	-	expression tag	UNP Q64610
A	873	HIS	-	expression tag	UNP Q64610

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)]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	B	9	Total	C	N	O	0	0	0
			105	58	2	45			

- Molecule 3 is (3,5-dichlorophenyl)methyl (3aR,6aS)-hexahydropyrrolo[3,4-c]pyrrole-2(1H)-carboxylate (CCD ID: XWR) (formula: $C_{14}H_{16}Cl_2N_2O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	Cl	N	O	0	0
			20	14	2	2	2		

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 6 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	4	Total	Cl	0	0
			4	4		

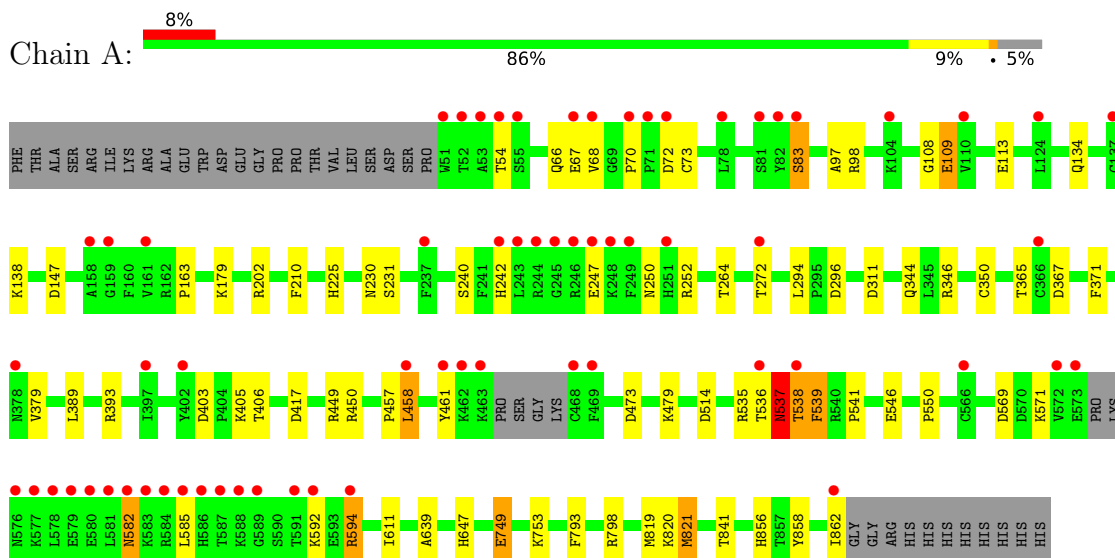
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	568	Total	O	0	0
			568	568		

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: Isoform 2 of Ectonucleotide pyrophosphatase/phosphodiesterase family member 2



- Molecule 2: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	83.92Å 92.09Å 120.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.96 – 1.74 41.96 – 1.74	Depositor EDS
% Data completeness (in resolution range)	96.3 (41.96-1.74) 96.3 (41.96-1.74)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.23 (at 1.74Å)	Xtriage
Refinement program	REFMAC 5.8.0411	Depositor
R, R_{free}	0.175 , 0.213 0.185 , 0.221	Depositor DCC
R_{free} test set	4875 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	22.1	Xtriage
Anisotropy	0.255	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 29.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7341	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.43% 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: NAG, ZN, XWR, BMA, CL, MAN, CA

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.91	1/6865 (0.0%)	1.18	17/9309 (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	7

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	856	HIS	CE1-NE2	-5.61	1.26	1.32

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	272	THR	CB-CA-C	8.12	123.08	109.84
1	A	539[A]	PHE	CA-C-N	7.33	131.43	122.42
1	A	539[A]	PHE	C-N-CA	7.33	131.43	122.42
1	A	539[B]	PHE	CA-C-N	7.33	131.43	122.42
1	A	539[B]	PHE	C-N-CA	7.33	131.43	122.42
1	A	344	GLN	CB-CA-C	-7.22	98.80	110.79
1	A	225	HIS	CA-CB-CG	6.51	120.31	113.80
1	A	473	ASP	CA-CB-CG	6.28	118.88	112.60
1	A	113	GLU	CB-CG-CD	5.86	122.57	112.60
1	A	147	ASP	CA-C-N	-5.80	112.14	122.07
1	A	147	ASP	C-N-CA	-5.80	112.14	122.07
1	A	264	THR	CA-CB-OG1	-5.40	101.50	109.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	311	ASP	CA-CB-CG	5.22	117.82	112.60
1	A	231	SER	CA-C-O	-5.15	115.14	120.70
1	A	147	ASP	CB-CA-C	-5.11	100.48	109.62
1	A	202	ARG	CA-C-O	5.10	123.38	119.46
1	A	749	GLU	CB-CG-CD	5.07	121.22	112.60

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	346	ARG	Sidechain
1	A	393	ARG	Sidechain
1	A	449[A]	ARG	Sidechain
1	A	449[B]	ARG	Sidechain
1	A	537[B]	ASN	Peptide
1	A	538[B]	THR	Peptide
1	A	798	ARG	Sidechain

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	6642	0	6421	47	0
2	B	105	0	88	0	0
3	A	20	0	0	4	0
4	A	1	0	0	0	0
5	A	1	0	0	0	0
6	A	4	0	0	0	0
7	A	568	0	0	11	0
All	All	7341	0	6509	47	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 4.

All (47) 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:594[A]:ARG:HH11	1:A:594[A]:ARG:CG	1.51	1.16
1:A:594[A]:ARG:HG3	1:A:594[A]:ARG:NH1	1.67	1.04
1:A:594[A]:ARG:HH11	1:A:594[A]:ARG:HG3	0.84	1.01
1:A:230[A]:ASN:ND2	7:A:1003:HOH:O	1.83	0.93
1:A:594[A]:ARG:CG	1:A:594[A]:ARG:NH1	2.17	0.88
1:A:536[B]:THR:O	1:A:537[B]:ASN:HB2	1.71	0.87
1:A:539[A]:PHE:O	1:A:541:PRO:HD3	1.78	0.84
1:A:134:GLN:NE2	7:A:1004:HOH:O	2.14	0.77
1:A:592:LYS:HA	7:A:1116:HOH:O	1.85	0.76
1:A:821:MET:HA	1:A:821:MET:HE2	1.67	0.74
1:A:594[A]:ARG:NH1	1:A:594[A]:ARG:HG2	2.07	0.68
1:A:210[B]:PHE:CE1	3:A:901:XWR:C08	2.82	0.62
1:A:54:THR:HA	1:A:73:CYS:HB3	1.80	0.62
1:A:536[B]:THR:O	1:A:537[B]:ASN:CB	2.46	0.62
1:A:582:ASN:HD22	1:A:585:LEU:HD12	1.64	0.62
1:A:240:SER:O	1:A:247:GLU:HG2	2.01	0.61
1:A:546:GLU:OE1	7:A:1005:HOH:O	2.15	0.60
1:A:403:ASP:OD2	1:A:406:THR:HG23	2.03	0.59
1:A:250:ASN:OD1	1:A:252:ARG:HG2	2.03	0.59
1:A:535:ARG:HG2	1:A:536[A]:THR:HG23	1.85	0.58
1:A:820:LYS:HE2	1:A:858[B]:TYR:CD2	2.40	0.57
1:A:793:PHE:CE2	1:A:819:MET:HE3	2.44	0.53
1:A:821:MET:CE	7:A:1479:HOH:O	2.57	0.53
1:A:210[A]:PHE:CE1	3:A:901:XWR:C08	2.95	0.50
1:A:479:LYS:HE2	7:A:1077:HOH:O	2.12	0.50
1:A:538[B]:THR:HG22	1:A:538[B]:THR:O	2.12	0.50
1:A:539[A]:PHE:O	1:A:541:PRO:CD	2.57	0.49
1:A:753:LYS:NZ	7:A:1020:HOH:O	2.45	0.49
1:A:514:ASP:O	1:A:537[B]:ASN:ND2	2.46	0.48
1:A:371:PHE:CE1	1:A:457:PRO:HA	2.49	0.47
1:A:294:LEU:O	7:A:1006:HOH:O	2.21	0.46
1:A:365:THR:OG1	1:A:367:ASP:OD1	2.27	0.46
1:A:582:ASN:ND2	1:A:585:LEU:HD12	2.30	0.46
1:A:296:ASP:N	1:A:296:ASP:OD1	2.49	0.46
1:A:210[A]:PHE:CZ	3:A:901:XWR:C08	2.99	0.45
1:A:569:ASP:OD2	1:A:647:HIS:HD2	1.99	0.45
1:A:841:THR:HB	7:A:1453:HOH:O	2.18	0.44
1:A:97:ALA:O	1:A:98:ARG:HB2	2.16	0.43
1:A:639:ALA:HB2	7:A:1206:HOH:O	2.18	0.43
1:A:163:PRO:HB3	1:A:350:CYS:O	2.19	0.43
1:A:210[B]:PHE:CZ	3:A:901:XWR:C08	3.02	0.42
1:A:458:LEU:HA	1:A:461[A]:TYR:CE2	2.55	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:821:MET:HE2	7:A:1479:HOH:O	2.20	0.41
1:A:550:PRO:HB2	1:A:611[A]:ILE:HG12	2.02	0.41
1:A:108:GLY:O	1:A:109:GLU:C	2.64	0.41
1:A:569:ASP:OD2	1:A:647:HIS:CD2	2.74	0.41

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	818/846 (97%)	787 (96%)	26 (3%)	5 (1%)	21 8

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	537[A]	ASN
1	A	537[B]	ASN
1	A	70	PRO
1	A	83	SER
1	A	109	GLU

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	747/765 (98%)	727 (97%)	20 (3%)	39	16

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	66	GLN
1	A	67	GLU
1	A	68	VAL
1	A	72	ASP
1	A	83	SER
1	A	138	LYS
1	A	179	LYS
1	A	242	HIS
1	A	379	VAL
1	A	389	LEU
1	A	405	LYS
1	A	417	ASP
1	A	458	LEU
1	A	571	LYS
1	A	582	ASN
1	A	594[A]	ARG
1	A	594[B]	ARG
1	A	749	GLU
1	A	821	MET
1	A	862	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	257	GLN
1	A	436	ASN
1	A	471	GLN
1	A	582	ASN
1	A	647	HIS

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	B	1	1,2	14,14,15	0.58	0	17,19,21	0.97	1 (5%)
2	NAG	B	2	2	14,14,15	0.80	0	17,19,21	1.14	1 (5%)
2	BMA	B	3	2	11,11,12	0.77	0	15,15,17	1.04	0
2	MAN	B	4	2	11,11,12	1.52	2 (18%)	15,15,17	1.79	2 (13%)
2	MAN	B	5	2	11,11,12	1.28	2 (18%)	15,15,17	1.00	0
2	MAN	B	6	2	11,11,12	1.35	1 (9%)	15,15,17	1.06	1 (6%)
2	MAN	B	7	2	11,11,12	1.48	2 (18%)	15,15,17	1.02	1 (6%)
2	MAN	B	8	2	11,11,12	0.71	0	15,15,17	1.12	2 (13%)
2	MAN	B	9	2	11,11,12	1.61	1 (9%)	15,15,17	1.54	2 (13%)

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	-	0/6/23/26	0/1/1/1
2	NAG	B	2	2	-	1/6/23/26	0/1/1/1
2	BMA	B	3	2	-	0/2/19/22	0/1/1/1
2	MAN	B	4	2	-	2/2/19/22	0/1/1/1
2	MAN	B	5	2	-	0/2/19/22	0/1/1/1
2	MAN	B	6	2	-	0/2/19/22	0/1/1/1
2	MAN	B	7	2	-	0/2/19/22	0/1/1/1
2	MAN	B	8	2	-	2/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	MAN	B	9	2	-	2/2/19/22	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	9	MAN	C2-C3	4.67	1.59	1.52
2	B	7	MAN	C2-C3	3.64	1.58	1.52
2	B	6	MAN	O5-C5	3.14	1.49	1.43
2	B	4	MAN	C2-C3	2.87	1.56	1.52
2	B	4	MAN	O5-C5	2.81	1.48	1.43
2	B	5	MAN	O5-C5	2.37	1.48	1.43
2	B	5	MAN	C2-C3	2.34	1.56	1.52
2	B	7	MAN	O5-C5	2.14	1.47	1.43

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	4	MAN	C1-O5-C5	5.82	119.98	112.19
2	B	2	NAG	C1-O5-C5	3.63	117.05	112.19
2	B	9	MAN	O2-C2-C3	3.43	117.27	110.15
2	B	9	MAN	O3-C3-C2	3.11	116.39	110.05
2	B	1	NAG	O4-C4-C5	-2.86	102.28	109.32
2	B	7	MAN	O2-C2-C3	2.59	115.53	110.15
2	B	8	MAN	C1-O5-C5	2.45	115.47	112.19
2	B	6	MAN	C1-C2-C3	2.16	112.80	109.64
2	B	8	MAN	O2-C2-C1	2.16	114.17	109.22
2	B	4	MAN	O3-C3-C2	2.07	114.28	110.05

There are no chirality outliers.

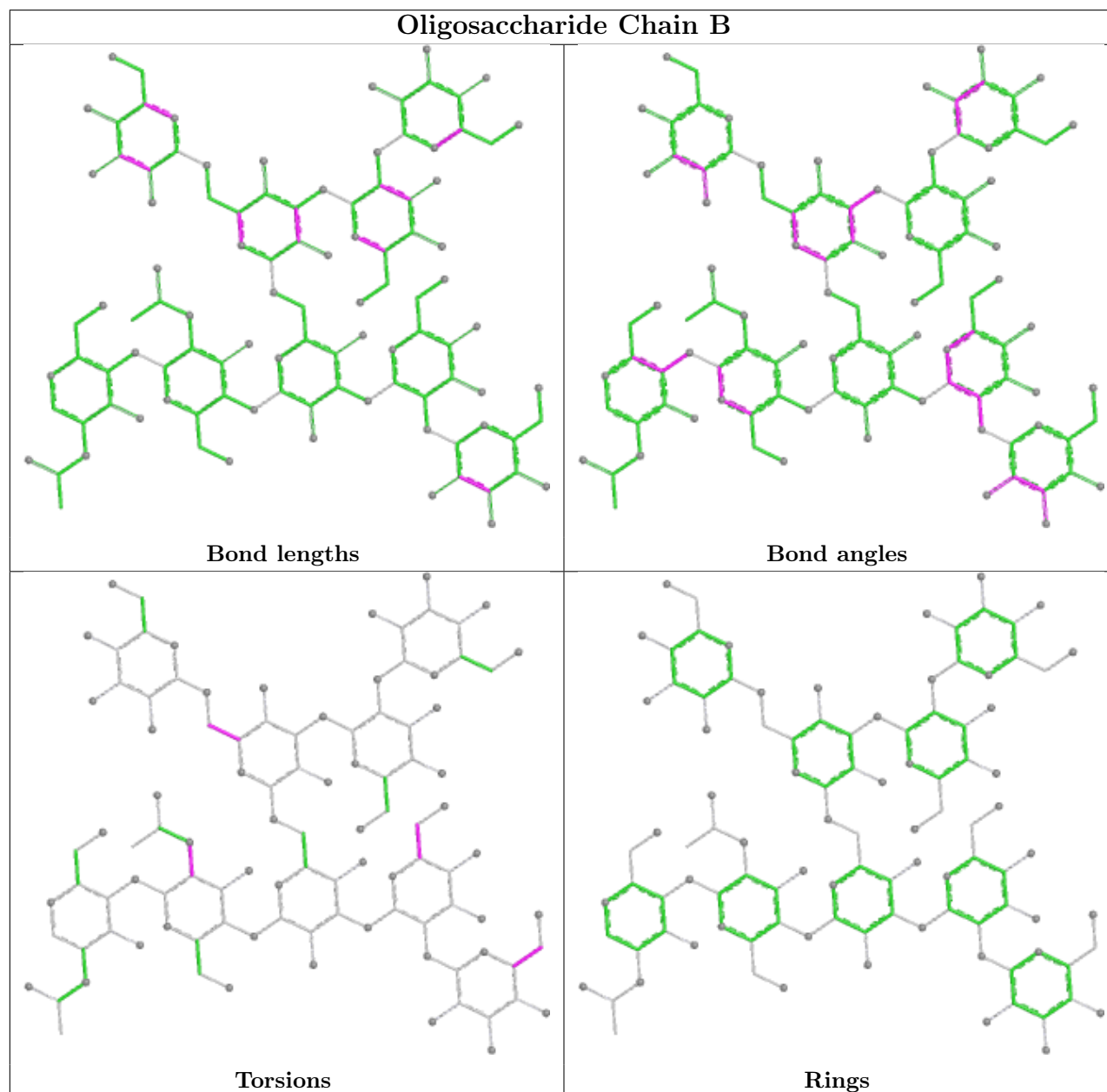
All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	8	MAN	O5-C5-C6-O6
2	B	9	MAN	O5-C5-C6-O6
2	B	4	MAN	C4-C5-C6-O6
2	B	9	MAN	C4-C5-C6-O6
2	B	4	MAN	O5-C5-C6-O6
2	B	8	MAN	C4-C5-C6-O6
2	B	2	NAG	C1-C2-N2-C7

There are no ring outliers.

No monomer is involved in short contacts.

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 7 ligands modelled in this entry, 6 are monoatomic - leaving 1 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	$\# Z > 2$
3	XWR	A	901	-	20,22,22	1.90	7 (35%)	27,31,31	3.05	11 (40%)

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	XWR	A	901	-	-	0/9/27/27	0/3/3/3

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	901	XWR	O13-C11	4.24	1.42	1.34
3	A	901	XWR	O12-C11	3.16	1.25	1.21
3	A	901	XWR	C16-C17	2.65	1.42	1.38
3	A	901	XWR	O13-C14	2.44	1.50	1.45
3	A	901	XWR	C20-C15	-2.40	1.35	1.39
3	A	901	XWR	C11-N03	2.36	1.39	1.35
3	A	901	XWR	C19-CL21	-2.11	1.69	1.74

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	901	XWR	O12-C11-N03	-7.05	111.24	124.30
3	A	901	XWR	C18-C19-CL21	-6.56	110.94	119.17
3	A	901	XWR	O13-C11-N03	5.99	122.22	111.77
3	A	901	XWR	C20-C19-C18	5.63	128.48	121.64
3	A	901	XWR	C14-O13-C11	4.66	127.25	115.51
3	A	901	XWR	C19-C20-C15	-4.58	115.04	119.71
3	A	901	XWR	C19-C18-C17	-3.36	113.39	117.43
3	A	901	XWR	C02-C04-C05	2.29	106.83	103.56
3	A	901	XWR	C01-N03-C11	-2.27	117.06	123.86
3	A	901	XWR	C08-C04-C05	-2.21	100.41	103.56
3	A	901	XWR	C04-C02-N03	-2.14	99.79	103.02

There are no chirality outliers.

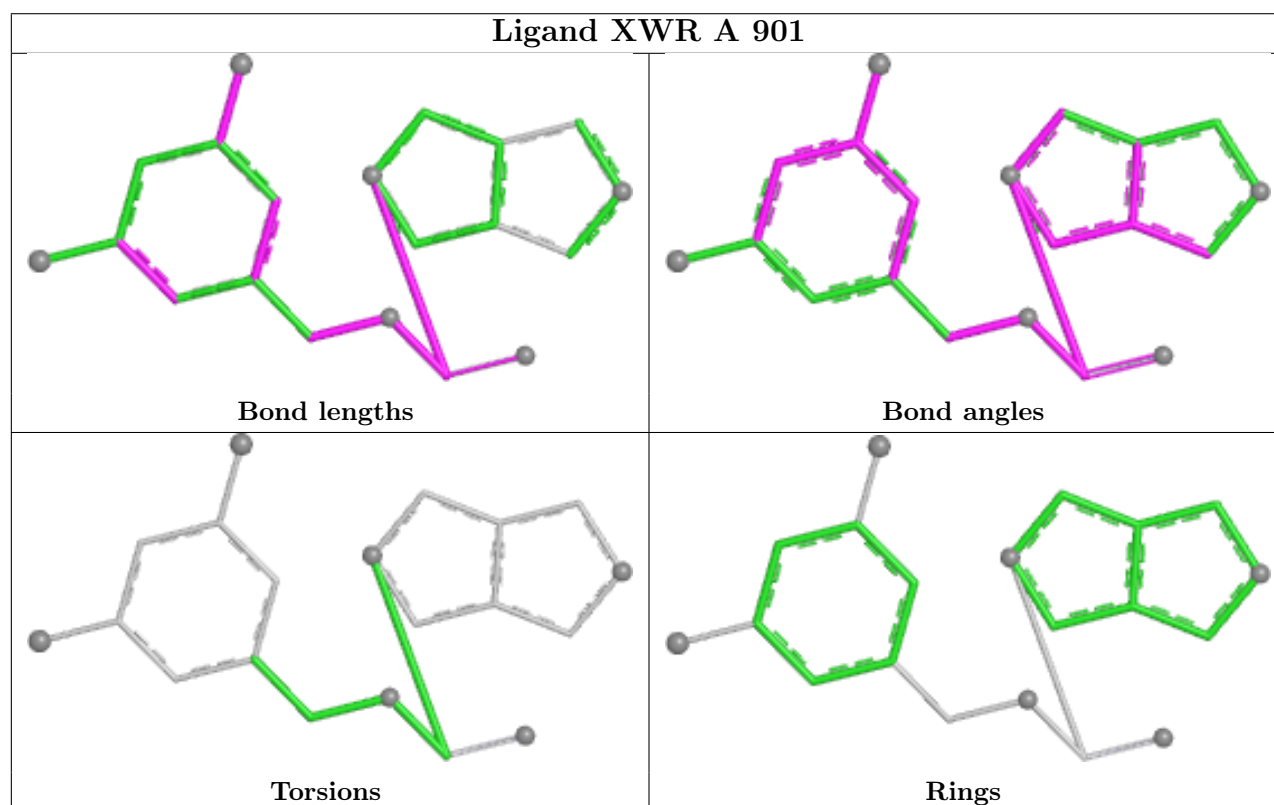
There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	901	XWR	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 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.



5.7 Other polymers ⓘ

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 ⓘ

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	806/846 (95%)	0.23	65 (8%) 18 23	10, 25, 78, 138	18 (2%)

All (65) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	249	PHE	7.6
1	A	581	LEU	7.0
1	A	243	LEU	6.8
1	A	469	PHE	6.8
1	A	572	VAL	6.5
1	A	578	LEU	6.3
1	A	51	TRP	5.8
1	A	468	CYS	5.8
1	A	585	LEU	5.5
1	A	68	VAL	4.9
1	A	862	ILE	4.8
1	A	587	THR	4.7
1	A	82	TYR	4.5
1	A	71	PRO	4.5
1	A	582	ASN	4.1
1	A	397	ILE	3.8
1	A	584	ARG	3.8
1	A	591	THR	3.7
1	A	54	THR	3.6
1	A	579	GLU	3.6
1	A	586	HIS	3.4
1	A	242	HIS	3.3
1	A	577	LYS	3.2
1	A	161	VAL	3.2
1	A	55	SER	3.2
1	A	237	PHE	3.2
1	A	461[A]	TYR	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	70	PRO	3.1
1	A	247	GLU	3.1
1	A	159	GLY	3.0
1	A	583	LYS	3.0
1	A	402	TYR	3.0
1	A	248	LYS	2.9
1	A	244	ARG	2.9
1	A	462	LYS	2.9
1	A	52	THR	2.9
1	A	573	GLU	2.9
1	A	104	LYS	2.8
1	A	566	CYS	2.7
1	A	538[A]	THR	2.7
1	A	158	ALA	2.7
1	A	580	GLU	2.7
1	A	78	LEU	2.7
1	A	245	GLY	2.7
1	A	251	HIS	2.6
1	A	366	CYS	2.6
1	A	576	ASN	2.6
1	A	246	ARG	2.6
1	A	588	LYS	2.6
1	A	110	VAL	2.5
1	A	463	LYS	2.5
1	A	589	GLY	2.5
1	A	378	ASN	2.4
1	A	81	SER	2.4
1	A	272	THR	2.3
1	A	137	CYS	2.3
1	A	592	LYS	2.3
1	A	53	ALA	2.2
1	A	124	LEU	2.2
1	A	458	LEU	2.1
1	A	67	GLU	2.1
1	A	72	ASP	2.1
1	A	83	SER	2.0
1	A	536[A]	THR	2.0
1	A	594[A]	ARG	2.0

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

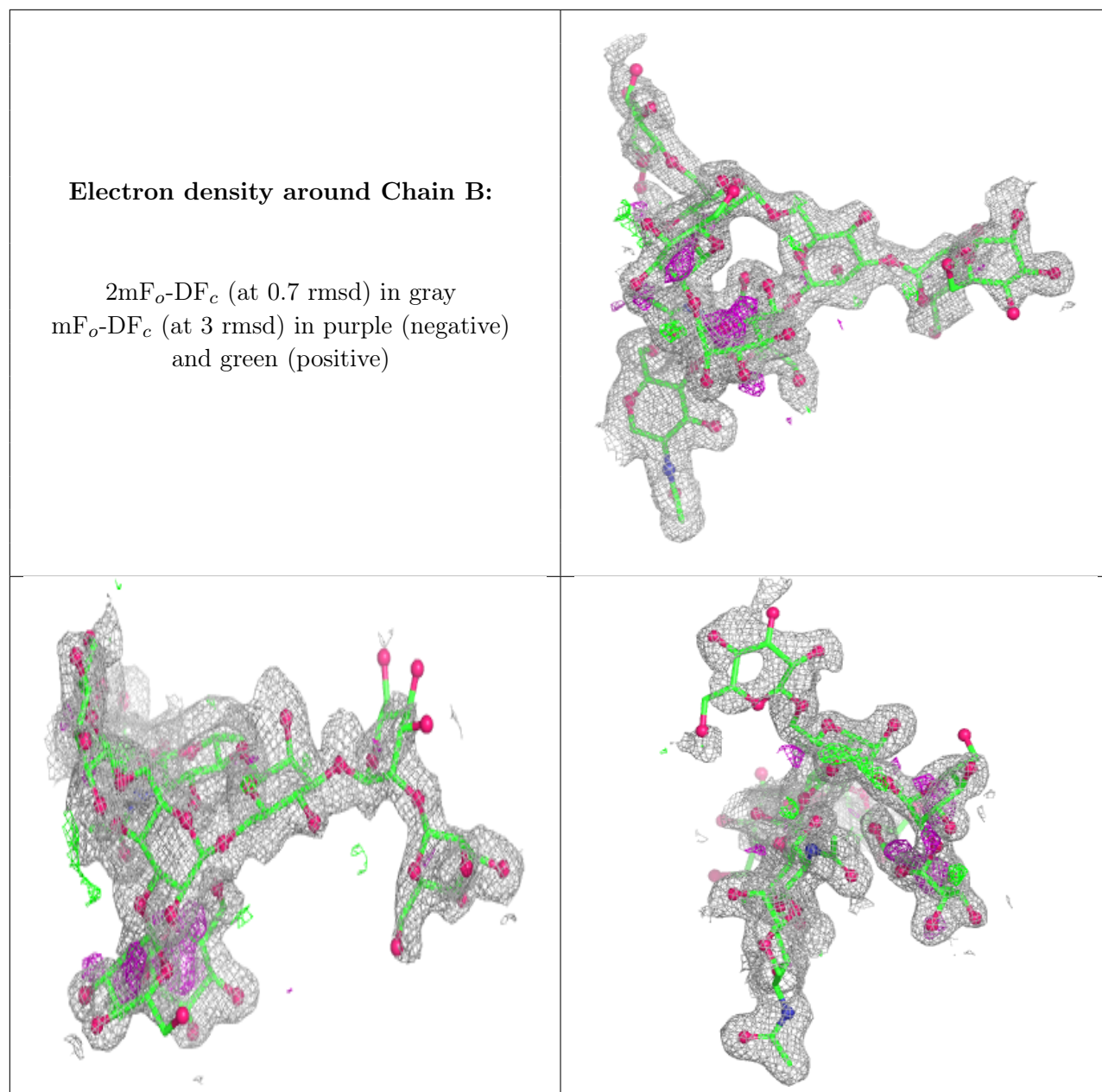
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

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	MAN	B	8	11/12	0.42	0.17	89,111,120,123	0
2	MAN	B	7	11/12	0.57	0.16	73,93,102,104	0
2	BMA	B	3	11/12	0.72	0.13	51,66,71,77	0
2	MAN	B	9	11/12	0.77	0.14	42,75,85,85	0
2	MAN	B	4	11/12	0.80	0.12	50,62,69,73	0
2	MAN	B	5	11/12	0.81	0.15	40,58,65,83	0
2	MAN	B	6	11/12	0.87	0.15	29,48,54,56	0
2	NAG	B	2	14/15	0.90	0.10	26,36,43,55	0
2	NAG	B	1	14/15	0.98	0.06	14,17,21,22	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.



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.

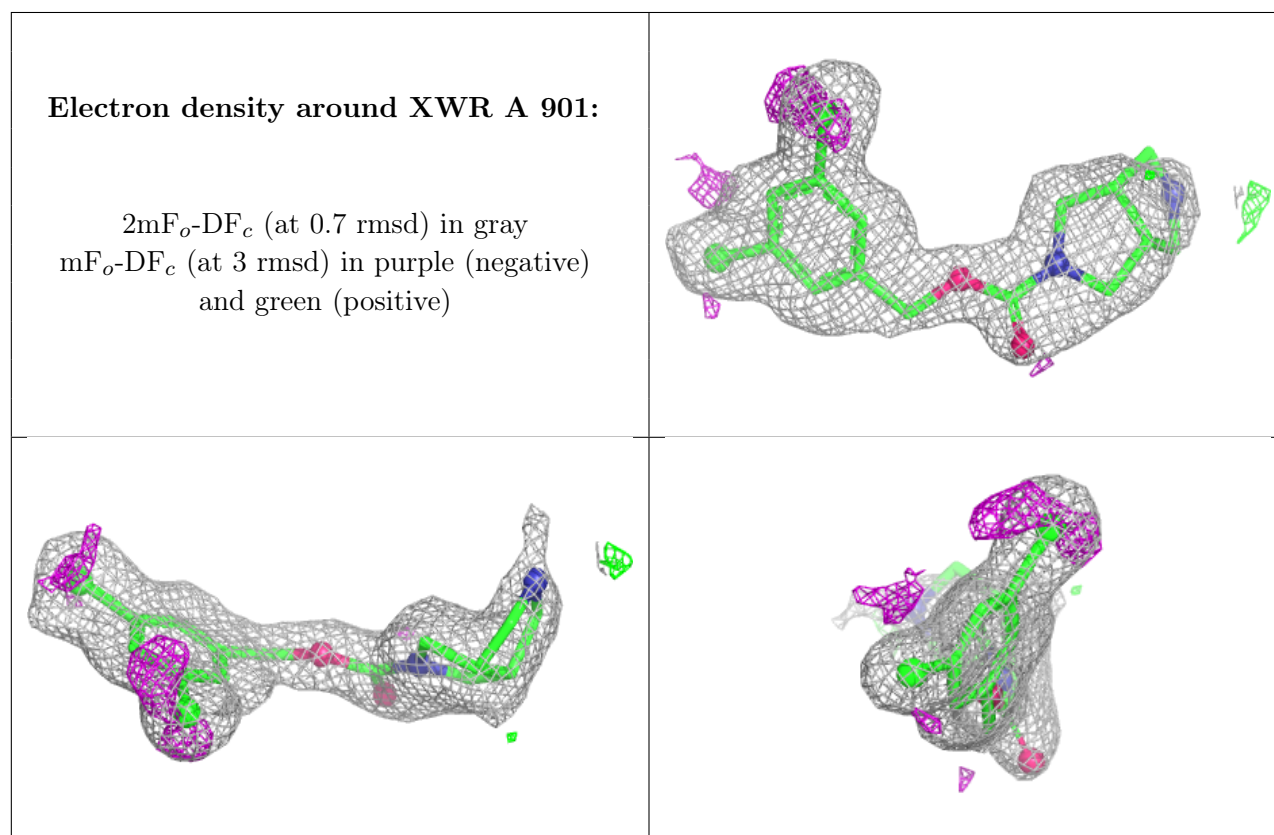
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	XWR	A	901	20/20	0.91	0.13	28,46,62,69	0
6	CL	A	905	1/1	0.94	0.09	44,44,44,44	0
6	CL	A	907	1/1	0.96	0.12	42,42,42,42	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
6	CL	A	906	1/1	0.97	0.07	47,47,47,47	0
6	CL	A	904	1/1	0.99	0.06	30,30,30,30	0
4	ZN	A	902	1/1	1.00	0.02	19,19,19,19	0
5	CA	A	903	1/1	1.00	0.02	17,17,17,17	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.



6.5 Other polymers ⓘ

There are no such residues in this entry.