W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Oct 20, 2025 – 10:07 AM EDT

PDB ID	:	9OMK / pdb_00009omk
Title	:	WrtF fucosyltransferase - trisaccharide acceptor
Authors	:	Forrester, T.J.B.; Kimber, M.S.
Deposited on	:	2025-05-14
Resolution	:	2.05 Å(reported)

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

|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

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 2.05 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.
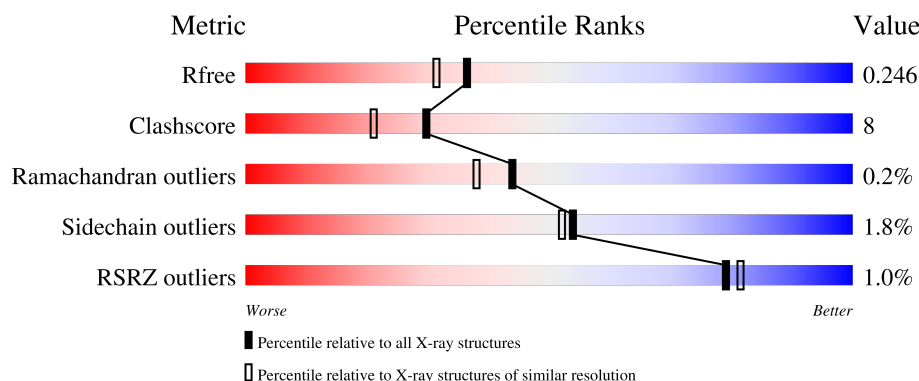
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	2096 (2.04-2.04)
Clashscore	180529	2229 (2.04-2.04)
Ramachandran outliers	177936	2217 (2.04-2.04)
Sidechain outliers	177891	2217 (2.04-2.04)
RSRZ outliers	164620	2096 (2.04-2.04)

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	279	81% 15% •
1	B	279	72% 19% • 9%

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 4321 atoms, of which 56 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 Glycosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	269	Total	C	N	O	S	0	1	0
			2084	1322	356	400	6			
1	B	255	Total	C	N	O	S	0	0	0
			1965	1250	332	377	6			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	expression tag	UNP A0A6P1C6J0
A	1	GLY	-	expression tag	UNP A0A6P1C6J0
A	268	ALA	-	expression tag	UNP A0A6P1C6J0
A	269	ALA	-	expression tag	UNP A0A6P1C6J0
A	270	ALA	-	expression tag	UNP A0A6P1C6J0
A	271	LEU	-	expression tag	UNP A0A6P1C6J0
A	272	GLU	-	expression tag	UNP A0A6P1C6J0
A	273	HIS	-	expression tag	UNP A0A6P1C6J0
A	274	HIS	-	expression tag	UNP A0A6P1C6J0
A	275	HIS	-	expression tag	UNP A0A6P1C6J0
A	276	HIS	-	expression tag	UNP A0A6P1C6J0
A	277	HIS	-	expression tag	UNP A0A6P1C6J0
A	278	HIS	-	expression tag	UNP A0A6P1C6J0
B	0	MET	-	expression tag	UNP A0A6P1C6J0
B	1	GLY	-	expression tag	UNP A0A6P1C6J0
B	268	ALA	-	expression tag	UNP A0A6P1C6J0
B	269	ALA	-	expression tag	UNP A0A6P1C6J0
B	270	ALA	-	expression tag	UNP A0A6P1C6J0
B	271	LEU	-	expression tag	UNP A0A6P1C6J0
B	272	GLU	-	expression tag	UNP A0A6P1C6J0
B	273	HIS	-	expression tag	UNP A0A6P1C6J0
B	274	HIS	-	expression tag	UNP A0A6P1C6J0
B	275	HIS	-	expression tag	UNP A0A6P1C6J0
B	276	HIS	-	expression tag	UNP A0A6P1C6J0
B	277	HIS	-	expression tag	UNP A0A6P1C6J0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	278	HIS	-	expression tag	UNP A0A6P1C6J0

- Molecule 2 is GUANOSINE-5'-MONOPHOSPHATE (CCD ID: 5GP) (formula: $C_{10}H_{14}N_5O_8P$) (labeled as "Ligand of Interest" by depositor).
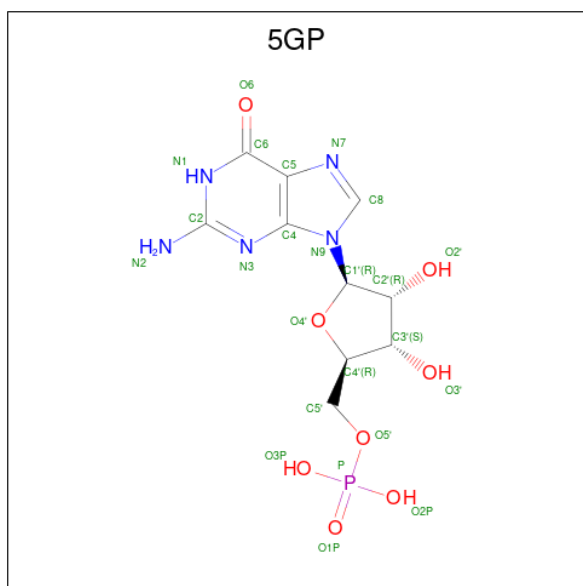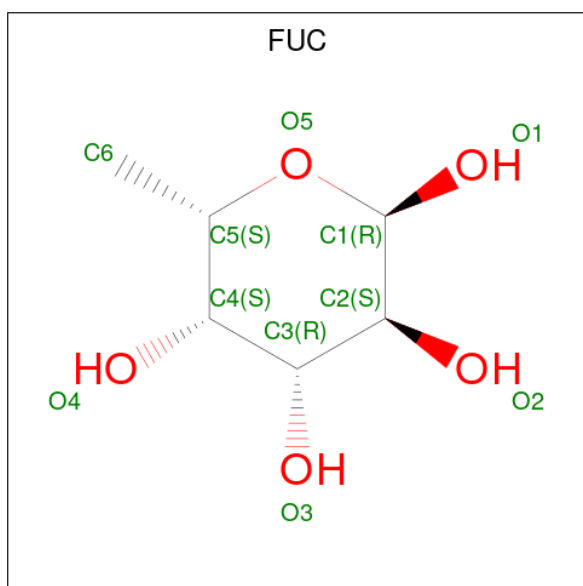

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			24	10	5	8	1		
2	B	1	Total	C	N	O	P	0	0
			24	10	5	8	1		

- Molecule 3 is DIMETHYL SULFOXIDE (CCD ID: DMS) (formula: C_2H_6OS).

DMS

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	H	O	S	0	0
			10	2	6	1	1		
3	A	1	Total	C	H	O	S	0	0
			10	2	6	1	1		
3	B	1	Total	C	H	O	S	0	0
			10	2	6	1	1		
3	B	1	Total	C	H	O	S	0	0
			10	2	6	1	1		

- Molecule 4 is alpha-L-fucopyranose (CCD ID: FUC) (formula: $C_6H_{12}O_5$) (labeled as "Ligand of Interest" by depositor).

FUC

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total 22	C 6	H 11	O 5	0	0
4	B	1	Total 11	C 6	O 5		0	0

- Molecule 5 is 6-deoxy-alpha-D-talopyranose (CCD ID: A1CCV) (formula: $C_6H_{12}O_5$) (labeled as "Ligand of Interest" by depositor).
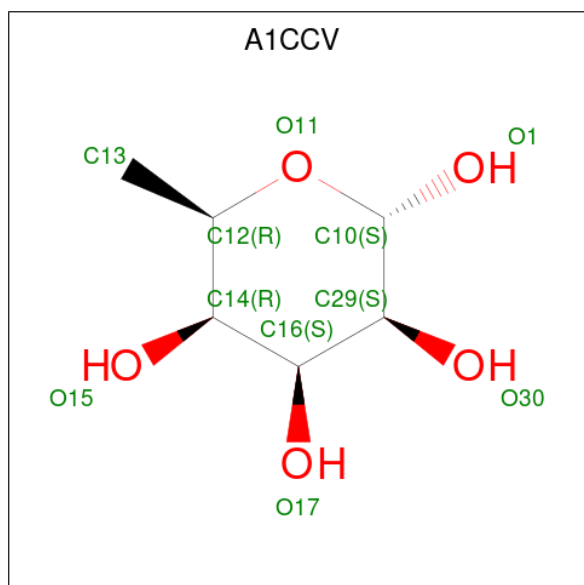
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total 20	C 6	H 10	O 4	0	0
5	B	1	Total 10	C 6	O 4		0	0

- Molecule 6 is beta-D-glucopyranose (CCD ID: BGC) (formula: $C_6H_{12}O_6$) (labeled as "Ligand of Interest" by depositor).

BGC
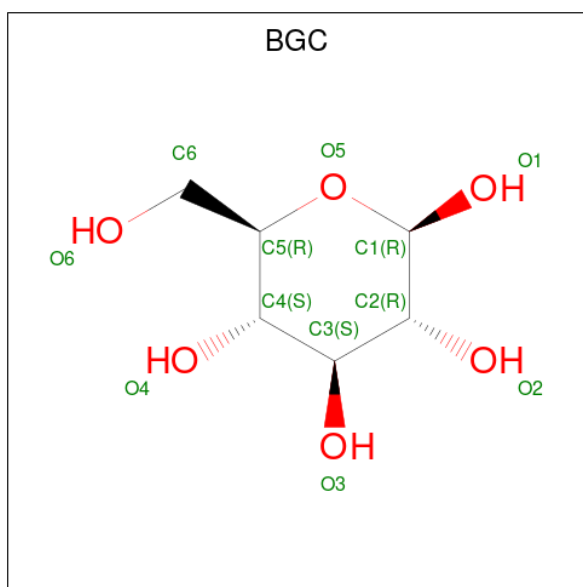
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total C H O 22 6 11 5		0	0
6	B	1	Total C O 11 6 5		0	0

- Molecule 7 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	40	Total O 40 40		0	0
7	B	48	Total O 48 48		0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Glycosyltransferase

Chain A:

- Molecule 1: Glycosyltransferase

Chain B:
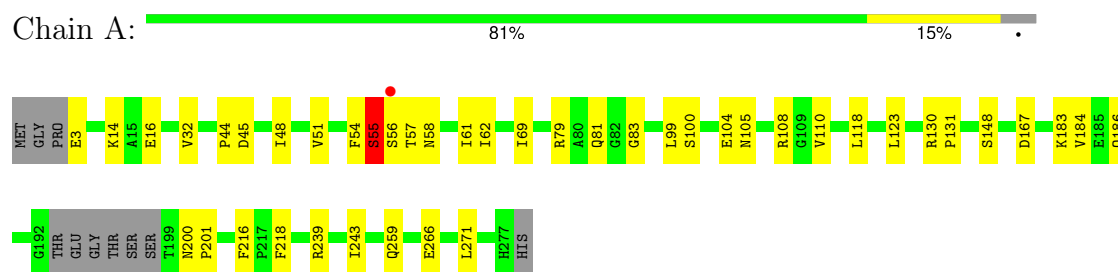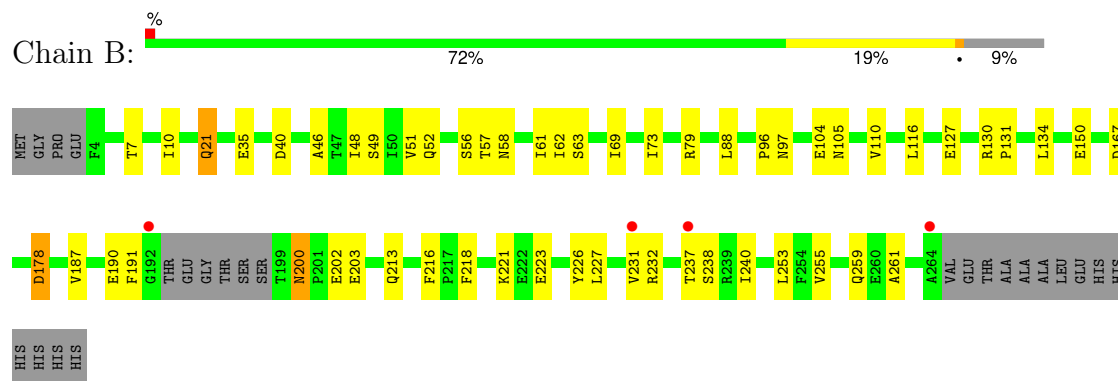
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α, β, γ	64.45Å 65.62Å 128.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.84 – 2.05 45.84 – 2.05	Depositor EDS
% Data completeness (in resolution range)	99.8 (45.84-2.05) 99.7 (45.84-2.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.43 (at 2.05Å)	Xtriage
Refinement program	PHENIX 1.19_4092	Depositor
R, R_{free}	0.211 , 0.242 0.211 , 0.246	Depositor DCC
R_{free} test set	2322 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	46.3	Xtriage
Anisotropy	0.562	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 55.5	EDS
L-test for twinning[2]	$< |L| > = 0.48, < L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.000 for k,h,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	4321	wwPDB-VP
Average B, all atoms (Å^2)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 18.87% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: FUC, BGC, 5GP, DMS, A1CCV

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	0.12	0/2126	0.30	0/2882
1	B	0.12	0/1999	0.29	0/2708
All	All	0.12	0/4125	0.29	0/5590

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	2084	0	2063	29	1
1	B	1965	0	1964	41	1
2	A	24	0	12	1	0
2	B	24	0	12	1	0
3	A	8	12	12	0	0
3	B	8	12	12	2	0
4	A	11	11	11	0	0
4	B	11	0	11	0	0
5	A	10	10	0	0	0
5	B	10	0	0	0	0
6	A	11	11	10	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	11	0	10	1	0
7	A	40	0	0	2	0
7	B	48	0	0	0	0
All	All	4265	56	4117	70	1

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 8.

All (70) 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:45:ASP:O	7:A:401:HOH:O	1.97	0.83
1:B:134:LEU:HD12	1:B:253:LEU:HD21	1.62	0.81
1:A:167:ASP:OD1	6:A:306:BGC:O6	2.11	0.67
1:A:48:ILE:HD12	7:A:401:HOH:O	1.97	0.63
1:B:105:ASN:O	1:B:110:VAL:HG12	1.99	0.63
1:A:51:VAL:HG12	1:A:61:ILE:HD11	1.82	0.62
1:B:200:ASN:HD21	1:B:202:GLU:HG3	1.64	0.61
1:A:100:SER:O	1:A:104:GLU:HG3	2.00	0.61
1:B:213:GLN:OE1	1:B:221:LYS:HD3	2.00	0.61
1:B:200:ASN:HD21	1:B:202:GLU:CG	2.14	0.60
1:B:48:ILE:O	1:B:52:GLN:HG3	2.02	0.59
1:B:255:VAL:O	1:B:259:GLN:HG2	2.03	0.59
1:B:69:ILE:HD13	2:B:301:5GP:H5'1	1.85	0.58
1:B:216:PHE:CE1	1:B:253:LEU:HD22	2.38	0.58
1:B:167:ASP:OD2	6:B:306:BGC:O4	2.15	0.57
1:A:184:VAL:HG12	1:A:186:GLN:HG3	1.87	0.57
1:A:216:PHE:HB3	1:A:218:PHE:CZ	2.39	0.57
1:A:62:ILE:HD11	1:A:79:ARG:HD2	1.86	0.57
1:B:134:LEU:CD1	1:B:253:LEU:HD21	2.33	0.55
1:A:51:VAL:CG1	1:A:61:ILE:HD11	2.38	0.54
1:B:253:LEU:C	1:B:253:LEU:HD23	2.33	0.53
1:B:51:VAL:HG12	1:B:61:ILE:HD11	1.90	0.53
1:A:69:ILE:HG12	2:A:301:5GP:C5	2.39	0.52
1:A:130:ARG:HB2	1:A:131:PRO:HD2	1.91	0.51
1:B:150:GLU:H	1:B:150:GLU:CD	2.20	0.50
1:A:54:PHE:O	1:A:56:SER:N	2.42	0.49
1:A:32:VAL:HG21	1:A:99:LEU:HB3	1.95	0.49
1:B:216:PHE:HE1	1:B:253:LEU:HD22	1.77	0.49
1:A:105:ASN:O	1:A:110:VAL:HG12	2.12	0.49
1:B:237:THR:OG1	1:B:240:ILE:HG13	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:200:ASN:OD1	1:A:201:PRO:HD2	2.13	0.48
1:B:231:VAL:HG12	1:B:261:ALA:HB1	1.96	0.48
1:A:167:ASP:OD2	6:A:306:BGC:O4	2.16	0.48
1:B:73:ILE:HD11	3:B:303:DMS:H12	1.95	0.48
1:B:216:PHE:HB3	1:B:218:PHE:CZ	2.48	0.48
1:A:54:PHE:C	1:A:56:SER:H	2.21	0.48
1:B:200:ASN:OD1	1:B:203:GLU:HG3	2.14	0.48
1:A:239:ARG:O	1:A:243:ILE:HG13	2.13	0.48
1:B:40:ASP:O	1:B:63:SER:HA	2.14	0.47
1:A:266:GLU:HA	1:A:266:GLU:OE1	2.15	0.47
1:B:178:ASP:O	1:B:178:ASP:CG	2.58	0.47
1:A:259:GLN:NE2	1:A:266:GLU:OE1	2.46	0.46
1:B:46:ALA:HB1	1:B:49:SER:OG	2.15	0.46
1:A:14:LYS:HA	1:A:45:ASP:OD2	2.15	0.46
1:B:62:ILE:HD11	1:B:79:ARG:CD	2.46	0.46
1:B:127:GLU:OE2	1:B:232:ARG:NE	2.50	0.44
1:B:190:GLU:HG2	1:B:191:PHE:N	2.31	0.44
1:B:237:THR:O	1:B:237:THR:HG23	2.17	0.44
1:B:73:ILE:HD11	3:B:303:DMS:C1	2.48	0.43
1:B:253:LEU:HD23	1:B:253:LEU:O	2.18	0.43
1:B:40:ASP:CG	1:B:48:ILE:HD11	2.44	0.43
1:B:130:ARG:HB2	1:B:131:PRO:HD2	1.99	0.43
1:B:223:GLU:O	1:B:227:LEU:HG	2.19	0.43
1:A:118:LEU:HD12	1:A:118:LEU:HA	1.91	0.43
1:B:105:ASN:HB3	1:B:110:VAL:HG11	2.00	0.43
1:A:271:LEU:HD23	1:A:271:LEU:HA	1.87	0.42
1:A:56:SER:C	1:A:58:ASN:H	2.27	0.42
1:B:10:ILE:HG23	1:B:88:LEU:O	2.19	0.42
1:B:56:SER:O	1:B:57:THR:C	2.62	0.42
1:B:21:GLN:H	1:B:21:GLN:HG3	1.59	0.42
1:A:3:GLU:HB2	1:A:81:GLN:O	2.20	0.42
1:B:226:TYR:OH	1:B:238:SER:N	2.53	0.41
1:A:14:LYS:HG2	1:A:44:PRO:HD2	2.02	0.41
1:B:116:LEU:HB2	1:B:187:VAL:HA	2.01	0.41
1:A:16:GLU:OE1	1:A:45:ASP:HB2	2.21	0.40
1:B:62:ILE:HD11	1:B:79:ARG:HD3	2.03	0.40
1:B:7:THR:HA	1:B:35:GLU:O	2.21	0.40
1:B:96:PRO:O	1:B:97:ASN:HB2	2.21	0.40
1:A:83:GLY:O	1:A:148:SER:HA	2.21	0.40
1:A:123:LEU:HD22	1:A:123:LEU:N	2.37	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:55:SER:OG	1:B:104:GLU:OE1[4_544]	2.09	0.11

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	266/279 (95%)	258 (97%)	7 (3%)	1 (0%)	30	23
1	B	251/279 (90%)	244 (97%)	7 (3%)	0	100	100
All	All	517/558 (93%)	502 (97%)	14 (3%)	1 (0%)	44	38

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	55	SER

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	223/230 (97%)	219 (98%)	4 (2%)	54	52
1	B	211/230 (92%)	207 (98%)	4 (2%)	52	50
All	All	434/460 (94%)	426 (98%)	8 (2%)	54	52

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

Mol	Chain	Res	Type
1	A	55	SER
1	A	57	THR
1	A	108	ARG
1	A	183	LYS
1	B	21	GLN
1	B	58	ASN
1	B	178	ASP
1	B	200	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	29	GLN
1	A	58	ASN
1	A	143	ASN
1	B	259	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

12 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	FUC	B	304	5	11,11,11	1.76	4 (36%)	16,16,16	1.08	2 (12%)
5	A1CCV	A	305	4,6	10,10,11	1.84	3 (30%)	14,14,16	2.49	5 (35%)
5	A1CCV	B	305	4,6	10,10,11	1.83	4 (40%)	14,14,16	0.86	0
3	DMS	B	303	-	3,3,3	0.68	0	3,3,3	0.51	0
6	BGC	A	306	5	11,11,12	1.89	3 (27%)	15,15,17	2.60	7 (46%)
3	DMS	A	303	-	3,3,3	0.69	0	3,3,3	0.53	0
6	BGC	B	306	5	11,11,12	1.64	3 (27%)	15,15,17	0.94	1 (6%)
3	DMS	B	302	-	3,3,3	0.68	0	3,3,3	0.50	0
4	FUC	A	304	5	11,11,11	1.74	5 (45%)	16,16,16	0.90	0
2	5GP	A	301	-	22,26,26	1.27	2 (9%)	24,40,40	1.31	3 (12%)
3	DMS	A	302	-	3,3,3	0.68	0	3,3,3	0.39	0
2	5GP	B	301	-	22,26,26	1.26	2 (9%)	24,40,40	1.34	4 (16%)

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	FUC	B	304	5	-	-	0/1/1/1
5	A1CCV	A	305	4,6	-	-	0/1/1/1
5	A1CCV	B	305	4,6	-	-	0/1/1/1
6	BGC	B	306	5	-	0/2/19/22	0/1/1/1
6	BGC	A	306	5	-	2/2/19/22	0/1/1/1
4	FUC	A	304	5	-	-	0/1/1/1
2	5GP	A	301	-	-	5/6/26/26	0/3/3/3
2	5GP	B	301	-	-	5/6/26/26	0/3/3/3

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	5GP	C5-C6	-4.13	1.39	1.47
2	B	301	5GP	C5-C6	-4.07	1.39	1.47
6	A	306	BGC	O5-C1	3.63	1.49	1.43
6	B	306	BGC	O5-C1	3.56	1.49	1.43
6	A	306	BGC	C2-C3	-3.31	1.47	1.52
5	A	305	A1CCV	C29-C16	-3.14	1.47	1.52
6	A	306	BGC	O5-C5	3.07	1.49	1.43
4	A	304	FUC	O5-C5	2.94	1.51	1.44
4	B	304	FUC	C6-C5	-2.82	1.44	1.51

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PDB
WORLDWIDE
PROTEIN DATA BANK

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	305	A1CCV	C29-C16	-2.82	1.48	1.52
5	B	305	A1CCV	O11-C10	2.82	1.48	1.43
5	A	305	A1CCV	O17-C16	2.80	1.49	1.43
4	B	304	FUC	O5-C5	2.79	1.51	1.44
5	B	305	A1CCV	O17-C16	2.77	1.49	1.43
4	A	304	FUC	C6-C5	-2.72	1.45	1.51
6	B	306	BGC	C2-C3	-2.58	1.48	1.52
2	B	301	5GP	C6-N1	-2.34	1.34	1.37
2	A	301	5GP	C6-N1	-2.30	1.34	1.37
4	B	304	FUC	C4-C3	-2.22	1.46	1.52
4	B	304	FUC	O3-C3	2.21	1.48	1.43
4	A	304	FUC	O3-C3	2.16	1.48	1.43
5	A	305	A1CCV	O11-C10	2.13	1.47	1.43
5	B	305	A1CCV	O11-C12	2.09	1.47	1.43
4	A	304	FUC	C1-C2	2.09	1.57	1.52
4	A	304	FUC	C4-C3	-2.07	1.47	1.52
6	B	306	BGC	O5-C5	2.05	1.47	1.43

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	306	BGC	C1-O5-C5	6.61	121.05	112.19
5	A	305	A1CCV	C13-C12-C14	-5.18	103.61	113.08
5	A	305	A1CCV	C16-C14-C12	4.91	117.27	109.81
6	A	306	BGC	O5-C5-C6	-4.41	99.08	107.66
5	A	305	A1CCV	O11-C12-C14	3.71	116.22	109.55
2	A	301	5GP	C8-N7-C5	3.01	107.67	102.55
2	B	301	5GP	C5-C6-N1	2.97	119.75	114.07
6	A	306	BGC	O4-C4-C5	-2.84	102.32	109.32
2	B	301	5GP	C8-N7-C5	2.82	107.34	102.55
2	A	301	5GP	C5-C6-N1	2.76	119.34	114.07
6	A	306	BGC	O5-C5-C4	2.71	117.42	110.83
4	B	304	FUC	C6-C5-C4	-2.54	108.43	113.08
5	A	305	A1CCV	O15-C14-C12	-2.54	104.14	109.74
6	B	306	BGC	C1-C2-C3	2.52	113.31	109.64
6	A	306	BGC	C6-C5-C4	2.49	119.13	113.02
2	B	301	5GP	C2-N1-C6	-2.46	120.61	125.11
2	A	301	5GP	C2-N1-C6	-2.32	120.86	125.11
4	B	304	FUC	O5-C5-C4	2.29	113.68	109.55
6	A	306	BGC	O3-C3-C4	-2.29	104.98	110.38
5	A	305	A1CCV	C10-O11-C12	-2.24	107.67	112.97
6	A	306	BGC	C3-C4-C5	-2.07	106.48	110.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	301	5GP	O6-C6-C5	-2.03	120.29	124.32

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	5GP	C5'-O5'-P-O2P
2	A	301	5GP	C5'-O5'-P-O3P
2	B	301	5GP	C5'-O5'-P-O1P
2	B	301	5GP	C5'-O5'-P-O2P
2	B	301	5GP	C5'-O5'-P-O3P
6	A	306	BGC	C4-C5-C6-O6
6	A	306	BGC	O5-C5-C6-O6
2	A	301	5GP	O4'-C4'-C5'-O5'
2	A	301	5GP	C3'-C4'-C5'-O5'
2	B	301	5GP	C3'-C4'-C5'-O5'
2	B	301	5GP	O4'-C4'-C5'-O5'
2	A	301	5GP	C5'-O5'-P-O1P

There are no ring outliers.

5 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	303	DMS	2	0
6	A	306	BGC	2	0
6	B	306	BGC	1	0
2	A	301	5GP	1	0
2	B	301	5GP	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 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 FUC B 304

Bond lengths

Bond angles

Torsions

Rings

Ligand A1CCV A 305

Bond lengths

Bond angles

Torsions

Rings

Full wwPDB X-ray Structure Validation Report

Ligand A1CCV B 305

Bond lengths

Bond angles

Torsions

Rings

Ligand BGC A 306

Bond lengths

Bond angles

Torsions

Rings

Ligand BGC B 306

Bond lengths

Bond angles

Torsions

Rings

Ligand FUC A 304

Bond lengths

Bond angles

Torsions

Rings

Ligand 5GP A 301

Bond lengths

Bond angles

Torsions

Rings

Ligand 5GP B 301

Bond lengths

Bond angles

Torsions

Rings

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 ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	269/279 (96%)	0.01	1 (0%)	89	90	40, 62, 82, 104	1 (0%)
1	B	255/279 (91%)	0.22	4 (1%)	70	73	43, 69, 100, 133	0
All	All	524/558 (93%)	0.11	5 (0%)	79	81	40, 64, 94, 133	1 (0%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	264	ALA	3.4
1	B	192	GLY	3.1
1	B	231	VAL	2.9
1	B	237	THR	2.6
1	A	56	SER	2.4

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

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	DMS	A	302	4/4	0.65	0.23	55,67,71,71	10
3	DMS	B	303	4/4	0.78	0.15	63,79,88,89	0
2	5GP	A	301	24/24	0.82	0.12	60,69,93,95	24
3	DMS	B	302	4/4	0.83	0.14	61,73,88,88	0
5	A1CCV	A	305	10/11	0.84	0.10	52,59,72,72	0
4	FUC	B	304	11/11	0.85	0.10	64,66,69,70	0
6	BGC	A	306	11/12	0.88	0.08	45,55,64,70	0
2	5GP	B	301	24/24	0.89	0.09	56,65,80,84	24
6	BGC	B	306	11/12	0.90	0.08	41,50,55,58	0
4	FUC	A	304	11/11	0.92	0.08	56,67,73,80	0
3	DMS	A	303	4/4	0.93	0.09	63,75,79,79	0
5	A1CCV	B	305	10/11	0.94	0.08	53,60,67,69	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 5GP A 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
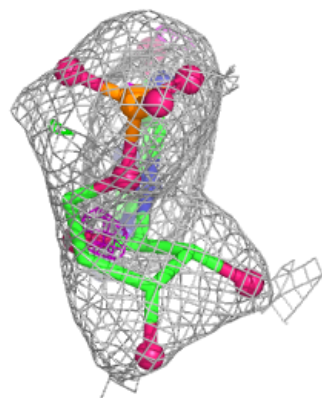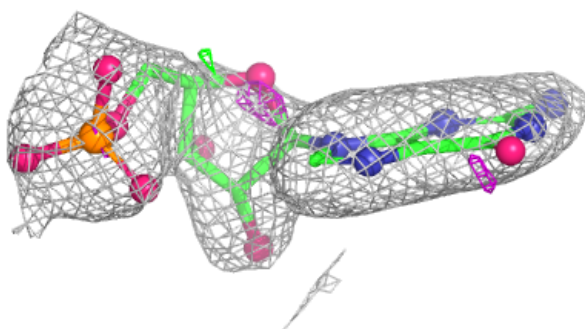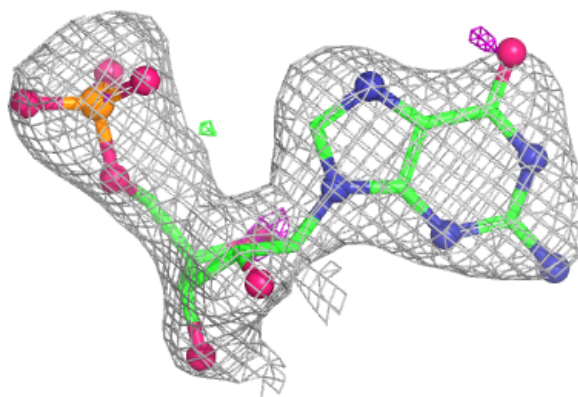
Electron density around A1CCV A 305:
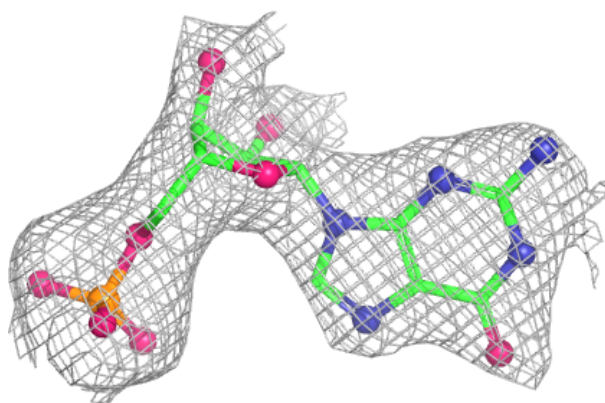
$2mF_o$-DF_c (at 0.7 rmsd) in gray
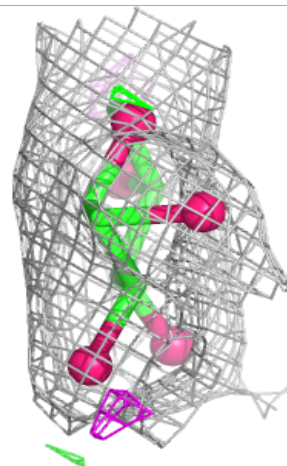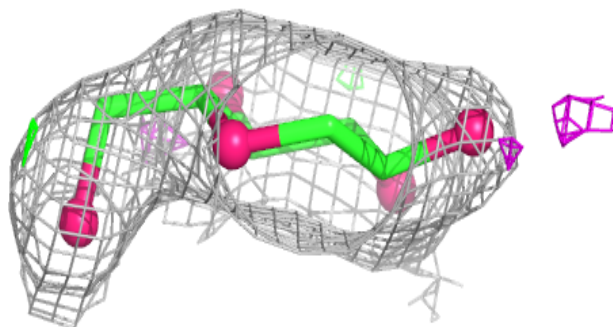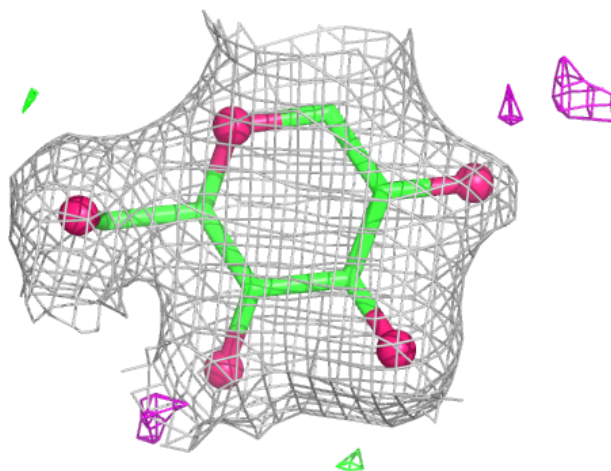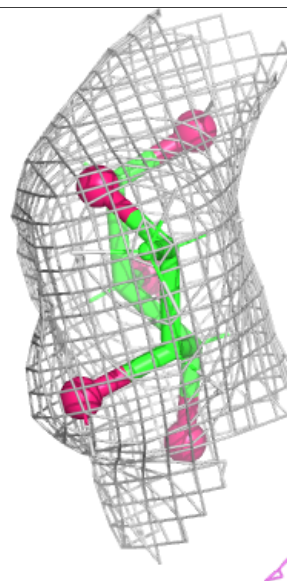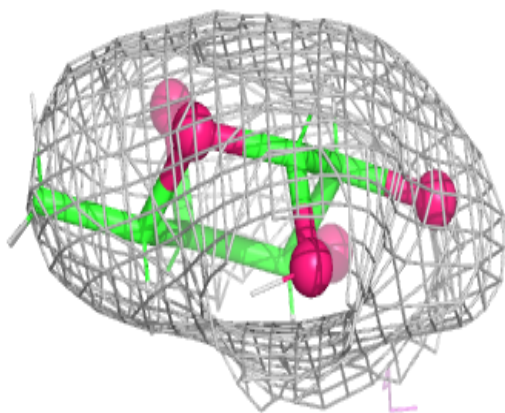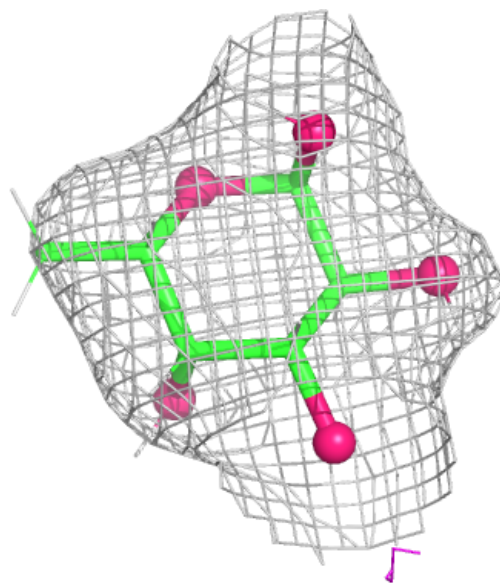mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
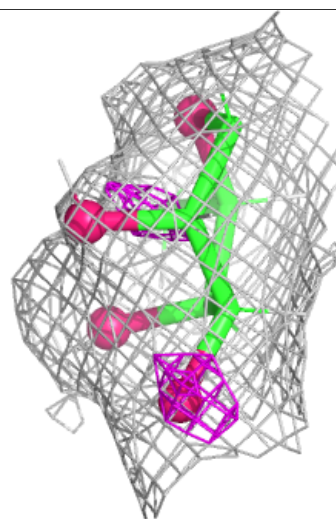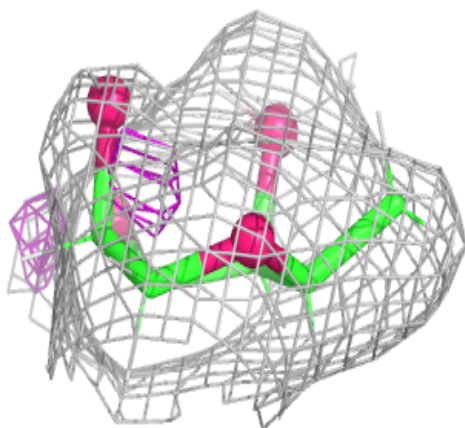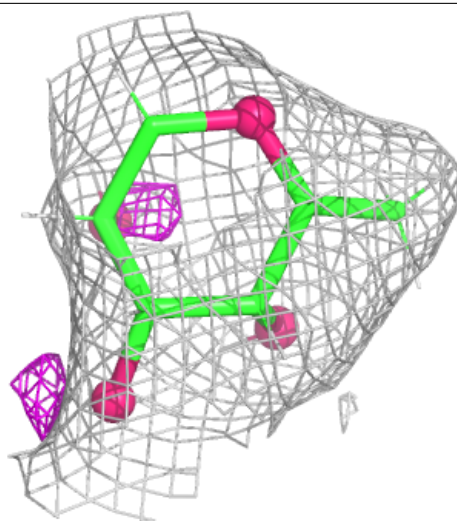
Electron density around FUC B 304:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
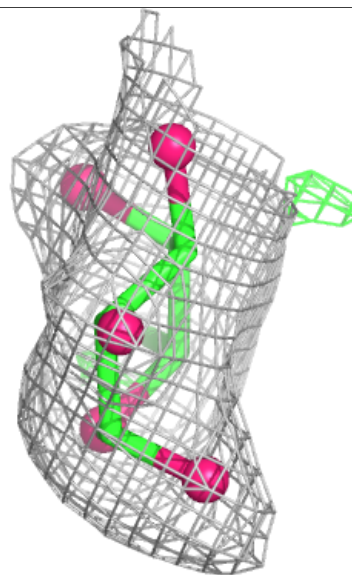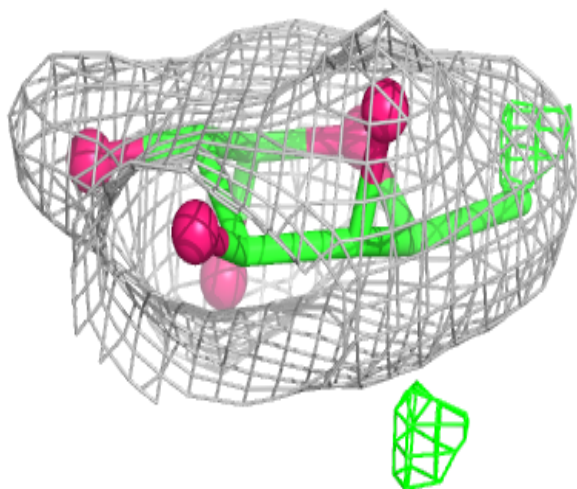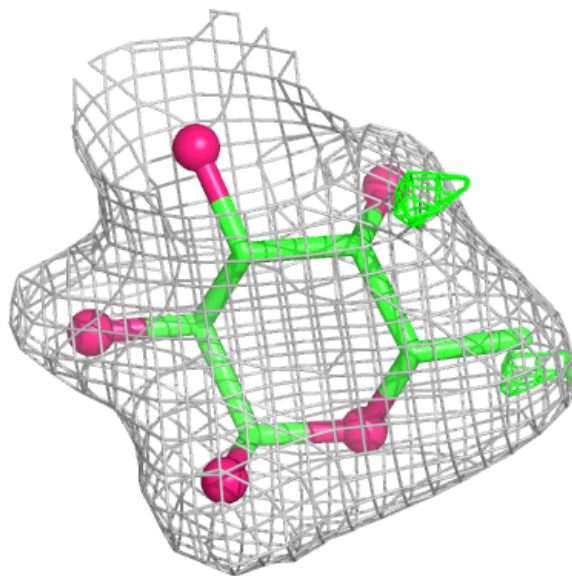
Electron density around BGC A 306:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
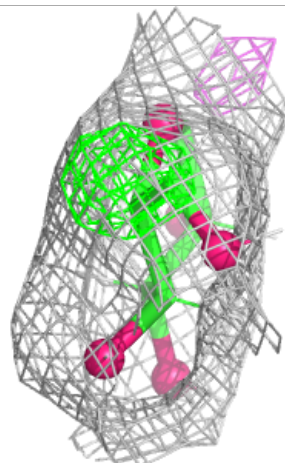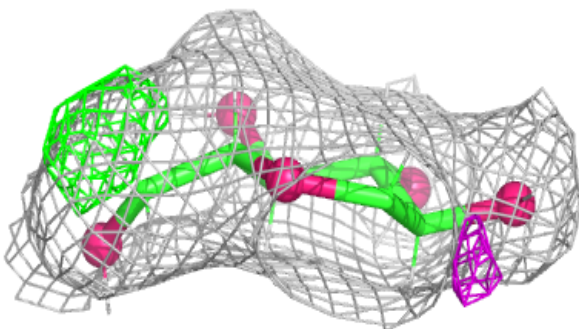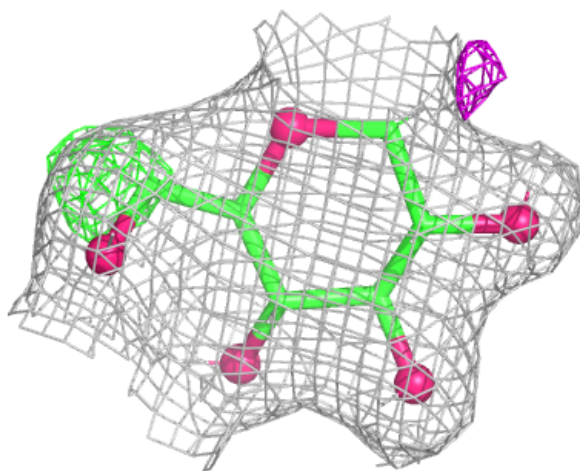
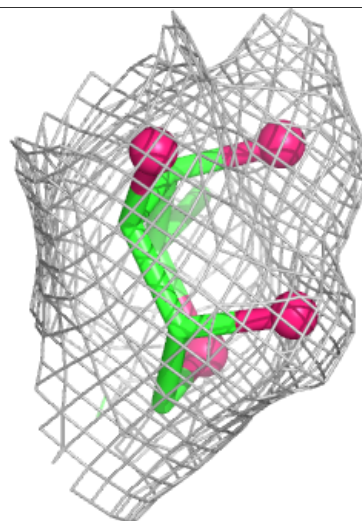**Electron density around 5GP B 301:**

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
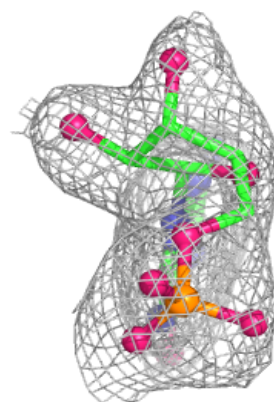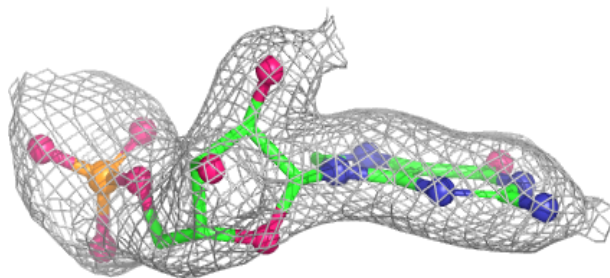
Electron density around BGC B 306:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
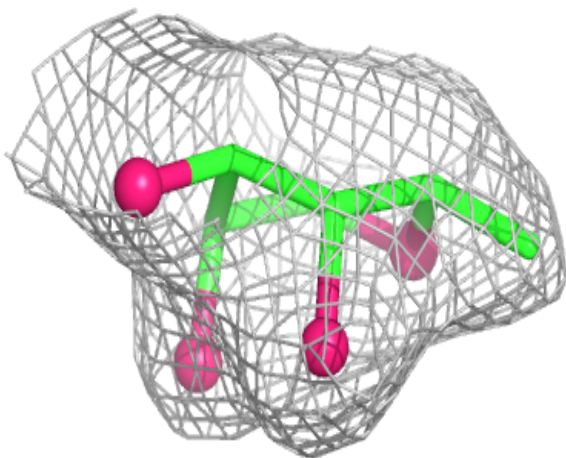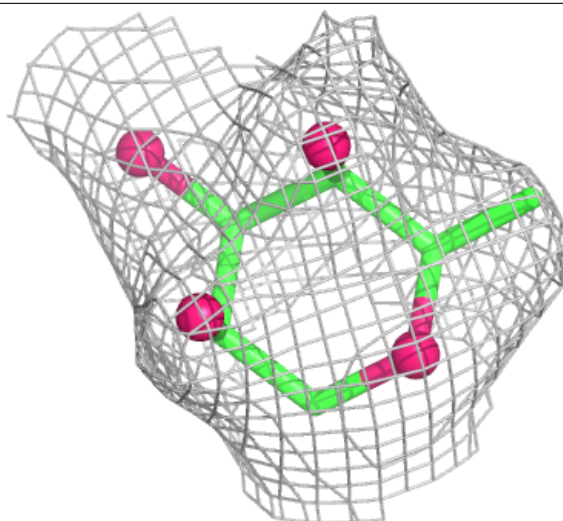
Electron density around FUC A 304:

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

Electron density around A1CCV B 305:

$2mF_o$-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.