



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 12, 2026 – 05:53 PM EDT

PDB ID : 9YO5 / pdb_00009yo5
Title : Crystal structure of integrin α 4b1 headpiece in complex with MR128 (Mg)
Authors : Monroy, M.F.; Lin, F.Y.; Qiao, Q.
Deposited on : 2025-10-13
Resolution : 2.55 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 Phenix2.2
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.2
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 : 9.0.015 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.51

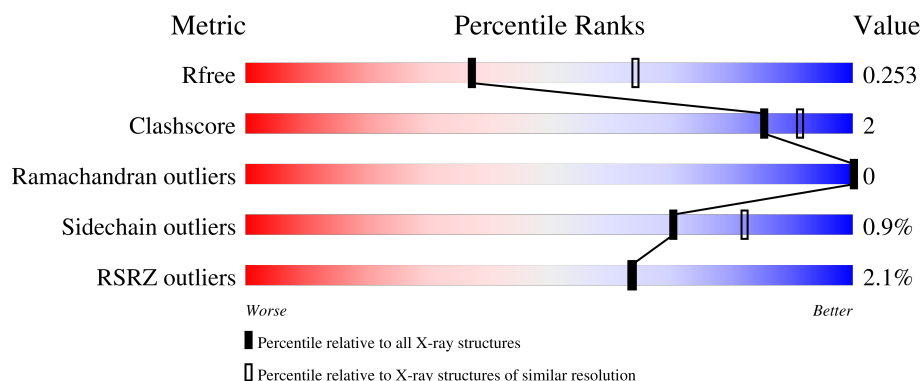
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.55 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	1091 (2.54-2.54)
Clashscore	190562	1120 (2.54-2.54)
Ramachandran outliers	187476	1106 (2.54-2.54)
Sidechain outliers	187428	1106 (2.54-2.54)
RSRZ outliers	180081	1091 (2.54-2.54)

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	597	% 94% 5% .
2	B	490	4% 89% 6% .
3	C	3	67% 33%
4	D	4	50% 50%
5	E	4	25% 50% 25%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 16510 atoms, of which 8048 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 Integrin α 4.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	588	Total	C	H	N	O	S	0	0	0
			8968	2858	4437	785	866	22			

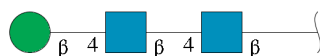
- Molecule 2 is a protein called Integrin beta-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	459	Total	C	H	N	O	S	0	0	0
			6956	2206	3414	596	709	31			

There are 11 discrepancies between the modelled and reference sequences:

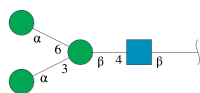
Chain	Residue	Modelled	Actual	Comment	Reference
B	92	HIS	THR	conflict	UNP P05556
B	195	THR	SER	conflict	UNP P05556
B	482	GLY	-	expression tag	UNP P05556
B	483	GLY	-	expression tag	UNP P05556
B	484	SER	-	expression tag	UNP P05556
B	485	GLU	-	expression tag	UNP P05556
B	486	ASN	-	expression tag	UNP P05556
B	487	LEU	-	expression tag	UNP P05556
B	488	TYR	-	expression tag	UNP P05556
B	489	PHE	-	expression tag	UNP P05556
B	490	GLN	-	expression tag	UNP P05556

- Molecule 3 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
3	C	3	Total	C	H	N	O	0	0	0
			63	22	24	2	15			

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



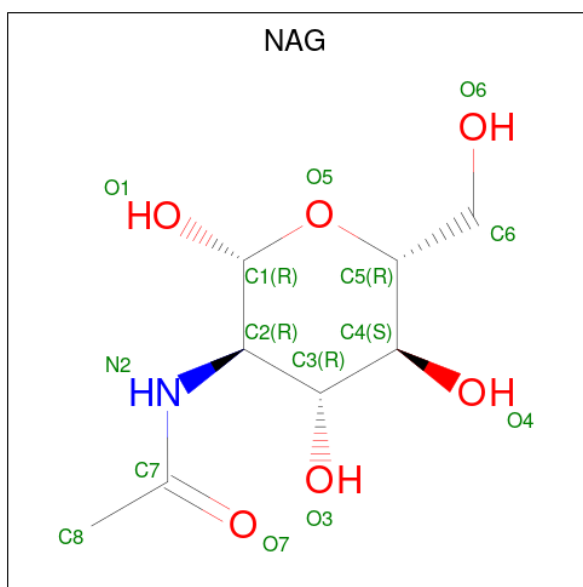
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	4	Total	C	H	N	O	0	0	0
			75	26	28	1	20			

- Molecule 5 is an oligosaccharide called alpha-D-mannopyranose-(1-6)-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
5	E	4	Total	C	H	N	O	0	0	0
			81	28	31	2	20			

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	H	N	O	0	0
			24	8	10	1	5		
6	A	1	Total	C	H	N	O	0	0
			24	8	10	1	5		
6	A	1	Total	C	H	N	O	0	0
			24	8	10	1	5		
6	A	1	Total	C	H	N	O	0	0
			24	8	10	1	5		
6	A	1	Total	C	H	N	O	0	0
			22	8	8	1	5		
6	B	1	Total	C	H	N	O	0	0
			24	8	10	1	5		
6	B	1	Total	C	H	N	O	0	0
			22	8	8	1	5		
6	B	1	Total	C	H	N	O	0	0
			24	8	10	1	5		

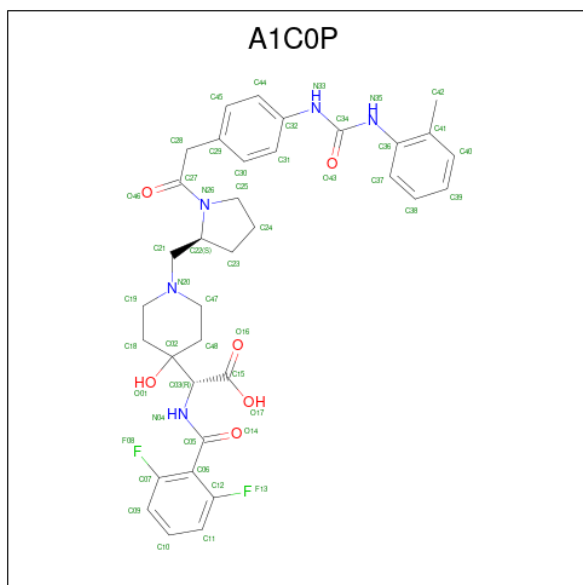
- Molecule 7 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	3	Total	Ca	0	0
			3	3		
7	B	2	Total	Ca	0	0
			2	2		

- Molecule 8 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	B	1	Total Mg 1 1	0	0

- Molecule 9 is (2R)-(2,6-difluorobenzamido)(4-hydroxy-1-((2S)-1-({4-[(2-methylphenyl)carbamamido]phenyl}acetyl)pyrrolidin-2-yl)methyl)piperidin-4-yl)acetic acid (CCD ID: A1C0P) (formula: C₃₅H₃₉F₂N₅O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
9	B	1	Total	C	F	H	N	O	0	0
			86	35	2	38	5	6		

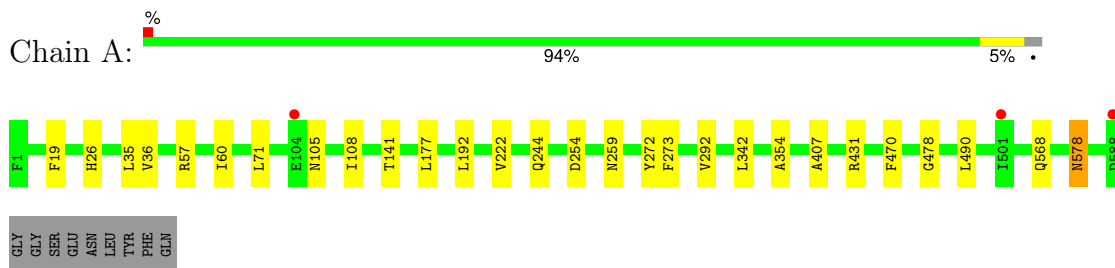
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	61	Total O 61 61	0	0
10	B	26	Total O 26 26	0	0

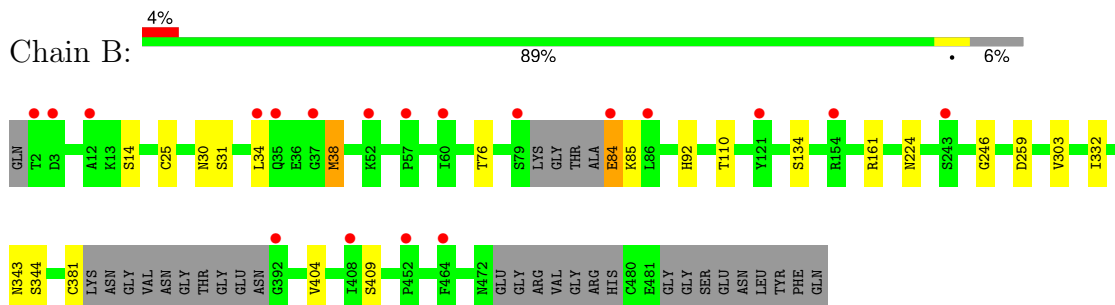
3 Residue-property plots [i](#)

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.

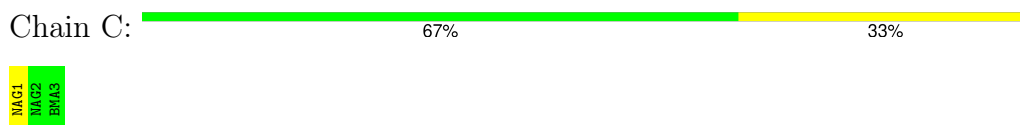
- Molecule 1: Integrin α 4



- Molecule 2: Integrin β 4-1



- Molecule 3: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



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



- Molecule 5: alpha-D-mannopyranose-(1-6)-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	83.75Å 110.35Å 126.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	69.85 – 2.55 69.85 – 2.55	Depositor EDS
% Data completeness (in resolution range)	99.9 (69.85-2.55) 99.9 (69.85-2.55)	Depositor EDS
R_{merge}	0.20	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.29 (at 2.55Å)	Xtriage
Refinement program	PHENIX (1.19.2_4158: ???)	Depositor
R, R_{free}	0.226 , 0.255 0.226 , 0.253	Depositor DCC
R_{free} test set	2000 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å ²)	50.7	Xtriage
Anisotropy	0.471	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 43.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	16510	wwPDB-VP
Average B, all atoms (Å ²)	75.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.78% 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, CA, A1C0P, MAN, NAG, MG

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	0.16	0/4624	0.33	0/6259
2	B	0.15	0/3603	0.32	0/4867
All	All	0.16	0/8227	0.32	0/11126

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	4531	4437	4434	20	2
2	B	3542	3414	3412	11	2
3	C	39	24	34	1	0
4	D	47	28	40	3	0
5	E	50	31	43	1	0
6	A	70	48	65	4	0
6	B	42	28	39	0	0
7	A	3	0	0	0	0
7	B	2	0	0	0	0
8	B	1	0	0	0	0
9	B	48	38	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
10	A	61	0	0	0	0
10	B	26	0	0	0	0
All	All	8462	8048	8067	36	2

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 2.

All (36) 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:35:LEU:CD1	1:A:108:ILE:HD13	2.26	0.65
4:D:1:NAG:O3	4:D:2:BMA:H2	1.96	0.64
1:A:71:LEU:HB3	1:A:141:THR:HG21	1.80	0.63
1:A:35:LEU:HD12	1:A:108:ILE:HD13	1.84	0.60
1:A:26:HIS:CG	1:A:108:ILE:HD11	2.39	0.56
6:A:602:NAG:H3	4:D:1:NAG:C1	2.36	0.55
1:A:342:LEU:HD11	1:A:354:ALA:HB2	1.92	0.52
6:A:603:NAG:O4	6:A:605:NAG:C1	2.59	0.51
1:A:177:LEU:HD11	3:C:1:NAG:H82	1.91	0.51
1:A:19:PHE:CE1	1:A:36:VAL:HG11	2.46	0.51
2:B:34:LEU:O	2:B:34:LEU:HG	2.12	0.50
1:A:578:ASN:OD1	6:A:604:NAG:C1	2.60	0.50
1:A:35:LEU:HD11	1:A:108:ILE:HD13	1.93	0.49
5:E:2:NAG:H4	5:E:3:BMA:O2	2.12	0.49
1:A:273:PHE:CZ	1:A:292:VAL:HG11	2.50	0.47
1:A:57:ARG:HD3	1:A:71:LEU:HD21	1.97	0.47
1:A:273:PHE:CE1	1:A:292:VAL:HG11	2.50	0.46
1:A:192:LEU:HD22	1:A:222:VAL:HG12	1.97	0.46
2:B:110:THR:HG22	2:B:409:SER:OG	2.15	0.46
6:A:602:NAG:O4	4:D:1:NAG:C1	2.63	0.46
2:B:343:ASN:O	2:B:344:SER:HB2	2.16	0.46
1:A:254:ASP:OD2	1:A:259:ASN:ND2	2.49	0.45
2:B:161:ARG:NH2	2:B:246:GLY:O	2.51	0.44
1:A:431:ARG:HD2	1:A:568:GLN:O	2.17	0.44
1:A:60:ILE:HG21	1:A:407:ALA:HB1	2.00	0.43
2:B:381:CYS:HA	2:B:404:VAL:HG12	2.01	0.43
2:B:84:GLU:HB2	2:B:85:LYS:H	1.66	0.42
1:A:470:PHE:CD1	1:A:490:LEU:HD11	2.54	0.42
2:B:303:VAL:HG22	2:B:332:ILE:HG12	2.01	0.42
1:A:192:LEU:CD2	1:A:222:VAL:HG12	2.50	0.42
1:A:26:HIS:ND1	1:A:108:ILE:HD11	2.35	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:134:SER:OG	2:B:259:ASP:OD2	2.28	0.41
2:B:30:ASN:O	2:B:31:SER:HB3	2.21	0.41
1:A:244:GLN:CD	1:A:244:GLN:N	2.79	0.41
2:B:76:THR:HG23	2:B:92:HIS:H	1.86	0.41
2:B:34:LEU:CD1	2:B:38:MET:HB2	2.52	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:478:GLY:H	2:B:84:GLU:OE2[1_655]	1.59	0.01
1:A:478:GLY:N	2:B:84:GLU:OE2[1_655]	2.19	0.01

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	586/597 (98%)	572 (98%)	14 (2%)	0	100	100
2	B	451/490 (92%)	430 (95%)	21 (5%)	0	100	100
All	All	1037/1087 (95%)	1002 (97%)	35 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	487/496 (98%)	484 (99%)	3 (1%)	78	87
2	B	403/431 (94%)	398 (99%)	5 (1%)	63	78
All	All	890/927 (96%)	882 (99%)	8 (1%)	70	82

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	105	ASN
1	A	272	TYR
1	A	578	ASN
2	B	14	SER
2	B	25	CYS
2	B	38	MET
2	B	84	GLU
2	B	224	ASN

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	72	GLN
1	A	319	ASN
1	A	437	ASN
2	B	92	HIS
2	B	141	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 ⓘ

11 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	C	1	1,3	14,14,15	0.44	0	17,19,21	0.49	0
3	NAG	C	2	3	14,14,15	0.29	0	17,19,21	0.43	0
3	BMA	C	3	3	11,11,12	0.73	0	15,15,17	0.79	0
4	NAG	D	1	4	14,14,15	0.33	0	17,19,21	0.71	1 (5%)
4	BMA	D	2	4	11,11,12	1.10	2 (18%)	15,15,17	2.16	2 (13%)
4	MAN	D	3	4	11,11,12	0.89	0	15,15,17	2.02	1 (6%)
4	MAN	D	4	4	11,11,12	1.02	1 (9%)	15,15,17	1.65	2 (13%)
5	NAG	E	1	1,5	14,14,15	0.32	0	17,19,21	0.52	0
5	NAG	E	2	5	14,14,15	0.40	0	17,19,21	0.53	0
5	BMA	E	3	5	11,11,12	1.27	2 (18%)	15,15,17	0.98	1 (6%)
5	MAN	E	4	5	11,11,12	0.77	0	15,15,17	1.73	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
3	NAG	C	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	2/6/23/26	0/1/1/1
3	BMA	C	3	3	-	2/2/19/22	0/1/1/1
4	NAG	D	1	4	-	1/6/23/26	0/1/1/1
4	BMA	D	2	4	-	2/2/19/22	0/1/1/1
4	MAN	D	3	4	-	2/2/19/22	1/1/1/1
4	MAN	D	4	4	-	2/2/19/22	1/1/1/1
5	NAG	E	1	1,5	-	0/6/23/26	0/1/1/1
5	NAG	E	2	5	-	2/6/23/26	0/1/1/1
5	BMA	E	3	5	-	1/2/19/22	0/1/1/1
5	MAN	E	4	5	-	1/2/19/22	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	4	MAN	C1-C2	2.93	1.59	1.52
5	E	3	BMA	C1-C2	2.84	1.59	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	2	BMA	C1-C2	2.45	1.58	1.52
5	E	3	BMA	C4-C5	2.22	1.57	1.53
4	D	2	BMA	C2-C3	2.13	1.55	1.52

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	3	MAN	C1-O5-C5	7.16	121.79	112.19
4	D	2	BMA	C1-O5-C5	7.11	121.72	112.19
5	E	4	MAN	C1-O5-C5	5.53	119.60	112.19
4	D	4	MAN	C1-O5-C5	4.97	118.84	112.19
4	D	2	BMA	O5-C5-C6	-2.43	102.93	107.66
5	E	4	MAN	O2-C2-C3	-2.43	105.13	110.15
5	E	3	BMA	O2-C2-C3	-2.30	105.38	110.15
4	D	4	MAN	O2-C2-C3	-2.11	105.78	110.15
4	D	1	NAG	O4-C4-C5	-2.04	104.29	109.32
5	E	4	MAN	O5-C1-C2	2.01	115.57	110.79

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	3	MAN	O5-C5-C6-O6
4	D	2	BMA	O5-C5-C6-O6
4	D	3	MAN	C4-C5-C6-O6
3	C	2	NAG	O5-C5-C6-O6
4	D	2	BMA	C4-C5-C6-O6
3	C	3	BMA	C4-C5-C6-O6
3	C	3	BMA	O5-C5-C6-O6
3	C	2	NAG	C4-C5-C6-O6
5	E	2	NAG	C8-C7-N2-C2
5	E	2	NAG	O7-C7-N2-C2
4	D	4	MAN	O5-C5-C6-O6
4	D	4	MAN	C4-C5-C6-O6
4	D	1	NAG	O5-C5-C6-O6
5	E	3	BMA	O5-C5-C6-O6
5	E	4	MAN	O5-C5-C6-O6

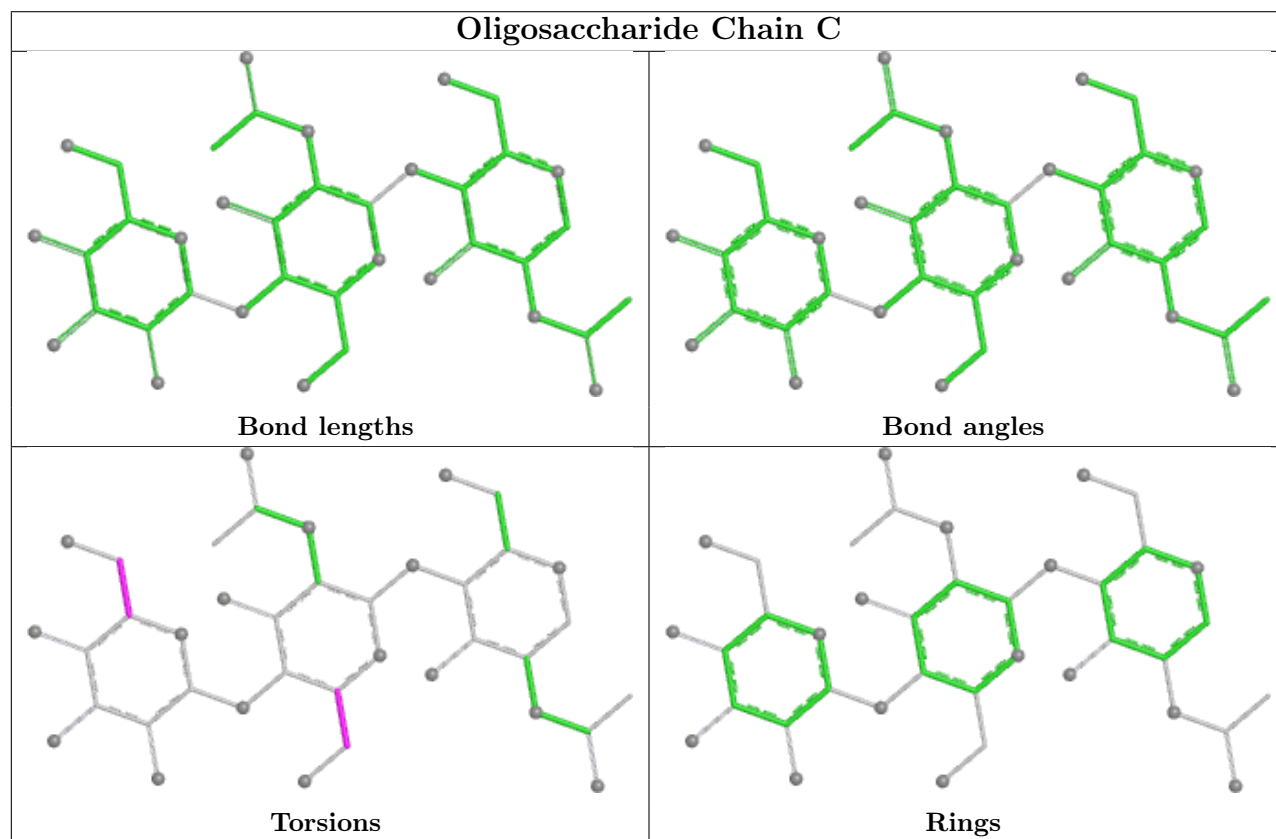
All (2) ring outliers are listed below:

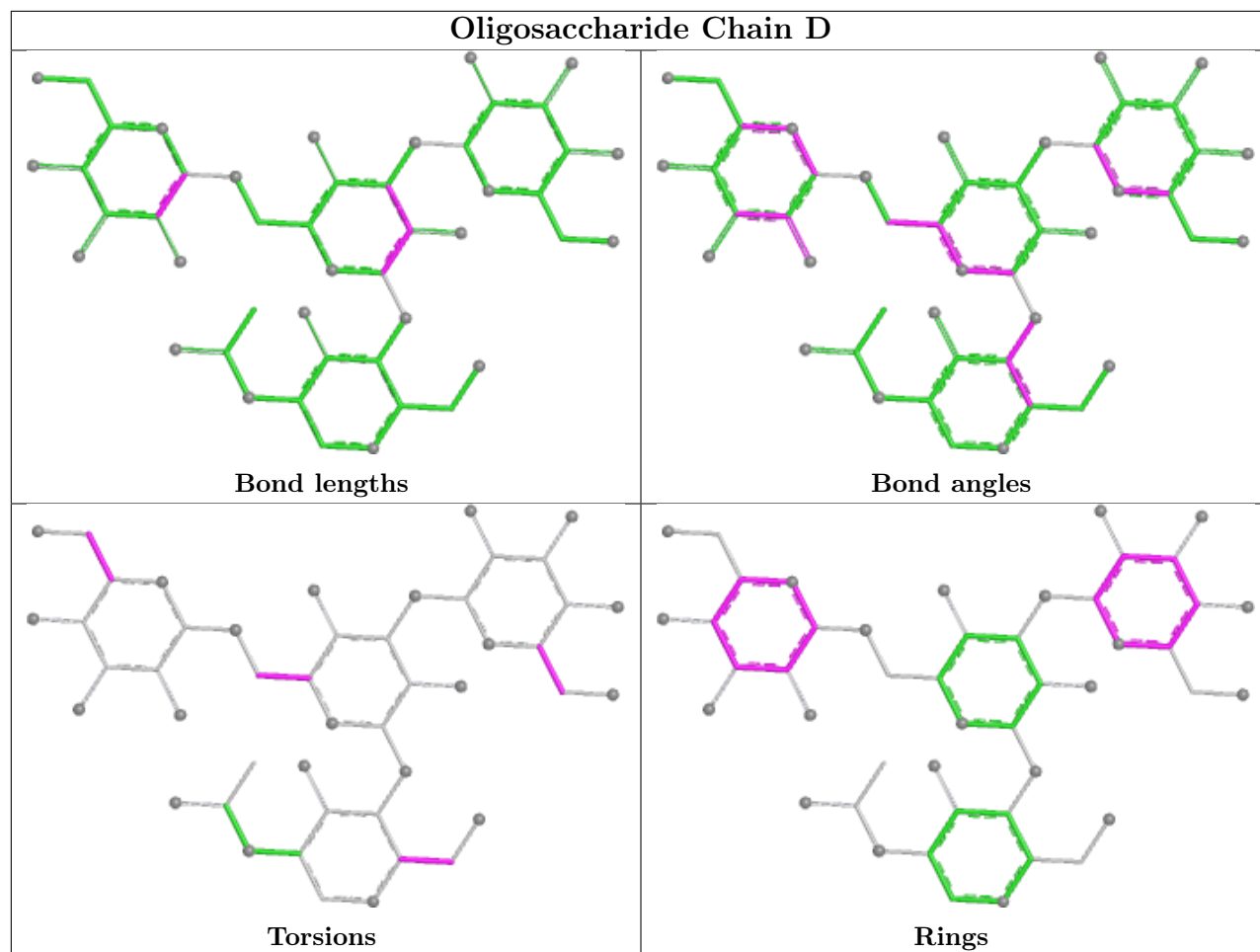
Mol	Chain	Res	Type	Atoms
4	D	3	MAN	C1-C2-C3-C4-C5-O5
4	D	4	MAN	C1-C2-C3-C4-C5-O5

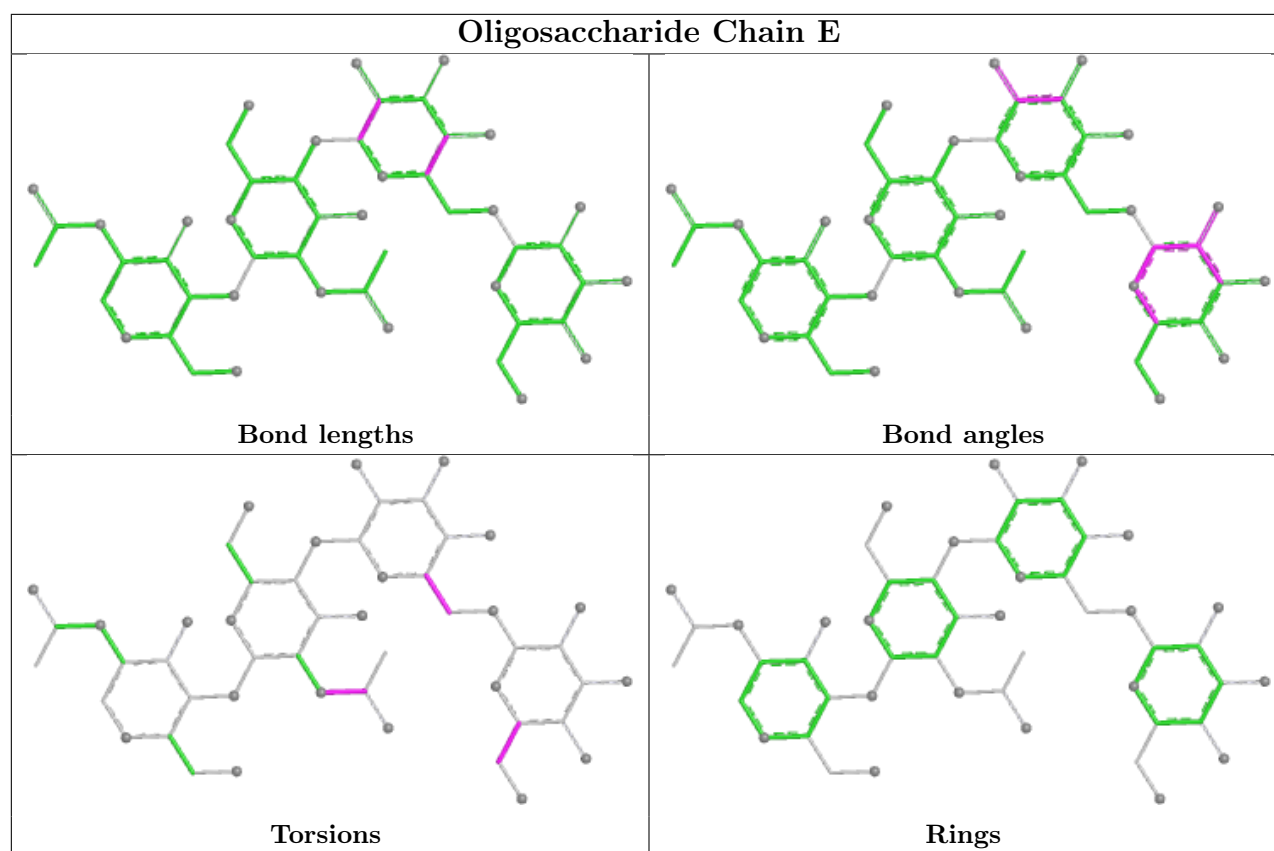
5 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	1	NAG	1	0
5	E	2	NAG	1	0
4	D	1	NAG	3	0
4	D	2	BMA	1	0
5	E	3	BMA	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 15 ligands modelled in this entry, 6 are monoatomic - leaving 9 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	$\# Z > 2$
6	NAG	A	601	1	14,14,15	0.26	0	17,19,21	0.99	1 (5%)
6	NAG	A	602	1	14,14,15	2.22	2 (14%)	17,19,21	1.42	1 (5%)
9	A1C0P	B	507	8	50,52,52	2.43	14 (28%)	66,74,74	1.75	12 (18%)
6	NAG	B	505	2	14,14,15	0.60	0	17,19,21	0.61	0
6	NAG	A	603	1	14,14,15	0.20	0	17,19,21	0.68	0
6	NAG	A	604	-	14,14,15	0.25	0	17,19,21	0.44	0
6	NAG	A	605	-	14,14,15	0.33	0	17,19,21	0.44	0
6	NAG	B	504	-	14,14,15	0.31	0	17,19,21	0.34	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
6	NAG	B	506	-	14,14,15	0.35	0	17,19,21	0.81	1 (5%)

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
6	NAG	A	601	1	-	2/6/23/26	0/1/1/1
6	NAG	A	602	1	-	3/6/23/26	0/1/1/1
9	A1C0P	B	507	8	-	11/36/60/60	0/5/5/5
6	NAG	B	505	2	-	2/6/23/26	0/1/1/1
6	NAG	A	603	1	-	0/6/23/26	0/1/1/1
6	NAG	A	604	-	-	2/6/23/26	0/1/1/1
6	NAG	A	605	-	-	2/6/23/26	0/1/1/1
6	NAG	B	504	-	-	2/6/23/26	0/1/1/1
6	NAG	B	506	-	-	4/6/23/26	0/1/1/1

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	B	507	A1C0P	C22-N26	-9.58	1.32	1.47
9	B	507	A1C0P	C25-N26	7.60	1.62	1.47
6	A	602	NAG	O5-C1	6.23	1.54	1.43
9	B	507	A1C0P	C05-N04	5.51	1.46	1.34
6	A	602	NAG	C1-C2	5.33	1.59	1.52
9	B	507	A1C0P	C34-N35	4.05	1.46	1.37
9	B	507	A1C0P	C34-N33	3.81	1.45	1.37
9	B	507	A1C0P	C24-C25	-3.63	1.39	1.51
9	B	507	A1C0P	C27-N26	3.60	1.45	1.35
9	B	507	A1C0P	C23-C22	2.64	1.59	1.53
9	B	507	A1C0P	O01-C02	-2.55	1.40	1.44
9	B	507	A1C0P	O43-C34	-2.36	1.18	1.23
9	B	507	A1C0P	C32-N33	2.13	1.46	1.41
9	B	507	A1C0P	C06-C05	2.06	1.53	1.51
9	B	507	A1C0P	O46-C27	-2.04	1.18	1.23
9	B	507	A1C0P	O14-C05	-2.03	1.18	1.23

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	B	507	A1C0P	C48-C02-C18	7.94	115.99	109.70
6	A	602	NAG	C1-O5-C5	4.92	118.78	112.19
9	B	507	A1C0P	C48-C47-N20	-4.46	106.61	111.16
9	B	507	A1C0P	C22-C21-N20	-4.21	107.98	113.40
6	A	601	NAG	C1-O5-C5	3.53	116.91	112.19
9	B	507	A1C0P	C19-C18-C02	3.22	114.74	112.07
9	B	507	A1C0P	C12-C06-C07	2.92	119.96	114.93
9	B	507	A1C0P	C12-C06-C05	-2.73	118.08	122.21
9	B	507	A1C0P	C18-C19-N20	-2.71	108.39	111.16
9	B	507	A1C0P	C40-C41-C36	2.46	119.81	117.50
6	B	506	NAG	C1-O5-C5	2.40	115.40	112.19
9	B	507	A1C0P	C42-C41-C36	-2.33	118.59	121.23
9	B	507	A1C0P	N35-C34-N33	2.24	116.78	112.44
9	B	507	A1C0P	C24-C25-N26	2.13	106.90	103.24
9	B	507	A1C0P	C25-N26-C22	-2.05	107.84	111.44

There are no chirality outliers.

All (28) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	B	507	A1C0P	C18-C02-C03-C15
9	B	507	A1C0P	C18-C02-C03-N04
9	B	507	A1C0P	C48-C02-C03-C15
9	B	507	A1C0P	C48-C02-C03-N04
9	B	507	A1C0P	C02-C03-N04-C05
9	B	507	A1C0P	C15-C03-N04-C05
9	B	507	A1C0P	N20-C21-C22-C23
9	B	507	A1C0P	N20-C21-C22-N26
6	B	506	NAG	O5-C5-C6-O6
6	B	505	NAG	O5-C5-C6-O6
6	B	506	NAG	C4-C5-C6-O6
6	B	505	NAG	C4-C5-C6-O6
6	A	602	NAG	O5-C5-C6-O6
6	A	605	NAG	C4-C5-C6-O6
6	B	506	NAG	C8-C7-N2-C2
6	B	506	NAG	O7-C7-N2-C2
6	A	604	NAG	O5-C5-C6-O6
6	A	602	NAG	C4-C5-C6-O6
6	A	605	NAG	O5-C5-C6-O6
6	B	504	NAG	O5-C5-C6-O6
6	A	604	NAG	C4-C5-C6-O6
6	A	601	NAG	C4-C5-C6-O6
9	B	507	A1C0P	C02-C03-C15-O16

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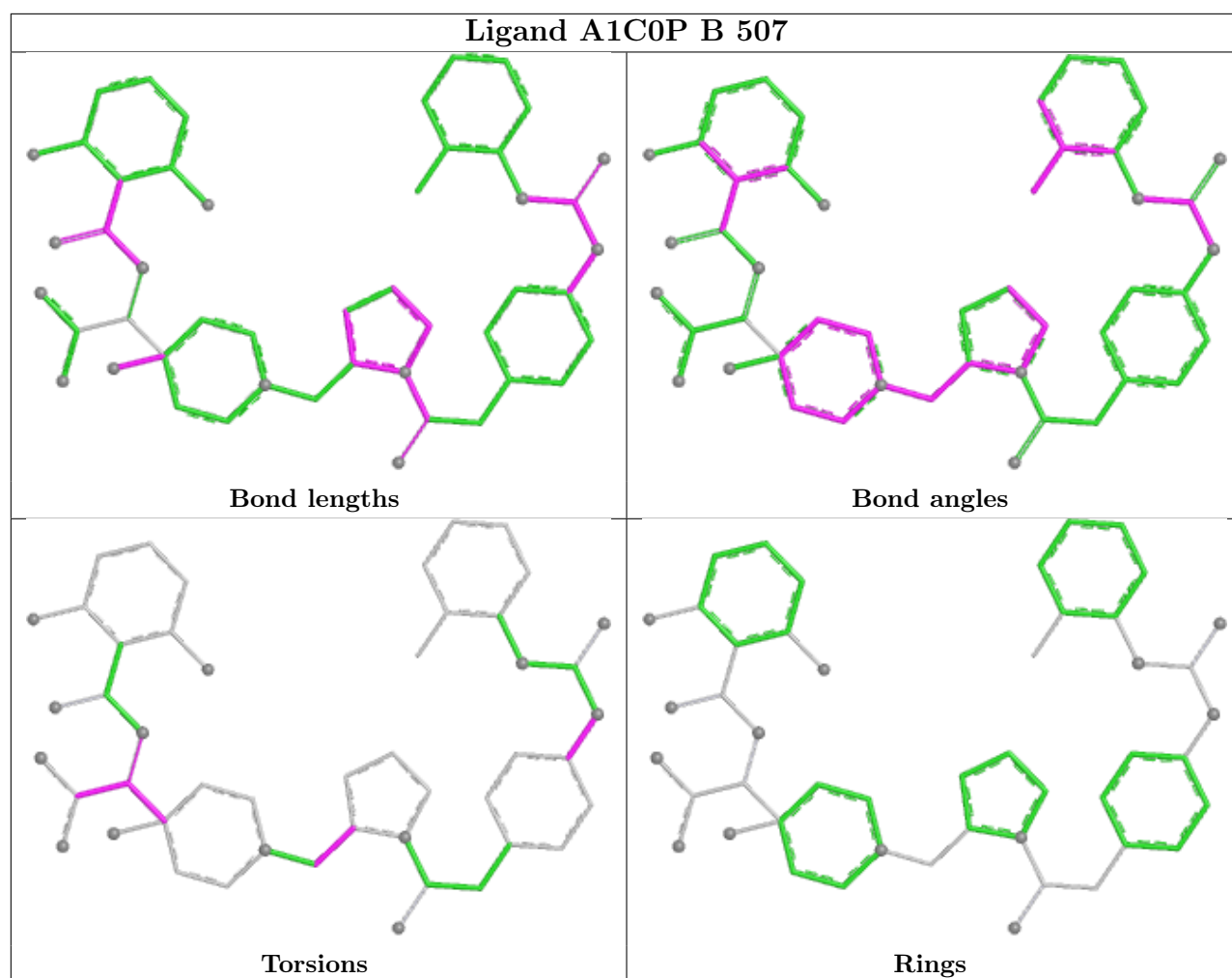
Mol	Chain	Res	Type	Atoms
9	B	507	A1C0P	C02-C03-C15-O17
6	A	602	NAG	C3-C2-N2-C7
6	A	601	NAG	O5-C5-C6-O6
6	B	504	NAG	C3-C2-N2-C7
9	B	507	A1C0P	C44-C32-N33-C34

There are no ring outliers.

4 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	602	NAG	2	0
6	A	603	NAG	1	0
6	A	604	NAG	1	0
6	A	605	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 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 [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	588/597 (98%)	0.10	3 (0%) 87 89	37, 63, 95, 119	0
2	B	459/490 (93%)	0.50	19 (4%) 41 42	41, 92, 122, 139	0
All	All	1047/1087 (96%)	0.27	22 (2%) 63 64	37, 69, 116, 139	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	392	GLY	4.5
2	B	86	LEU	3.5
2	B	2	THR	2.8
2	B	52	LYS	2.8
2	B	452	PRO	2.6
2	B	34	LEU	2.6
1	A	104	GLU	2.5
2	B	37	GLY	2.5
2	B	57	PRO	2.3
1	A	588	ASP	2.3
2	B	464	PHE	2.3
2	B	12	ALA	2.3
2	B	79	SER	2.2
2	B	3	ASP	2.2
1	A	501	ILE	2.2
2	B	35	GLN	2.1
2	B	84	GLU	2.1
2	B	243	SER	2.1
2	B	60	ILE	2.0
2	B	408	ILE	2.0
2	B	121	TYR	2.0
2	B	154	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](#)

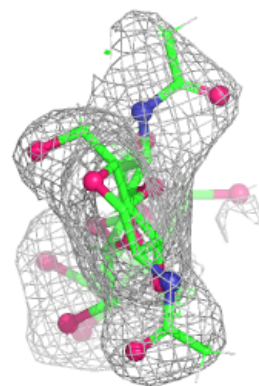
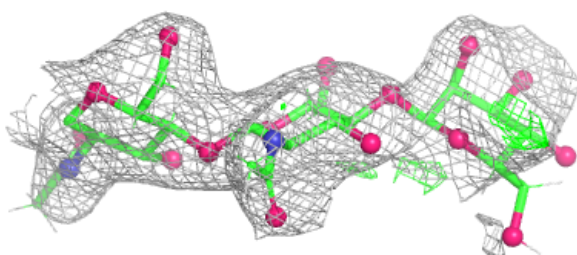
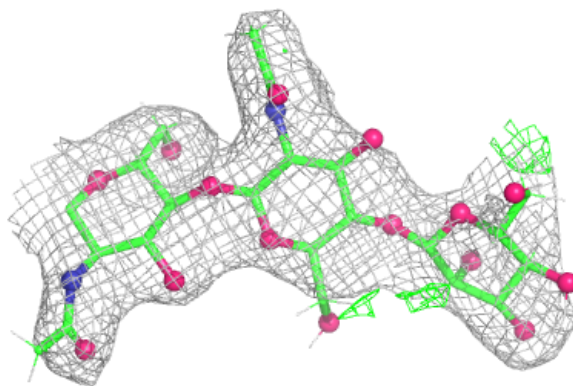
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	BMA	C	3	11/12	0.46	0.14	88,103,131,131	0
4	MAN	D	3	11/12	0.49	0.18	75,92,111,120	0
4	MAN	D	4	11/12	0.50	0.17	86,100,120,121	0
5	MAN	E	4	11/12	0.57	0.12	93,106,128,129	0
5	BMA	E	3	11/12	0.61	0.11	82,90,111,111	0
4	NAG	D	1	14/15	0.67	0.16	73,85,104,105	0
3	NAG	C	2	14/15	0.69	0.13	72,88,112,114	0
4	BMA	D	2	11/12	0.71	0.14	74,84,109,109	0
5	NAG	E	2	14/15	0.83	0.13	77,84,102,102	0
5	NAG	E	1	14/15	0.88	0.10	70,80,95,96	0
3	NAG	C	1	14/15	0.91	0.10	58,68,83,85	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.

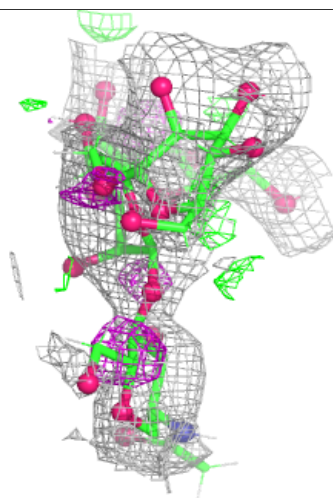
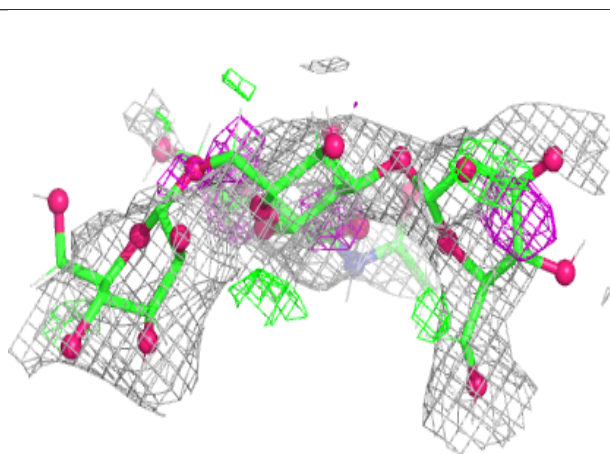
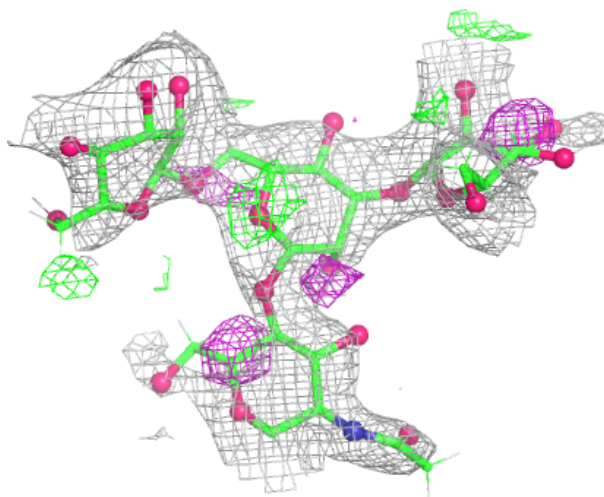
Electron density around Chain C:

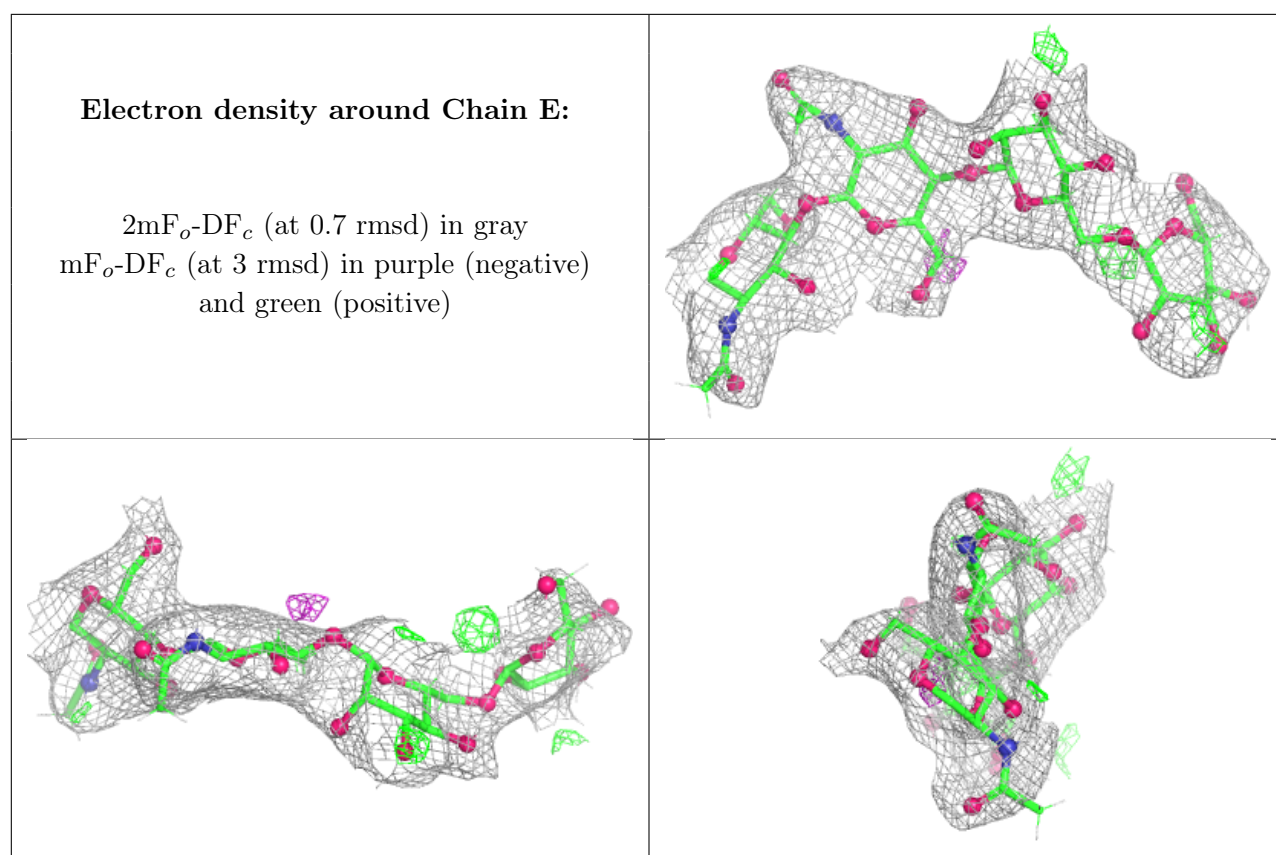
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain 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.

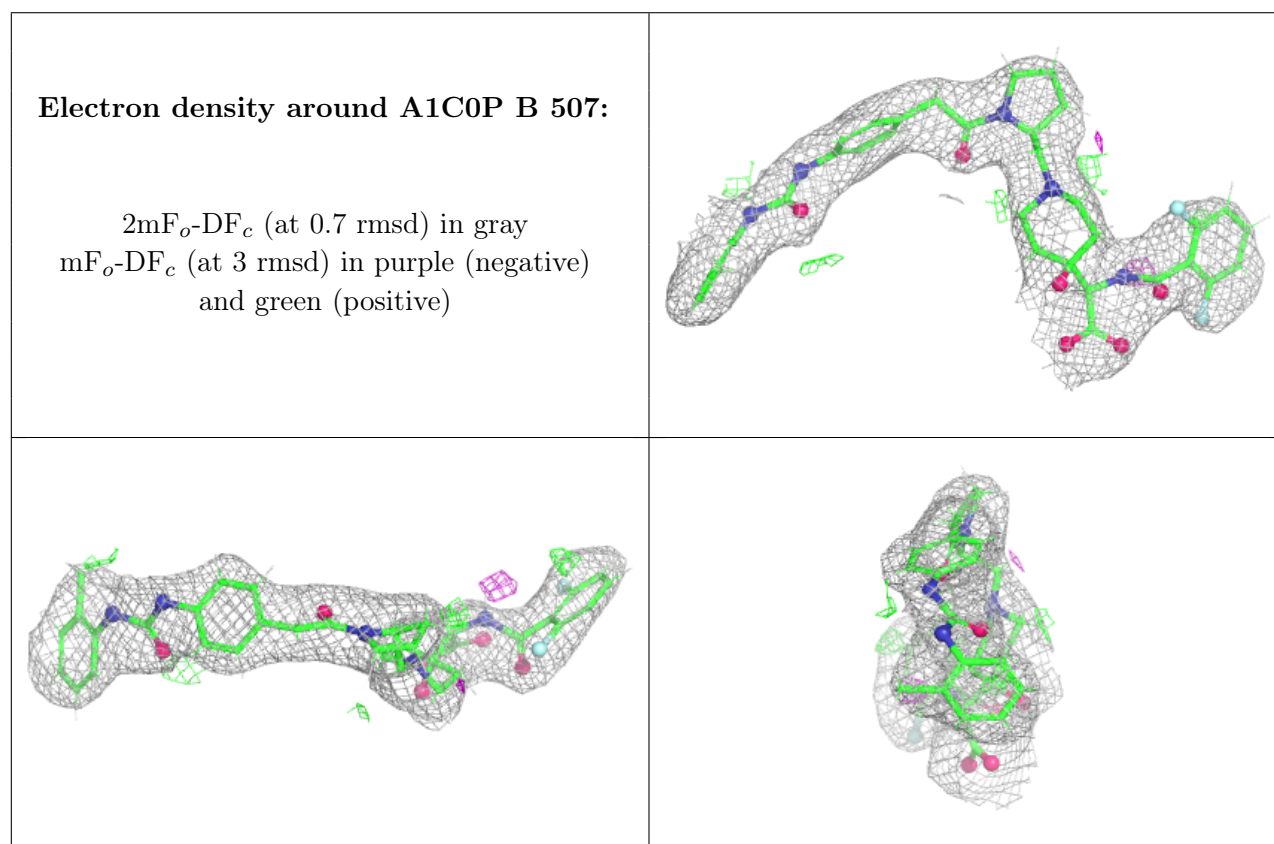
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	NAG	B	504	14/15	0.39	0.16	88,109,134,136	0
6	NAG	A	605	14/15	0.41	0.19	83,103,145,154	0
6	NAG	A	604	14/15	0.61	0.15	84,101,129,130	0
6	NAG	B	506	14/15	0.61	0.16	82,95,106,112	0
6	NAG	A	602	14/15	0.64	0.16	70,94,107,114	0
6	NAG	A	601	14/15	0.68	0.18	89,97,120,123	0
6	NAG	A	603	14/15	0.73	0.17	57,79,95,103	0
6	NAG	B	505	14/15	0.78	0.14	67,78,91,102	0
9	A1C0P	B	507	48/48	0.91	0.10	40,57,78,84	0
7	CA	A	607	1/1	0.99	0.02	53,53,53,53	0
7	CA	A	608	1/1	0.99	0.03	50,50,50,50	0
7	CA	B	501	1/1	0.99	0.07	45,45,45,45	0
7	CA	B	502	1/1	0.99	0.03	64,64,64,64	0
8	MG	B	503	1/1	0.99	0.05	49,49,49,49	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
7	CA	A	606	1/1	0.99	0.03	46,46,46,46	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 [i](#)

There are no such residues in this entry.