



# Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2024 – 10:51 AM EDT

PDB ID : 1ROB  
Title : STRUCTURE OF THE CRYSTALLINE COMPLEX OF CYTIDYLIC ACID  
(2'-CMP) WITH RIBONUCLEASE AT 1.6 ANGSTROMS RESOLUTION  
Authors : Lisgarten, J.N.; Palmer, R.A.  
Deposited on : 1993-08-23  
Resolution : 1.60 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.36.2  
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) : 2.36.2

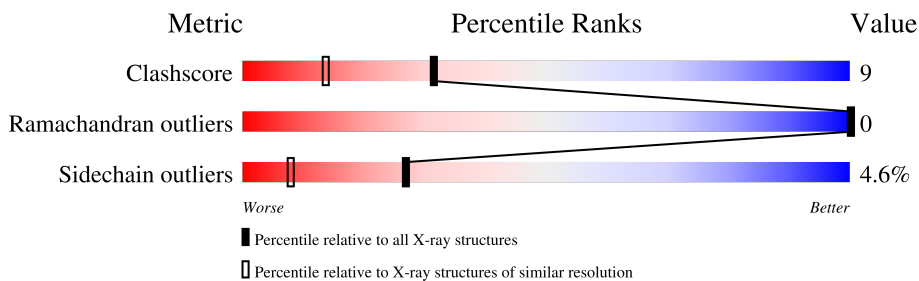
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.60 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))
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	124	

## 2 Entry composition [i](#)

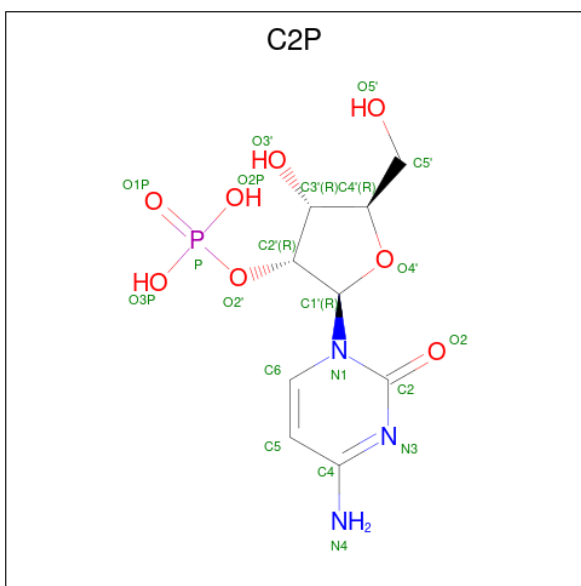
There are 3 unique types of molecules in this entry. The entry contains 1077 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 RIBONUCLEASE A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	124	955	577	171	195	12	0	1	0

- Molecule 2 is CYTIDINE-2'-MONOPHOSPHATE (three-letter code: C2P) (formula: C<sub>9</sub>H<sub>14</sub>N<sub>3</sub>O<sub>8</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	21	9	3	8	1	0	0

- Molecule 3 is water.

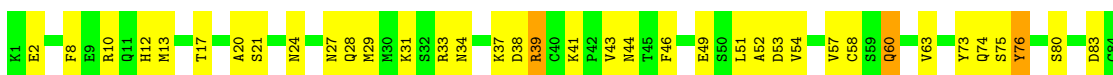
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	101	Total	O	0	0
			101	101		

### 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. 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. 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: RIBONUCLEASE A

Chain A:  52% 41% 7%



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	30.51Å 38.24Å 53.30Å 90.00° 106.10° 90.00°	Depositor
Resolution (Å)	(Not available) – 1.60 22.65 – 1.59	Depositor EDS
% Data completeness (in resolution range)	(Not available) ((Not available)-1.60) 73.9 (22.65-1.59)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.78 (at 1.59Å)	Xtrriage
Refinement program	RESTRAIN	Depositor
R, $R_{free}$	0.170 , (Not available) 0.237 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	14.1	Xtrriage
Anisotropy	0.700	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 26.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	0.031 for h,-k,-h-l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	1077	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	0.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.18% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: C2P

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	1.36	3/976 (0.3%)	2.33	53/1316 (4.0%)

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	A	0	4

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	28	GLN	CD-OE1	5.75	1.36	1.24
1	A	124	VAL	C-OXT	5.07	1.32	1.23
1	A	44	ASN	CG-OD1	5.01	1.34	1.24

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	33	ARG	NE-CZ-NH2	13.30	126.95	120.30
1	A	73	TYR	CB-CG-CD1	-12.72	113.37	121.00
1	A	97	TYR	CB-CG-CD2	-12.50	113.50	121.00
1	A	10	ARG	NE-CZ-NH1	12.00	126.30	120.30
1	A	92	TYR	CG-CD2-CE2	-10.72	112.72	121.30
1	A	83	ASP	CB-CG-OD2	-10.47	108.87	118.30
1	A	97	TYR	CB-CG-CD1	10.47	127.28	121.00
1	A	49	GLU	OE1-CD-OE2	-9.72	111.64	123.30
1	A	86	GLU	OE1-CD-OE2	9.61	134.83	123.30
1	A	39	ARG	CD-NE-CZ	-9.51	110.29	123.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	73	TYR	CD1-CG-CD2	9.25	128.07	117.90
1	A	97	TYR	CG-CD2-CE2	-8.19	114.75	121.30
1	A	10	ARG	NE-CZ-NH2	-7.86	116.37	120.30
1	A	63	VAL	CA-CB-CG2	7.70	122.45	110.90
1	A	73	TYR	CG-CD1-CE1	-7.67	115.16	121.30
1	A	76	TYR	CB-CG-CD2	-7.64	116.41	121.00
1	A	97	TYR	CG-CD1-CE1	7.21	127.06	121.30
1	A	39	ARG	NE-CZ-NH1	-7.19	116.70	120.30
1	A	53	ASP	CB-CG-OD2	7.00	124.60	118.30
1	A	8	PHE	CB-CG-CD2	6.93	125.66	120.80
1	A	116	VAL	CA-CB-CG2	6.80	121.10	110.90
1	A	73	TYR	CZ-CE2-CD2	-6.79	113.69	119.80
1	A	97	TYR	CD1-CE1-CZ	-6.72	113.75	119.80
1	A	60	GLN	CA-CB-CG	-6.70	98.66	113.40
1	A	33	ARG	NH1-CZ-NH2	-6.62	112.12	119.40
1	A	53	ASP	O-C-N	6.14	132.53	122.70
1	A	88	GLY	O-C-N	-6.01	113.09	122.70
1	A	92	TYR	CD1-CG-CD2	6.00	124.50	117.90
1	A	92	TYR	CB-CG-CD1	-5.93	117.44	121.00
1	A	105	HIS	O-C-N	5.83	132.03	122.70
1	A	38	ASP	CB-CG-OD1	5.77	123.49	118.30
1	A	29	MET	O-C-N	5.75	131.91	122.70
1	A	83	ASP	OD1-CG-OD2	5.75	134.22	123.30
1	A	118	VAL	CA-CB-CG2	-5.68	102.38	110.90
1	A	46	PHE	CG-CD2-CE2	-5.65	114.59	120.80
1	A	57	VAL	CA-CB-CG2	5.62	119.33	110.90
1	A	99	THR	O-C-N	-5.59	113.76	122.70
1	A	97	TYR	CZ-CE2-CD2	5.58	124.82	119.80
1	A	57	VAL	CG1-CB-CG2	-5.49	102.11	110.90
1	A	85	ARG	CG-CD-NE	-5.49	100.27	111.80
1	A	52	ALA	O-C-N	-5.49	113.92	122.70
1	A	120	PHE	CB-CG-CD2	-5.42	117.01	120.80
1	A	10	ARG	O-C-N	-5.40	114.07	122.70
1	A	80	SER	N-CA-CB	-5.37	102.45	110.50
1	A	39	ARG	NE-CZ-NH2	5.31	122.95	120.30
1	A	12	HIS	CA-C-O	-5.27	109.03	120.10
1	A	73	TYR	CG-CD2-CE2	-5.18	117.16	121.30
1	A	121	ASP	CB-CG-OD2	5.14	122.93	118.30
1	A	31	LYS	O-C-N	-5.10	114.54	122.70
1	A	113	ASN	CB-CG-OD1	-5.07	111.46	121.60
1	A	54	VAL	CA-C-O	-5.04	109.51	120.10
1	A	17	THR	O-C-N	-5.04	114.63	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	87	THR	O-C-N	5.04	131.76	123.20

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	111	GLU	Mainchain
1	A	118	VAL	Mainchain
1	A	2	GLU	Mainchain
1	A	99	THR	Mainchain

## 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	955	0	907	17	3
2	A	21	0	11	0	0
3	A	101	0	0	2	3
All	All	1077	0	918	17	3

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 9.

All (17) 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:27:ASN:HD21	1:A:97:TYR:H	1.19	0.91
1:A:20:ALA:O	1:A:101:GLN:NE2	2.22	0.72
1:A:74:GLN:HB2	1:A:107:ILE:HG12	1.75	0.68
1:A:27:ASN:ND2	1:A:97:TYR:H	1.94	0.63
1:A:60:GLN:HG2	1:A:76:TYR:CE2	2.36	0.60
1:A:101:GLN:HG2	3:A:256:HOH:O	2.02	0.59
1:A:113:ASN:HA	1:A:114:PRO:C	2.29	0.53
1:A:41:LYS:HE2	1:A:43:VAL:O	2.12	0.49
1:A:27:ASN:HD21	1:A:97:TYR:N	2.00	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:60:GLN:HG2	1:A:76:TYR:CD2	2.49	0.48
1:A:34:ASN:HA	3:A:168:HOH:O	2.16	0.45
1:A:74:GLN:HG2	1:A:75:SER:N	2.32	0.44
1:A:24:ASN:HD22	1:A:24:ASN:HA	1.59	0.43
1:A:13:MET:HG3	1:A:51:LEU:HD13	2.01	0.43
1:A:86:GLU:HG2	1:A:90:SER:CB	2.51	0.41
1:A:39:ARG:HA	1:A:92:TYR:CD1	2.56	0.40
1:A:86:GLU:CG	1:A:90:SER:CB	2.99	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:110:CYS:SG	3:A:211:HOH:O[2_756]	0.84	1.36
1:A:58:CYS:SG	3:A:211:HOH:O[2_756]	1.88	0.32
1:A:110:CYS:CB	3:A:211:HOH:O[2_756]	2.15	0.05

## 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	123/124 (99%)	116 (94%)	7 (6%)	0	<b>100</b> <b>100</b>

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	110/109 (101%)	105 (96%)	5 (4%)	27 8

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	SER
1	A	37	LYS
1	A	89	SER
1	A	91	LYS
1	A	103	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	24	ASN
1	A	27	ASN
1	A	28	GLN

### 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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

1 ligand is 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	C2P	A	126	-	22,22,22	1.53	6 (27%)	32,33,33	2.54	11 (34%)

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	C2P	A	126	-	-	0/11/27/27	0/2/2/2

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	126	C2P	P-O2'	-3.23	1.53	1.59
2	A	126	C2P	C3'-C2'	2.73	1.59	1.52
2	A	126	C2P	C6-N1	-2.33	1.32	1.38
2	A	126	C2P	P-O2P	-2.30	1.46	1.54
2	A	126	C2P	C2-N1	-2.24	1.35	1.40
2	A	126	C2P	O2-C2	-2.12	1.19	1.23

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	126	C2P	O4'-C4'-C5'	8.59	127.77	109.21
2	A	126	C2P	N4-C4-N3	4.73	126.27	117.97
2	A	126	C2P	C4-N3-C2	4.20	127.03	120.25
2	A	126	C2P	O2-C2-N3	3.80	128.52	122.33
2	A	126	C2P	C5-C4-N3	-3.26	115.79	121.33
2	A	126	C2P	C1'-N1-C2	-2.70	112.39	118.42
2	A	126	C2P	O5'-C5'-C4'	-2.65	102.20	111.29
2	A	126	C2P	O2'-C2'-C1'	2.61	119.52	110.10
2	A	126	C2P	C2'-C3'-C4'	-2.58	96.39	101.99
2	A	126	C2P	C1'-N1-C6	2.38	126.04	120.84
2	A	126	C2P	O3'-C3'-C4'	-2.01	105.25	111.05

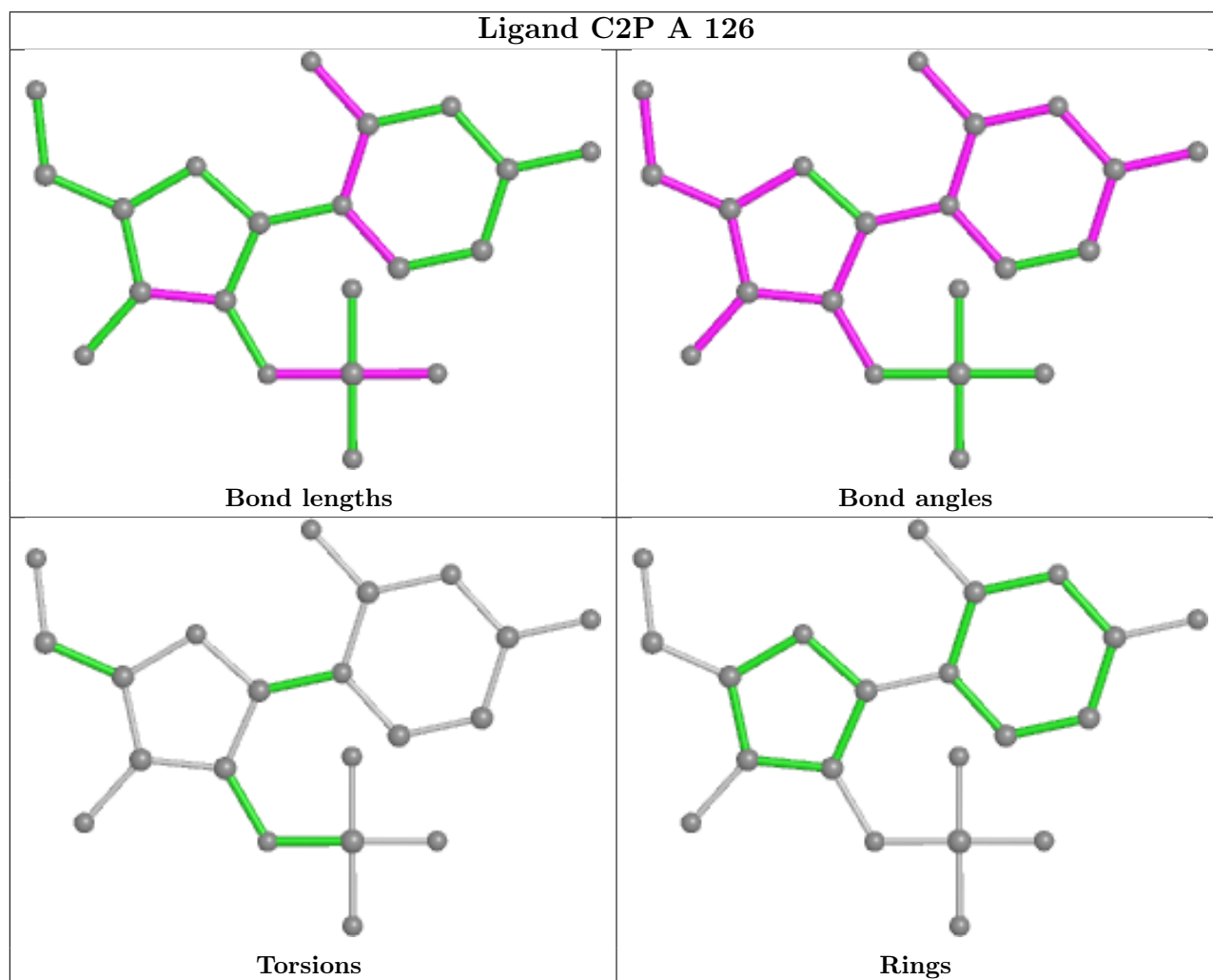
There are no chirality outliers.

There are no torsion outliers.

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 than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

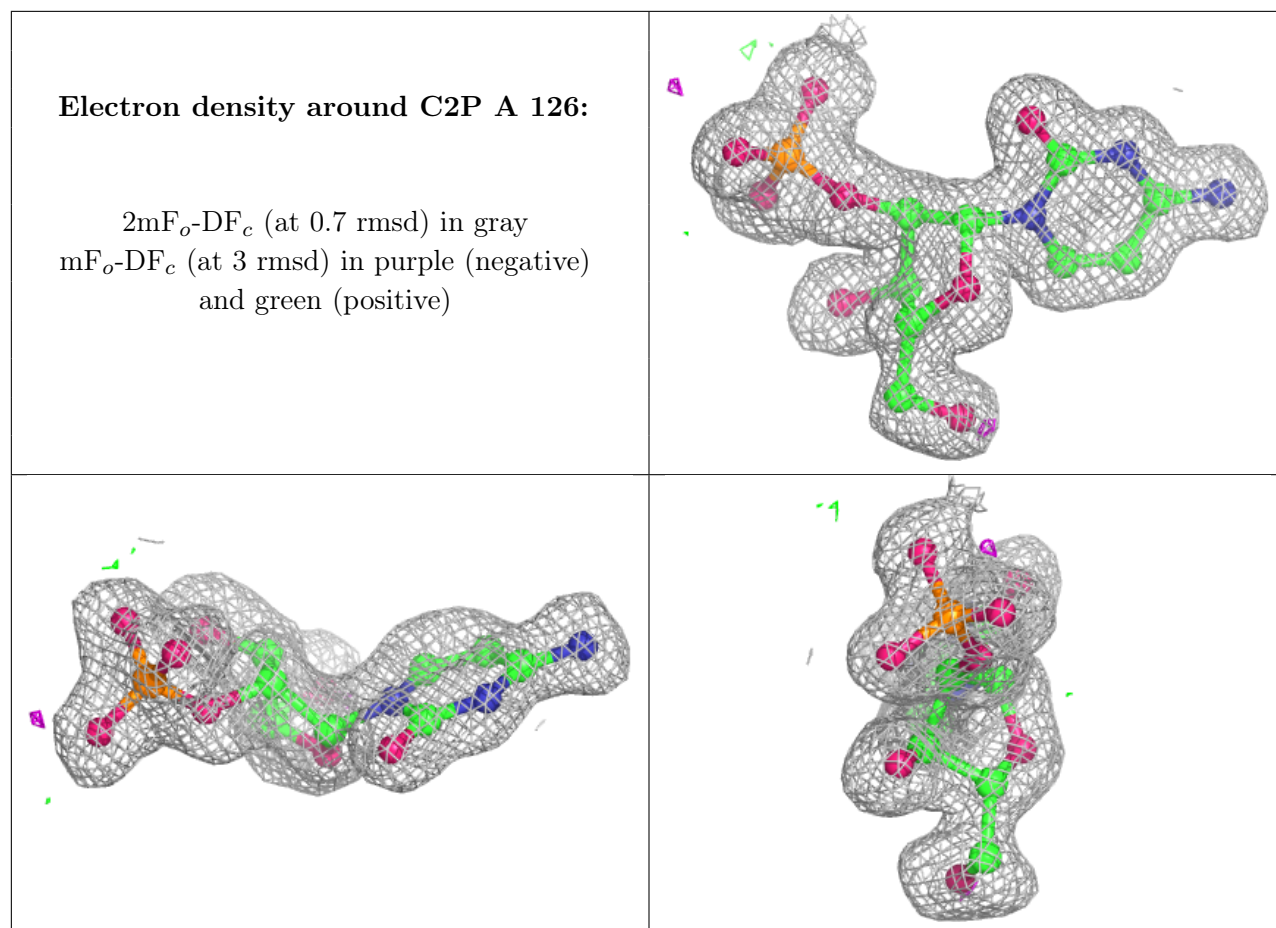
### 6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.5 Other polymers [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.