Full wwPDB X-ray Structure Validation Report ⓘ

May 11, 2026 – 12:59 PM EDT

PDB ID	:	9YOW / pdb_00009yow
Title	:	Crystal structure of GMPPNP bound KRAS G12C in complex with CYPA and RMC-4791
Authors	:	Pourfarjam, Y.; Lito, P.
Deposited on	:	2025-10-13
Resolution	:	1.57 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

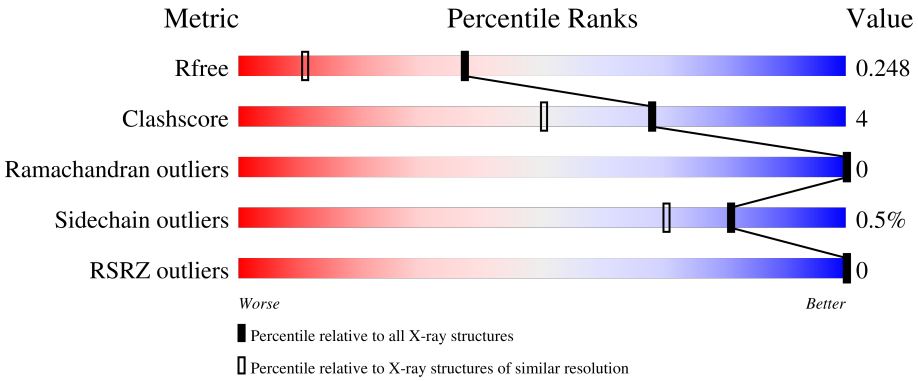
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

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 1.57 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1094 (1.58-1.58)
Clashscore	190562	1105 (1.58-1.58)
Ramachandran outliers	187476	1082 (1.58-1.58)
Sidechain outliers	187428	1081 (1.58-1.58)
RSRZ outliers	180081	1094 (1.58-1.58)

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	170	89% 11%
1	C	170	87% 13%
2	B	166	94% 5% •
2	D	166	93% 6% •

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
5	A1CYT	B	201	X	-	-	-
5	A1CYT	D	201	X	-	-	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 11125 atoms, of which 5283 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 Isoform 2B of GTPase KRas.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	170	Total	C	H	N	O	S	0	3	0
			2683	846	1329	233	266	9			
1	C	170	Total	C	H	N	O	S	0	4	0
			2702	851	1338	234	270	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	expression tag	UNP P01116
A	12	CYS	GLY	engineered mutation	UNP P01116
C	0	GLY	-	expression tag	UNP P01116
C	12	CYS	GLY	engineered mutation	UNP P01116

- Molecule 2 is a protein called Peptidyl-prolyl cis-trans isomerase A.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	D	164	Total	C	H	N	O	S	0	0	0
			2492	798	1236	218	231	9			
2	B	164	Total	C	H	N	O	S	0	0	0
			2492	798	1236	218	231	9			

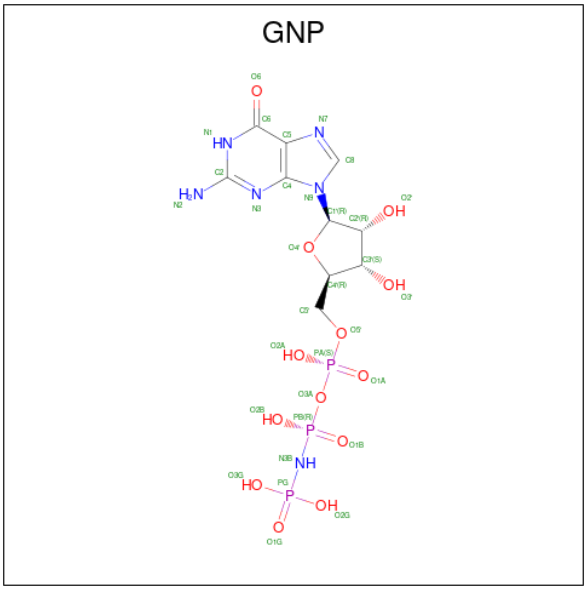
There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	0	GLY	-	expression tag	UNP P62937
D	120	LYS	GLU	conflict	UNP P62937
B	0	GLY	-	expression tag	UNP P62937
B	120	LYS	GLU	conflict	UNP P62937

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

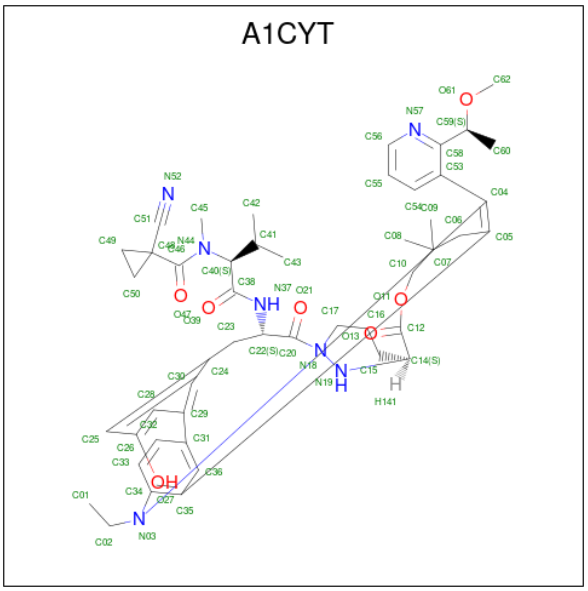
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0
3	C	1	Total Mg 1 1	0	0

- Molecule 4 is PHOSPHOAMINOPHOSPHONIC ACID-GUANYLATE ESTER (CCD ID: GNP) (formula: $C_{10}H_{17}N_6O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	A	1	Total 45	C 10	H 13	N 6	O 13	P 3	0	0
4	C	1	Total 45	C 10	H 13	N 6	O 13	P 3	0	0

- Molecule 5 is 1-cyano-N-[(2S)-1-{[(1M,8S,10S,14S,21M)-22-ethyl-4-hydroxy-21-{2-[(1S)-1-methoxyethyl]pyridin-3-yl}-18,18-dimethyl-9,15-dioxo-16-oxa-10,22,28-triazapentacyclo[18.5.2.1 2,6 .1 10,14 .0 23,27]nonacosa-1(25),2(29),3,5,20,23,26-heptaen-8-yl]amino}-3-methyl-1-oxobutan-2-yl]-N-methylcyclopropane-1-carboxamide (CCD ID: A1CYT) (formula: $C_{48}H_{59}N_7O_7$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	D	1	Total C H N O 121 48 59 7 7	0	0
5	B	1	Total C H N O 121 48 59 7 7	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	110	Total O 110 110	0	0
6	C	97	Total O 97 97	0	0
6	D	114	Total O 114 114	0	0
6	B	101	Total O 101 101	0	0

3 Residue-property plots (i)

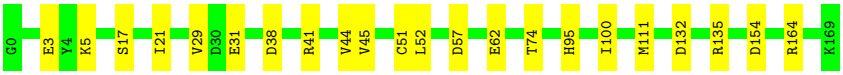
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Isoform 2B of GTPase KRas

Chain A:

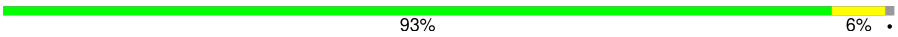
• Molecule 1: Isoform 2B of GTPase KRas

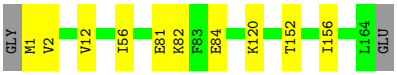
Chain C:



• Molecule 2: Peptidyl-prolyl cis-trans isomerase A

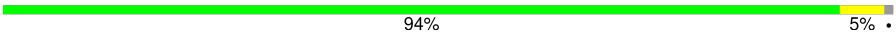
Chain D:

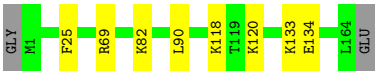




• Molecule 2: Peptidyl-prolyl cis-trans isomerase A

Chain B:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	47.52Å 102.03Å 66.35Å 90.00° 90.32° 90.00°	Depositor
Resolution (Å)	33.18 – 1.57 33.18 – 1.57	Depositor EDS
% Data completeness (in resolution range)	96.0 (33.18-1.57) 95.2 (33.18-1.57)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	22.45 (at 1.57Å)	Xtriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, R_{free}	0.222 , 0.245 0.226 , 0.248	Depositor DCC
R_{free} test set	4310 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å^2)	17.8	Xtriage
Anisotropy	0.237	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 24.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.39$, $< L^2 > = 0.22$	Xtriage
Estimated twinning fraction	0.138 for h,-k,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	11125	wwPDB-VP
Average B, all atoms (Å^2)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.99% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG, A1CYT, GNP

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	0.08	0/1396	0.26	0/1884
1	C	0.08	0/1406	0.24	0/1897
2	B	0.10	0/1284	0.28	0/1720
2	D	0.11	0/1284	0.30	0/1720
All	All	0.09	0/5370	0.27	0/7221

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1354	1329	1314	12	0
1	C	1364	1338	1323	15	0
2	B	1256	1236	1238	6	0
2	D	1256	1236	1238	7	0
3	A	1	0	0	0	0
3	C	1	0	0	0	0
4	A	32	13	13	0	0
4	C	32	13	13	0	0
5	B	62	59	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	D	62	59	0	0	0
6	A	110	0	0	2	0
6	B	101	0	0	2	0
6	C	97	0	0	4	0
6	D	114	0	0	1	0
All	All	5842	5283	5139	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 4.

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)
1:C:3:GLU:O	6:C:301:HOH:O	1.99	0.79
1:A:67:MET:HE1	1:C:52:LEU:HD22	1.69	0.75
1:C:132:ASP:OD1	1:C:135:ARG:NH2	2.26	0.69
1:C:51:CYS:SG	1:C:164:ARG:NH2	2.67	0.68
1:A:38:ASP:OD2	6:A:301:HOH:O	2.12	0.66
1:C:154:ASP:OD2	6:C:302:HOH:O	2.12	0.66
1:C:38:ASP:OD2	6:C:303:HOH:O	2.16	0.61
1:C:31:GLU:OE1	1:C:31:GLU:N	2.29	0.61
2:D:82:LYS:HE3	2:D:82:LYS:HA	1.84	0.59
1:A:3:GLU:OE1	1:C:74:THR:HG21	2.04	0.57
2:B:69:ARG:HH11	2:B:69:ARG:HG3	1.71	0.56
2:B:118:LYS:NZ	6:B:303:HOH:O	2.41	0.54
2:B:82:LYS:NZ	6:B:308:HOH:O	2.43	0.52
2:D:12:VAL:HG22	2:D:156:ILE:CD1	2.43	0.48
1:A:24:ILE:HD11	1:A:55:ILE:HD12	1.96	0.48
1:A:29:VAL:O	1:A:29:VAL:HG23	2.14	0.47
1:A:72:MET:SD	1:A:99:GLN:HG2	2.55	0.46
1:C:62:GLU:OE2	1:C:95:HIS:ND1	2.44	0.46
1:A:30:ASP:OD2	6:A:302:HOH:O	2.21	0.46
1:A:118[B]:CYS:SG	1:A:143:GLU:HB3	2.57	0.45
2:D:120:LYS:H	2:D:120:LYS:HD3	1.82	0.45
2:D:84:GLU:H	2:D:84:GLU:CD	2.26	0.44
2:B:133:LYS:HG2	2:B:134:GLU:OE1	2.17	0.44
1:C:21:ILE:HD13	1:C:29:VAL:HG21	2.01	0.43
1:C:3:GLU:OE2	1:C:41:ARG:NH2	2.52	0.43
1:C:17:SER:OG	1:C:57:ASP:OD2	2.38	0.42
1:A:80:CYS:SG	1:A:111:MET:HE3	2.60	0.42
1:A:84:ILE:HG21	1:A:118[B]:CYS:SG	2.60	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:100:ILE:HG21	1:C:111:MET:HE2	2.01	0.42
1:C:5:LYS:NZ	6:C:301:HOH:O	2.53	0.42
2:D:1:MET:N	6:D:307:HOH:O	2.45	0.42
2:B:25:PHE:CD2	2:B:90:LEU:HD13	2.55	0.42
2:B:69:ARG:HG3	2:B:69:ARG:NH1	2.35	0.42
1:A:17:SER:OG	1:A:57:ASP:OD2	2.39	0.41
2:D:81:GLU:C	2:D:82:LYS:HD2	2.45	0.41
2:D:56:ILE:HD12	2:D:152:THR:HG21	2.03	0.40
1:C:44:VAL:HG22	1:C:45:VAL:N	2.36	0.40
1:A:102:ARG:HH11	1:A:102:ARG:HG2	1.87	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	171/170 (101%)	170 (99%)	1 (1%)	0	100	100
1	C	172/170 (101%)	168 (98%)	4 (2%)	0	100	100
2	B	162/166 (98%)	159 (98%)	3 (2%)	0	100	100
2	D	162/166 (98%)	157 (97%)	5 (3%)	0	100	100
All	All	667/672 (99%)	654 (98%)	13 (2%)	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	151/150 (101%)	150 (99%)	1 (1%)	76	61
1	C	153/150 (102%)	153 (100%)	0	100	100
2	B	132/133 (99%)	131 (99%)	1 (1%)	73	57
2	D	132/133 (99%)	131 (99%)	1 (1%)	73	57
All	All	568/566 (100%)	565 (100%)	3 (0%)	81	70

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	149	ARG
2	D	2	VAL
2	B	120	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	43	GLN
2	D	70	HIS

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)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
5	A1CYT	D	201	-	63,68,68	3.02	21 (33%)	78,102,102	1.20	9 (11%)
4	GNP	C	202	3	34,34,34	1.35	5 (14%)	47,54,54	0.89	0
5	A1CYT	B	201	-	63,68,68	3.02	20 (31%)	78,102,102	1.22	11 (14%)
4	GNP	A	202	3	34,34,34	1.36	5 (14%)	47,54,54	0.89	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	GNP	C	202	3	-	4/18/38/38	0/3/3/3
5	A1CYT	D	201	-	1/1/15/15	7/68/86/86	0/5/7/7
5	A1CYT	B	201	-	1/1/15/15	6/68/86/86	0/5/7/7
4	GNP	A	202	3	-	4/18/38/38	0/3/3/3

All (51) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	201	A1CYT	C46-N44	14.49	1.49	1.35
5	B	201	A1CYT	C46-N44	14.47	1.49	1.35
5	B	201	A1CYT	C20-N18	8.96	1.48	1.35
5	D	201	A1CYT	C20-N18	8.93	1.47	1.35
5	D	201	A1CYT	C38-N37	6.65	1.48	1.34
5	B	201	A1CYT	C38-N37	6.64	1.48	1.34
5	B	201	A1CYT	C06-C05	5.45	1.58	1.51
5	B	201	A1CYT	N19-N18	5.43	1.49	1.43
5	D	201	A1CYT	N19-N18	5.41	1.49	1.43
5	D	201	A1CYT	C06-C05	5.36	1.57	1.51
4	A	202	GNP	PB-O3A	4.84	1.65	1.59
4	C	202	GNP	PB-O3A	4.80	1.65	1.59
5	B	201	A1CYT	C17-N18	4.34	1.52	1.46
5	D	201	A1CYT	C15-C14	-4.29	1.45	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	201	A1CYT	C17-N18	4.26	1.52	1.46
5	B	201	A1CYT	C15-C14	-4.19	1.45	1.53
5	D	201	A1CYT	O11-C12	4.10	1.41	1.33
5	B	201	A1CYT	O11-C12	4.06	1.41	1.33
5	D	201	A1CYT	C53-C04	-3.63	1.43	1.48
5	B	201	A1CYT	C53-C04	-3.59	1.43	1.48
5	D	201	A1CYT	C16-C15	-3.45	1.44	1.53
5	B	201	A1CYT	C16-C15	-3.43	1.44	1.53
4	C	202	GNP	PB-O1B	3.26	1.51	1.46
4	A	202	GNP	PB-O1B	3.23	1.51	1.46
4	A	202	GNP	PG-N3B	3.11	1.71	1.63
4	C	202	GNP	PG-N3B	3.06	1.71	1.63
4	C	202	GNP	PG-O1G	2.84	1.50	1.46
4	A	202	GNP	PG-O1G	2.83	1.50	1.46
5	D	201	A1CYT	C04-N03	-2.83	1.34	1.39
5	D	201	A1CYT	C48-C51	2.80	1.53	1.47
5	B	201	A1CYT	C48-C51	2.79	1.53	1.47
5	B	201	A1CYT	C33-C34	2.76	1.43	1.39
5	B	201	A1CYT	C04-C05	2.74	1.41	1.37
5	D	201	A1CYT	C33-C34	2.71	1.43	1.39
5	D	201	A1CYT	C36-C35	2.69	1.44	1.39
5	B	201	A1CYT	C04-N03	-2.66	1.35	1.39
5	B	201	A1CYT	C36-C35	2.63	1.43	1.39
5	D	201	A1CYT	C04-C05	2.58	1.41	1.37
5	D	201	A1CYT	C31-C29	-2.57	1.42	1.49
5	B	201	A1CYT	C31-C29	-2.55	1.43	1.49
5	B	201	A1CYT	C23-C24	2.29	1.56	1.51
4	C	202	GNP	PB-O2B	-2.28	1.50	1.56
5	D	201	A1CYT	C23-C24	2.28	1.56	1.51
4	A	202	GNP	PB-O2B	-2.27	1.50	1.56
5	D	201	A1CYT	O39-C38	-2.18	1.19	1.23
5	B	201	A1CYT	C14-C12	2.16	1.57	1.52
5	B	201	A1CYT	O39-C38	-2.15	1.19	1.23
5	D	201	A1CYT	C14-C12	2.13	1.57	1.52
5	D	201	A1CYT	C34-N03	-2.13	1.35	1.39
5	B	201	A1CYT	C34-N03	-2.07	1.35	1.39
5	D	201	A1CYT	O27-C26	2.00	1.41	1.37

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	201	A1CYT	O11-C12-C14	3.35	119.46	111.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	D	201	A1CYT	O11-C12-C14	3.28	119.30	111.58
5	B	201	A1CYT	C50-C48-C49	2.74	60.01	58.28
5	D	201	A1CYT	C50-C48-C49	2.72	60.00	58.28
5	D	201	A1CYT	C34-N03-C04	2.66	110.50	108.37
5	B	201	A1CYT	C34-N03-C04	2.63	110.48	108.37
5	B	201	A1CYT	C15-C16-C17	2.57	114.13	110.75
5	B	201	A1CYT	C56-N57-C58	2.54	121.97	116.92
5	D	201	A1CYT	C15-C16-C17	2.49	114.02	110.75
5	D	201	A1CYT	C53-C04-C05	-2.48	125.76	128.34
5	D	201	A1CYT	C56-N57-C58	2.43	121.76	116.92
5	B	201	A1CYT	C53-C04-C05	-2.43	125.81	128.34
5	B	201	A1CYT	O11-C12-O13	-2.25	120.02	124.14
5	B	201	A1CYT	C16-C15-C14	2.23	113.91	110.97
5	B	201	A1CYT	O11-C10-C07	-2.15	105.55	109.25
5	D	201	A1CYT	C17-N18-C20	2.12	128.05	120.97
5	D	201	A1CYT	O11-C10-C07	-2.11	105.62	109.25
5	D	201	A1CYT	O11-C12-O13	-2.09	120.33	124.14
5	B	201	A1CYT	C17-N18-C20	2.07	127.88	120.97
5	B	201	A1CYT	C20-N18-N19	2.01	122.26	119.42

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	D	201	A1CYT	N18
5	B	201	A1CYT	N18

All (21) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	202	GNP	PB-N3B-PG-O1G
4	A	202	GNP	PG-N3B-PB-O1B
4	A	202	GNP	PG-N3B-PB-O3A
4	C	202	GNP	PB-N3B-PG-O1G
4	C	202	GNP	PG-N3B-PB-O1B
5	D	201	A1CYT	C53-C58-C59-C60
5	B	201	A1CYT	C53-C58-C59-C60
5	D	201	A1CYT	N37-C22-C23-C24
5	B	201	A1CYT	N37-C22-C23-C24
5	D	201	A1CYT	C53-C58-C59-O61
5	B	201	A1CYT	C53-C58-C59-O61
5	D	201	A1CYT	C20-C22-C23-C24
5	B	201	A1CYT	C20-C22-C23-C24

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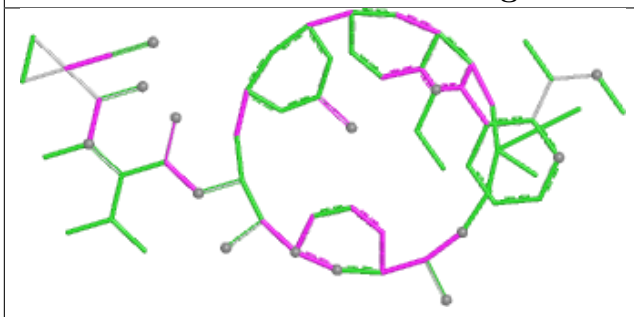
Mol	Chain	Res	Type	Atoms
4	C	202	GNP	PG-N3B-PB-O3A
5	D	201	A1CYT	O13-C12-O11-C10
5	D	201	A1CYT	C58-C59-O61-C62
5	D	201	A1CYT	C14-C12-O11-C10
4	A	202	GNP	PA-O3A-PB-O1B
4	C	202	GNP	PA-O3A-PB-O1B
5	B	201	A1CYT	C58-C59-O61-C62
5	B	201	A1CYT	C60-C59-O61-C62

There are no ring outliers.

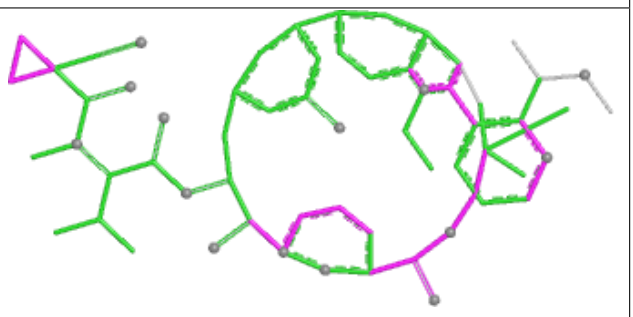
No monomer is involved in short contacts.

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.

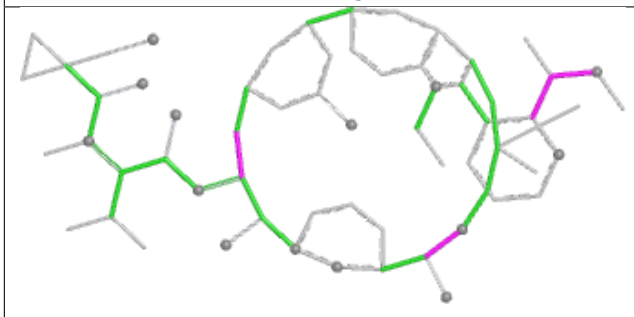
Ligand A1CYT D 201



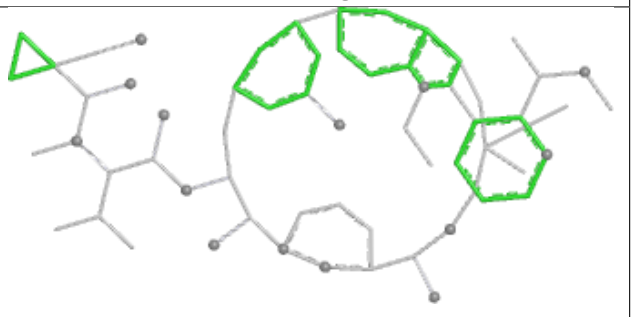
Bond lengths



Bond angles

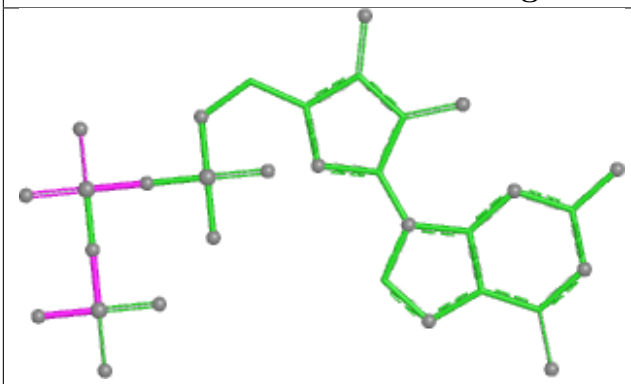


Torsions

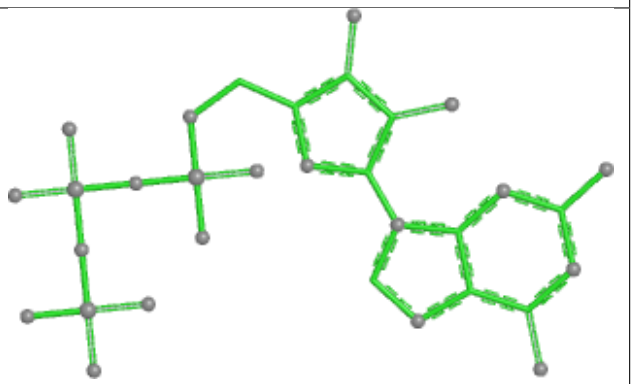


Rings

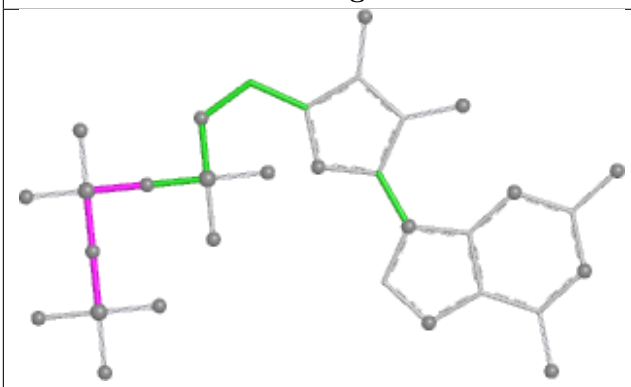
Ligand GNP C 202



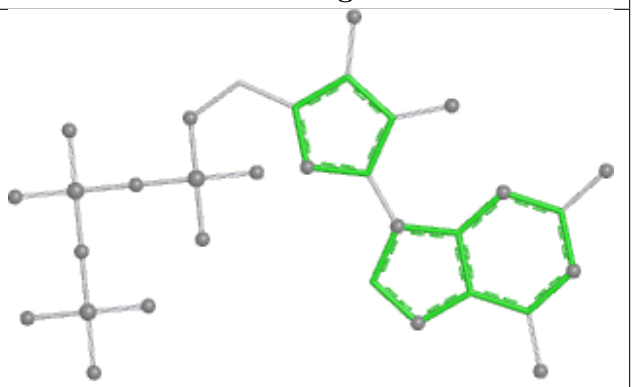
Bond lengths



Bond angles

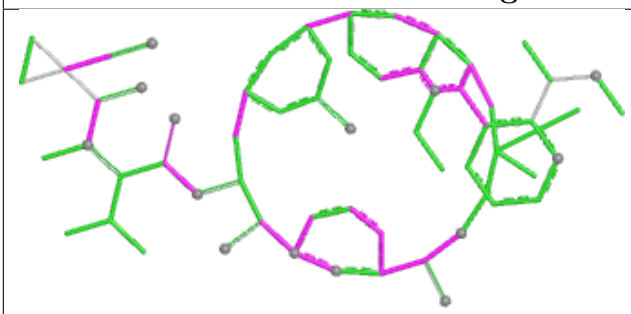


Torsions

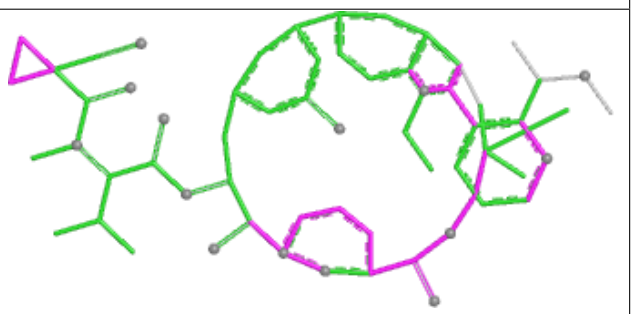


Rings

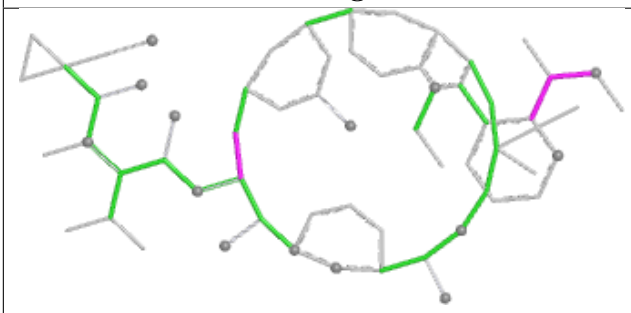
Ligand A1CYT B 201



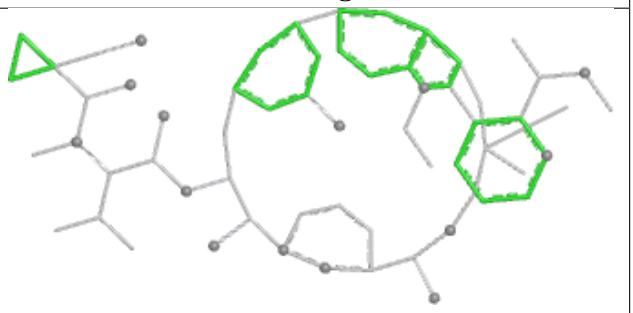
Bond lengths



Bond angles

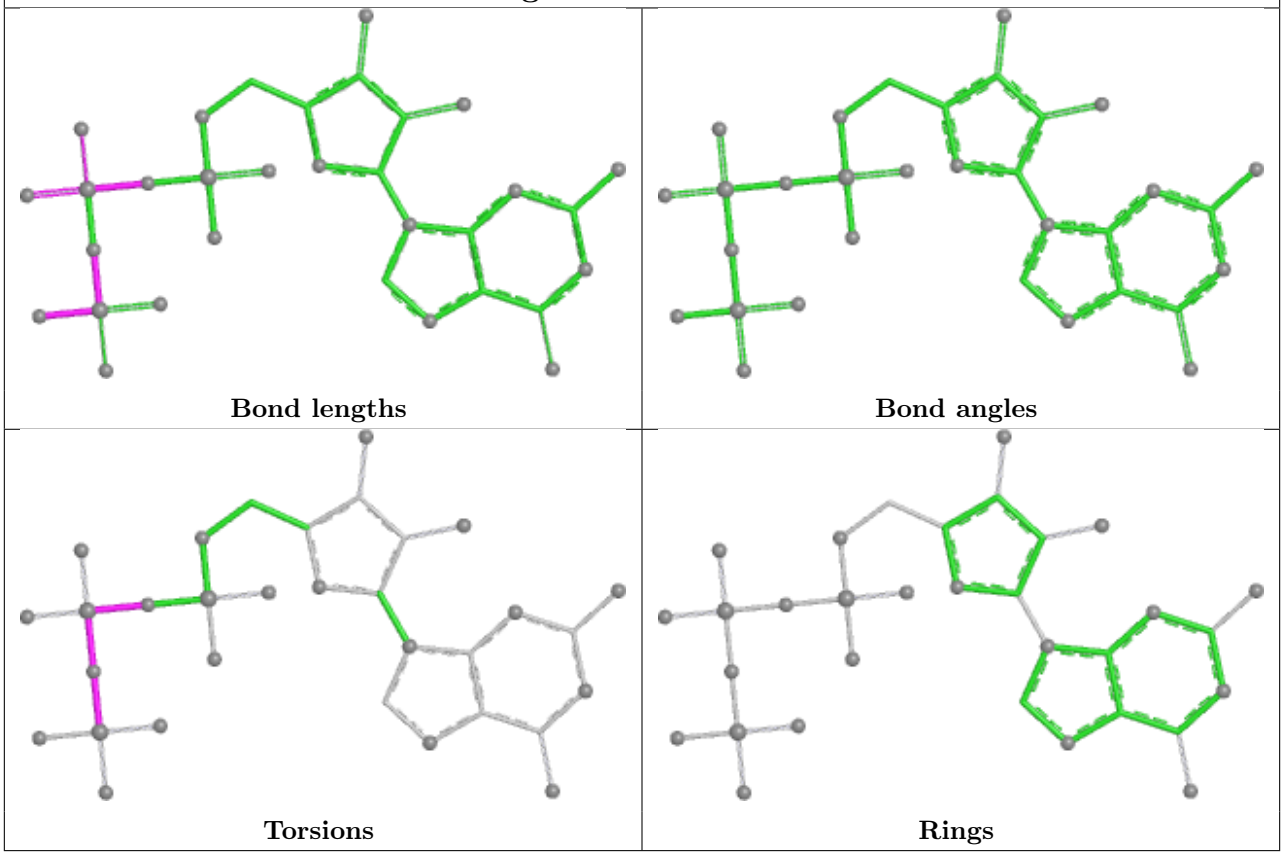


Torsions



Rings

Ligand GNP A 202



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, 95^{th} 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	170/170 (100%)	-1.10	0	100	100	11, 22, 35, 56	1 (0%)
1	C	170/170 (100%)	-1.11	0	100	100	10, 21, 32, 52	2 (1%)
2	B	164/166 (98%)	-1.12	0	100	100	16, 21, 29, 39	0
2	D	164/166 (98%)	-1.16	0	100	100	16, 20, 27, 42	0
All	All	668/672 (99%)	-1.12	0	100	100	10, 21, 31, 56	3 (0%)

There are no RSRZ outliers to report.

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, 95^{th} 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
5	A1CYT	D	201	62/62	0.99	0.03	14,17,22,25	0
5	A1CYT	B	201	62/62	0.99	0.03	13,16,19,24	0
4	GNP	A	202	32/32	1.00	0.02	14,17,24,25	0
4	GNP	C	202	32/32	1.00	0.02	14,17,24,29	0

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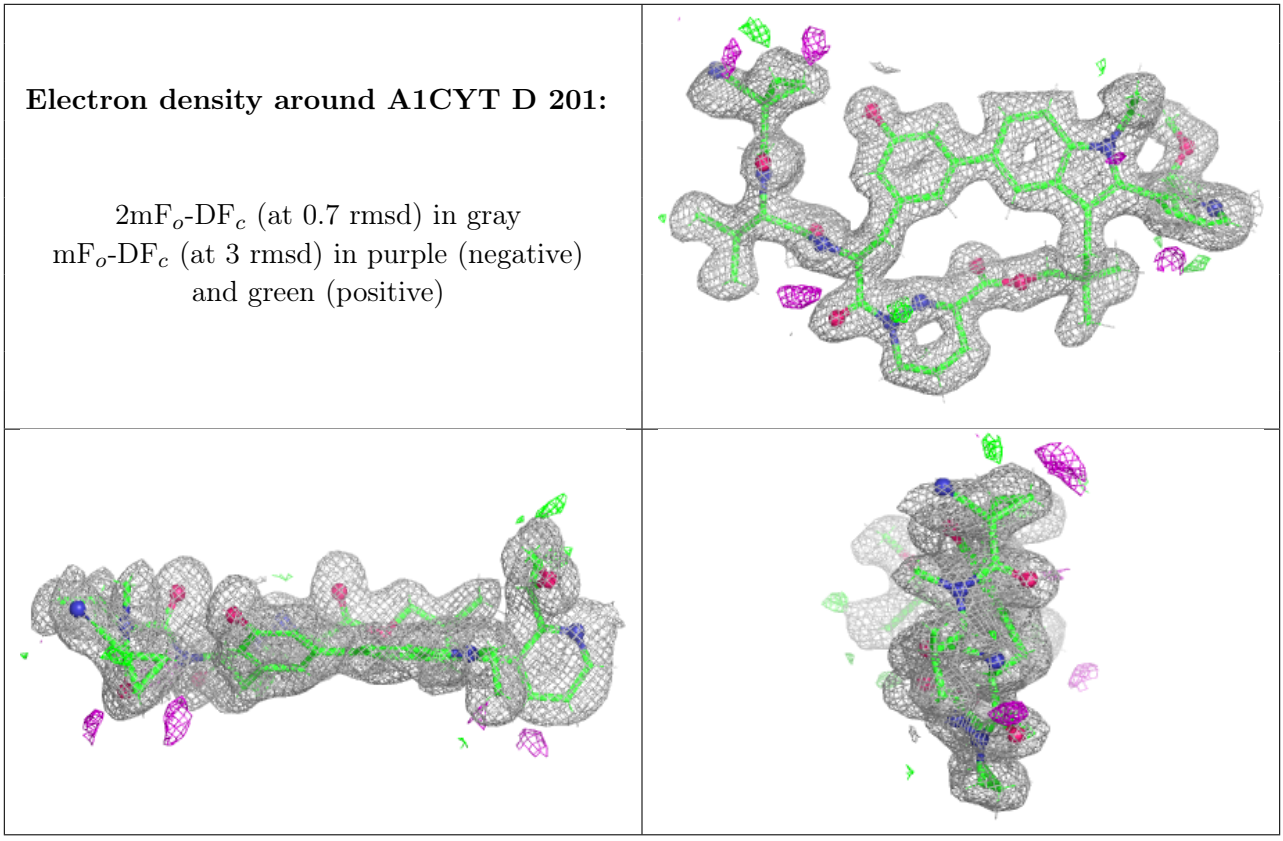
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	MG	A	201	1/1	1.00	0.01	15,15,15,15	0
3	MG	C	201	1/1	1.00	0.02	16,16,16,16	0

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.

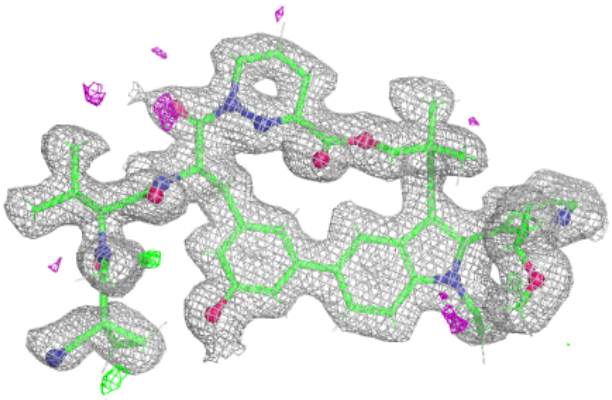
Electron density around A1CYT D 201:

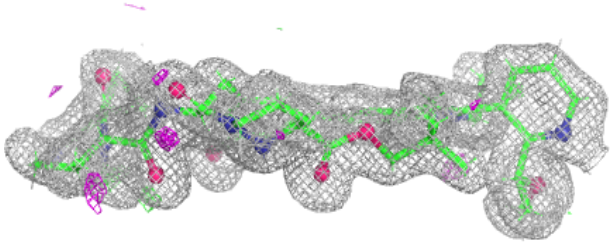
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

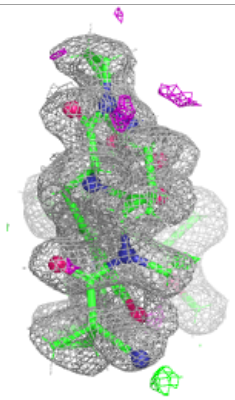


Electron density around A1CYT B 201:

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

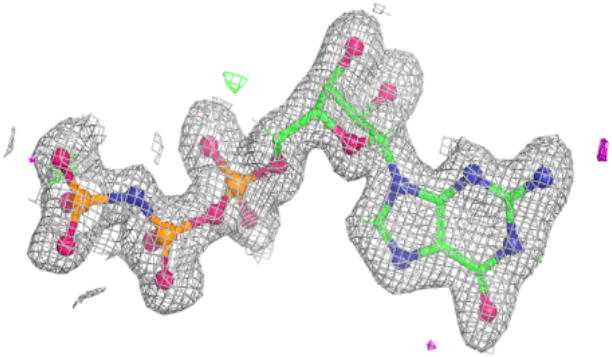


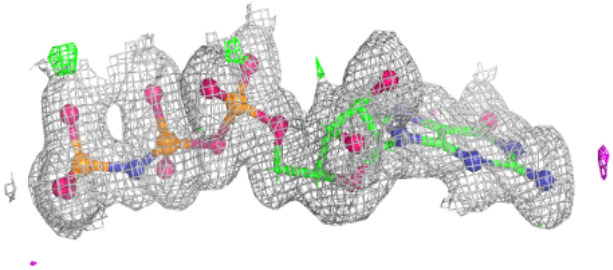


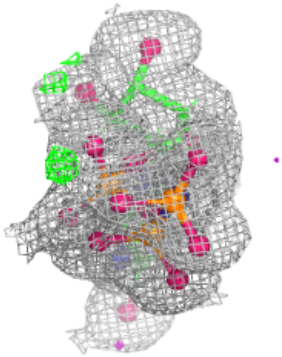


Electron density around GNP A 202:

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

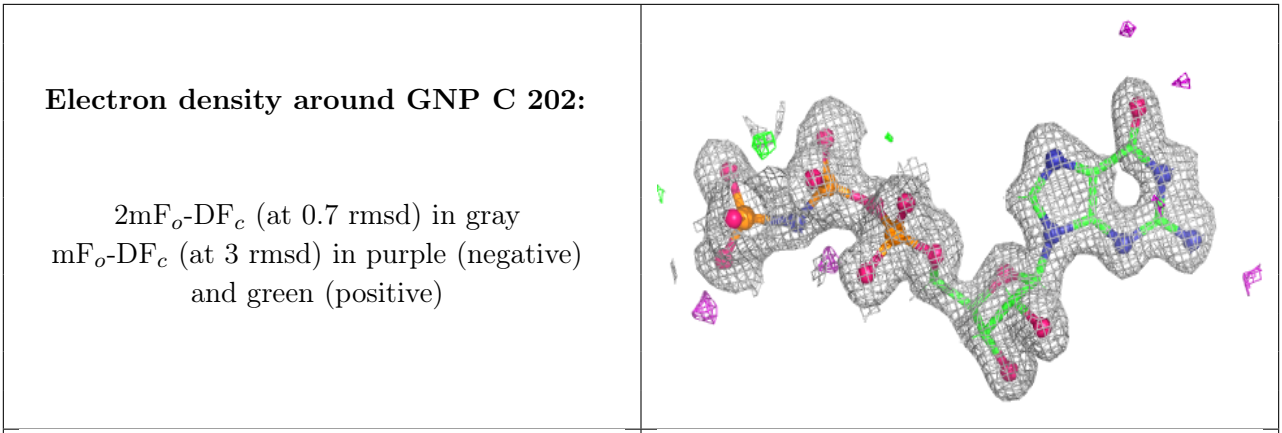


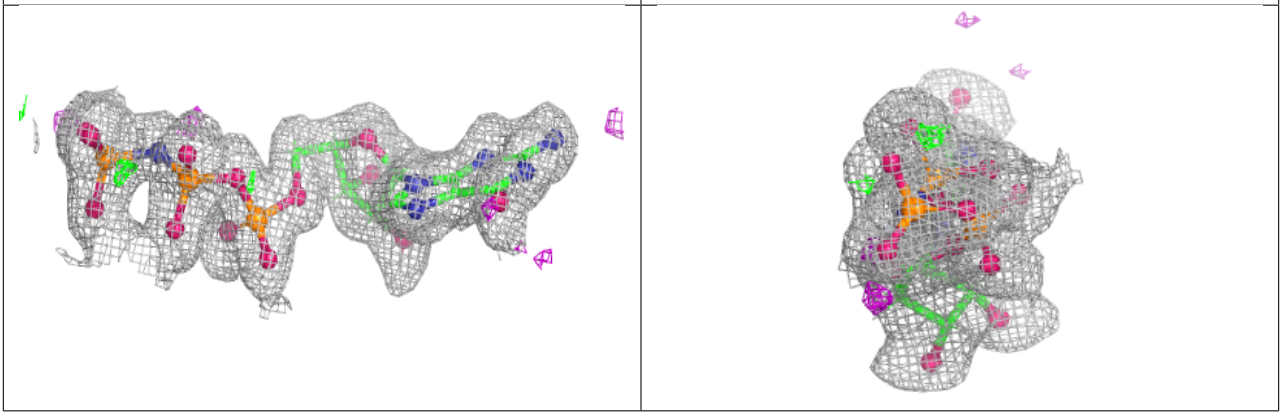




Electron density around GNP C 202:

$2mF_o$-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.