



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 26, 2024 – 09:56 AM EDT

PDB ID : 5F1A
Title : The Crystal Structure of Salicylate Bound to Human Cyclooxygenase-2
Authors : Lucido, M.J.; Orlando, B.J.; Malkowski, M.G.
Deposited on : 2015-11-30
Resolution : 2.38 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

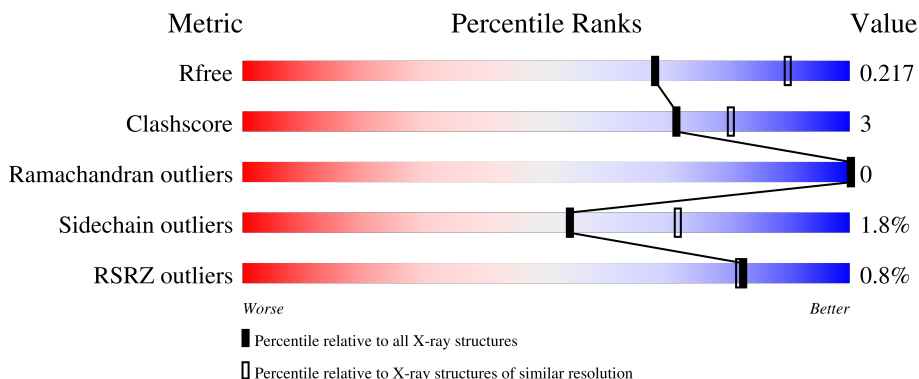
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.38 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}	164625	6699 (2.40-2.36)
Clashscore	180529	7414 (2.40-2.36)
Ramachandran outliers	177936	7337 (2.40-2.36)
Sidechain outliers	177891	7338 (2.40-2.36)
RSRZ outliers	164620	6699 (2.40-2.36)

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	553	 92% 7%
1	B	553	 91% 8%
2	C	4	 100%
3	D	3	 33% 67%

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
4	SAL	B	601	-	-	X	-
5	COH	A	602	X	-	-	-
5	COH	B	602	X	-	-	-

2 Entry composition i

There are 10 unique types of molecules in this entry. The entry contains 9596 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 Prostaglandin G/H synthase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	553	4466	2882	753	805	26	0	2	0
1	B	552	4447	2865	753	803	26	0	2	0

There are 2 discrepancies between the modelled and reference sequences:

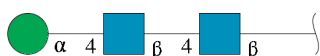
Chain	Residue	Modelled	Actual	Comment	Reference
A	33	LYS	-	expression tag	UNP P35354
B	33	LYS	-	expression tag	UNP P35354

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



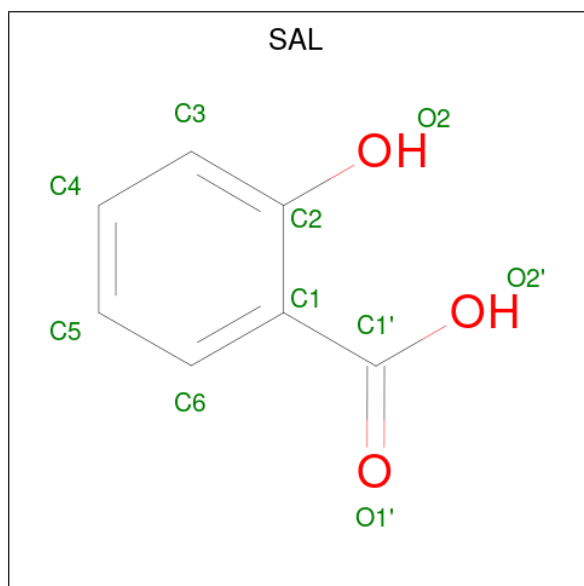
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	4	50	28	2	20	0	0	0

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



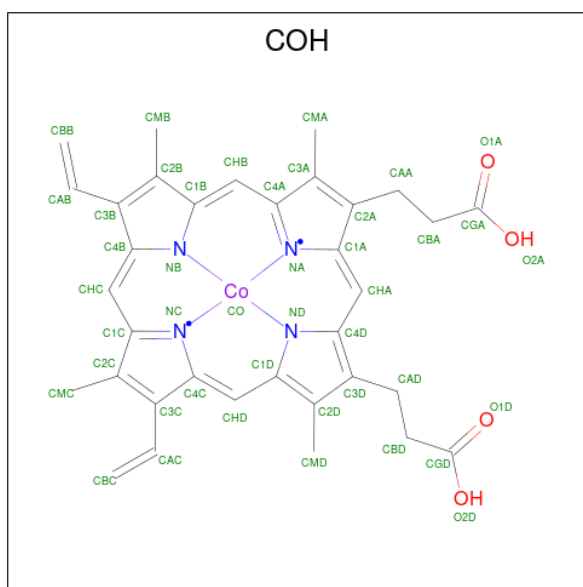
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	3	39	22	2	15	0	0	0

- Molecule 4 is 2-HYDROXYBENZOIC ACID (three-letter code: SAL) (formula: C₇H₆O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
4	A	1	10	7	3	0	0
4	B	1	10	7	3	0	0

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING CO (three-letter code: COH) (formula: C₃₄H₃₂CoN₄O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
5	A	1	Total	C	Co	N	O	0	0
			43	34	1	4	4		
5	B	1	Total	C	Co	N	O	0	0
			43	34	1	4	4		

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C₈H₁₅NO₆).



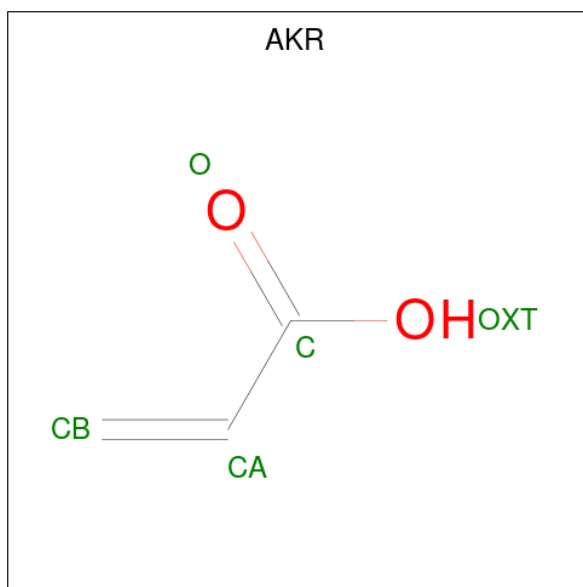
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

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

- Molecule 7 is ACRYLIC ACID (three-letter code: AKR) (formula: $C_3H_4O_2$).



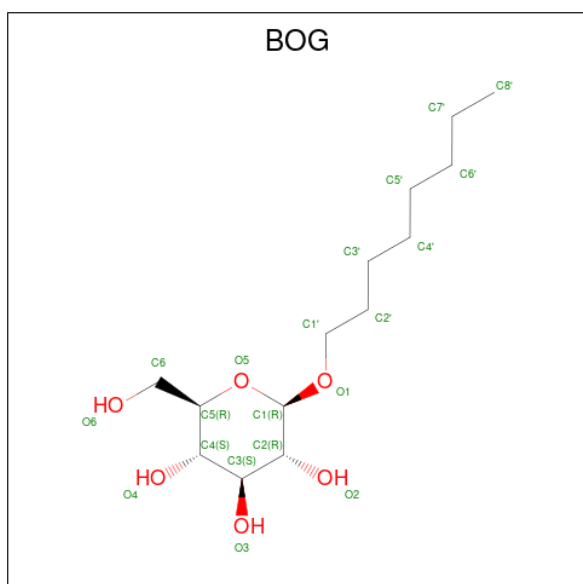
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			5	3	2		
7	B	1	Total	C	O	0	0
			5	3	2		
7	B	1	Total	C	O	0	0
			5	3	2		

- Molecule 8 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C O 4 2 2	0	0
8	A	1	Total C O 4 2 2	0	0
8	A	1	Total C O 4 2 2	0	0
8	B	1	Total C O 4 2 2	0	0
8	B	1	Total C O 4 2 2	0	0

- Molecule 9 is octyl beta-D-glucopyranoside (three-letter code: BOG) (formula: C₁₄H₂₈O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	C	O	0	0
			20	14	6		

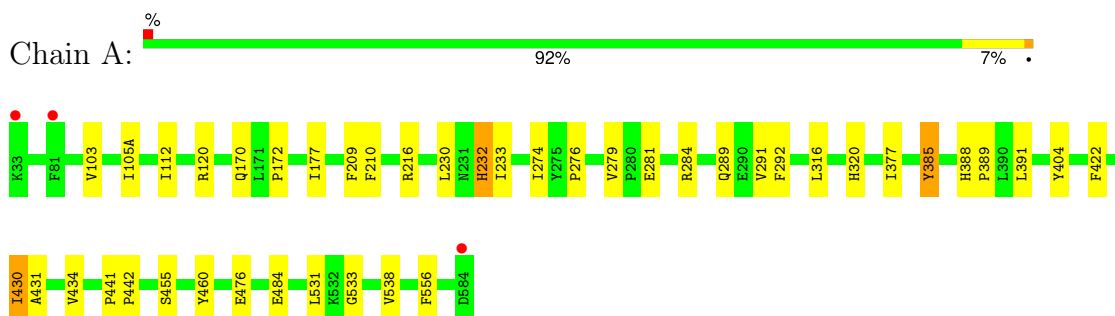
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	212	Total	O	0	0
			212	212		
10	B	179	Total	O	0	0
			179	179		

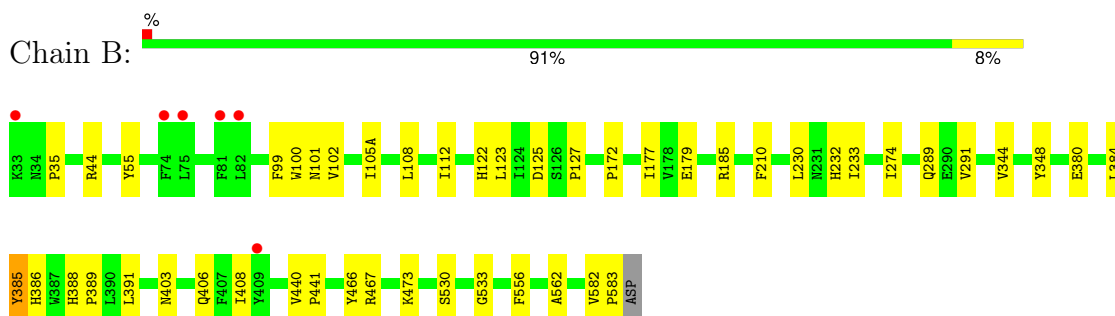
3 Residue-property plots [i](#)

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: Prostaglandin G/H synthase 2



- Molecule 1: Prostaglandin G/H synthase 2



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



- Molecule 3: alpha-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	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	118.41Å 132.66Å 178.74Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.32 – 2.38 33.32 – 2.38	Depositor EDS
% Data completeness (in resolution range)	99.5 (33.32-2.38) 99.4 (33.32-2.38)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.30 (at 2.34Å)	Xtrriage
Refinement program	PHENIX 1.9-1692	Depositor
R, R_{free}	0.174 , 0.218 0.177 , 0.217	Depositor DCC
R_{free} test set	2792 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	34.1	Xtrriage
Anisotropy	0.531	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 46.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9596	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.49% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: AKR, EDO, COH, BOG, MAN, NAG, SAL

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	0.37	0/4605	0.45	0/6252
1	B	0.34	0/4583	0.45	1/6224 (0.0%)
All	All	0.35	0/9188	0.45	1/12476 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	384	LEU	CA-CB-CG	5.25	127.38	115.30

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	4466	0	4317	25	0
1	B	4447	0	4293	28	0
2	C	50	0	43	1	0
3	D	39	0	34	0	0
4	A	10	0	4	3	0
4	B	10	0	4	4	0
5	A	43	0	30	4	0
5	B	43	0	30	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	14	0	13	0	0
6	B	28	0	26	1	0
7	A	5	0	3	0	0
7	B	10	0	6	1	0
8	A	12	0	18	3	0
8	B	8	0	12	3	0
9	B	20	0	28	2	0
10	A	212	0	0	2	0
10	B	179	0	0	1	0
All	All	9596	0	8861	57	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 3.

All (57) 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:533:GLY:HA3	8:B:612:EDO:H11	1.54	0.87
1:B:385:TYR:CE2	4:B:601:SAL:H3	2.15	0.81
1:B:530:SER:HA	8:B:612:EDO:H21	1.67	0.77
5:A:602:COH:HMB1	5:A:602:COH:HBB1	1.68	0.75
5:A:602:COH:HMC1	5:A:602:COH:HBC1	1.71	0.71
1:B:185:ARG:HE	9:B:608:BOG:H62	1.58	0.69
4:A:601:SAL:O2	10:A:701:HOH:O	2.11	0.68
1:A:385:TYR:CE2	4:A:601:SAL:H3	2.30	0.67
1:A:274:ILE:HD12	1:A:291:VAL:HG12	1.84	0.58
1:B:467:ARG:NH2	1:B:473:LYS:O	2.34	0.58
1:A:281:GLU:HA	1:A:284:ARG:HD2	1.85	0.58
1:A:172:PRO:HG2	1:A:177:ILE:HD11	1.88	0.56
1:B:179:GLU:HB3	9:B:608:BOG:H4'2	1.89	0.54
1:B:230:LEU:HD13	1:B:233:ILE:HD12	1.90	0.54
1:A:388[B]:HIS:HE1	5:A:602:COH:ND	2.05	0.54
4:B:601:SAL:O2	10:B:702:HOH:O	2.19	0.54
5:B:602:COH:HBB1	5:B:602:COH:HHC	1.90	0.53
1:B:44:ARG:NH2	1:B:125:ASP:OD1	2.42	0.53
1:B:172:PRO:HG2	1:B:177:ILE:HD11	1.90	0.53
1:B:389:PRO:HD3	1:B:440:VAL:HG22	1.90	0.52
1:A:391:LEU:HB3	1:A:404:TYR:OH	2.11	0.51
1:A:216:ARG:HB2	2:C:2:NAG:H81	1.92	0.50
1:B:274:ILE:HD12	1:B:291:VAL:HG12	1.93	0.48
1:A:276:PRO:HG2	1:A:279:VAL:HG23	1.94	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:562:ALA:HA	8:B:611:EDO:H21	1.96	0.47
1:A:230:LEU:HG	1:A:233:ILE:HD12	1.96	0.47
1:A:430:ILE:HG13	1:A:431:ALA:N	2.30	0.47
1:A:170:GLN:NE2	10:A:714:HOH:O	2.48	0.46
1:B:210:PHE:HB3	5:B:602:COH:HBD1	1.97	0.46
1:B:344:VAL:HA	1:B:348:TYR:HB3	1.97	0.46
1:A:533:GLY:HA3	8:A:611:EDO:H22	1.98	0.46
1:A:538:VAL:HG23	1:B:127:PRO:HB2	1.99	0.45
1:B:385:TYR:CZ	4:B:601:SAL:H3	2.50	0.45
1:A:389:PRO:HB2	1:A:434:VAL:HA	1.98	0.45
1:A:385:TYR:CZ	4:A:601:SAL:H3	2.52	0.44
1:A:120:ARG:HG3	1:A:531:LEU:HD12	2.00	0.44
1:B:35:PRO:HB2	1:B:55:TYR:HB3	1.98	0.44
1:B:406:GLN:HB3	6:B:607:NAG:H62	2.00	0.42
1:A:209:PHE:HB2	1:A:377:ILE:HG13	2.02	0.42
1:B:100:TRP:HZ3	1:B:112:ILE:HD13	1.83	0.42
1:A:316:LEU:O	1:A:320:HIS:N	2.53	0.42
1:B:582:VAL:HA	1:B:583:PRO:HD3	1.91	0.42
1:B:99:PHE:O	1:B:102:VAL:HG12	2.20	0.41
1:B:385:TYR:HE2	4:B:601:SAL:H3	1.75	0.41
1:B:403:ASN:HB2	7:B:610:AKR:O	2.20	0.41
1:A:232:HIS:HB2	1:A:292:PHE:CE2	2.56	0.41
1:A:103:VAL:HG11	1:A:112:ILE:HD12	2.02	0.41
1:A:120:ARG:HH21	8:A:610:EDO:C2	2.34	0.41
1:A:441:PRO:HA	1:A:442:PRO:HD3	1.98	0.41
1:A:455[A]:SER:HB2	1:A:460:TYR:CD2	2.56	0.41
1:A:120:ARG:HH21	8:A:610:EDO:H21	1.86	0.41
1:B:380:GLU:HG2	1:B:466:TYR:CE1	2.55	0.41
1:B:391:LEU:HB2	1:B:441:PRO:HG2	2.02	0.40
1:A:210:PHE:HB3	5:A:602:COH:HBD1	2.03	0.40
1:B:386:HIS:HB3	1:B:388[A]:HIS:NE2	2.36	0.40
1:B:105(A):ILE:HD13	1:B:108:LEU:HD12	2.03	0.40

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	553/553 (100%)	536 (97%)	17 (3%)	0	100	100
1	B	552/553 (100%)	536 (97%)	16 (3%)	0	100	100
All	All	1105/1106 (100%)	1072 (97%)	33 (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	485/492 (99%)	476 (98%)	9 (2%)	52	70
1	B	482/492 (98%)	474 (98%)	8 (2%)	56	73
All	All	967/984 (98%)	950 (98%)	17 (2%)	54	72

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	105(A)	ILE
1	A	232	HIS
1	A	289	GLN
1	A	385	TYR
1	A	422	PHE
1	A	430	ILE
1	A	476	GLU
1	A	484	GLU
1	A	556	PHE
1	B	101	ASN
1	B	122	HIS
1	B	123	LEU
1	B	232	HIS
1	B	289	GLN

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Mol	Chain	Res	Type
1	B	385	TYR
1	B	408	ILE
1	B	556	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

7 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	2,1	14,14,15	0.20	0	17,19,21	0.63	1 (5%)
2	NAG	C	2	2	14,14,15	0.50	0	17,19,21	0.75	0
2	MAN	C	3	2	11,11,12	1.30	1 (9%)	15,15,17	1.64	3 (20%)
2	MAN	C	4	2	11,11,12	0.80	0	15,15,17	0.84	1 (6%)
3	NAG	D	1	3,1	14,14,15	0.30	0	17,19,21	0.50	0
3	NAG	D	2	3	14,14,15	0.67	1 (7%)	17,19,21	0.58	0
3	MAN	D	3	3	11,11,12	0.98	1 (9%)	15,15,17	1.39	1 (6%)

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	2,1	-	0/6/23/26	0/1/1/1
2	NAG	C	2	2	-	1/6/23/26	0/1/1/1
2	MAN	C	3	2	-	2/2/19/22	1/1/1/1
2	MAN	C	4	2	-	2/2/19/22	0/1/1/1
3	NAG	D	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	2/6/23/26	0/1/1/1
3	MAN	D	3	3	-	0/2/19/22	1/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	3	MAN	C4-C5	2.66	1.58	1.53
3	D	3	MAN	O5-C5	2.49	1.48	1.43
3	D	2	NAG	O5-C1	-2.44	1.39	1.43

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	3	MAN	C1-O5-C5	4.62	118.38	112.19
2	C	3	MAN	C1-O5-C5	3.77	117.23	112.19
2	C	3	MAN	O2-C2-C3	-2.46	105.05	110.15
2	C	4	MAN	O2-C2-C3	-2.18	105.63	110.15
2	C	3	MAN	O2-C2-C1	2.09	114.02	109.22
2	C	1	NAG	C1-O5-C5	2.07	114.96	112.19

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	3	MAN	O5-C5-C6-O6
3	D	2	NAG	O5-C5-C6-O6
3	D	2	NAG	C4-C5-C6-O6
2	C	3	MAN	C4-C5-C6-O6
2	C	4	MAN	O5-C5-C6-O6
2	C	4	MAN	C4-C5-C6-O6
2	C	2	NAG	C1-C2-N2-C7

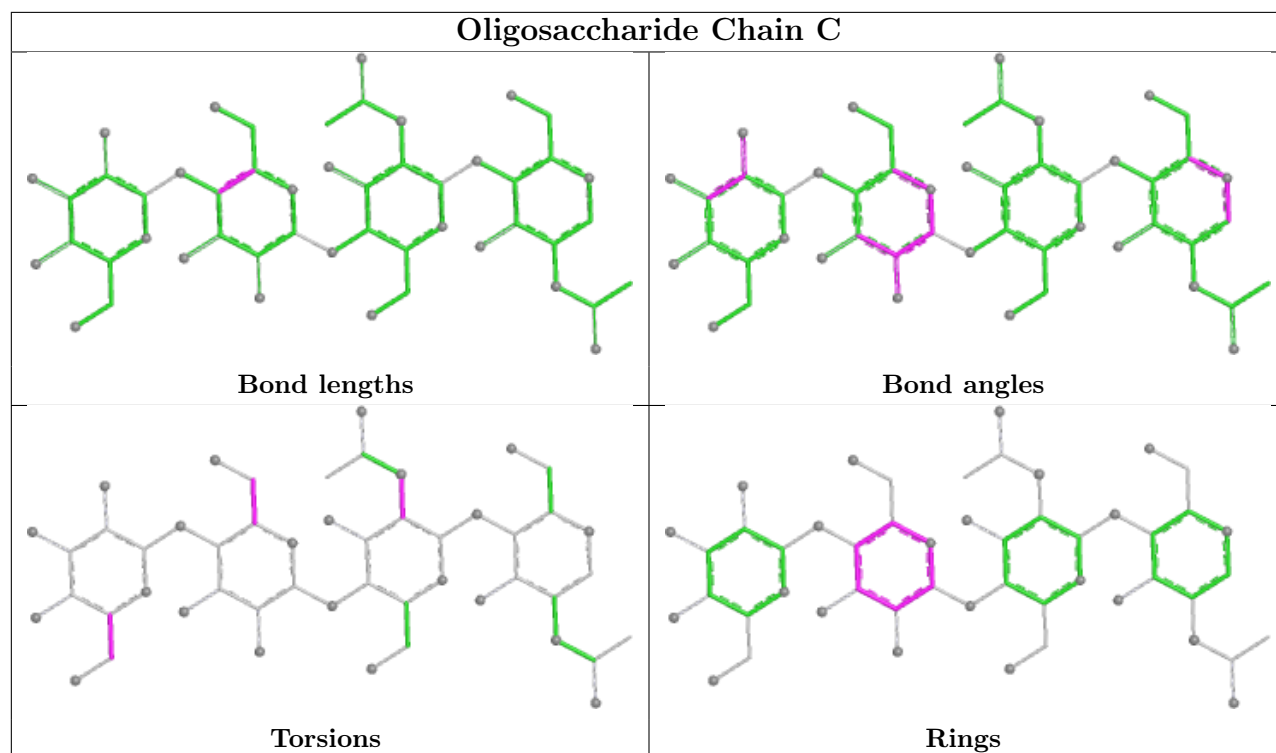
All (2) ring outliers are listed below:

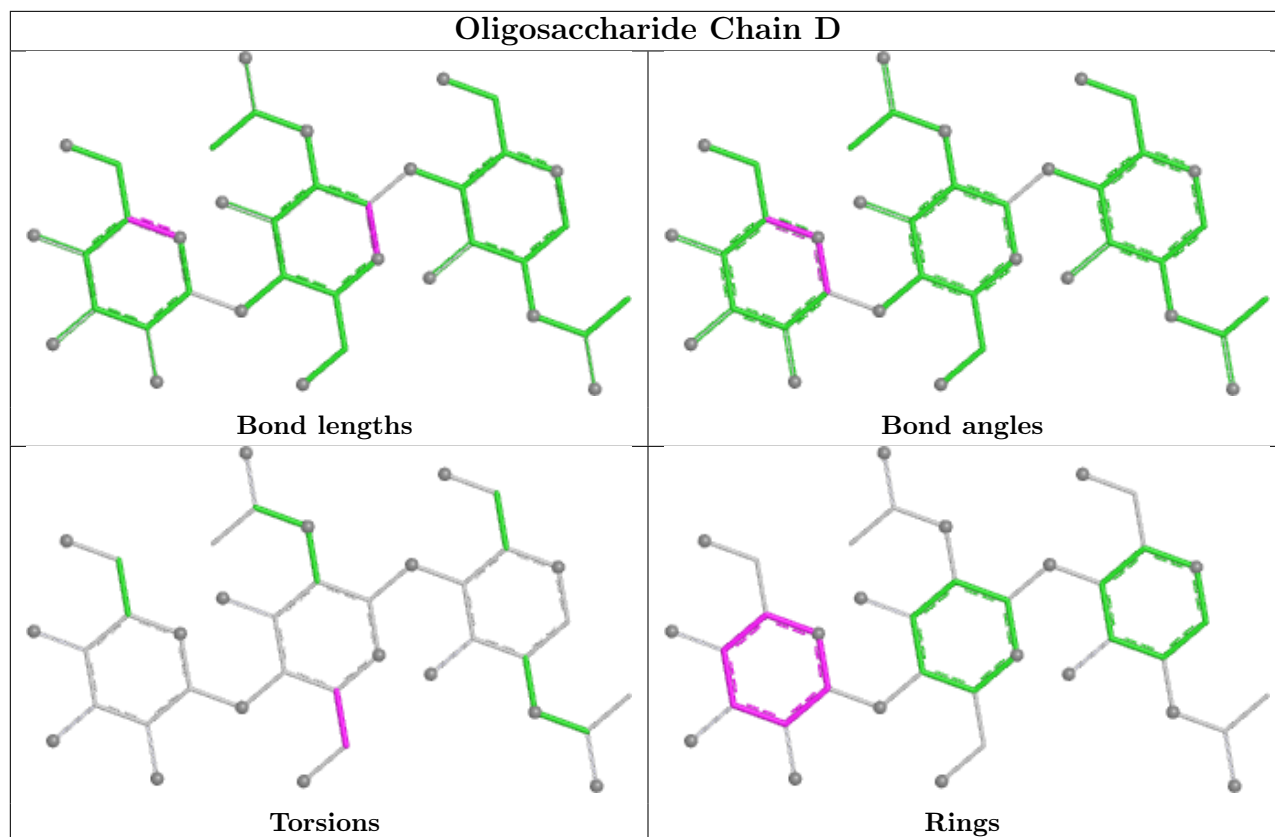
Mol	Chain	Res	Type	Atoms
2	C	3	MAN	C1-C2-C3-C4-C5-O5
3	D	3	MAN	C1-C2-C3-C4-C5-O5

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	2	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](#)

16 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
6	NAG	B	607	1	14,14,15	1.21	1 (7%)	17,19,21	1.56	1 (5%)
6	NAG	B	603	1	14,14,15	0.79	1 (7%)	17,19,21	0.59	0
7	AKR	A	608	-	4,4,4	1.08	0	4,4,4	1.29	1 (25%)
8	EDO	A	609	-	3,3,3	0.43	0	2,2,2	0.36	0
5	COH	A	602	1	47,50,50	1.58	8 (17%)	55,82,82	1.34	9 (16%)
8	EDO	A	611	-	3,3,3	0.39	0	2,2,2	0.40	0
5	COH	B	602	1	47,50,50	1.61	9 (19%)	55,82,82	1.51	10 (18%)
4	SAL	A	601	-	10,10,10	1.98	5 (50%)	13,13,13	1.14	2 (15%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	EDO	B	612	-	3,3,3	0.38	0	2,2,2	0.27	0
6	NAG	A	607	1	14,14,15	0.20	0	17,19,21	0.49	0
7	AKR	B	609	-	4,4,4	1.20	1 (25%)	4,4,4	0.96	0
8	EDO	A	610	-	3,3,3	0.23	0	2,2,2	0.72	0
8	EDO	B	611	-	3,3,3	0.47	0	2,2,2	0.36	0
9	BOG	B	608	-	20,20,20	0.50	0	25,25,25	0.94	2 (8%)
7	AKR	B	610	-	4,4,4	1.11	0	4,4,4	1.15	0
4	SAL	B	601	-	10,10,10	1.82	3 (30%)	13,13,13	1.30	2 (15%)

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	B	607	1	-	2/6/23/26	0/1/1/1
4	SAL	B	601	-	-	0/4/4/4	0/1/1/1
6	NAG	B	603	1	-	1/6/23/26	0/1/1/1
7	AKR	A	608	-	-	2/2/2/2	-
8	EDO	A	609	-	-	0/1/1/1	-
5	COH	A	602	1	1/1/3/9	8/14/54/54	-
8	EDO	A	611	-	-	1/1/1/1	-
5	COH	B	602	1	1/1/3/9	5/14/54/54	-
8	EDO	B	612	-	-	0/1/1/1	-
6	NAG	A	607	1	-	2/6/23/26	0/1/1/1
7	AKR	B	609	-	-	2/2/2/2	-
8	EDO	A	610	-	-	1/1/1/1	-
8	EDO	B	611	-	-	1/1/1/1	-
9	BOG	B	608	-	-	6/11/31/31	0/1/1/1
7	AKR	B	610	-	-	0/2/2/2	-
4	SAL	A	601	-	-	0/4/4/4	0/1/1/1

All (28) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	602	COH	C3D-C2D	5.80	1.54	1.37
5	A	602	COH	C3D-C2D	5.66	1.54	1.37
6	B	607	NAG	O5-C1	4.13	1.50	1.43
5	A	602	COH	CO-ND	3.68	2.14	1.97
4	B	601	SAL	C1-C2	3.43	1.46	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	602	COH	CO-ND	3.37	2.13	1.97
5	A	602	COH	CAB-C3B	3.16	1.55	1.47
5	A	602	COH	CO-NA	3.13	2.10	1.96
4	A	601	SAL	C6-C1	-3.02	1.35	1.39
5	B	602	COH	CAB-C3B	2.96	1.55	1.47
5	A	602	COH	CAC-C3C	2.92	1.55	1.47
5	B	602	COH	CAC-C3C	2.90	1.55	1.47
5	B	602	COH	CO-NA	2.80	2.09	1.96
6	B	603	NAG	C1-C2	2.72	1.56	1.52
4	A	601	SAL	O2'-C1'	-2.70	1.22	1.30
4	B	601	SAL	C6-C1	-2.70	1.35	1.39
4	A	601	SAL	C3-C2	-2.53	1.35	1.39
4	B	601	SAL	O2'-C1'	-2.50	1.23	1.30
4	A	601	SAL	C1-C2	2.37	1.44	1.40
5	A	602	COH	CMC-C2C	2.25	1.55	1.50
5	A	602	COH	CMB-C2B	2.16	1.55	1.50
7	B	609	AKR	OXT-C	-2.10	1.25	1.30
5	B	602	COH	CMC-C2C	2.09	1.55	1.50
5	A	602	COH	CMA-C3A	2.08	1.55	1.50
4	A	601	SAL	C1-C1'	-2.05	1.45	1.49
5	B	602	COH	CHD-C4C	2.05	1.39	1.34
5	B	602	COH	CMB-C2B	2.03	1.54	1.50
5	B	602	COH	CMA-C3A	2.03	1.54	1.50

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	607	NAG	C1-O5-C5	6.25	120.56	112.19
5	B	602	COH	C2B-C1B-NB	-4.16	107.64	110.88
5	A	602	COH	C2B-C1B-NB	-4.09	107.70	110.88
5	B	602	COH	C2C-C1C-NC	-3.37	107.45	110.96
5	A	602	COH	C3A-C4A-NA	-3.09	107.75	110.96
5	B	602	COH	C3A-C4A-NA	-2.98	107.86	110.96
5	B	602	COH	C4C-NC-C1C	2.95	108.88	105.12
4	B	601	SAL	C6-C1-C2	2.89	121.78	118.15
5	B	602	COH	C3C-C2C-C1C	2.88	108.58	106.41
5	A	602	COH	C2C-C1C-NC	-2.86	107.98	110.96
5	B	602	COH	O2D-CGD-CBD	2.60	122.20	114.00
5	A	602	COH	C4C-NC-C1C	2.49	108.28	105.12
4	B	601	SAL	C3-C2-C1	-2.41	117.38	119.89
9	B	608	BOG	C1-O5-C5	2.41	118.42	113.72
5	B	602	COH	C1A-NA-C4A	2.29	108.03	105.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	B	608	BOG	O5-C1-O1	-2.28	104.65	110.04
4	A	601	SAL	C6-C1-C2	2.28	121.01	118.15
5	A	602	COH	C1D-C2D-C3D	-2.26	105.42	107.00
5	B	602	COH	C4B-NB-C1B	2.22	108.39	105.11
5	A	602	COH	C4B-NB-C1B	2.15	108.29	105.11
5	B	602	COH	C2A-C1A-NA	-2.15	107.94	110.57
5	A	602	COH	C1A-NA-C4A	2.12	107.81	105.12
5	B	602	COH	O1D-CGD-CBD	-2.12	116.38	123.09
5	A	602	COH	O1D-CGD-CBD	-2.10	116.42	123.09
5	A	602	COH	O2D-CGD-CBD	2.09	120.61	114.00
4	A	601	SAL	O1'-C1'-C1	-2.09	116.98	121.97
7	A	608	AKR	OXT-C-CA	2.08	119.86	114.19

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	A	602	COH	NB
5	B	602	COH	NB

All (31) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	602	COH	C2D-C3D-CAD-CBD
5	A	602	COH	C4D-C3D-CAD-CBD
7	A	608	AKR	O-C-CA-CB
7	A	608	AKR	OXT-C-CA-CB
7	B	609	AKR	O-C-CA-CB
7	B	609	AKR	OXT-C-CA-CB
9	B	608	BOG	C2-C1-O1-C1'
9	B	608	BOG	O5-C1-O1-C1'
5	B	602	COH	C2A-CAA-CBA-CGA
6	B	607	NAG	O5-C5-C6-O6
6	B	607	NAG	C4-C5-C6-O6
6	A	607	NAG	C8-C7-N2-C2
6	A	607	NAG	O7-C7-N2-C2
5	A	602	COH	C2A-CAA-CBA-CGA
9	B	608	BOG	O5-C5-C6-O6
6	B	603	NAG	O5-C5-C6-O6
8	A	611	EDO	O1-C1-C2-O2
9	B	608	BOG	C2'-C3'-C4'-C5'
5	A	602	COH	C3D-CAD-CBD-CGD
9	B	608	BOG	C5'-C6'-C7'-C8'

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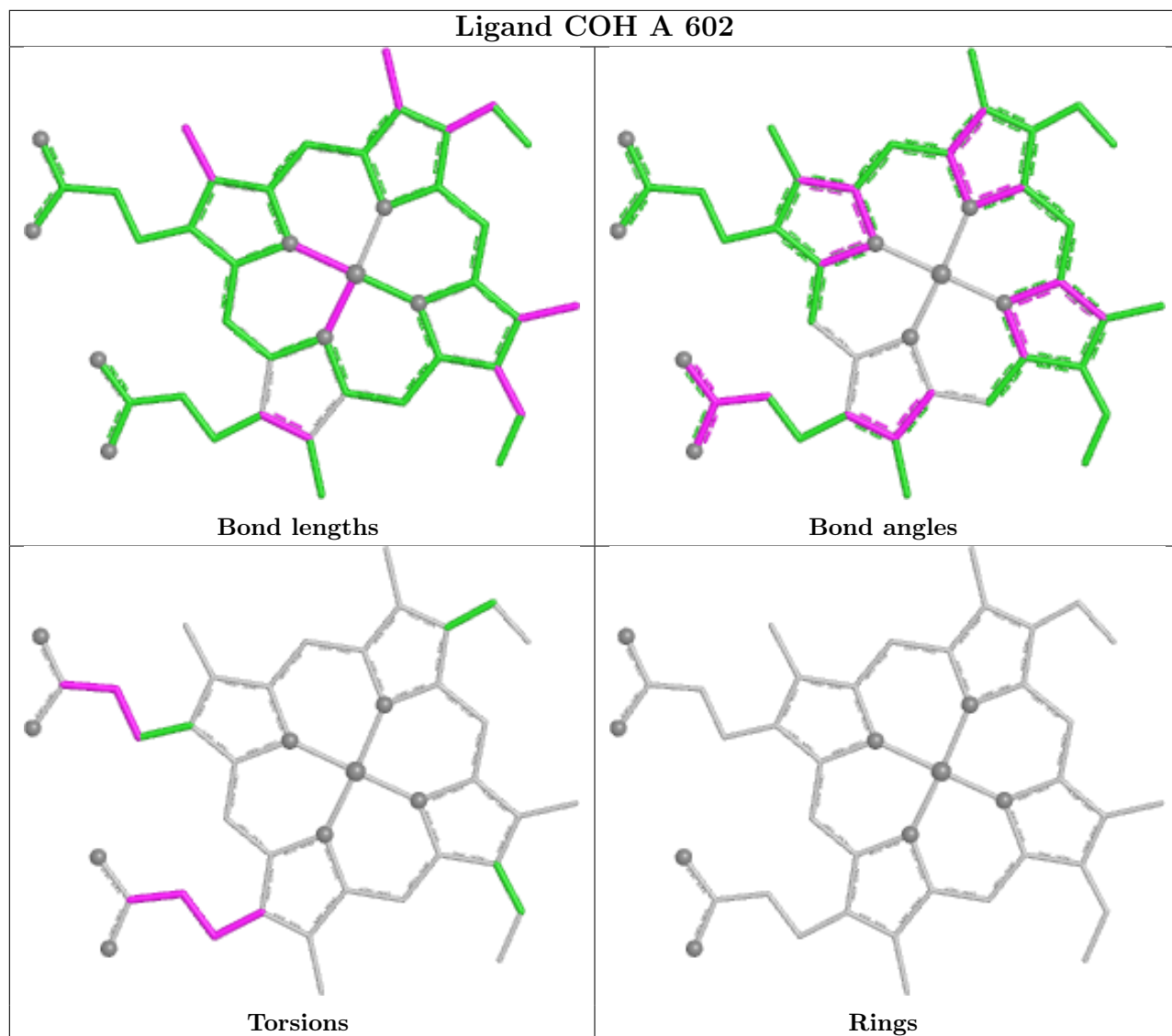
Mol	Chain	Res	Type	Atoms
8	A	610	EDO	O1-C1-C2-O2
5	A	602	COH	CAD-CBD-CGD-O1D
9	B	608	BOG	C3'-C4'-C5'-C6'
5	B	602	COH	CAA-CBA-CGA-O2A
5	B	602	COH	CAD-CBD-CGD-O1D
5	A	602	COH	CAD-CBD-CGD-O2D
5	B	602	COH	CAA-CBA-CGA-O1A
5	B	602	COH	CAD-CBD-CGD-O2D
5	A	602	COH	CAA-CBA-CGA-O2A
5	A	602	COH	CAA-CBA-CGA-O1A
8	B	611	EDO	O1-C1-C2-O2

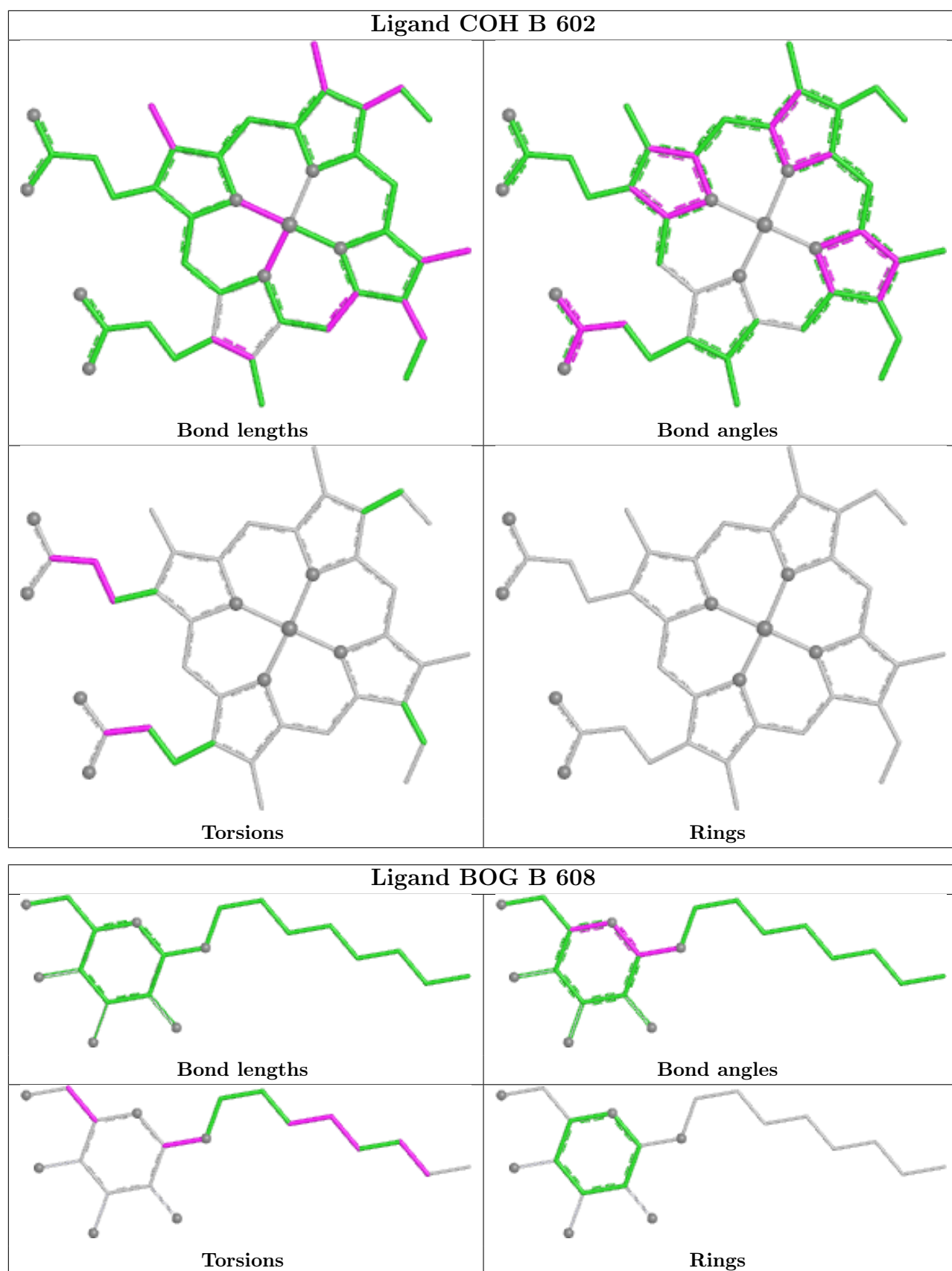
There are no ring outliers.

11 monomers are involved in 23 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	607	NAG	1	0
5	A	602	COH	4	0
8	A	611	EDO	1	0
5	B	602	COH	2	0
4	A	601	SAL	3	0
8	B	612	EDO	2	0
8	A	610	EDO	2	0
8	B	611	EDO	1	0
9	B	608	BOG	2	0
7	B	610	AKR	1	0
4	B	601	SAL	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 [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	553/553 (100%)	-0.37	3 (0%) 87 86	22, 39, 63, 83	2 (0%)
1	B	552/553 (99%)	-0.23	6 (1%) 77 77	23, 43, 75, 94	2 (0%)
All	All	1105/1106 (99%)	-0.30	9 (0%) 82 82	22, 41, 69, 94	4 (0%)

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	409	TYR	3.5
1	A	584	ASP	2.8
1	B	33	LYS	2.7
1	B	81	PHE	2.7
1	A	33	LYS	2.4
1	B	82	LEU	2.4
1	A	81	PHE	2.4
1	B	74	PHE	2.3
1	B	75	LEU	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.

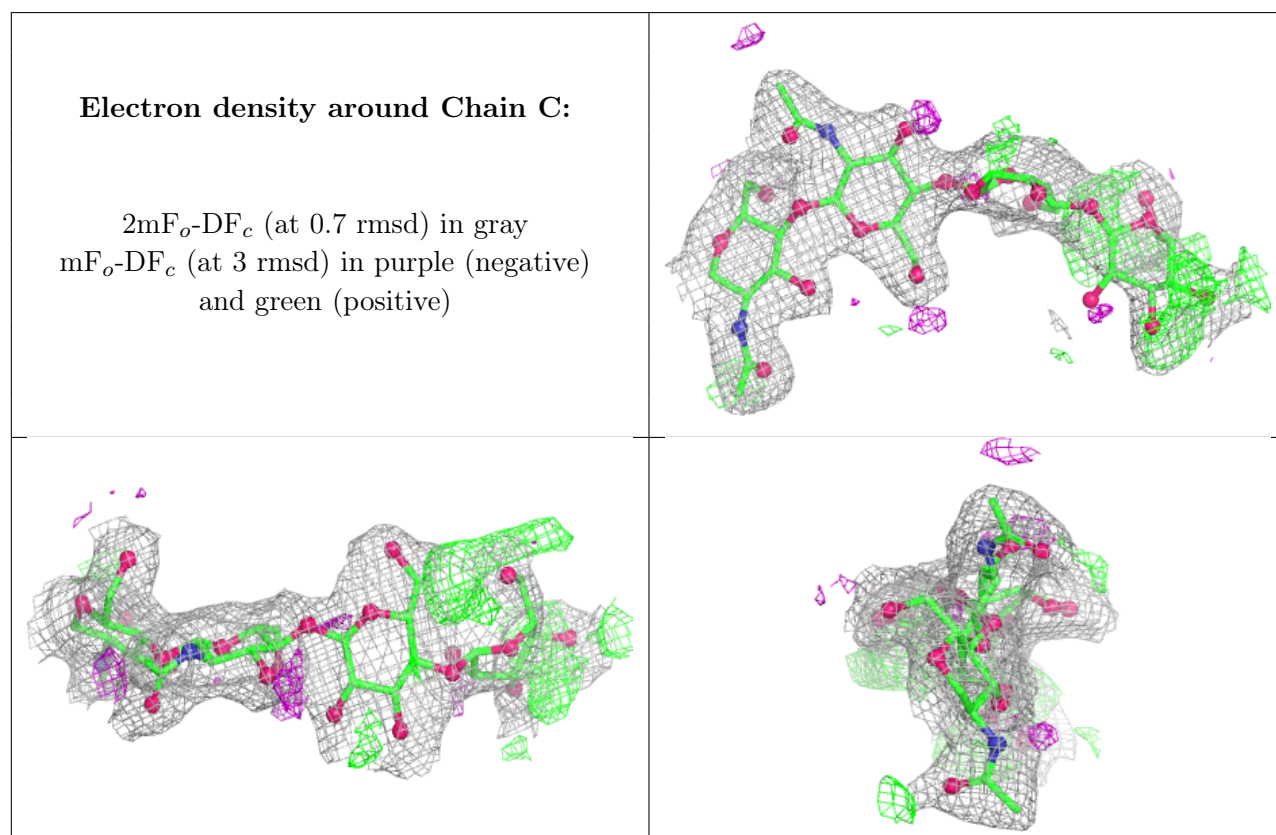
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	MAN	C	4	11/12	0.50	0.25	86,93,100,103	0

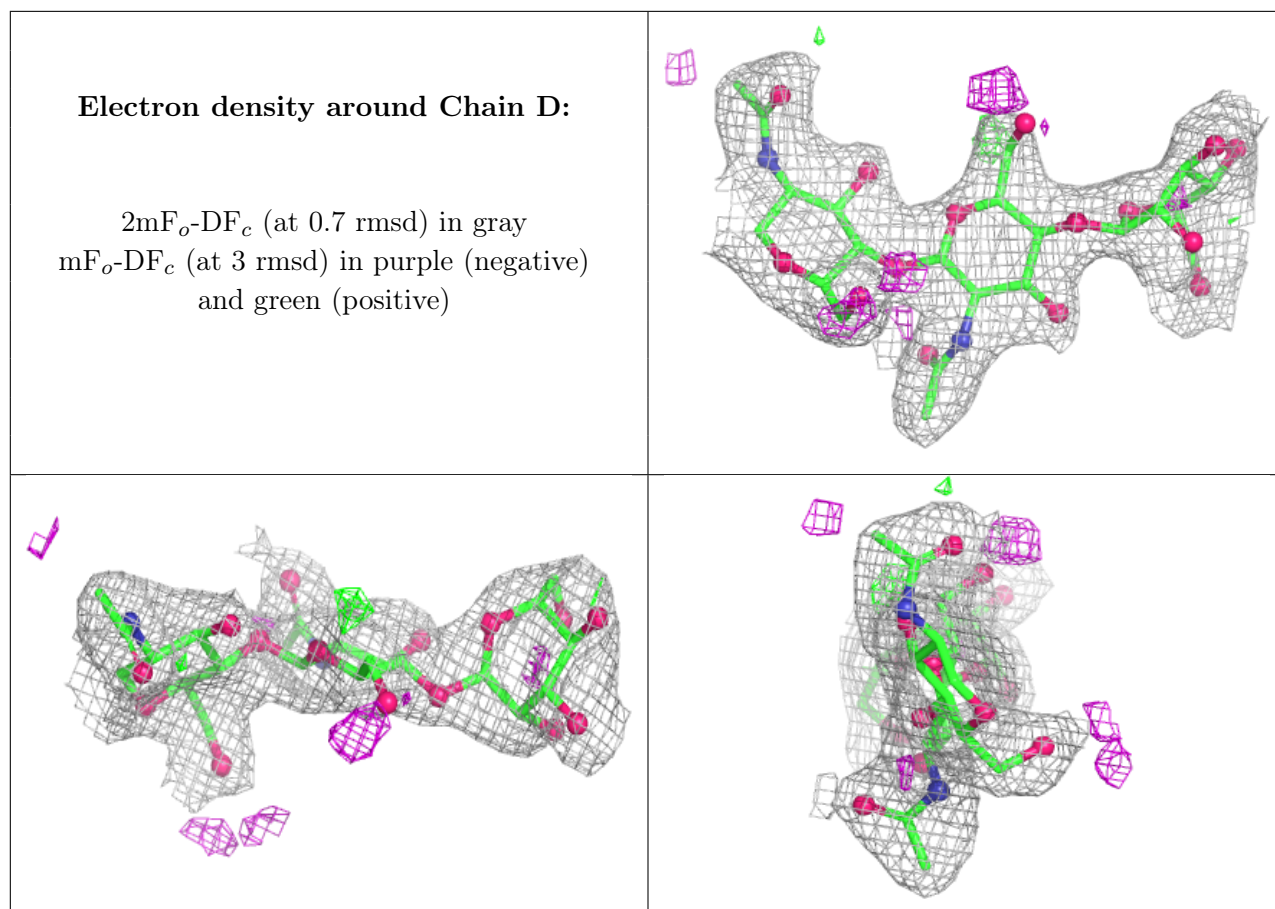
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	MAN	D	3	11/12	0.68	0.14	66,73,76,76	0
2	MAN	C	3	11/12	0.69	0.14	63,68,85,86	0
3	NAG	D	2	14/15	0.83	0.12	44,54,63,64	0
2	NAG	C	2	14/15	0.91	0.09	33,39,47,57	0
3	NAG	D	1	14/15	0.95	0.07	30,35,40,44	0
2	NAG	C	1	14/15	0.96	0.06	28,30,31,34	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 [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.

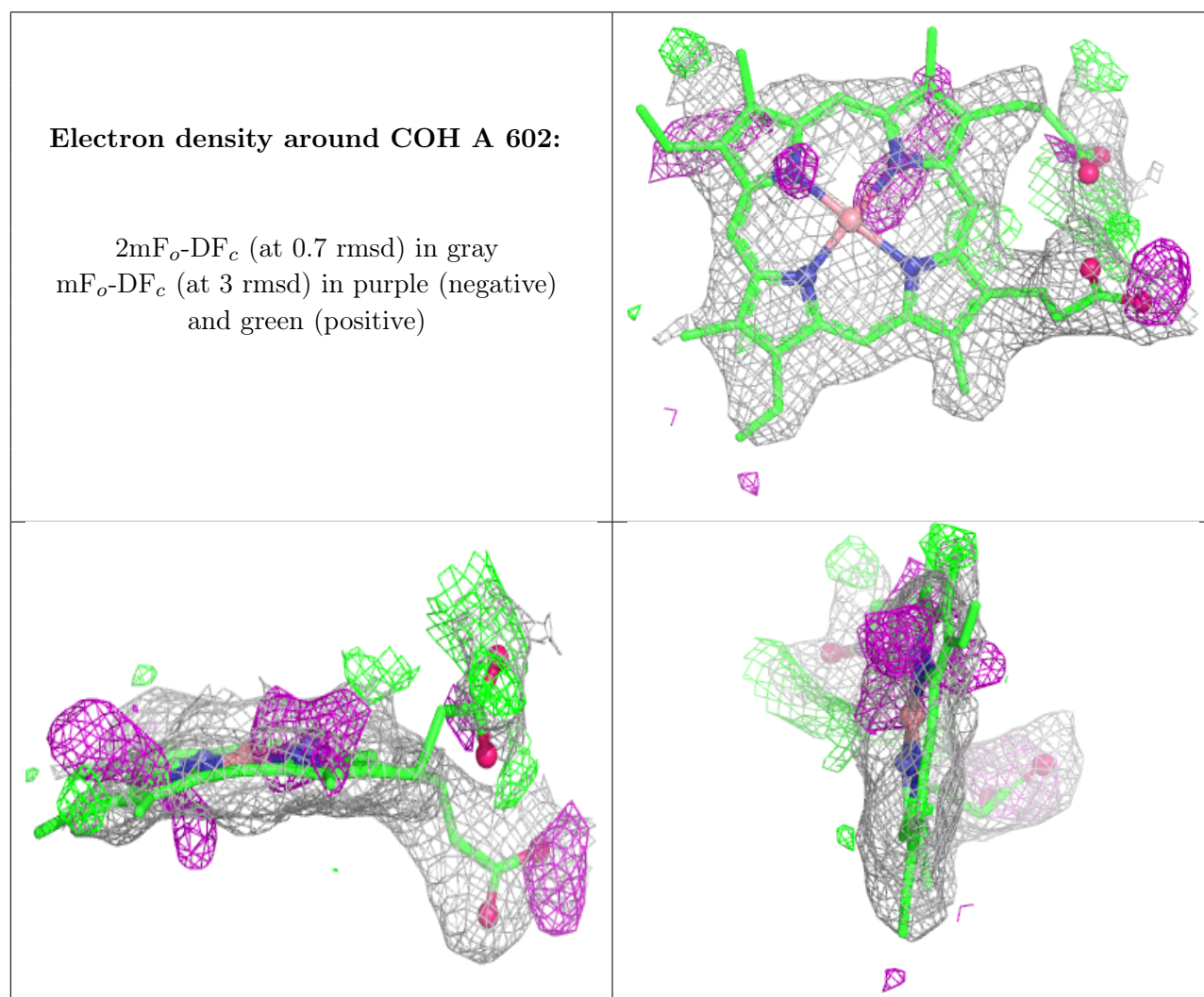
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	NAG	B	603	14/15	0.60	0.17	53,84,89,89	0
7	AKR	B	610	5/5	0.77	0.16	67,67,67,68	0
6	NAG	B	607	14/15	0.82	0.13	61,70,74,77	0
6	NAG	A	607	14/15	0.84	0.10	57,59,64,67	0
5	COH	A	602	43/43	0.86	0.17	51,61,78,83	0
5	COH	B	602	43/43	0.87	0.17	48,72,83,91	0
9	BOG	B	608	20/20	0.87	0.13	50,69,74,74	0
4	SAL	B	601	10/10	0.88	0.17	83,83,84,84	0
4	SAL	A	601	10/10	0.90	0.12	54,55,57,57	0
8	EDO	A	610	4/4	0.90	0.15	63,63,63,63	0
7	AKR	B	609	5/5	0.90	0.13	48,48,49,50	0
8	EDO	B	611	4/4	0.91	0.12	43,43,45,45	0
7	AKR	A	608	5/5	0.91	0.16	51,51,55,58	0

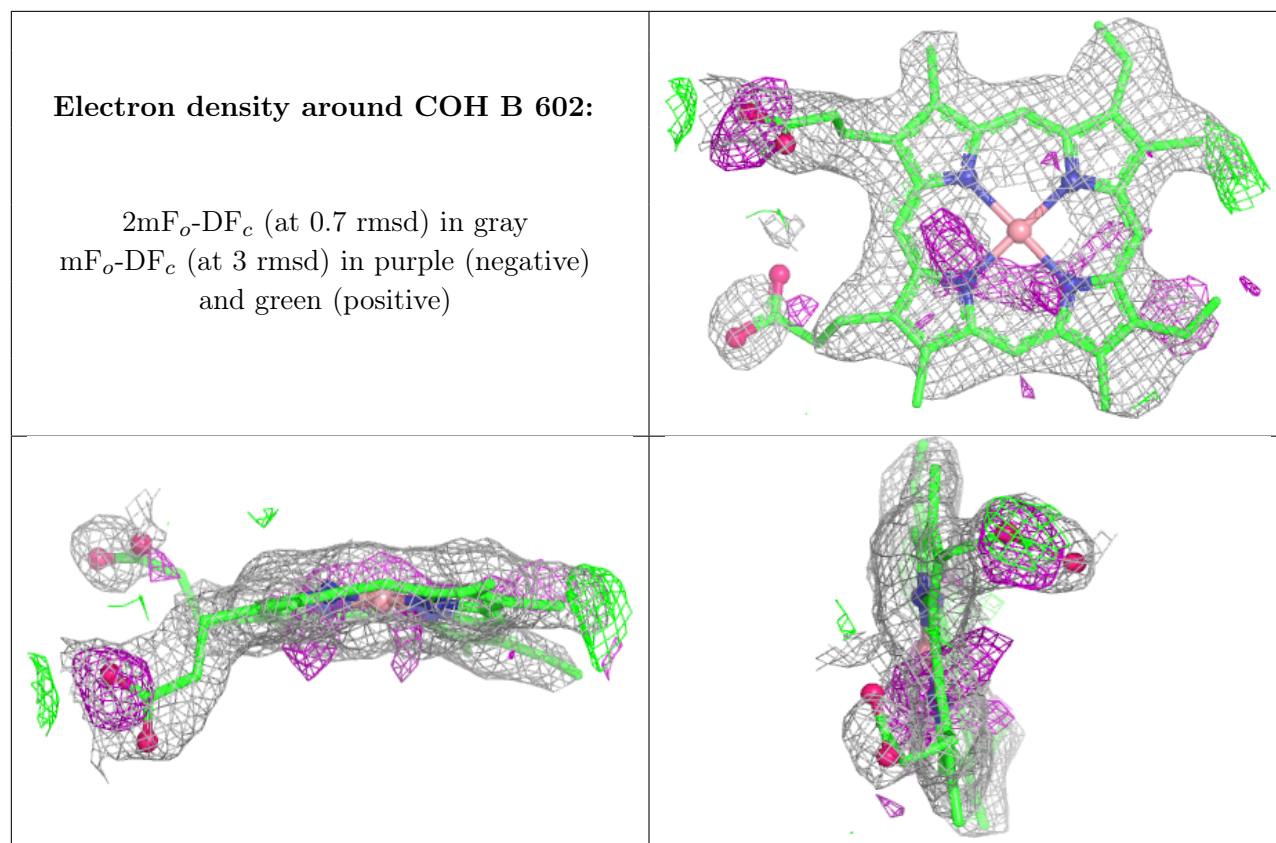
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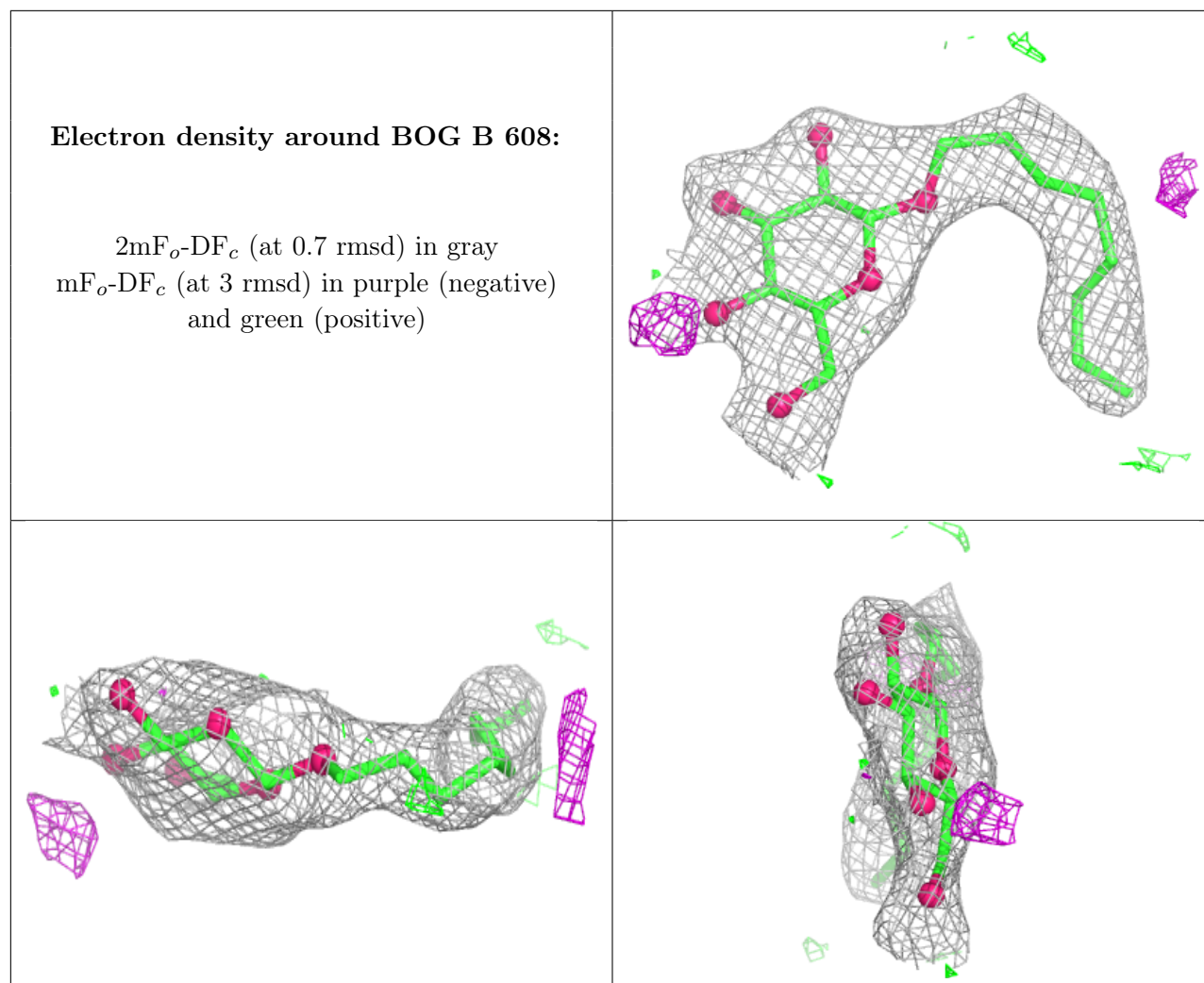
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
8	EDO	A	609	4/4	0.94	0.11	47,48,49,50	0
8	EDO	B	612	4/4	0.94	0.11	45,46,47,47	0
8	EDO	A	611	4/4	0.94	0.11	47,47,48,48	0

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.