wwPDB X-ray Structure Validation Summary Report (i)

Dec 2, 2023 – 04:19 pm GMT

PDB ID	:	2BYR
Title	:	CRYSTAL STRUCTURE OF ACHBP FROM APLYSIA CALIFORNICA in complex with methyllycaconitine
Authors	:	Hansen, S.B.; Sulzenbacher, G.; Huxford, T.; Marchot, P.; Taylor, P.; Bourne, Y.
Deposited on	:	2005-08-03
Resolution	:	2.45 Å(reported)

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

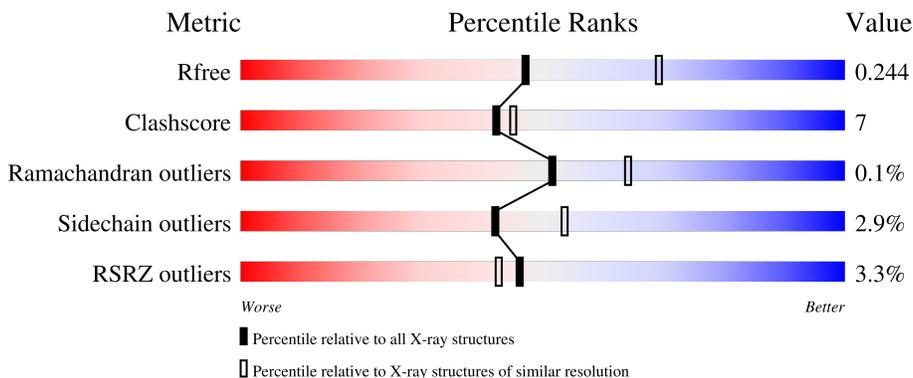|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.45 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	Percentile Ranks	Value
Rfree		0.244
Clashscore		7
Ramachandran outliers		0.1%
Sidechain outliers		2.9%
RSRZ outliers		3.3%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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	227	% 80% 11% •• 6%
1	B	227	% 81% 11% • 7%
1	C	227	2% 81% 11% • 7%
1	D	227	3% 82% 11% 7%

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Mol	Chain	Length	Quality of chain
1	E	227	% 82% 12% 6%
1	F	227	3% 79% 12% 8%
1	G	227	3% 82% 7% 10%
1	H	227	11% 78% 10% 10%
1	I	227	4% 83% 11% 6%
1	J	227	% 86% 7% 7%

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 18062 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 ACETYLCHOLINE-BINDING PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	213	Total 1737	C 1096	N 289	O 342	S 10	0	7	0
1	B	210	Total 1714	C 1082	N 288	O 334	S 10	0	8	0
1	C	210	Total 1699	C 1073	N 284	O 333	S 9	0	5	0
1	D	211	Total 1720	C 1084	N 290	O 337	S 9	0	6	0
1	E	214	Total 1733	C 1090	N 290	O 343	S 10	0	4	0
1	F	209	Total 1700	C 1074	N 284	O 333	S 9	0	6	0
1	G	205	Total 1637	C 1035	N 267	O 326	S 9	0	1	0
1	H	204	Total 1634	C 1032	N 270	O 324	S 8	0	1	0
1	I	213	Total 1724	C 1085	N 287	O 343	S 9	0	4	0
1	J	212	Total 1718	C 1084	N 285	O 339	S 10	0	5	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	TYR	-	expression tag	UNP Q8WSF8
A	-6	LYS	-	expression tag	UNP Q8WSF8
A	-5	ASP	-	expression tag	UNP Q8WSF8
A	-4	ASP	-	expression tag	UNP Q8WSF8
A	-3	ASP	-	expression tag	UNP Q8WSF8
A	-2	ASP	-	expression tag	UNP Q8WSF8
A	-1	LYS	-	expression tag	UNP Q8WSF8
A	0	LEU	-	expression tag	UNP Q8WSF8
B	-7	TYR	-	expression tag	UNP Q8WSF8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-6	LYS	-	expression tag	UNP Q8WSF8
B	-5	ASP	-	expression tag	UNP Q8WSF8
B	-4	ASP	-	expression tag	UNP Q8WSF8
B	-3	ASP	-	expression tag	UNP Q8WSF8
B	-2	ASP	-	expression tag	UNP Q8WSF8
B	-1	LYS	-	expression tag	UNP Q8WSF8
B	0	LEU	-	expression tag	UNP Q8WSF8
C	-7	TYR	-	expression tag	UNP Q8WSF8
C	-6	LYS	-	expression tag	UNP Q8WSF8
C	-5	ASP	-	expression tag	UNP Q8WSF8
C	-4	ASP	-	expression tag	UNP Q8WSF8
C	-3	ASP	-	expression tag	UNP Q8WSF8
C	-2	ASP	-	expression tag	UNP Q8WSF8
C	-1	LYS	-	expression tag	UNP Q8WSF8
C	0	LEU	-	expression tag	UNP Q8WSF8
D	-7	TYR	-	expression tag	UNP Q8WSF8
D	-6	LYS	-	expression tag	UNP Q8WSF8
D	-5	ASP	-	expression tag	UNP Q8WSF8
D	-4	ASP	-	expression tag	UNP Q8WSF8
D	-3	ASP	-	expression tag	UNP Q8WSF8
D	-2	ASP	-	expression tag	UNP Q8WSF8
D	-1	LYS	-	expression tag	UNP Q8WSF8
D	0	LEU	-	expression tag	UNP Q8WSF8
E	-7	TYR	-	expression tag	UNP Q8WSF8
E	-6	LYS	-	expression tag	UNP Q8WSF8
E	-5	ASP	-	expression tag	UNP Q8WSF8
E	-4	ASP	-	expression tag	UNP Q8WSF8
E	-3	ASP	-	expression tag	UNP Q8WSF8
E	-2	ASP	-	expression tag	UNP Q8WSF8
E	-1	LYS	-	expression tag	UNP Q8WSF8
E	0	LEU	-	expression tag	UNP Q8WSF8
F	-7	TYR	-	expression tag	UNP Q8WSF8
F	-6	LYS	-	expression tag	UNP Q8WSF8
F	-5	ASP	-	expression tag	UNP Q8WSF8
F	-4	ASP	-	expression tag	UNP Q8WSF8
F	-3	ASP	-	expression tag	UNP Q8WSF8
F	-2	ASP	-	expression tag	UNP Q8WSF8
F	-1	LYS	-	expression tag	UNP Q8WSF8
F	0	LEU	-	expression tag	UNP Q8WSF8
G	-7	TYR	-	expression tag	UNP Q8WSF8
G	-6	LYS	-	expression tag	UNP Q8WSF8
G	-5	ASP	-	expression tag	UNP Q8WSF8

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Chain	Residue	Modelled	Actual	Comment	Reference
G	-4	ASP	-	expression tag	UNP Q8WSF8
G	-3	ASP	-	expression tag	UNP Q8WSF8
G	-2	ASP	-	expression tag	UNP Q8WSF8
G	-1	LYS	-	expression tag	UNP Q8WSF8
G	0	LEU	-	expression tag	UNP Q8WSF8
H	-7	TYR	-	expression tag	UNP Q8WSF8
H	-6	LYS	-	expression tag	UNP Q8WSF8
H	-5	ASP	-	expression tag	UNP Q8WSF8
H	-4	ASP	-	expression tag	UNP Q8WSF8
H	-3	ASP	-	expression tag	UNP Q8WSF8
H	-2	ASP	-	expression tag	UNP Q8WSF8
H	-1	LYS	-	expression tag	UNP Q8WSF8
H	0	LEU	-	expression tag	UNP Q8WSF8
I	-7	TYR	-	expression tag	UNP Q8WSF8
I	-6	LYS	-	expression tag	UNP Q8WSF8
I	-5	ASP	-	expression tag	UNP Q8WSF8
I	-4	ASP	-	expression tag	UNP Q8WSF8
I	-3	ASP	-	expression tag	UNP Q8WSF8
I	-2	ASP	-	expression tag	UNP Q8WSF8
I	-1	LYS	-	expression tag	UNP Q8WSF8
I	0	LEU	-	expression tag	UNP Q8WSF8
J	-7	TYR	-	expression tag	UNP Q8WSF8
J	-6	LYS	-	expression tag	UNP Q8WSF8
J	-5	ASP	-	expression tag	UNP Q8WSF8
J	-4	ASP	-	expression tag	UNP Q8WSF8
J	-3	ASP	-	expression tag	UNP Q8WSF8
J	-2	ASP	-	expression tag	UNP Q8WSF8
J	-1	LYS	-	expression tag	UNP Q8WSF8
J	0	LEU	-	expression tag	UNP Q8WSF8

- Molecule 2 is METHYLLYCACONITINE (three-letter code: MLK) (formula: $C_{37}H_{50}N_2O_{10}$).

MLK
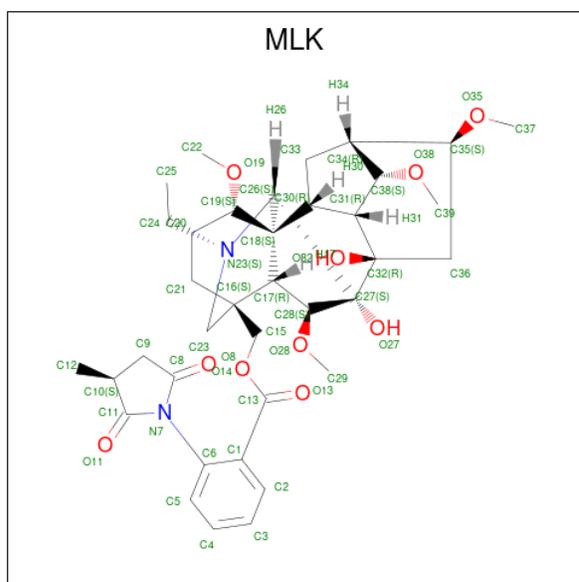
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total 49	C 37	N 2	O 10	0	0
2	B	1	Total 49	C 37	N 2	O 10	0	0
2	C	1	Total 49	C 37	N 2	O 10	0	0
2	D	1	Total 49	C 37	N 2	O 10	0	0
2	E	1	Total 49	C 37	N 2	O 10	0	0
2	F	1	Total 49	C 37	N 2	O 10	0	0
2	G	1	Total 49	C 37	N 2	O 10	0	0
2	H	1	Total 49	C 37	N 2	O 10	0	0
2	I	1	Total 49	C 37	N 2	O 10	0	0
2	J	1	Total 49	C 37	N 2	O 10	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	113	Total 113	O 113	0	0
3	B	91	Total 91	O 91	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	54	Total 54	O 54	0	0
3	D	58	Total 58	O 58	0	0
3	E	88	Total 88	O 88	0	0
3	F	32	Total 32	O 32	0	0
3	G	23	Total 23	O 23	0	0
3	H	14	Total 14	O 14	0	0
3	I	29	Total 29	O 29	0	0
3	J	54	Total 54	O 54	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: ACETYLCHOLINE-BINDING PROTEIN
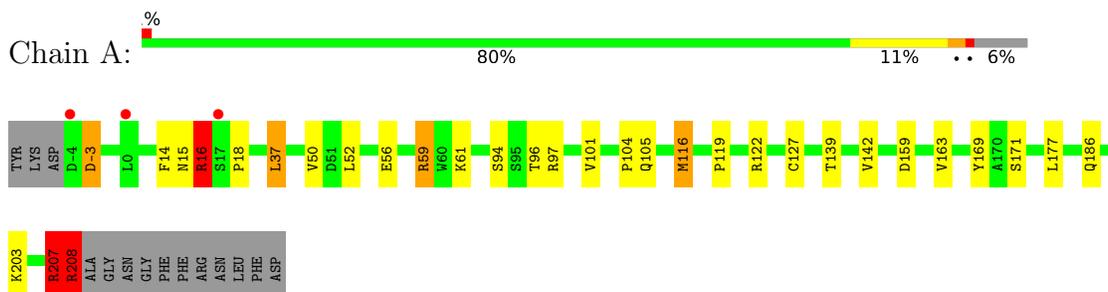
- Molecule 1: ACETYLCHOLINE-BINDING PROTEIN
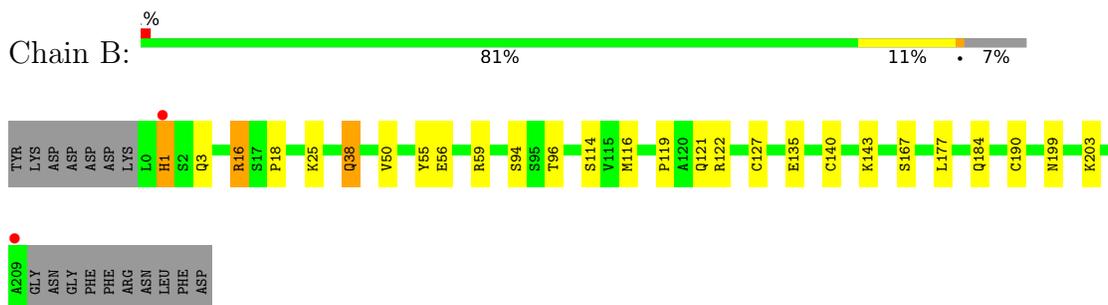
- Molecule 1: ACETYLCHOLINE-BINDING PROTEIN
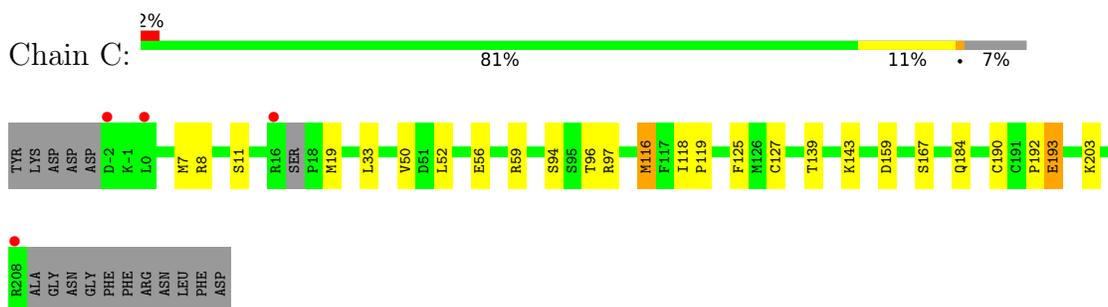
- Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

PHE
ARG
ASN
LEU
PHE
ASP

● Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain E:

%

82%   12%   6%

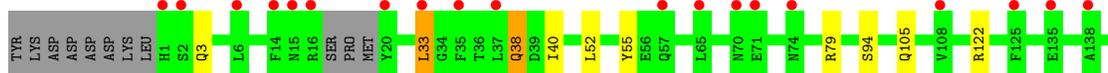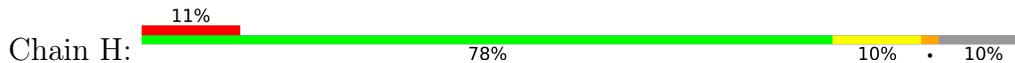TYR LYS D-5 D-4 D-3 M7 R16 S17 P18 K25 T30 Q38 V50 D51 L52 E56 Q57 Q58 R59 N70 S94 V101 Q105 M116 P119 R122 F125 M126 C127 C140 K143 K157 S167 E175 Q184 R207 R208 ALA

GLY
ASN
GLY
PHE
PHE
ARG
ASN
LEU
PHE
ASP

● Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain F:

3%

79%   12%   8%

TYR LYS ASP ASP ASP LYS L0 H1 N5 N15 R16 S17 P18 M19 Y20 L33 G34 F35 Q38 V50 D51 L52 E56 I75 V99 Q105 P119 A120 Q121 R122 C127 A141 V142 K143 V148 L156 S167 Y168 Y169 A170 S171 S172 E175

N199 R207 R208 ALA GLY ASN GLY PHE PHE ARG ASN LEU PHE ASP

● Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain G:

3%

82%   7% · 10%

TYR LYS ASP ASP ASP ASP LYS LEU HIS SER Q3 L6 M7 L13 R16 S17 P18 M19 L33 T36 L37 Q38 E56 Q57 Q58 S94 S95 T96 P119 K157 L177 Q186 C190 C191 P192 L200 K203 R207 ARG ALA GLY ASN GLY PHE PHE

ARG
ASN
LEU
PHE
ASP

● Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain H:

11%

78%   10% · 10%

TYR LYS ASP ASP ASP LYS LEU H1 S2 Q3 L6 F14 N15 R16 SER PRO MET Y20 L33 G34 F35 T36 L37 Q38 D39 I40 L52 Y55 E56 Q57 L65 N70 E71 N74 R79 S94 Q105 V108 R122 F125 E135 A138
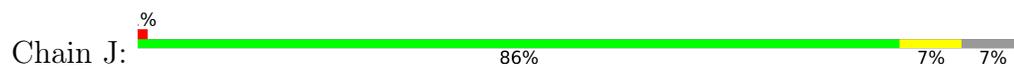
A141 V142 K143 Y149 F152 E153 I154 D155 L156 K157 T160 S167 Y168 Y169 A170 S171 S172 K173 Y174 E175 V185 C190 E193 P194 L200 V201 R205 E206 R207 ARG ALA GLY ASN GLY PHE PHE ARG ASN LEU PHE ASP

● Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain I:

4%

83%   11%   6%

TYR LYS D-5 L0 H1 M7 N15 R16 S17 P18 MET Y20 P21 G22 K25 D26 D27 T36 L37 Q38 S45 V50 D51 L52 E56 Q57 Q58 R59 S94 S95 T96 M116 R122 C127 D128 P129 K157 K173 Q186 S189 C190 Y195

K203 R207 R208 ALA GLY ASN GLY PHE PHE ARG ASN LEU PHE ASP

• Molecule 1: ACETYLCHOLINE-BINDING PROTEIN

Chain J:

TYR LYS ASP ASP D-3 H1 S2 Q3 S17 P18 M19 Q38 S45 V50 T96 I106 C127 K143 S167 L177 Q184 Y195 K203 R207 R208 ALA GLY ASN GLY PHE PHE ARG ASN LEU PHE ASP
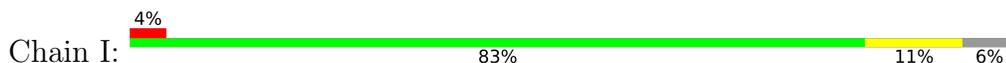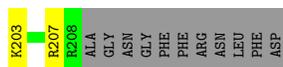
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	67.27Å 135.78Å 147.29Å 90.00° 99.46° 90.00°	Depositor
Resolution (Å)	20.00 – 2.45 66.35 – 2.45	Depositor EDS
% Data completeness (in resolution range)	100.0 (20.00-2.45) 98.5 (66.35-2.45)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$< I/\sigma(I) >$ [1]	2.47 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.193 , 0.232 0.211 , 0.244	Depositor DCC
R_{free} test set	1891 reflections (2.00%)	wwPDB-VP
Wilson B-factor (Å^2)	36.8	Xtriage
Anisotropy	0.237	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 44.1	EDS
L-test for twinning[2]	$< |L| > = 0.47, < L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	18062	wwPDB-VP
Average B, all atoms (Å^2)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.38% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MLK

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	0.48	0/1806	0.71	3/2458 (0.1%)
1	B	0.46	0/1787	0.64	2/2432 (0.1%)
1	C	0.43	0/1761	0.63	0/2397
1	D	0.40	0/1785	0.62	0/2430
1	E	0.46	0/1790	0.63	1/2437 (0.0%)
1	F	0.40	0/1765	0.65	2/2405 (0.1%)
1	G	0.39	0/1681	0.57	0/2293
1	H	0.38	0/1677	0.55	0/2286
1	I	0.39	0/1779	0.57	0/2422
1	J	0.41	0/1779	0.58	0/2422
All	All	0.42	0/17610	0.62	8/23982 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1
1	C	0	1
1	D	0	1
1	F	0	1
1	G	0	1
1	H	0	1
All	All	0	6

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	208	ARG	NE-CZ-NH1	7.39	124.00	120.30
1	F	207[A]	ARG	NE-CZ-NH2	6.34	123.47	120.30
1	F	207[B]	ARG	NE-CZ-NH2	6.34	123.47	120.30
1	A	16	ARG	NE-CZ-NH1	6.00	123.30	120.30
1	B	140	CYS	CA-CB-SG	-5.54	104.04	114.00

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	1	HIS	Peptide
1	C	190	CYS	Peptide
1	D	190	CYS	Peptide
1	F	0	LEU	Peptide
1	G	190	CYS	Peptide

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1737	0	1672	35	0
1	B	1714	0	1655	27	0
1	C	1699	0	1634	15	0
1	D	1720	0	1656	23	0
1	E	1733	0	1661	23	0
1	F	1700	0	1637	31	0
1	G	1637	0	1565	14	0
1	H	1634	0	1563	16	0
1	I	1724	0	1650	36	0
1	J	1718	0	1652	17	0
2	A	49	0	50	4	0
2	B	49	0	50	3	0
2	C	49	0	50	3	0
2	D	49	0	50	3	0
2	E	49	0	50	7	0
2	F	49	0	50	6	0
2	G	49	0	50	4	0
2	H	49	0	50	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	I	49	0	50	6	0
2	J	49	0	50	3	0
3	A	113	0	0	1	0
3	B	91	0	0	3	0
3	C	54	0	0	0	0
3	D	58	0	0	1	0
3	E	88	0	0	3	0
3	F	32	0	0	1	0
3	G	23	0	0	0	0
3	H	14	0	0	0	0
3	I	29	0	0	1	0
3	J	54	0	0	0	0
All	All	18062	0	16845	237	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 7.

The worst 5 of 237 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:59[B]:ARG:HD3	1:A:116[B]:MET:CE	1.17	1.60
1:I:59[B]:ARG:CG	1:I:116[B]:MET:HE3	1.31	1.54
1:I:59[B]:ARG:CG	1:I:116[B]:MET:CE	1.94	1.46
1:A:59[B]:ARG:CD	1:A:116[B]:MET:CE	2.09	1.28
1:A:59[B]:ARG:CD	1:A:116[B]:MET:HE2	1.65	1.19

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	218/227 (96%)	213 (98%)	5 (2%)	0	100	100
1	B	216/227 (95%)	211 (98%)	4 (2%)	1 (0%)	29	34
1	C	211/227 (93%)	206 (98%)	5 (2%)	0	100	100
1	D	215/227 (95%)	209 (97%)	4 (2%)	2 (1%)	17	19
1	E	216/227 (95%)	211 (98%)	5 (2%)	0	100	100
1	F	213/227 (94%)	206 (97%)	7 (3%)	0	100	100
1	G	204/227 (90%)	201 (98%)	3 (2%)	0	100	100
1	H	201/227 (88%)	194 (96%)	7 (4%)	0	100	100
1	I	213/227 (94%)	206 (97%)	7 (3%)	0	100	100
1	J	215/227 (95%)	211 (98%)	4 (2%)	0	100	100
All	All	2122/2270 (94%)	2068 (98%)	51 (2%)	3 (0%)	51	64

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	18	PRO
1	D	19	MET
1	D	18	PRO

5.3.2 Protein sidechains ⓘ

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	201/205 (98%)	188 (94%)	13 (6%)	17	21
1	B	198/205 (97%)	193 (98%)	5 (2%)	47	60
1	C	195/205 (95%)	188 (96%)	7 (4%)	35	46
1	D	198/205 (97%)	196 (99%)	2 (1%)	76	84
1	E	199/205 (97%)	195 (98%)	4 (2%)	55	67
1	F	196/205 (96%)	189 (96%)	7 (4%)	35	46
1	G	187/205 (91%)	181 (97%)	6 (3%)	39	50
1	H	186/205 (91%)	176 (95%)	10 (5%)	22	28

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	I	198/205 (97%)	192 (97%)	6 (3%)	41	52
1	J	198/205 (97%)	195 (98%)	3 (2%)	65	76
All	All	1956/2050 (95%)	1893 (97%)	63 (3%)	42	50

5 of 63 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	25	LYS
1	I	0	LEU
1	F	156	LEU
1	I	-5	ASP
1	I	203	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 30 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	105	GLN
1	I	186	GLN
1	F	199	ASN
1	J	199	ASN
1	H	162	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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

10 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	#$|Z| > 2$
2	MLK	E	301	-	54,56,56	1.50	8 (14%)	78,92,92	1.29	10 (12%)
2	MLK	C	301	-	54,56,56	1.56	7 (12%)	78,92,92	1.21	9 (11%)
2	MLK	B	301	-	54,56,56	1.64	7 (12%)	78,92,92	1.17	7 (8%)
2	MLK	D	301	-	54,56,56	1.58	6 (11%)	78,92,92	1.34	11 (14%)
2	MLK	A	301	-	54,56,56	1.49	7 (12%)	78,92,92	1.34	9 (11%)
2	MLK	G	301	-	54,56,56	1.55	7 (12%)	78,92,92	1.18	10 (12%)
2	MLK	H	301	-	54,56,56	1.44	6 (11%)	78,92,92	1.42	10 (12%)
2	MLK	I	301	-	54,56,56	1.52	6 (11%)	78,92,92	1.22	7 (8%)
2	MLK	J	301	-	54,56,56	1.45	7 (12%)	78,92,92	1.36	9 (11%)
2	MLK	F	301	-	54,56,56	1.59	7 (12%)	78,92,92	1.08	8 (10%)

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	MLK	E	301	-	-	0/24/141/141	0/2/8/8
2	MLK	C	301	-	-	0/24/141/141	0/2/8/8
2	MLK	B	301	-	-	0/24/141/141	0/2/8/8
2	MLK	D	301	-	-	0/24/141/141	0/2/8/8
2	MLK	A	301	-	-	0/24/141/141	0/2/8/8
2	MLK	G	301	-	-	0/24/141/141	0/2/8/8
2	MLK	H	301	-	-	0/24/141/141	0/2/8/8
2	MLK	I	301	-	-	0/24/141/141	0/2/8/8
2	MLK	J	301	-	-	0/24/141/141	0/2/8/8
2	MLK	F	301	-	-	2/24/141/141	0/2/8/8

The worst 5 of 68 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	301	MLK	C11-N7	-5.80	1.32	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	301	MLK	C1-C6	5.64	1.49	1.41
2	F	301	MLK	C11-N7	-5.48	1.32	1.40
2	E	301	MLK	C1-C6	5.45	1.49	1.41
2	D	301	MLK	C1-C6	5.39	1.49	1.41

The worst 5 of 90 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	J	301	MLK	O8-C8-N7	4.62	128.14	124.01
2	H	301	MLK	O8-C8-N7	4.42	127.96	124.01
2	E	301	MLK	O8-C8-N7	4.40	127.94	124.01
2	D	301	MLK	O8-C8-N7	4.37	127.92	124.01
2	I	301	MLK	C10-C11-N7	4.26	110.94	108.26

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	F	301	MLK	O13-C13-O14-C15
2	F	301	MLK	C1-C13-O14-C15

There are no ring outliers.

10 monomers are involved in 45 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	301	MLK	7	0
2	C	301	MLK	3	0
2	B	301	MLK	3	0
2	D	301	MLK	3	0
2	A	301	MLK	4	0
2	G	301	MLK	4	0
2	H	301	MLK	6	0
2	I	301	MLK	6	0
2	J	301	MLK	3	0
2	F	301	MLK	6	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 MLK E 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK C 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK B 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK D 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK A 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK G 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK H 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK I 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK J 301

Bond lengths

Bond angles

Torsions

Rings

Ligand MLK F 301

Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å^2)	Q<0.9
1	A	213/227 (93%)	0.10	3 (1%) 75	74	15, 28, 56, 77	0
1	B	210/227 (92%)	0.05	2 (0%) 82	83	14, 31, 62, 78	0
1	C	210/227 (92%)	0.05	4 (1%) 66	64	20, 38, 67, 96	0
1	D	211/227 (92%)	0.17	6 (2%) 53	49	22, 39, 74, 85	0
1	E	214/227 (94%)	0.06	3 (1%) 75	74	18, 30, 65, 92	0
1	F	209/227 (92%)	0.38	6 (2%) 51	47	29, 48, 75, 92	0
1	G	205/227 (90%)	0.36	6 (2%) 51	47	33, 55, 85, 95	0
1	H	204/227 (89%)	1.06	26 (12%) 3	2	45, 65, 95, 106	0
1	I	213/227 (93%)	0.38	10 (4%) 31	29	32, 51, 92, 100	0
1	J	212/227 (93%)	0.06	3 (1%) 75	74	22, 39, 69, 99	0
All	All	2101/2270 (92%)	0.27	69 (3%) 46	43	14, 43, 81, 106	0

The worst 5 of 69 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	209	ALA	5.4
1	H	16	ARG	5.2
1	I	190	CYS	5.0
1	H	1	HIS	4.6
1	H	33	LEU	4.4

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 (i)

There are no monosaccharides in this entry.

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
2	MLK	I	301	49/49	0.88	0.21	49,52,56,57	0
2	MLK	H	301	49/49	0.89	0.17	51,52,59,59	0
2	MLK	G	301	49/49	0.90	0.18	45,46,56,56	0
2	MLK	A	301	49/49	0.93	0.14	28,30,40,40	0
2	MLK	D	301	49/49	0.93	0.17	39,40,45,45	0
2	MLK	F	301	49/49	0.93	0.18	43,44,48,48	0
2	MLK	C	301	49/49	0.95	0.14	30,32,40,40	0
2	MLK	E	301	49/49	0.95	0.16	27,28,37,38	0
2	MLK	J	301	49/49	0.95	0.15	30,33,39,39	0
2	MLK	B	301	49/49	0.96	0.14	23,25,31,32	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.
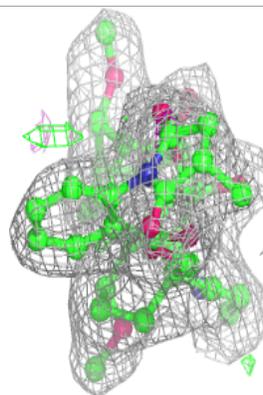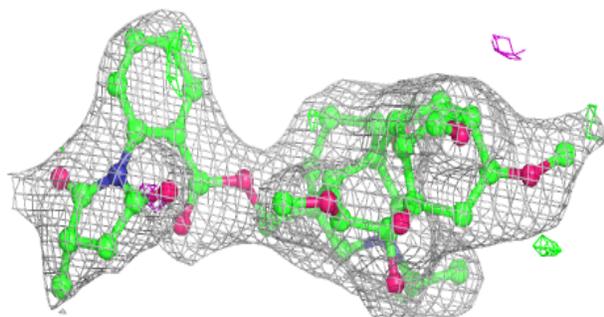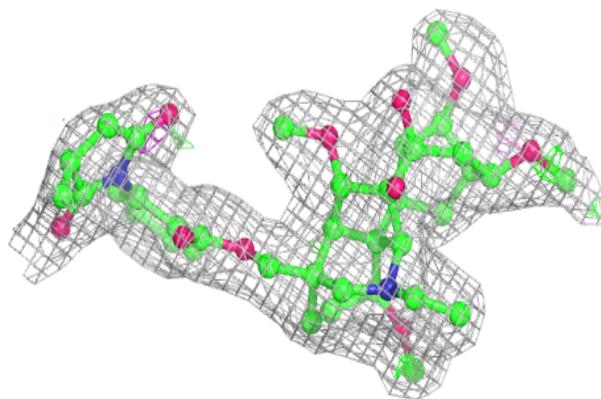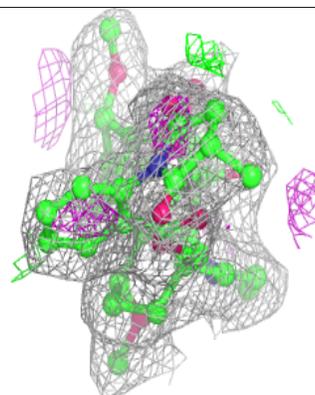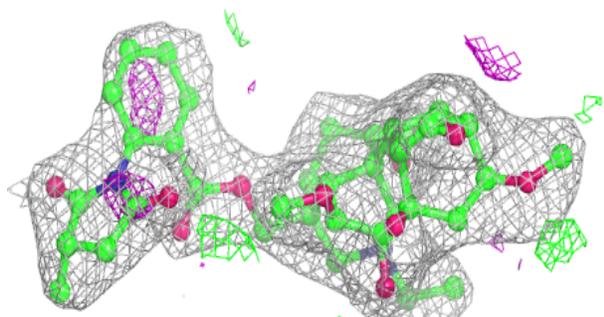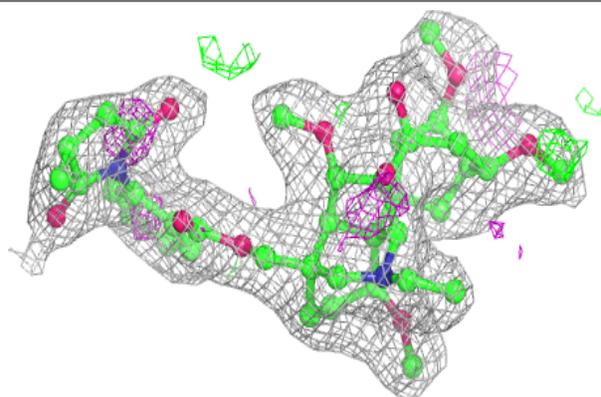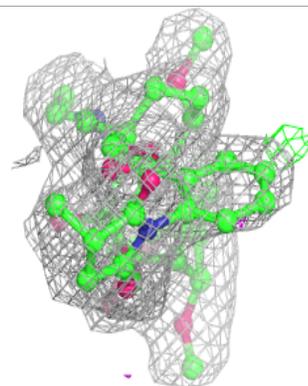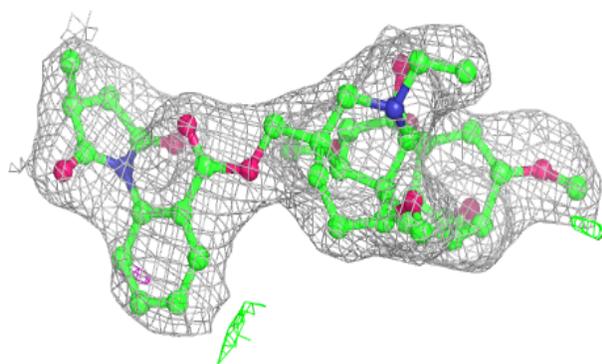
Electron density around MLK I 301:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
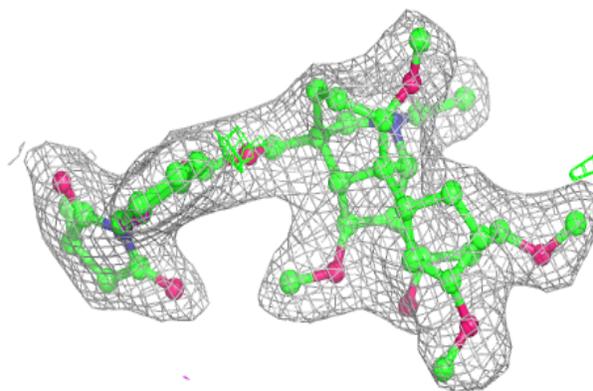and green (positive)
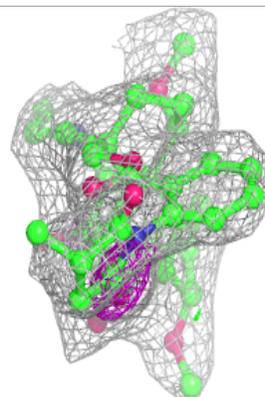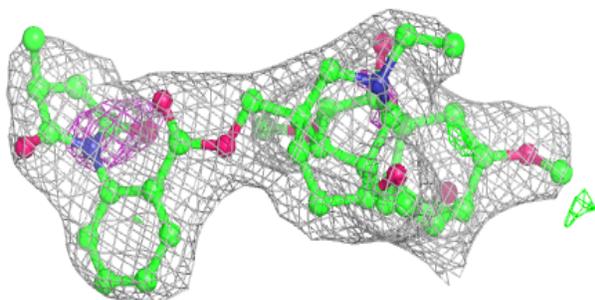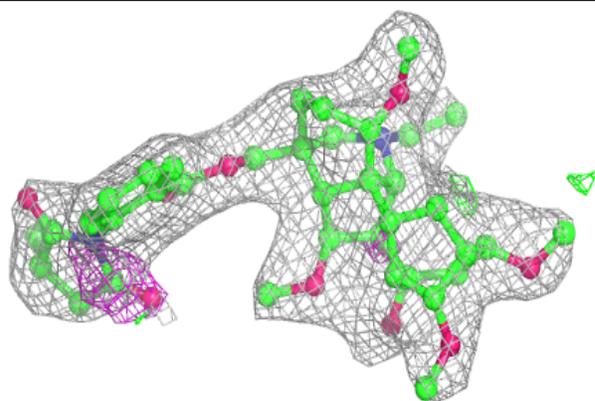
Electron density around MLK H 301:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
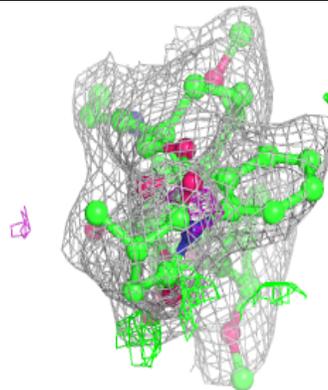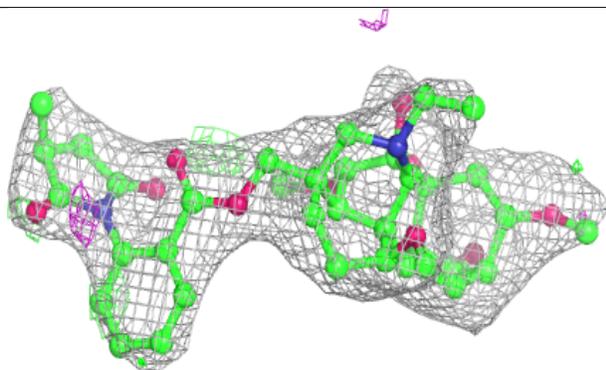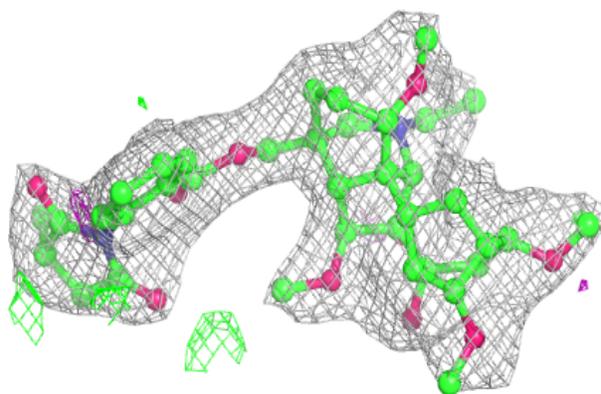
Electron density around MLK G 301:

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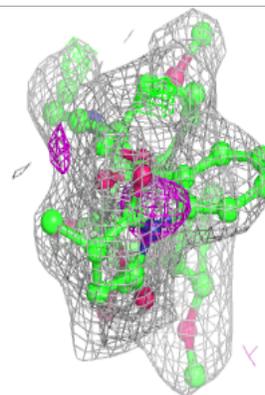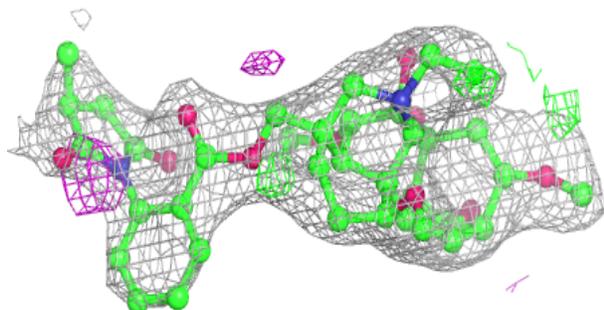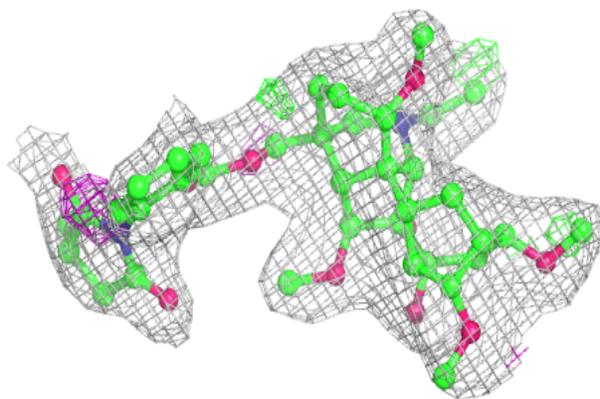
Electron density around MLK A 301:

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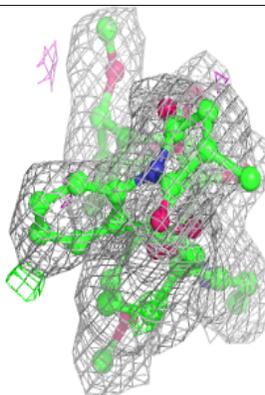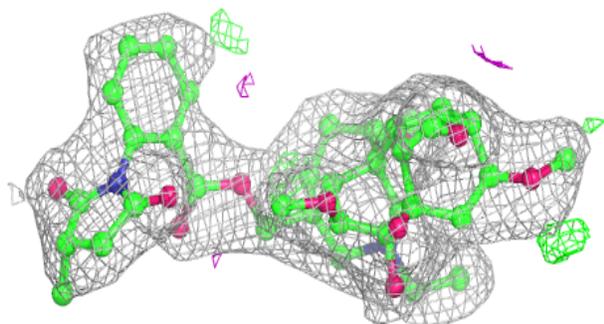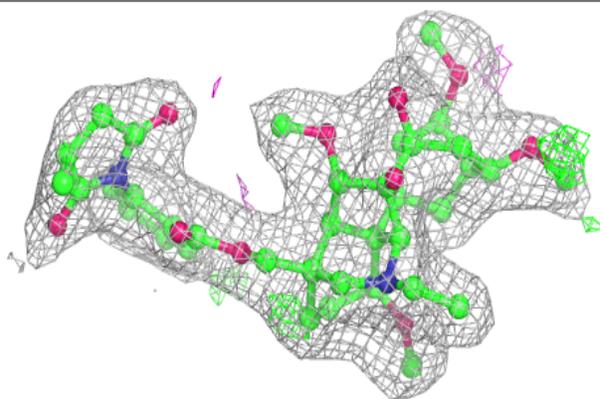
Electron density around MLK D 301:

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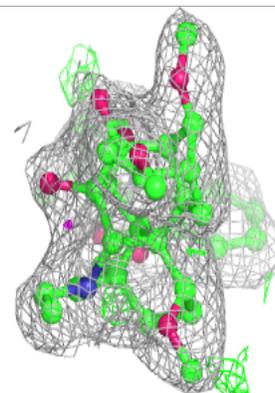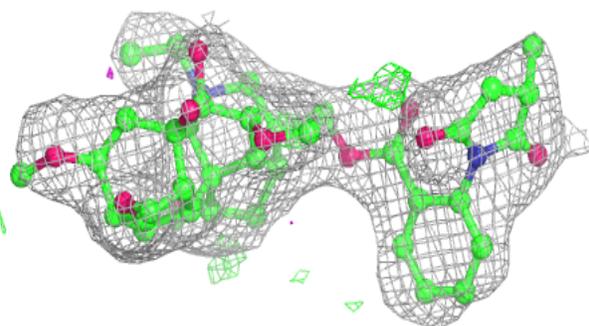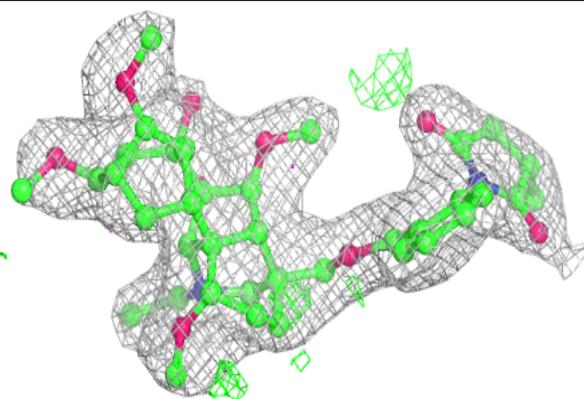
Electron density around MLK F 301:

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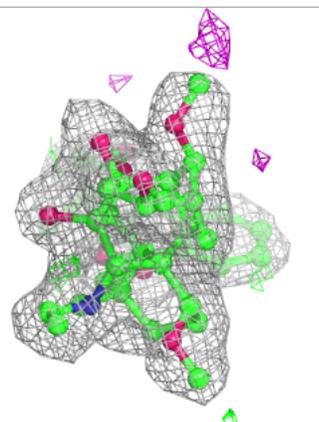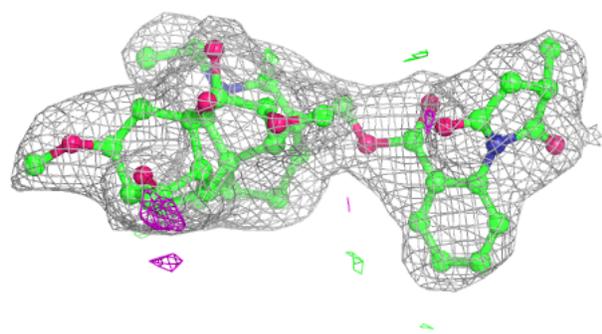$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)
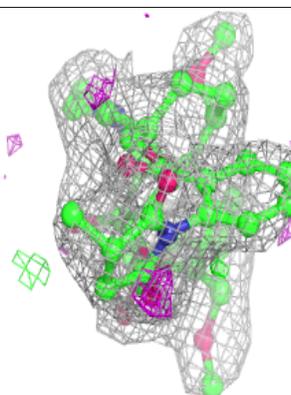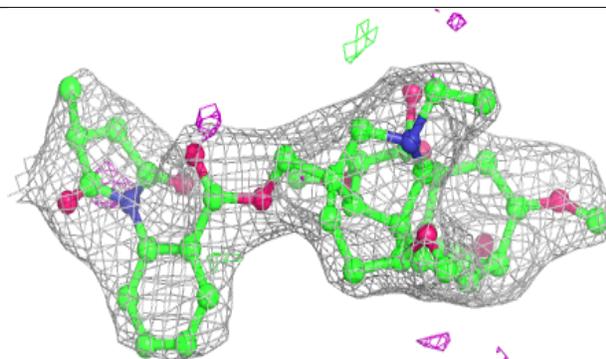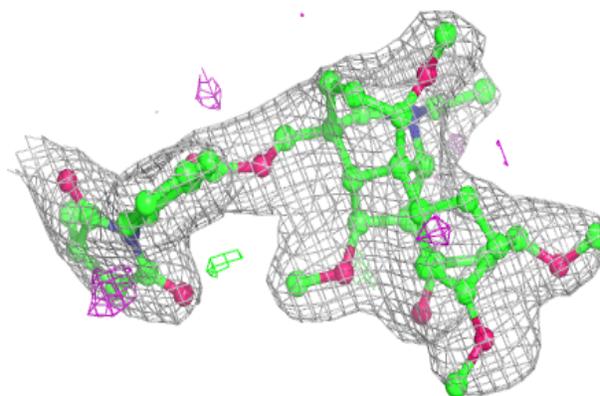
Electron density around MLK C 301:

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

Electron density around MLK E 301:

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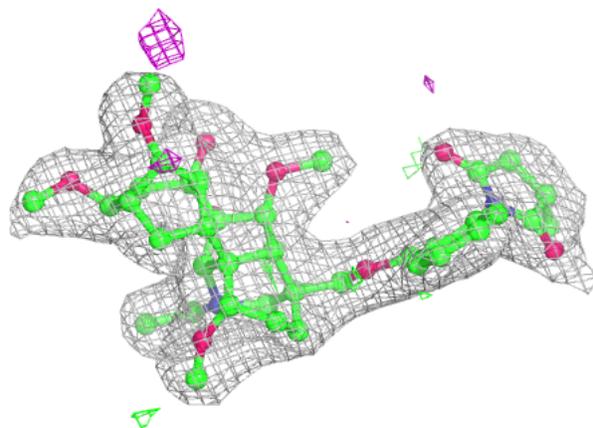$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around MLK J 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 MLK 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)

6.5 Other polymers ⓘ

There are no such residues in this entry.