Full wwPDB X-ray Structure Validation Report (i)

Jun 24, 2024 – 07:40 AM EDT

PDB ID	:	6BPL
Title	:	E. coli MsbA in complex with LPS and inhibitor G907
Authors	:	Ho, H.; Koth, C.M.; Payandeh, J.
Deposited on	:	2017-11-23
Resolution	:	2.91 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 (i) 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 (i)) were used in the production of this report:

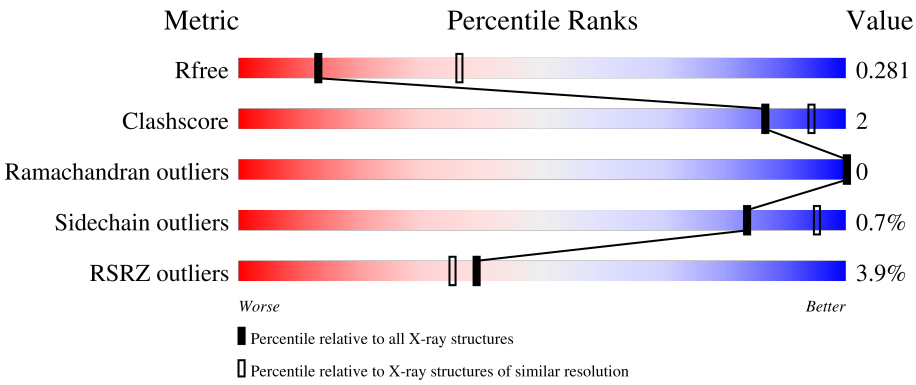
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.91 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}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 <=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	582	3% 94% 5% •
1	B	582	5% 94% • •
2	C	5	40% 60%
3	D	4	50% 50%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GMH	C	1	-	-	-	X
2	GLC	C	3	-	-	-	X
2	GMH	C	5	-	-	-	X
3	KDO	D	3	-	-	-	X
3	GMH	D	4	-	-	-	X
6	FTT	A	603	-	-	-	X

2 Entry composition (i)

There are 11 unique types of molecules in this entry. The entry contains 9180 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.

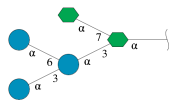
- Molecule 1 is a protein called Lipid A export ATP-binding/permease protein MsbA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	576	4469	2829	778	835	27	0	0	0
1	B	565	4358	2764	757	812	25	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

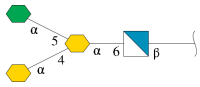
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP Q8FJB1
A	65	VAL	MET	conflict	UNP Q8FJB1
A	84	VAL	ILE	conflict	UNP Q8FJB1
B	1	SER	-	expression tag	UNP Q8FJB1
B	65	VAL	MET	conflict	UNP Q8FJB1
B	84	VAL	ILE	conflict	UNP Q8FJB1

- Molecule 2 is an oligosaccharide called alpha-D-glucopyranose-(1-3)-[alpha-D-glucopyranose-(1-6)]alpha-D-glucopyranose-(1-3)-[L-glycero-alpha-D-manno-heptopyranose-(1-7)]L-glycero-alpha-D-manno-heptopyranose.



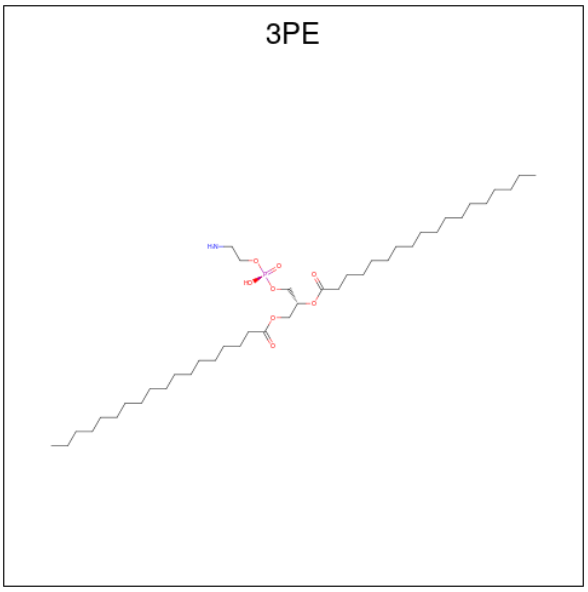
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
			Total	C	O			
2	C	5	59	32	27	0	0	0

- Molecule 3 is an oligosaccharide called 3-deoxy-alpha-D-manno-oct-2-ulopyranosonic acid-(2-4)-[L-glycero-alpha-D-manno-heptopyranose-(1-5)]3-deoxy-alpha-D-manno-oct-2-ulopyranosonic acid-(2-6)-2-amino-2-deoxy-beta-D-glucopyranose.



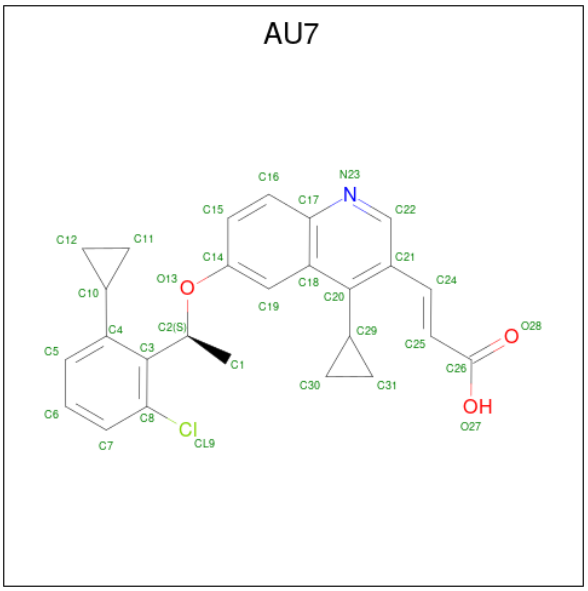
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	4	54	29	1	24	0	0	0

- Molecule 4 is 1,2-DIACYL-SN-GLYCERO-3-PHOSPHOETHANOLAMINE (three-letter code: 3PE) (formula: $C_{41}H_{82}NO_8P$).



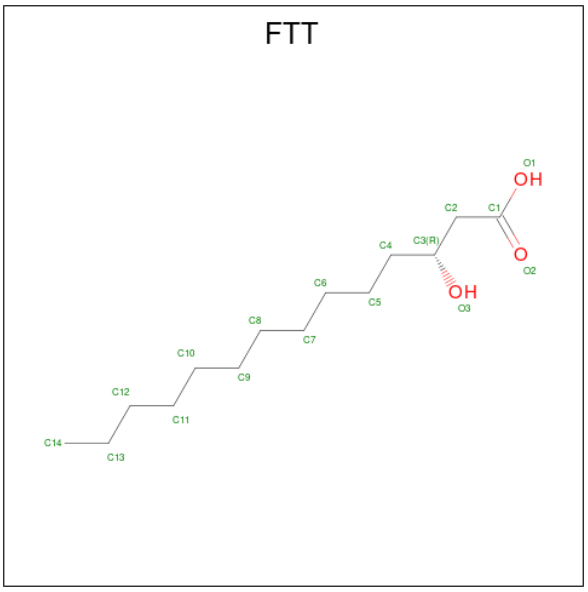
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
4	A	1	22	12	1	8	1	0	0
			Total	C	N	O	P		
4	B	1	19	9	1	8	1	0	0
			Total	C					
4	B	1	10	10				0	0
			Total	C					
4	B	1	7	7				0	0

- Molecule 5 is (2E)-3-{6-[(1S)-1-(2-chloro-6-cyclopropylphenyl)ethoxy]-4-cyclopropylquinolin-3-yl}prop-2-enoic acid (three-letter code: AU7) (formula: $C_{26}H_{24}ClNO_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	O		
5	A	1	31	26	1	1	3	0	0
			Total	C	Cl	N	O		
5	B	1	31	26	1	1	3	0	0

- Molecule 6 is 3-HYDROXY-TETRADECANOIC ACID (three-letter code: FTT) (formula: $C_{14}H_{28}O_3$).



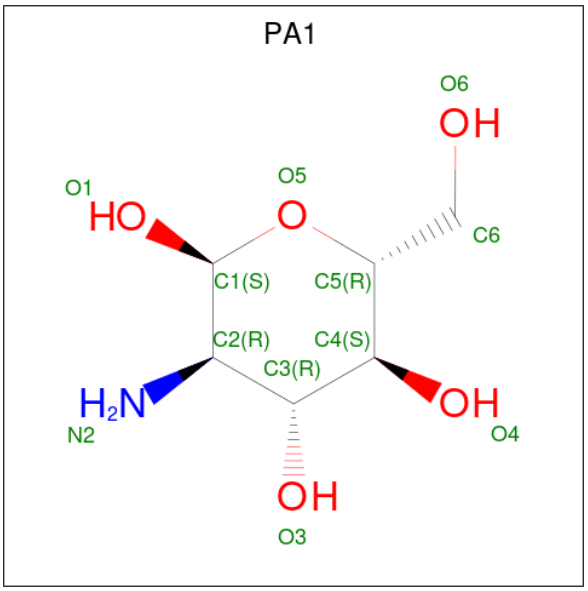
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	A	1	16	14	2	0	0

Continued on next page...

Continued from previous page...

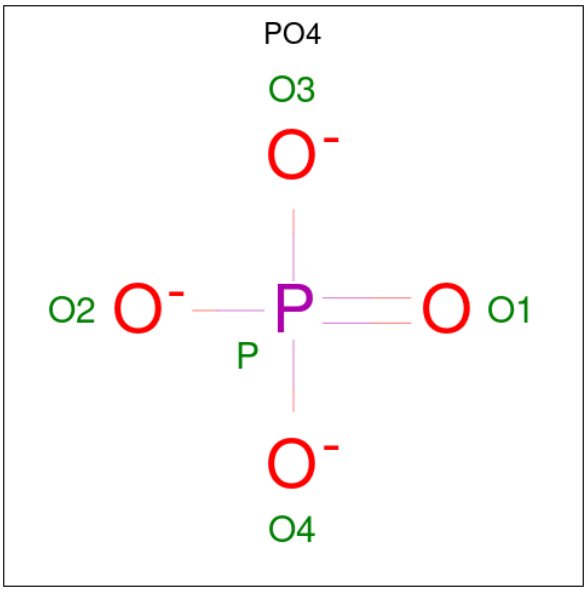
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O			
6	B	1	16	14	2		0	0
			Total	C	O			
6	B	1	16	14	2		0	0
			Total	C	O			
6	B	1	16	14	2		0	0

- Molecule 7 is 2-amino-2-deoxy-alpha-D-glucopyranose (three-letter code: PA1) (formula: $C_6H_{13}NO_5$).



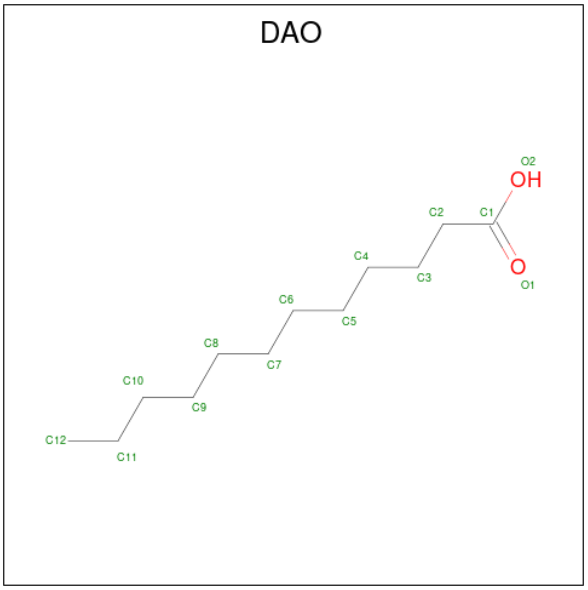
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
7	B	1	12	6	1	5	0	0

- Molecule 8 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



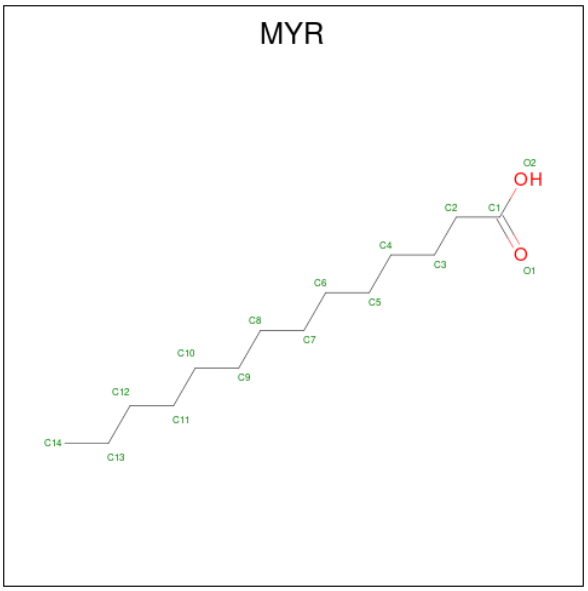
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	B	1	Total O P 4 3 1	0	0
8	B	1	Total O P 4 3 1	0	0

- Molecule 9 is LAURIC ACID (three-letter code: DAO) (formula: $C_{12}H_{24}O_2$).



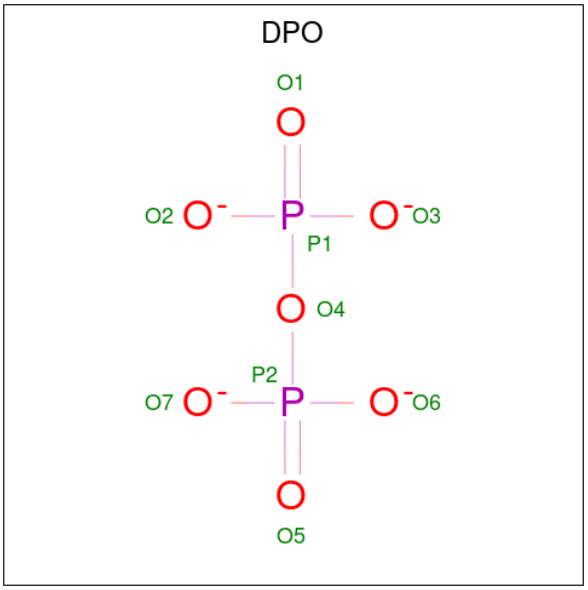
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	B	1	Total C O 13 12 1	0	0

- Molecule 10 is MYRISTIC ACID (three-letter code: MYR) (formula: $C_{14}H_{28}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
10	B	1	15	14	1	0	0

- Molecule 11 is DIPHOSPHATE (three-letter code: DPO) (formula: O_7P_2).



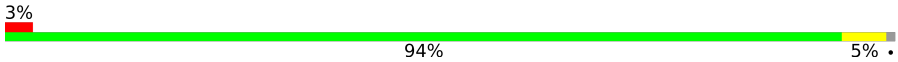
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
11	B	1	8	6	2	0	0

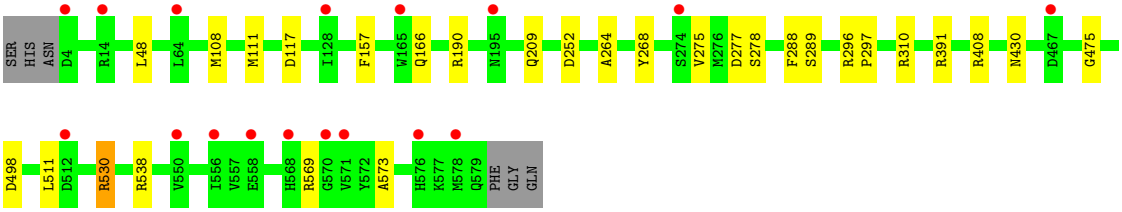
3 Residue-property plots (i)

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: Lipid A export ATP-binding/permease protein MsbA

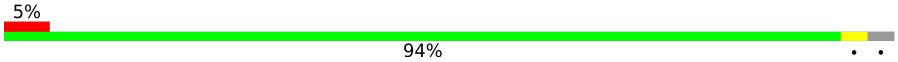
Chain A:

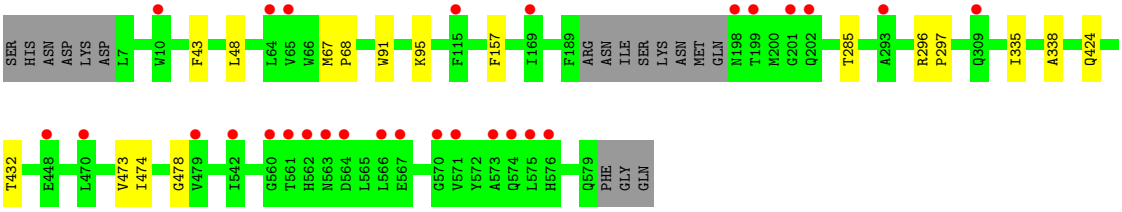




• Molecule 1: Lipid A export ATP-binding/permease protein MsbA

Chain B:





• Molecule 2: alpha-D-glucopyranose-(1-3)-[alpha-D-glucopyranose-(1-6)]alpha-D-glucopyranose-(1-3)-[L-glycero-alpha-D-manno-heptopyranose-(1-7)]L-glycero-alpha-D-manno-heptopyranose

Chain C:

• Molecule 3: 3-deoxy-alpha-D-manno-oct-2-ulopyranosonic acid-(2-4)-[L-glycero-alpha-D-manno-heptopyranose-(1-5)]3-deoxy-alpha-D-manno-oct-2-ulopyranosonic acid-(2-6)-2-amino-2-deoxy-beta-D-glucopyranose

Chain D:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	74.75Å 91.61Å 111.01Å 90.00° 89.39° 90.00°	Depositor
Resolution (Å)	39.90 – 2.91 39.91 – 2.91	Depositor EDS
% Data completeness (in resolution range)	89.6 (39.90-2.91) 89.6 (39.91-2.91)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.36 (at 2.90Å)	Xtriage
Refinement program	PHENIX (dev_2747: ???)	Depositor
R, R_{free}	0.233 , 0.283 0.237 , 0.281	Depositor DCC
R_{free} test set	1482 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	79.9	Xtriage
Anisotropy	0.191	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 56.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.027 for h,-k,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	9180	wwPDB-VP
Average B, all atoms (Å^2)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.93% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: GMH, PA1, GLC, KDO, 3PE, DPO, MYR, FTT, PO4, AU7, DAO, GCS

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	0.25	0/4534	0.43	0/6127
1	B	0.26	0/4421	0.43	0/5978
All	All	0.25	0/8955	0.43	0/12105

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 (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	4469	0	4592	19	0
1	B	4358	0	4471	9	0
2	C	59	0	50	3	0
3	D	54	0	39	3	0
4	A	22	0	18	0	0
4	B	36	0	44	0	0
5	A	31	0	0	1	0
5	B	31	0	0	2	0
6	A	16	0	27	2	0
6	B	48	0	79	3	0
7	B	12	0	10	4	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	B	8	0	0	0	0
9	B	13	0	23	2	0
10	B	15	0	27	2	0
11	B	8	0	0	0	0
All	All	9180	0	9380	38	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 2.

All (38) 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)
7:B:605:PA1:H62	3:D:2:KDO:H81	1.63	0.80
1:A:498:ASP:OD1	1:A:530:ARG:NH2	2.22	0.72
1:A:288:PHE:CD2	6:A:603:FTT:H141	2.25	0.71
1:A:289:SER:HB3	9:B:613:DAO:H92	1.81	0.63
1:B:296:ARG:HB2	1:B:297:PRO:HD3	1.82	0.60
1:A:430:ASN:HA	1:A:475:GLY:HA3	1.88	0.55
3:D:2:KDO:H7	3:D:4:GMH:C1	2.37	0.53
1:A:277:ASP:OD1	1:A:278:SER:N	2.39	0.52
2:C:2:GLC:H4	2:C:4:GLC:C1	2.40	0.52
1:A:296:ARG:HB3	1:A:297:PRO:HD3	1.91	0.52
1:B:432:THR:HA	1:B:473:VAL:HA	1.93	0.51
6:B:614:FTT:H131	10:B:615:MYR:H132	1.93	0.50
1:B:67:MET:HB2	1:B:68:PRO:HD3	1.94	0.50
1:B:474:ILE:CG2	1:B:478:GLY:HA2	2.43	0.49
1:A:288:PHE:CG	6:A:603:FTT:H141	2.49	0.47
1:A:296:ARG:NH2	7:B:605:PA1:H2	2.30	0.47
1:A:296:ARG:HH22	7:B:605:PA1:C1	2.29	0.46
1:A:310:ARG:NH2	2:C:3:GLC:O2	2.48	0.46
3:D:1:GCS:H62	3:D:2:KDO:H32	1.64	0.46
1:A:48:LEU:HD21	6:B:614:FTT:H122	1.98	0.46
1:A:264:ALA:O	1:A:268:TYR:N	2.44	0.45
2:C:2:GLC:O5	2:C:4:GLC:O6	2.30	0.45
1:A:569:ARG:HA	1:A:573:ALA:HB2	1.99	0.44
1:A:166:GLN:HB2	1:A:275:VAL:HG21	2.00	0.44
6:B:614:FTT:C13	10:B:615:MYR:H132	2.48	0.44
1:B:335:ILE:HG21	1:B:338:ALA:HB2	1.99	0.44
5:A:602:AU7:O13	5:A:602:AU7:C10	2.66	0.43
1:A:190:ARG:NH1	1:A:252:ASP:OD1	2.51	0.43
1:A:296:ARG:HH21	7:B:605:PA1:H2	1.84	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:474:ILE:HG22	1:B:478:GLY:HA2	2.02	0.42
1:B:48:LEU:HD21	1:B:285:THR:HG22	2.02	0.41
5:B:604:AU7:C24	5:B:604:AU7:C31	2.97	0.41
1:A:108:MET:HA	1:A:111:MET:HG2	2.01	0.41
1:A:391:ARG:NH2	1:A:408:ARG:HA	2.36	0.41
1:A:511:LEU:HD21	1:A:538:ARG:HG2	2.03	0.41
5:B:604:AU7:O13	5:B:604:AU7:C10	2.69	0.41
1:B:48:LEU:HD11	9:B:613:DAO:C10	2.51	0.41
1:B:91:TRP:O	1:B:95:LYS:HG2	2.22	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	574/582 (99%)	551 (96%)	23 (4%)	0	100	100
1	B	561/582 (96%)	532 (95%)	29 (5%)	0	100	100
All	All	1135/1164 (98%)	1083 (95%)	52 (5%)	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	491/496 (99%)	487 (99%)	4 (1%)	81	94
1	B	475/496 (96%)	472 (99%)	3 (1%)	86	96
All	All	966/992 (97%)	959 (99%)	7 (1%)	84	95

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	117	ASP
1	A	157	PHE
1	A	209	GLN
1	A	530	ARG
1	B	43	PHE
1	B	157	PHE
1	B	424	GLN

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)

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	GMH	C	1	2	13,13,14	0.48	0	17,18,20	1.15	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	GLC	C	2	2	11,11,12	0.84	0	15,15,17	1.38	3 (20%)
2	GLC	C	3	2	11,11,12	0.40	0	15,15,17	3.13	3 (20%)
2	GLC	C	4	2	11,11,12	0.51	0	15,15,17	1.50	4 (26%)
2	GMH	C	5	2	13,13,14	0.62	0	17,18,20	1.66	4 (23%)
3	GCS	D	1	6,8,1,3	11,11,12	0.33	0	12,15,17	0.84	0
3	KDO	D	2	3	15,15,16	0.70	0	19,21,24	1.54	5 (26%)
3	KDO	D	3	3	15,15,16	0.69	0	19,21,24	1.55	4 (21%)
3	GMH	D	4	11,3	13,13,14	0.42	0	17,18,20	2.27	5 (29%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GMH	C	1	2	-	5/6/23/26	0/1/1/1
2	GLC	C	2	2	-	2/2/19/22	0/1/1/1
2	GLC	C	3	2	-	2/2/19/22	0/1/1/1
2	GLC	C	4	2	-	0/2/19/22	0/1/1/1
2	GMH	C	5	2	-	4/6/23/26	0/1/1/1
3	GCS	D	1	6,8,1,3	-	2/2/19/22	0/1/1/1
3	KDO	D	2	3	-	1/10/26/30	0/1/1/1
3	KDO	D	3	3	-	4/10/26/30	0/1/1/1
3	GMH	D	4	11,3	-	4/6/23/26	0/1/1/1

There are no bond length outliers.

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	3	GLC	C1-O5-C5	10.57	126.51	112.19
3	D	4	GMH	C1-C2-C3	6.27	117.37	109.67
2	C	5	GMH	C1-C2-C3	4.56	115.27	109.67
2	C	3	GLC	C1-C2-C3	4.52	115.22	109.67
3	D	3	KDO	C4-C3-C2	4.27	117.46	109.81
3	D	4	GMH	C6-C5-C4	-4.02	107.36	114.03
3	D	2	KDO	C4-C3-C2	3.28	115.68	109.81
3	D	2	KDO	C4-C5-C6	-3.20	103.97	110.41
3	D	4	GMH	C2-C3-C4	3.17	116.38	110.89
3	D	4	GMH	C1-O5-C5	2.99	116.38	111.48

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	5	GMH	C6-C5-C4	-2.70	109.55	114.03
3	D	3	KDO	O6-C2-C3	2.67	114.13	110.46
2	C	4	GLC	O3-C3-C2	-2.60	105.01	109.99
2	C	5	GMH	C1-O5-C5	2.60	115.73	111.48
3	D	3	KDO	C3-C4-C5	2.56	114.41	110.69
2	C	2	GLC	C1-C2-C3	2.47	112.71	109.67
2	C	4	GLC	O5-C5-C6	-2.39	103.46	107.20
2	C	4	GLC	C3-C4-C5	2.36	114.45	110.24
2	C	2	GLC	O3-C3-C2	2.31	114.41	109.99
2	C	1	GMH	C3-C4-C5	2.28	114.90	109.68
2	C	2	GLC	C1-O5-C5	2.25	115.23	112.19
2	C	4	GLC	C1-C2-C3	-2.23	106.93	109.67
3	D	2	KDO	O5-C5-C6	2.18	115.72	109.94
3	D	4	GMH	C3-C4-C5	2.15	114.60	109.68
3	D	2	KDO	O6-C2-C3	2.13	113.39	110.46
2	C	5	GMH	O5-C1-C2	2.12	114.05	110.77
3	D	2	KDO	O1A-C1-C2	-2.11	117.58	122.57
2	C	3	GLC	O5-C5-C6	-2.09	103.93	107.20
3	D	3	KDO	O6-C2-C1	2.06	111.74	107.70

There are no chirality outliers.

All (24) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	1	GMH	C4-C5-C6-C7
2	C	1	GMH	C4-C5-C6-O6
2	C	1	GMH	O5-C5-C6-C7
2	C	1	GMH	O5-C5-C6-O6
2	C	5	GMH	C4-C5-C6-C7
2	C	5	GMH	C4-C5-C6-O6
2	C	5	GMH	O5-C5-C6-C7
2	C	5	GMH	O5-C5-C6-O6
3	D	3	KDO	C5-C6-C7-O7
3	D	3	KDO	C5-C6-C7-C8
3	D	3	KDO	O6-C6-C7-O7
3	D	3	KDO	O6-C6-C7-C8
3	D	4	GMH	C4-C5-C6-O6
3	D	4	GMH	O5-C5-C6-C7
3	D	4	GMH	O5-C5-C6-O6
2	C	3	GLC	O5-C5-C6-O6
3	D	1	GCS	C4-C5-C6-O6
3	D	1	GCS	O5-C5-C6-O6

Continued on next page...

Continued from previous page...

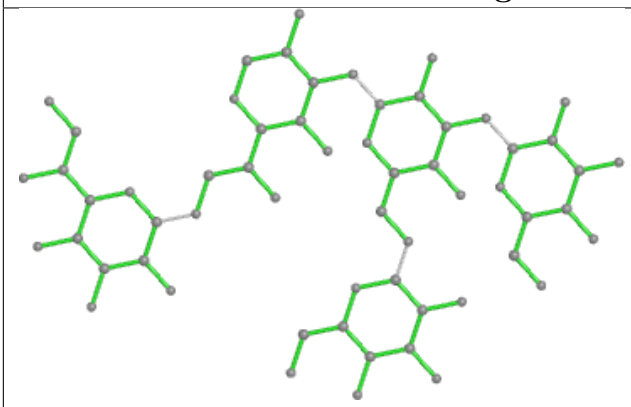
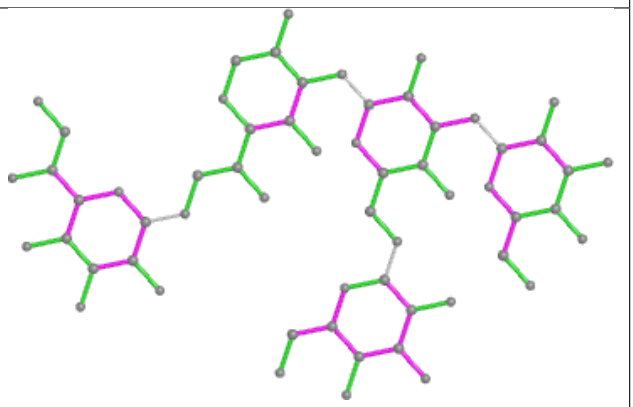
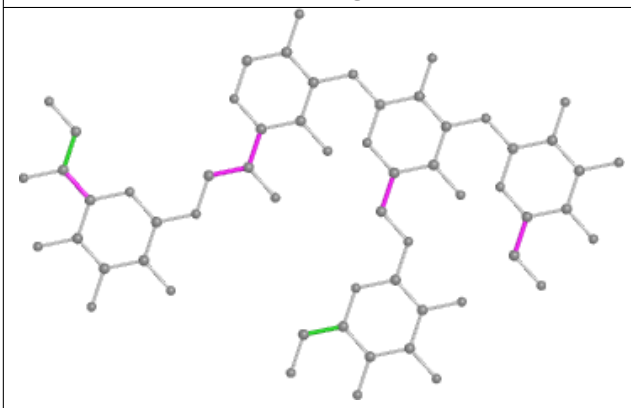
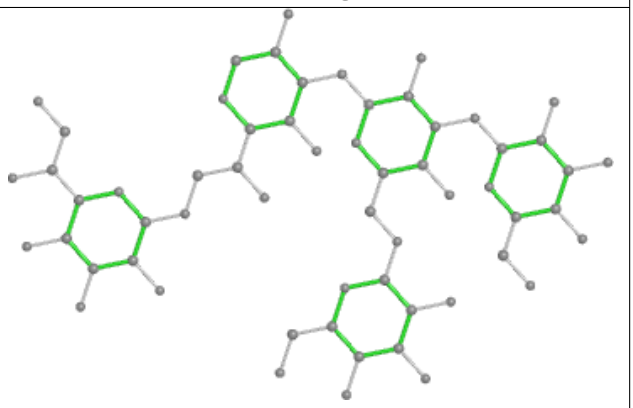
Mol	Chain	Res	Type	Atoms
2	C	2	GLC	C4-C5-C6-O6
2	C	2	GLC	O5-C5-C6-O6
2	C	3	GLC	C4-C5-C6-O6
2	C	1	GMH	O6-C6-C7-O7
3	D	2	KDO	O1A-C1-C2-O6
3	D	4	GMH	C4-C5-C6-C7

There are no ring outliers.

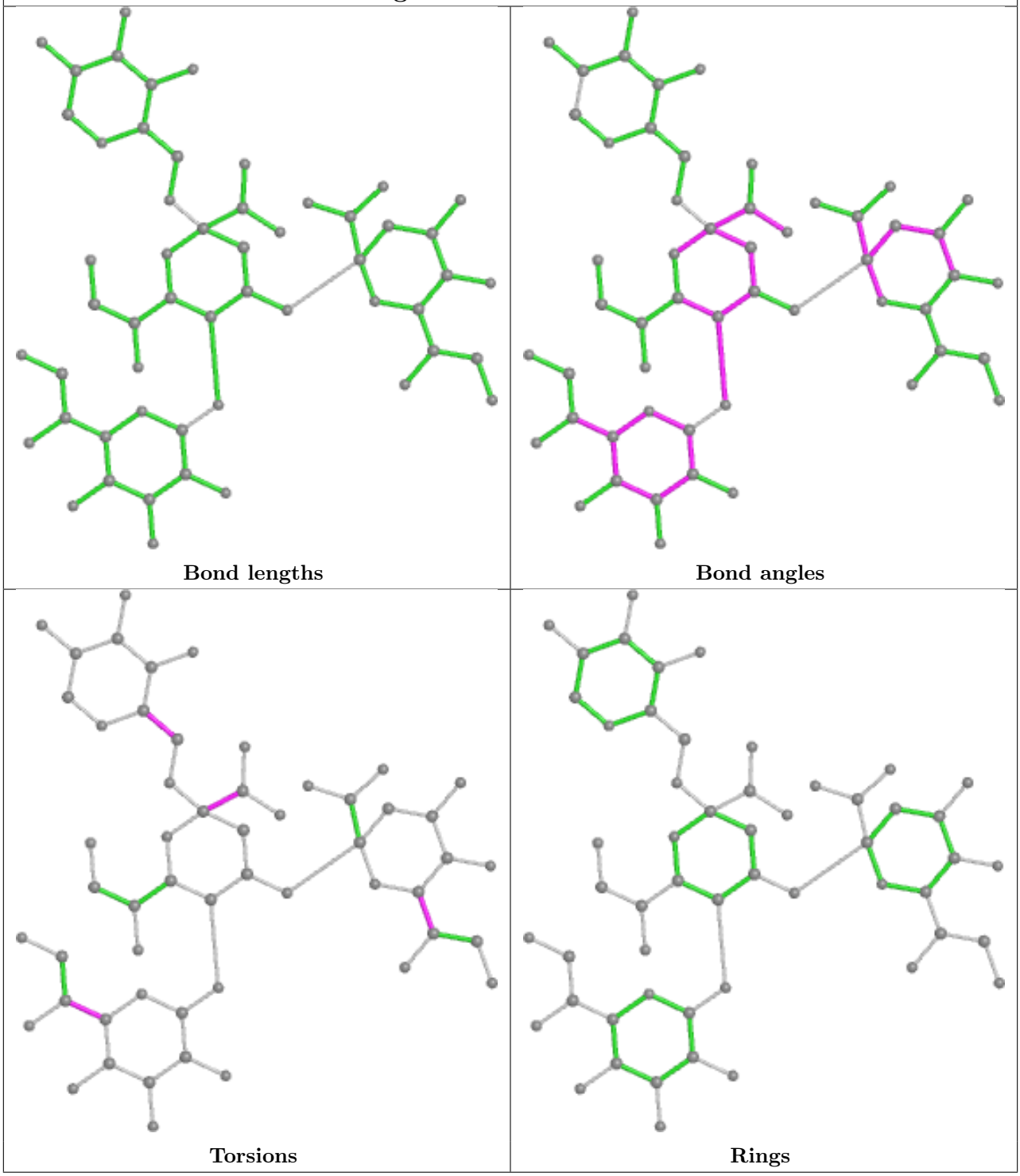
6 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	1	GCS	1	0
2	C	4	GLC	2	0
2	C	3	GLC	1	0
2	C	2	GLC	2	0
3	D	2	KDO	3	0
3	D	4	GMH	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.

Oligosaccharide Chain C	
 Bond lengths	 Bond angles
 Torsions	 Rings

Oligosaccharide Chain D



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	$\#\|Z\| > 2$
4	3PE	B	603	-	6,6,50	0.64	0	5,5,55	0.16	0
10	MYR	B	615	6	14,14,15	0.38	0	13,13,15	0.71	0
11	DPO	B	617	3	3,7,8	0.75	0	6,10,13	1.01	0
6	FTT	B	612	9,3	15,15,16	0.37	0	15,15,17	1.06	1 (6%)
6	FTT	B	614	10,3	15,15,16	0.35	0	15,15,17	1.06	2 (13%)
8	PO4	B	616	3	0,3,4	-	-	0,3,6	-	-
8	PO4	B	606	7	0,3,4	-	-	0,3,6	-	-
4	3PE	B	602	-	9,9,50	0.71	0	8,8,55	0.15	0
4	3PE	A	601	-	21,21,50	1.84	4 (19%)	24,26,55	1.56	4 (16%)
5	AU7	A	602	-	34,35,35	1.29	2 (5%)	47,51,51	1.47	5 (10%)
5	AU7	B	604	-	34,35,35	1.27	3 (8%)	47,51,51	1.49	5 (10%)
7	PA1	B	605	6,8	12,12,12	0.73	0	16,17,17	1.42	2 (12%)
4	3PE	B	601	-	18,18,50	1.97	3 (16%)	21,23,55	1.83	5 (23%)
6	FTT	A	603	7	15,15,16	0.37	0	15,15,17	0.98	1 (6%)
6	FTT	B	607	7	15,15,16	0.38	0	15,15,17	0.95	1 (6%)
9	DAO	B	613	6	12,12,13	0.37	0	11,11,13	0.80	0

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
4	3PE	B	603	-	-	2/4/4/54	-
10	MYR	B	615	6	-	3/11/12/13	-
11	DPO	B	617	3	-	1/2/5/6	-
6	FTT	B	612	9,3	-	5/14/14/15	-
6	FTT	B	614	10,3	-	3/14/14/15	-
4	3PE	B	602	-	-	4/7/7/54	-
4	3PE	A	601	-	-	7/24/24/54	-
5	AU7	A	602	-	-	1/21/25/25	0/5/5/5
5	AU7	B	604	-	-	3/21/25/25	0/5/5/5
7	PA1	B	605	6,8	-	2/2/22/22	0/1/1/1

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	3PE	B	601	-	-	11/20/20/54	-
6	FTT	A	603	7	-	5/14/14/15	-
6	FTT	B	607	7	-	3/14/14/15	-
9	DAO	B	613	6	-	7/9/10/11	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	601	3PE	P-O13	5.92	1.83	1.59
4	A	601	3PE	P-O13	5.44	1.81	1.59
5	A	602	AU7	O28-C26	4.94	1.35	1.23
5	B	604	AU7	O28-C26	4.78	1.35	1.23
5	A	602	AU7	O27-C26	-3.22	1.21	1.30
5	B	604	AU7	O27-C26	-3.10	1.22	1.30
4	A	601	3PE	C3-C2	2.96	1.59	1.50
4	B	601	3PE	C3-C2	2.77	1.59	1.50
4	A	601	3PE	O13-C11	-2.38	1.35	1.44
4	A	601	3PE	O21-C21	2.12	1.40	1.34
4	B	601	3PE	O13-C11	-2.07	1.36	1.44
5	B	604	AU7	C17-N23	-2.05	1.33	1.37

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	601	3PE	O21-C21-C22	5.47	121.16	111.09
5	A	602	AU7	C21-C24-C25	-4.99	117.01	126.93
4	A	601	3PE	O21-C21-C22	4.47	121.14	111.50
5	B	604	AU7	C22-N23-C17	4.01	121.73	116.91
5	A	602	AU7	C22-N23-C17	3.94	121.66	116.91
5	B	604	AU7	C1-C2-C3	-3.83	108.97	113.48
5	B	604	AU7	C21-C24-C25	-3.81	119.36	126.93
4	B	601	3PE	O12-P-O14	3.45	129.30	112.24
4	A	601	3PE	O12-P-O14	3.45	129.29	112.24
7	B	605	PA1	C4-C3-C2	-3.36	105.29	111.07
5	B	604	AU7	O13-C2-C3	3.23	112.41	107.64
5	A	602	AU7	C1-C2-C3	-3.02	109.92	113.48
5	A	602	AU7	O13-C2-C3	2.76	111.71	107.64
4	B	601	3PE	O13-P-O14	-2.67	98.63	109.07
6	B	612	FTT	O2-C1-C2	-2.63	117.78	125.43
5	A	602	AU7	C14-O13-C2	2.53	121.87	118.57
4	A	601	3PE	O13-P-O14	-2.52	99.22	109.07

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	B	607	FTT	O2-C1-C2	-2.50	118.15	125.43
6	B	614	FTT	O2-C1-C2	-2.37	118.52	125.43
7	B	605	PA1	O4-C4-C5	2.37	115.18	109.30
6	B	614	FTT	C3-C2-C1	-2.30	108.71	112.75
5	B	604	AU7	C18-C17-N23	-2.30	120.38	122.83
6	A	603	FTT	O2-C1-C2	-2.28	118.78	125.43
4	B	601	3PE	O21-C21-O22	-2.17	118.64	122.96
4	B	601	3PE	C2-O21-C21	2.15	121.89	117.90
4	A	601	3PE	O21-C21-O22	-2.13	118.55	123.70

There are no chirality outliers.

All (57) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	601	3PE	C1-O11-P-O12
4	B	601	3PE	C1-O11-P-O14
4	B	601	3PE	C11-O13-P-O11
4	B	601	3PE	C11-O13-P-O14
4	B	601	3PE	C2-C1-O11-P
4	B	601	3PE	O13-C11-C12-N
4	B	601	3PE	O22-C21-O21-C2
5	B	604	AU7	C21-C20-C29-C31
6	B	612	FTT	O2-C1-C2-C3
4	B	601	3PE	C22-C21-O21-C2
7	B	605	PA1	C4-C5-C6-O6
4	A	601	3PE	O32-C31-O31-C3
7	B	605	PA1	O5-C5-C6-O6
4	A	601	3PE	C32-C31-O31-C3
4	B	601	3PE	C1-O11-P-O13
9	B	613	DAO	C11-C10-C9-C8
6	B	612	FTT	C6-C7-C8-C9
4	A	601	3PE	C21-C22-C23-C24
6	A	603	FTT	C5-C6-C7-C8
9	B	613	DAO	C2-C3-C4-C5
6	B	607	FTT	C9-C10-C11-C12
10	B	615	MYR	C11-C10-C9-C8
6	B	607	FTT	C4-C5-C6-C7
4	B	602	3PE	C2E-C2F-C2G-C2H
6	A	603	FTT	C6-C7-C8-C9
4	A	601	3PE	C2-C3-O31-C31
4	A	601	3PE	C22-C23-C24-C25
6	A	603	FTT	O3-C3-C4-C5

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
6	B	614	FTT	C11-C10-C9-C8
4	B	602	3PE	C29-C2A-C2B-C2C
9	B	613	DAO	C5-C6-C7-C8
6	B	614	FTT	C7-C8-C9-C10
6	A	603	FTT	C2-C3-C4-C5
4	B	603	3PE	C2F-C2G-C2H-C2I
4	B	602	3PE	C2A-C2B-C2C-C2D
9	B	613	DAO	C4-C5-C6-C7
6	A	603	FTT	C11-C12-C13-C14
10	B	615	MYR	C10-C11-C12-C13
9	B	613	DAO	C7-C8-C9-C10
10	B	615	MYR	C4-C5-C6-C7
9	B	613	DAO	C9-C10-C11-C12
5	B	604	AU7	C18-C20-C29-C30
4	A	601	3PE	C11-O13-P-O11
6	B	612	FTT	C5-C6-C7-C8
9	B	613	DAO	C3-C4-C5-C6
6	B	612	FTT	C4-C5-C6-C7
5	B	604	AU7	C21-C20-C29-C30
4	B	601	3PE	C2-C3-O31-C31
6	B	607	FTT	O2-C1-C2-C3
4	A	601	3PE	O21-C2-C3-O31
6	B	612	FTT	C10-C11-C12-C13
11	B	617	DPO	P1-O4-P2-O7
4	B	602	3PE	C2D-C2E-C2F-C2G
4	B	603	3PE	C2D-C2E-C2F-C2G
5	A	602	AU7	O13-C2-C3-C4
4	B	601	3PE	C11-O13-P-O12
6	B	614	FTT	C3-C4-C5-C6

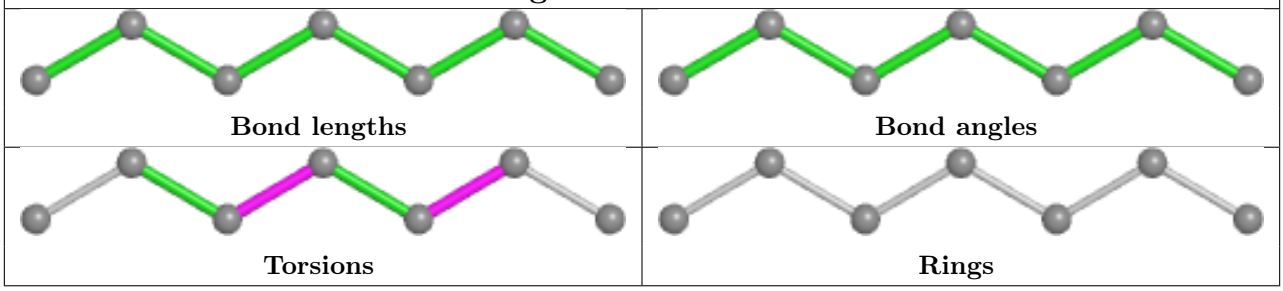
There are no ring outliers.

7 monomers are involved in 14 short contacts:

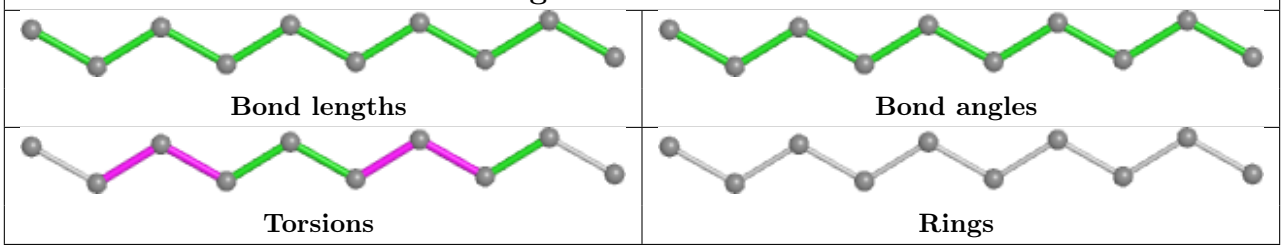
Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	B	615	MYR	2	0
6	B	614	FTT	3	0
5	A	602	AU7	1	0
5	B	604	AU7	2	0
7	B	605	PA1	4	0
6	A	603	FTT	2	0
9	B	613	DAO	2	0

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 then 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.

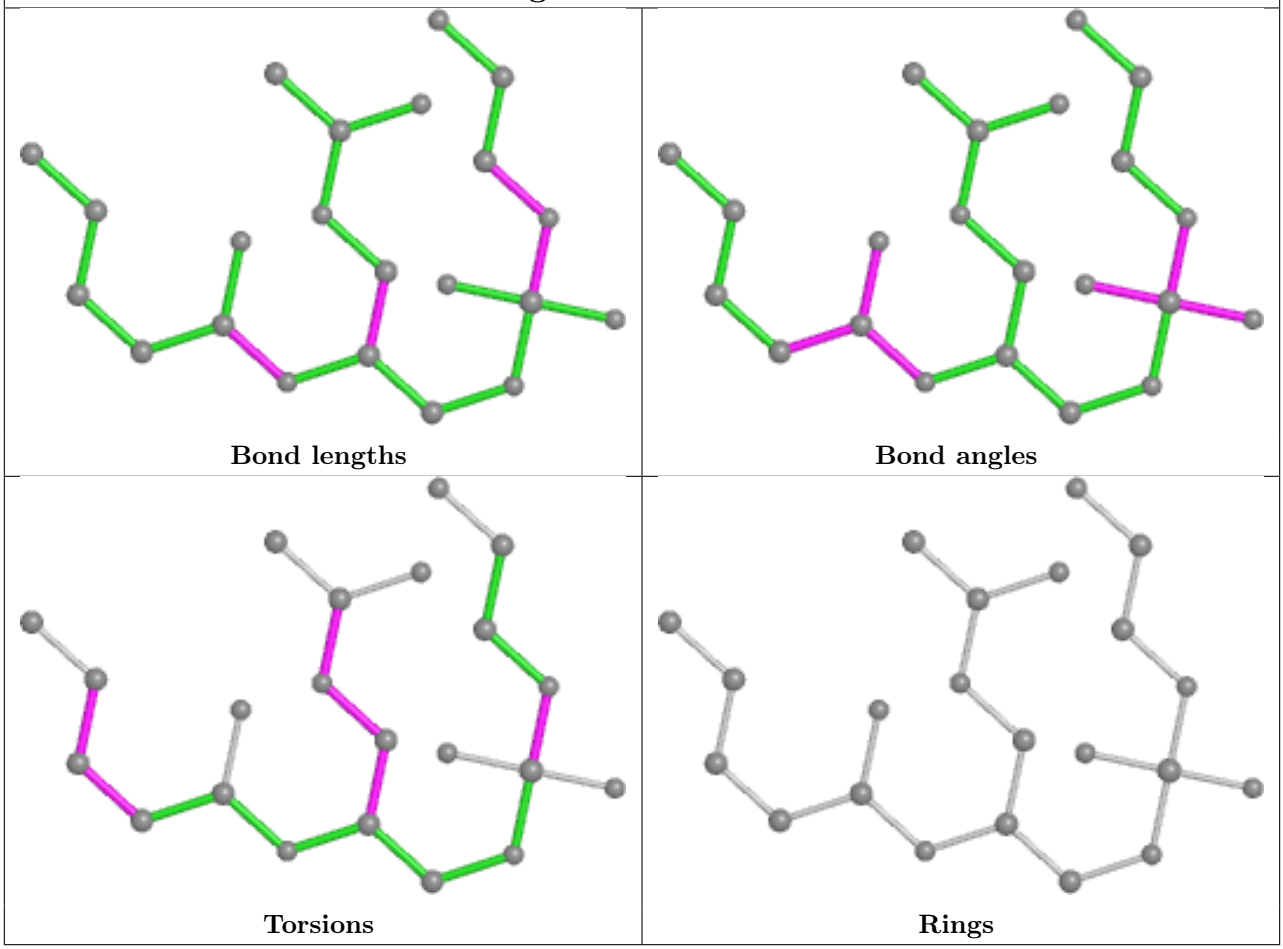
Ligand 3PE B 603



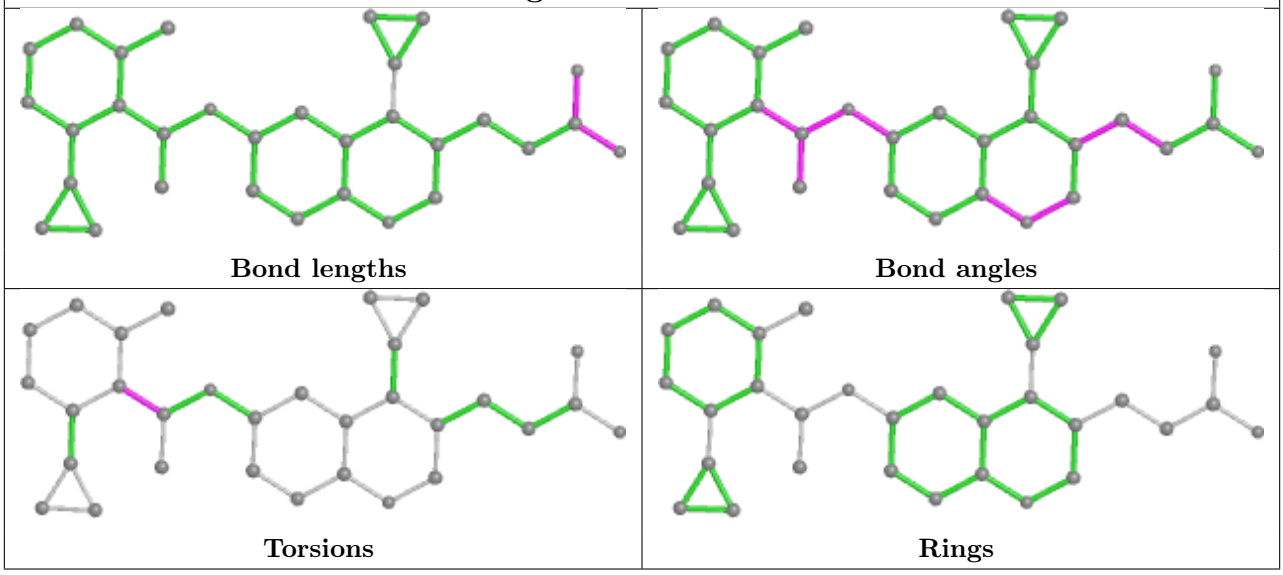
Ligand 3PE B 602



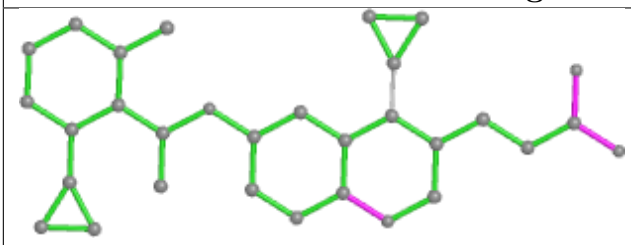
Ligand 3PE A 601



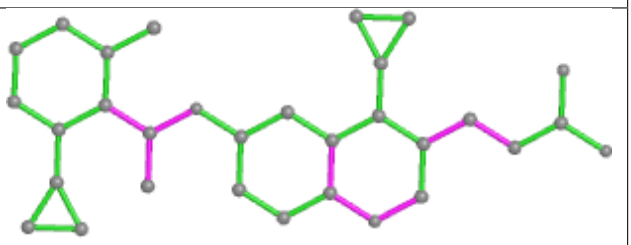
Ligand AU7 A 602



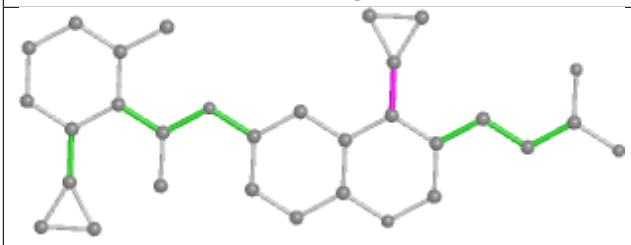
Ligand AU7 B 604



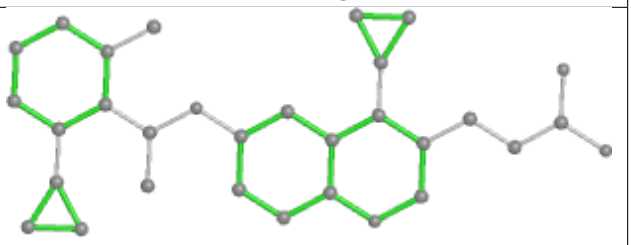
Bond lengths



Bond angles

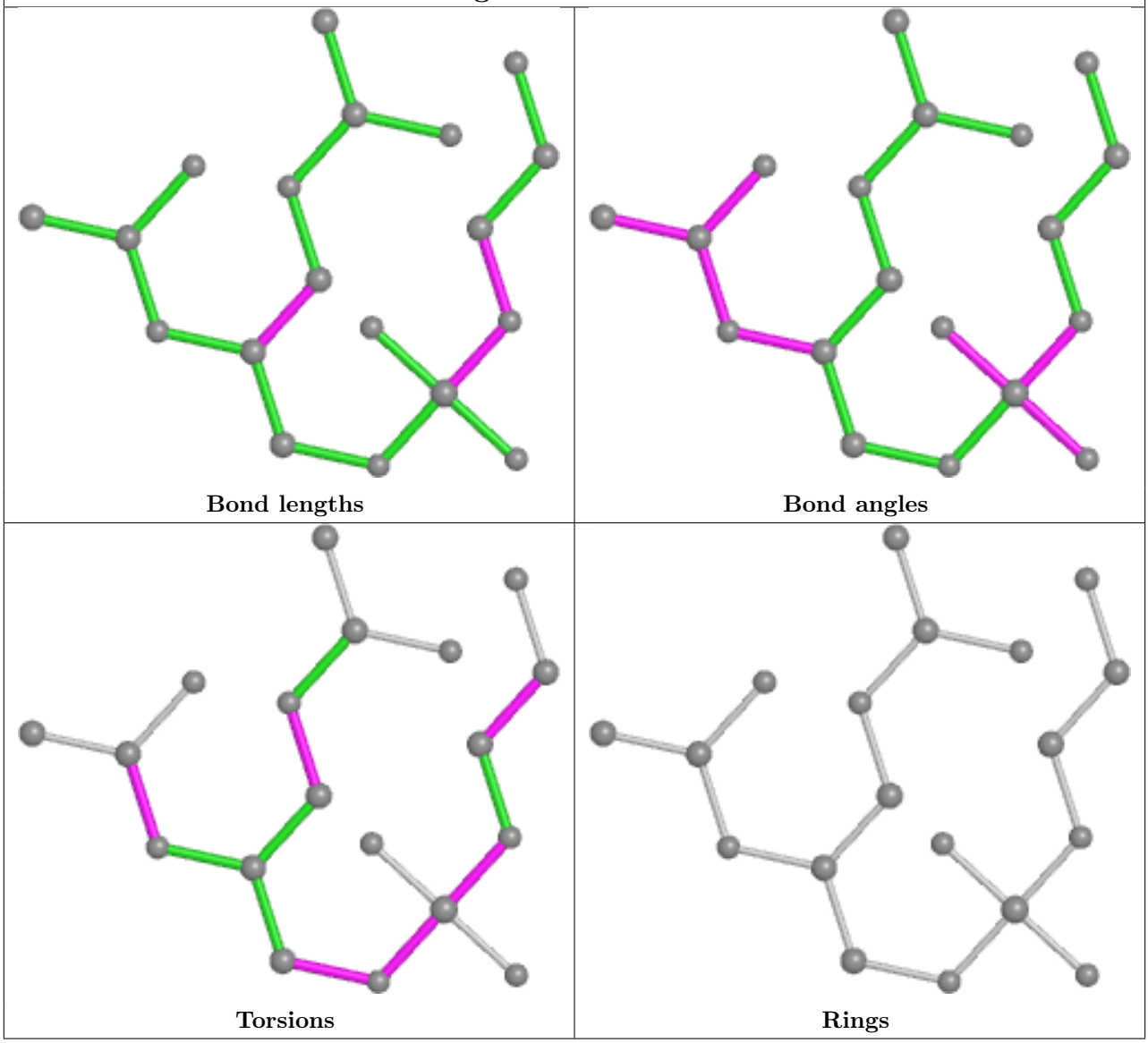


Torsions



Rings

Ligand 3PE B 601



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	576/582 (98%)	0.10	17 (2%)	50	45	44, 68, 111, 135	0
1	B	565/582 (97%)	0.22	28 (4%)	28	25	43, 77, 112, 147	0
All	All	1141/1164 (98%)	0.16	45 (3%)	39	35	43, 72, 112, 147	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	561	THR	6.3
1	B	566	LEU	5.5
1	B	575	LEU	4.9
1	B	563	ASN	4.7
1	B	562	HIS	4.6
1	A	4	ASP	4.5
1	B	570	GLY	4.4
1	A	556	ILE	4.2
1	B	576	HIS	4.1
1	B	202	GLN	4.0
1	A	578	MET	3.7
1	B	573	ALA	3.6
1	A	558	GLU	3.5
1	B	198	ASN	3.3
1	A	570	GLY	3.1
1	B	10	TRP	3.0
1	B	564	ASP	2.9
1	B	65	VAL	2.9
1	B	64	LEU	2.8
1	A	568	HIS	2.8
1	A	64	LEU	2.8
1	A	165	TRP	2.7
1	A	128	ILE	2.7
1	B	567	GLU	2.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	512	ASP	2.6
1	B	169	ILE	2.6
1	B	309	GLN	2.6
1	B	470	LEU	2.6
1	B	560	GLY	2.6
1	A	274	SER	2.6
1	A	576	HIS	2.5
1	B	201	GLY	2.5
1	B	448	GLU	2.4
1	A	195	ASN	2.4
1	A	14	ARG	2.4
1	A	571	VAL	2.3
1	A	467	ASP	2.3
1	A	550	VAL	2.2
1	B	199	THR	2.2
1	B	574	GLN	2.2
1	B	115	PHE	2.1
1	B	571	VAL	2.1
1	B	293	ALA	2.0
1	B	542	ILE	2.0
1	B	479	VAL	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	GLC	C	2	11/12	0.38	0.35	161,168,179,181	0
3	KDO	D	3	15/16	0.39	0.44	109,129,142,145	0
2	GMH	C	1	13/14	0.64	0.41	142,149,165,172	0
2	GMH	C	5	13/14	0.66	0.46	103,138,146,148	0
2	GLC	C	4	11/12	0.72	0.35	155,164,179,182	0
2	GLC	C	3	11/12	0.79	0.54	154,165,169,171	0
3	GMH	D	4	13/14	0.80	0.44	135,149,158,166	0

Continued on next page...

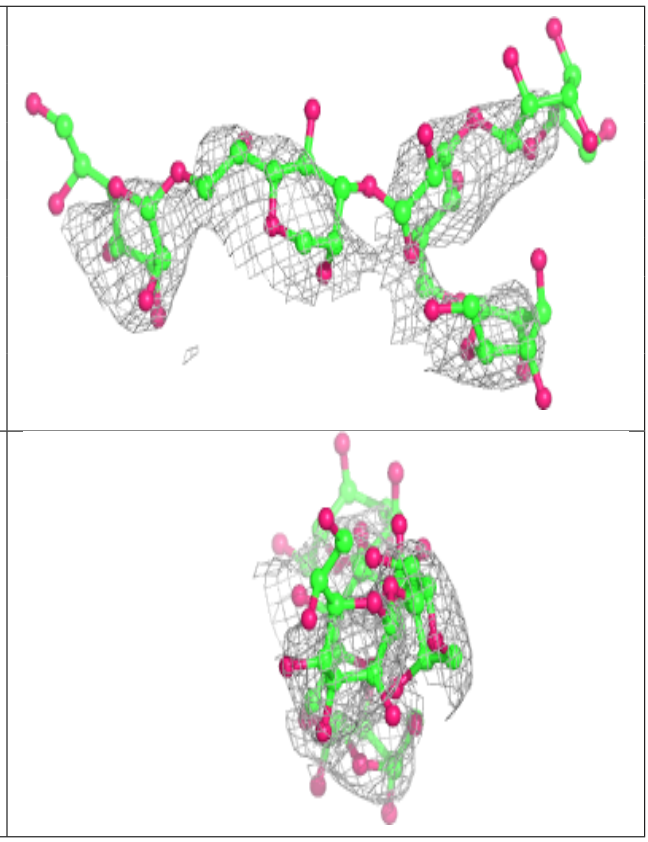
Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	KDO	D	2	15/16	0.82	0.44	125,139,147,149	0
3	GCS	D	1	11/12	0.87	0.37	111,118,132,134	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.

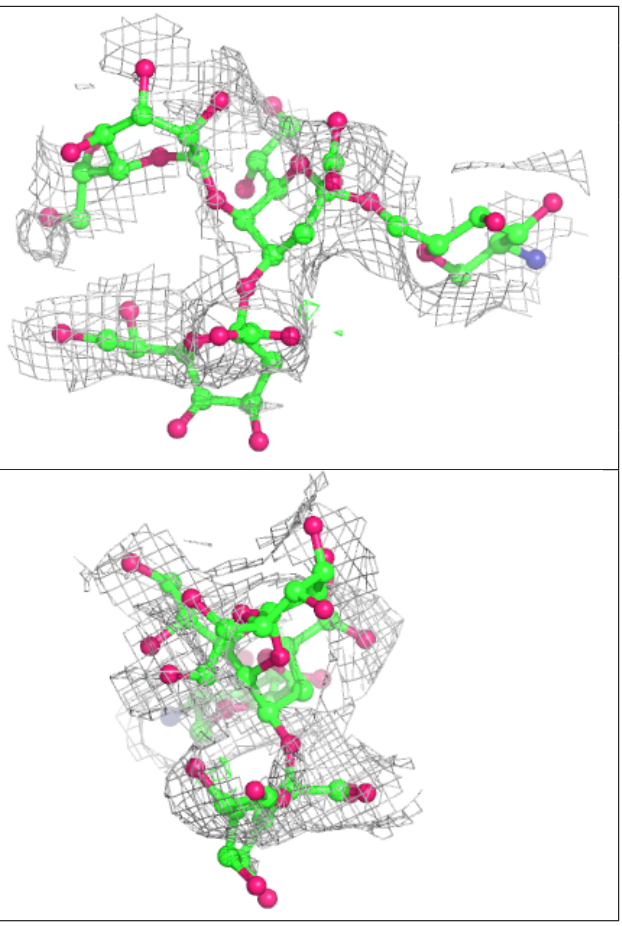
Electron density around Chain C:

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	FTT	A	603	16/17	0.75	0.51	68,88,106,108	0
6	FTT	B	614	16/17	0.78	0.38	65,94,110,125	0
10	MYR	B	615	15/16	0.78	0.35	65,75,95,101	0
4	3PE	B	602	10/51	0.82	0.17	58,80,89,94	0
6	FTT	B	612	16/17	0.83	0.50	79,96,114,122	0
4	3PE	A	601	22/51	0.84	0.25	63,94,107,190	0
9	DAO	B	613	13/14	0.85	0.39	62,81,90,96	0
6	FTT	B	607	16/17	0.86	0.34	69,94,113,114	0
11	DPO	B	617	8/9	0.87	0.22	159,167,171,177	0
7	PA1	B	605	12/12	0.88	0.33	103,114,123,131	0
4	3PE	B	601	19/51	0.88	0.18	85,101,109,119	0
4	3PE	B	603	7/51	0.93	0.13	59,80,85,85	0

Continued on next page...

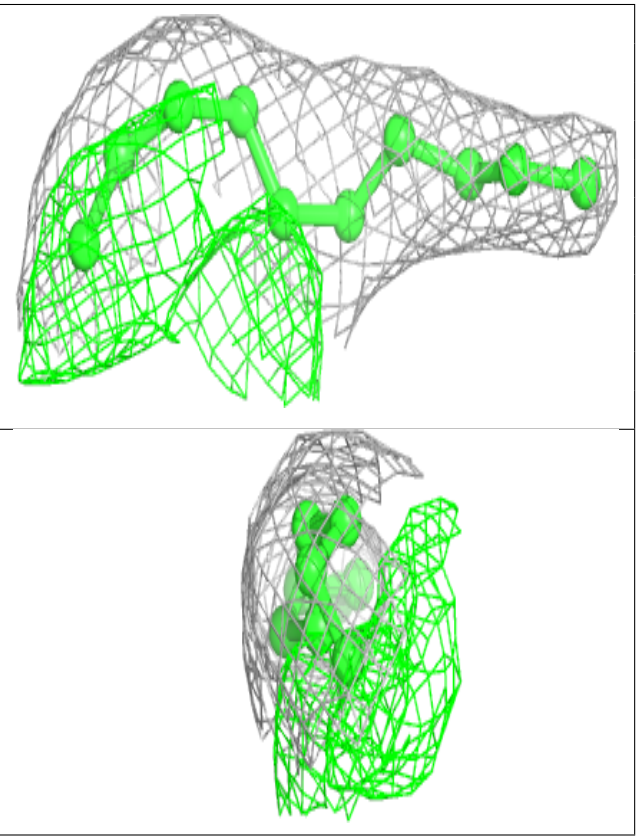
Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	AU7	B	604	31/31	0.94	0.23	50,69,81,82	0
8	PO4	B	606	4/5	0.95	0.36	81,85,116,118	0
5	AU7	A	602	31/31	0.95	0.23	43,54,67,70	0
8	PO4	B	616	4/5	0.97	0.39	85,90,96,112	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.

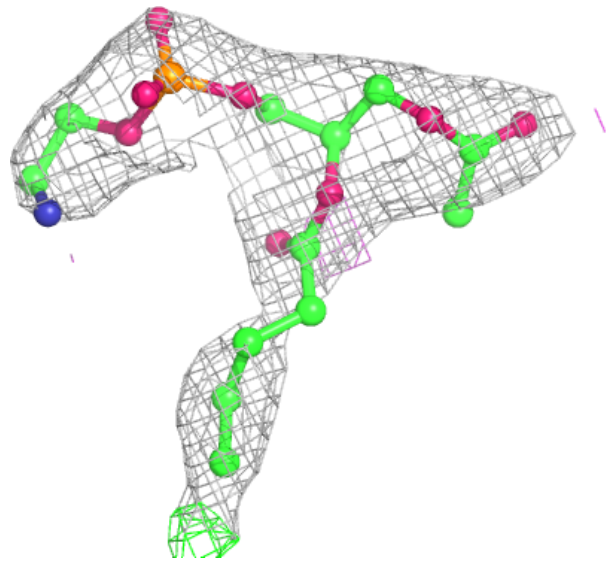
Electron density around 3PE B 602:

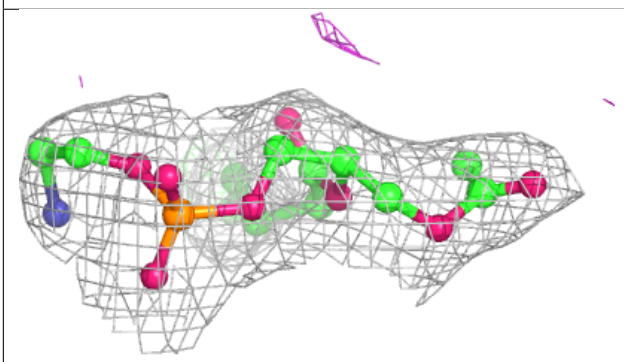
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)

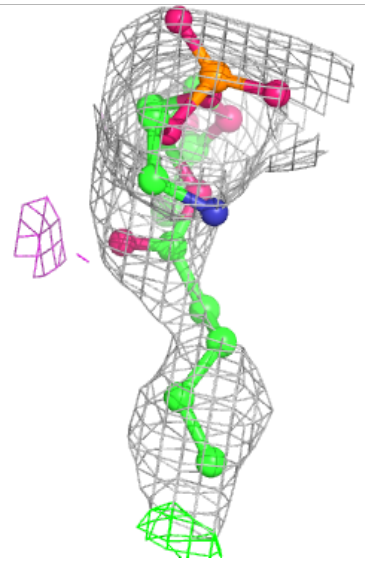


Electron density around 3PE A 601:

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

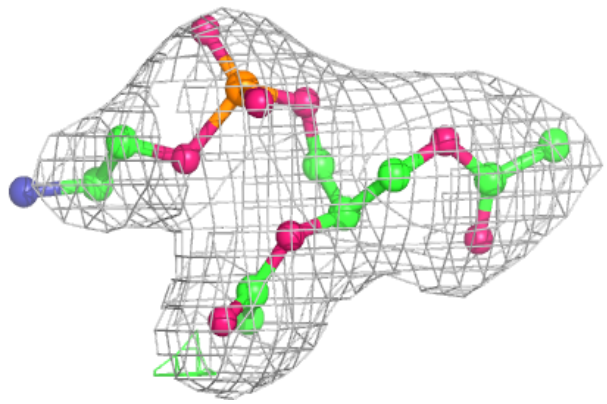


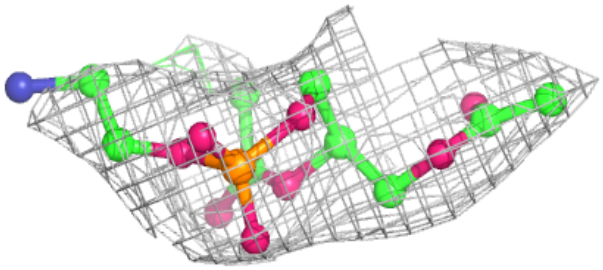


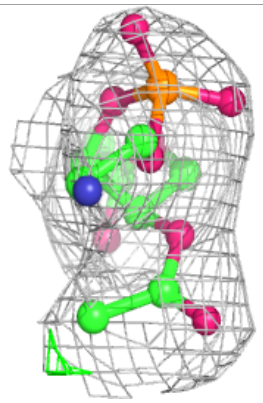


Electron density around 3PE B 601:

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

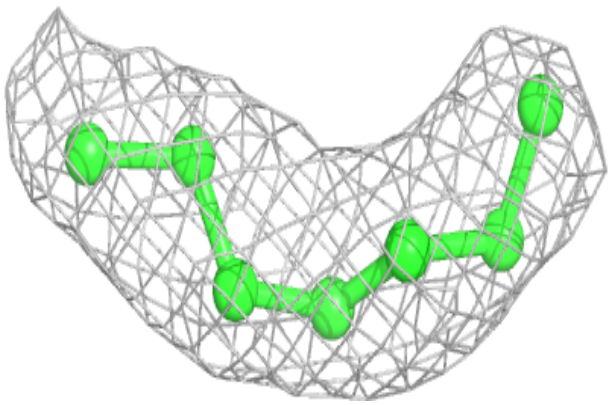


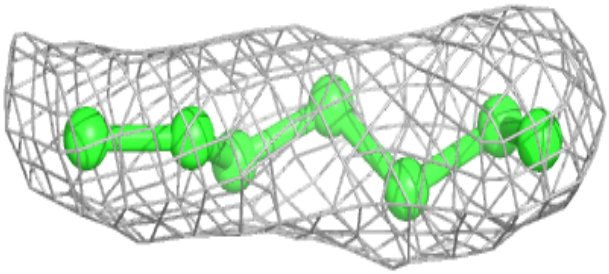


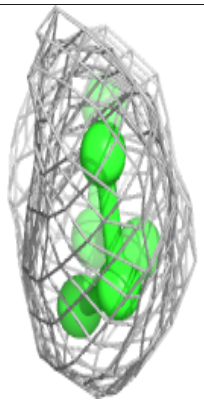


Electron density around 3PE B 603:

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

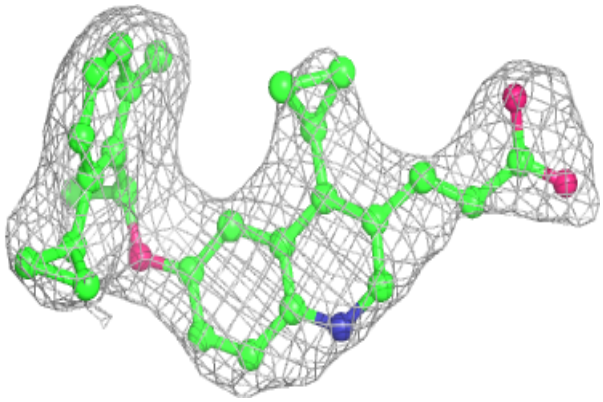


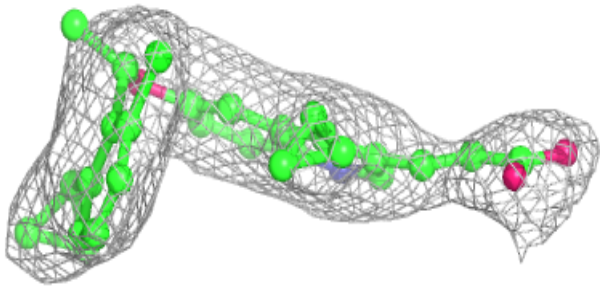


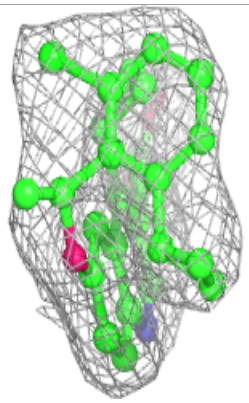


Electron density around AU7 B 604:

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

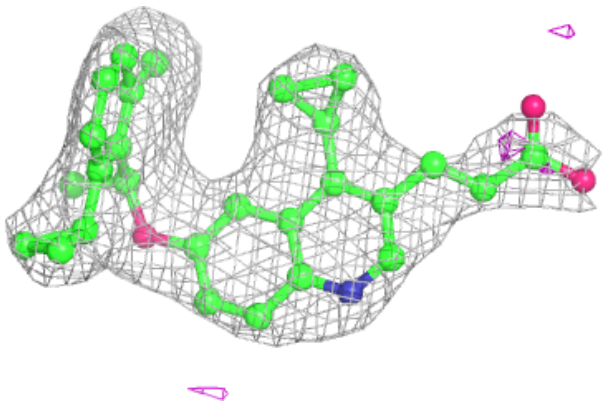


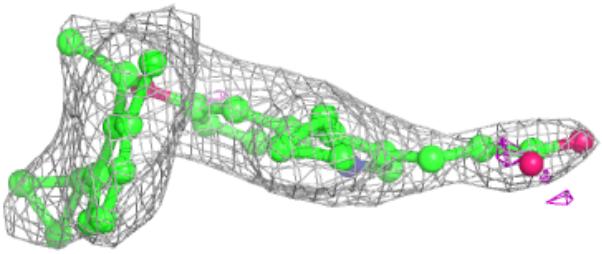


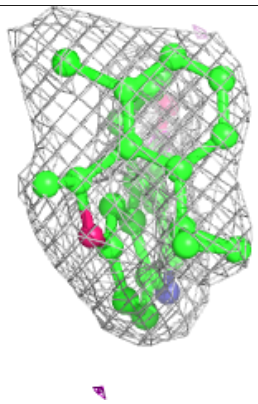


Electron density around AU7 A 602:

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







6.5 Other polymers (i)

There are no such residues in this entry.