Full wwPDB NMR Structure Validation Report (i)

May 29, 2024 – 10:31 AM EDT

PDB ID	:	6RSA
Title	:	NUCLEAR MAGNETIC RESONANCE AND NEUTRON DIFFRACTION STUDIES OF THE COMPLEX OF RIBONUCLEASE*A WITH URIDINE VANADATE, A TRANSITION-STATE ANALOGUE
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Deposited on	:	1986-02-25

This is a Full wwPDB NMR 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/NMRValidationReportHelp
with specific help available everywhere you see the (i) symbol.

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

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

MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

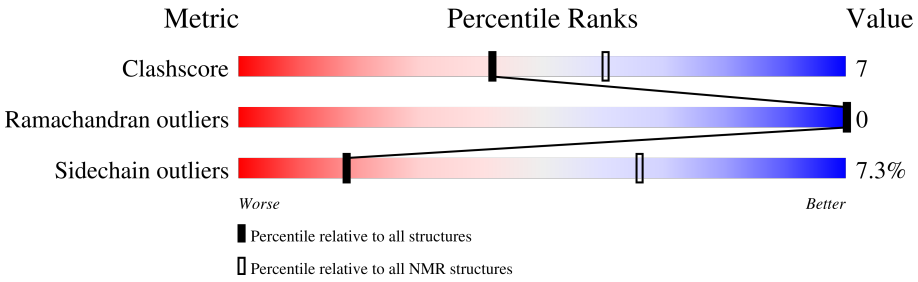
1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
NEUTRON DIFFRACTION, SOLUTION NMR

The reported resolution of this entry is 2.00 Å.

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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%

Mol	Chain	Length	Quality of chain
1	A	124	56% 35% 6% •

2 Ensemble composition and analysis (i)

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

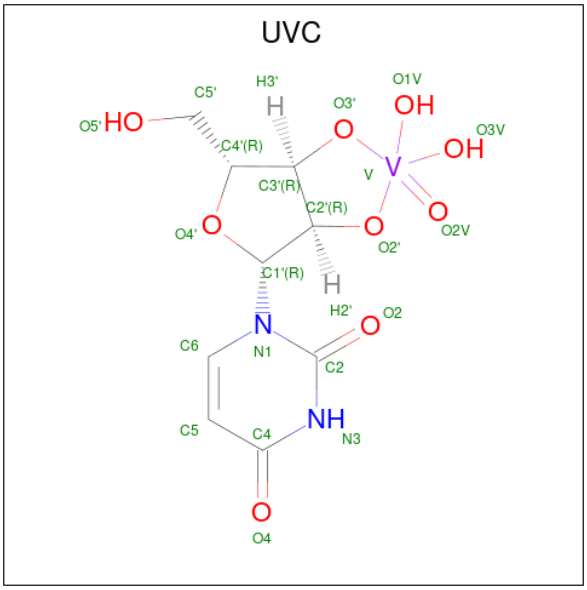
3 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2227 atoms, of which 692 are hydrogens and 451 are deuteriums.

- Molecule 1 is a protein called RIBONUCLEASE A.

Mol	Chain	Residues	Atoms							Trace
			Total	C	D	H	N	O	S	
1	A	124	1860	575	225	684	171	193	12	0

- Molecule 2 is URIDINE-2',3'-VANADATE (three-letter code: UVC) (formula: $C_9H_{12}N_2O_9V$).



Mol	Chain	Residues	Atoms						
			Total	C	D	H	N	O	V
2	A	1	31	9	2	8	2	9	1

- Molecule 3 is water.

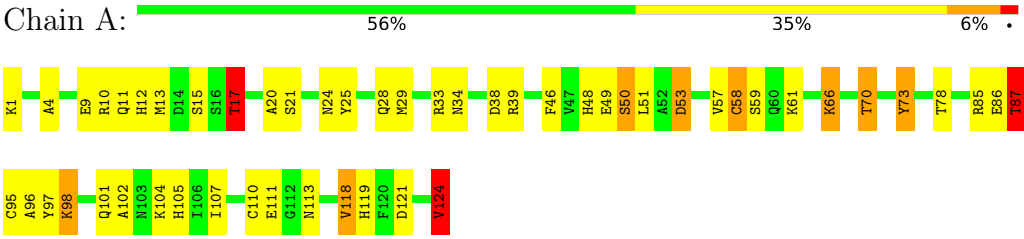
Mol	Chain	Residues	Atoms		
			Total	D	O
3	A	112	336	224	112

4 Residue-property plots (i)

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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 outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: RIBONUCLEASE A

Chain A:



5 Refinement protocol and experimental data overview

Of the ? calculated structures, 1 were deposited, based on the following criterion: *?*.

The authors did not provide any information on software used for structure solution, optimization or refinement.

No chemical shift data was provided.

6 Model quality (i)

6.1 Standard geometry (i)

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

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 (average) 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	1.30	3/967 (0.3%)	2.42	63/1304 (4.8%)
All	All	1.30	3/967 (0.3%)	2.42	63/1304 (4.8%)

All bond outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	50	SER	CB-OG	-7.13	1.32	1.42
1	A	86	GLU	CD-OE1	-6.25	1.18	1.25
1	A	86	GLU	CD-OE2	-5.06	1.20	1.25

All angle outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	10	ARG	NE-CZ-NH2	15.10	127.85	120.30
1	A	33	ARG	NE-CZ-NH1	14.29	127.44	120.30
1	A	1	LYS	CA-CB-CG	12.69	141.31	113.40
1	A	53	ASP	CB-CG-OD1	-11.13	108.28	118.30
1	A	118	VAL	CG1-CB-CG2	10.23	127.27	110.90
1	A	38	ASP	CB-CG-OD1	-10.09	109.22	118.30
1	A	1	LYS	N-CA-CB	-8.88	94.61	110.60
1	A	9	GLU	OE1-CD-OE2	7.86	132.73	123.30
1	A	59	SER	N-CA-CB	7.68	122.02	110.50
1	A	15	SER	CB-CA-C	-7.57	95.71	110.10
1	A	91	LYS	CA-CB-CG	7.50	129.90	113.40
1	A	124	VAL	CB-CA-C	7.44	125.54	111.40
1	A	124	VAL	CA-C-O	-7.04	105.33	120.10
1	A	111	GLU	OE1-CD-OE2	6.99	131.68	123.30
1	A	12	HIS	CA-C-O	-6.80	105.81	120.10
1	A	118	VAL	N-CA-CB	-6.78	96.60	111.50
1	A	17	THR	CA-CB-OG1	-6.75	94.82	109.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	73	TYR	CB-CG-CD2	-6.66	117.00	121.00
1	A	53	ASP	N-CA-CB	6.60	122.48	110.60
1	A	73	TYR	CB-CG-CD1	6.57	124.94	121.00
1	A	17	THR	N-CA-CB	-6.39	98.15	110.30
1	A	86	GLU	OE1-CD-OE2	6.27	130.83	123.30
1	A	97	TYR	CG-CD2-CE2	-6.27	116.28	121.30
1	A	70	THR	N-CA-CB	-6.25	98.42	110.30
1	A	12	HIS	CA-C-N	6.16	130.75	117.20
1	A	15	SER	CA-CB-OG	-6.16	94.57	111.20
1	A	46	PHE	N-CA-CB	6.15	121.67	110.60
1	A	110	CYS	O-C-N	6.03	132.34	122.70
1	A	85	ARG	CB-CG-CD	-5.99	96.04	111.60
1	A	107	ILE	CA-C-O	5.97	132.64	120.10
1	A	10	ARG	NE-CZ-NH1	-5.92	117.34	120.30
1	A	98	LYS	CA-CB-CG	5.87	126.30	113.40
1	A	95	CYS	CB-CA-C	5.86	122.12	110.40
1	A	4	ALA	CB-CA-C	5.83	118.84	110.10
1	A	121	ASP	CB-CG-OD1	5.78	123.50	118.30
1	A	33	ARG	NE-CZ-NH2	-5.64	117.48	120.30
1	A	39	ARG	CB-CG-CD	5.58	126.09	111.60
1	A	57	VAL	CA-CB-CG2	5.51	119.17	110.90
1	A	96	ALA	CA-C-O	-5.48	108.60	120.10
1	A	124	VAL	CA-CB-CG1	5.46	119.08	110.90
1	A	17	THR	CA-CB-CG2	5.41	119.98	112.40
1	A	53	ASP	CB-CG-OD2	5.40	123.16	118.30
1	A	87	THR	N-CA-CB	-5.39	100.05	110.30
1	A	96	ALA	O-C-N	5.38	131.30	122.70
1	A	91	LYS	O-C-N	5.32	131.21	122.70
1	A	118	VAL	CB-CA-C	5.30	121.47	111.40
1	A	21	SER	N-CA-CB	-5.25	102.62	110.50
1	A	58	CYS	N-CA-CB	5.25	120.05	110.60
1	A	102	ALA	N-CA-CB	5.24	117.44	110.10
1	A	87	THR	CA-CB-CG2	5.24	119.73	112.40
1	A	107	ILE	CA-CB-CG2	5.21	121.31	110.90
1	A	97	TYR	CB-CG-CD1	-5.19	117.89	121.00
1	A	78	THR	OG1-CB-CG2	-5.17	98.12	110.00
1	A	111	GLU	O-C-N	5.16	131.98	123.20
1	A	13	MET	CG-SD-CE	-5.11	92.02	100.20
1	A	24	ASN	CA-CB-CG	-5.10	102.17	113.40
1	A	124	VAL	N-CA-CB	-5.09	100.30	111.50
1	A	9	GLU	CG-CD-OE2	-5.08	108.13	118.30
1	A	28	GLN	CB-CG-CD	5.05	124.73	111.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	20	ALA	N-CA-CB	5.04	117.16	110.10
1	A	49	GLU	CA-CB-CG	5.03	124.47	113.40
1	A	66	LYS	CD-CE-NZ	5.03	123.28	111.70
1	A	51	LEU	CB-CA-C	5.01	119.72	110.20

There are no chirality outliers.

There are no planarity outliers.

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	1176	684	905	17
2	A	23	8	10	2
3	A	336	0	0	8
All	All	1535	692	915	18

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.

All clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:58:CYS:O	3:A:339:DOD:O	0.78	2.01
1:A:119:HIS:ND1	3:A:323:DOD:O	0.76	2.18
1:A:17:THR:HG22	1:A:48:HIS:ND1	0.70	2.00
1:A:53:ASP:OD2	3:A:184:DOD:O	0.70	2.10
2:A:125:UVC:O3'	3:A:323:DOD:O	0.63	2.17
1:A:113:ASN:ND2	3:A:140:DOD:O	0.60	2.34
1:A:87:THR:CG2	1:A:89:SER:HB2	0.53	2.34
1:A:17:THR:CG2	1:A:48:HIS:CE1	0.49	2.95
1:A:17:THR:HG22	1:A:48:HIS:CE1	0.46	2.45
1:A:66:LYS:NZ	3:A:327:DOD:O	0.46	2.49
1:A:61:LYS:O	1:A:73:TYR:HA	0.46	2.11
1:A:17:THR:CG2	1:A:48:HIS:ND1	0.45	2.78
1:A:101:GLN:HG2	3:A:235:DOD:O	0.45	2.10
1:A:105:HIS:N	1:A:124:VAL:OXT	0.43	2.47

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:119:HIS:CE1	3:A:323:DOD:O	0.43	2.67
1:A:11:GLN:NE2	2:A:125:UVC:O1V	0.41	2.53
1:A:104:LYS:HB3	1:A:124:VAL:OXT	0.41	2.15
1:A:25:TYR:CZ	1:A:29:MET:HG3	0.40	2.51

6.3 Torsion angles (i)

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	122/124 (98%)	117 (96%)	5 (4%)	0 (0%)	100	100
All	All	122/124 (98%)	117 (96%)	5 (4%)	0 (0%)	100	100

There are no Ramachandran outliers.

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	109/109 (100%)	101 (93%)	8 (7%)	18	66
All	All	109/109 (100%)	101 (93%)	8 (7%)	18	66

All 8 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	17	THR
1	A	34	ASN
1	A	50	SER
1	A	70	THR
1	A	87	THR

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Mol	Chain	Res	Type
1	A	98	LYS
1	A	118	VAL
1	A	124	VAL

6.3.3 RNA

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains

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

6.5 Carbohydrates

There are no monosaccharides in this entry.

6.6 Ligand geometry

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds 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 is the number of standard deviations the observed value is removed from the expected value. A bond length with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
2	UVC	A	125	-	20,23,23	1.06	1 (5%)

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of 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 angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

Mol	Type	Chain	Res	Link	Bond angles		
					Counts	RMSZ	#Z>2
2	UVC	A	125	-	24,38,38	2.45	11 (45%)

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	UVC	A	125	-	-	0,6,34,34	0,3,3,3

All bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	125	UVC	C2-N1	2.39	1.34	1.38

All angle outliers are listed below. They are sorted according to the Z-score.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	125	UVC	O3'-C3'-C4'	5.99	117.15	110.97
2	A	125	UVC	O4'-C1'-N1	4.27	98.61	108.36
2	A	125	UVC	C2'-C1'-N1	4.06	106.34	114.22
2	A	125	UVC	C6-N1-C2	3.56	125.55	120.99
2	A	125	UVC	C4'-O4'-C1'	3.39	101.98	109.47
2	A	125	UVC	C2'-C3'-C4'	2.92	96.78	103.72
2	A	125	UVC	O2-C2-N1	2.45	126.04	122.79
2	A	125	UVC	N3-C2-N1	2.41	111.68	114.89
2	A	125	UVC	O4'-C4'-C5'	2.40	104.03	109.21
2	A	125	UVC	O4'-C4'-C3'	2.28	109.75	104.87
2	A	125	UVC	O2'-C2'-C1'	2.01	105.82	111.50

There are no chirality outliers.

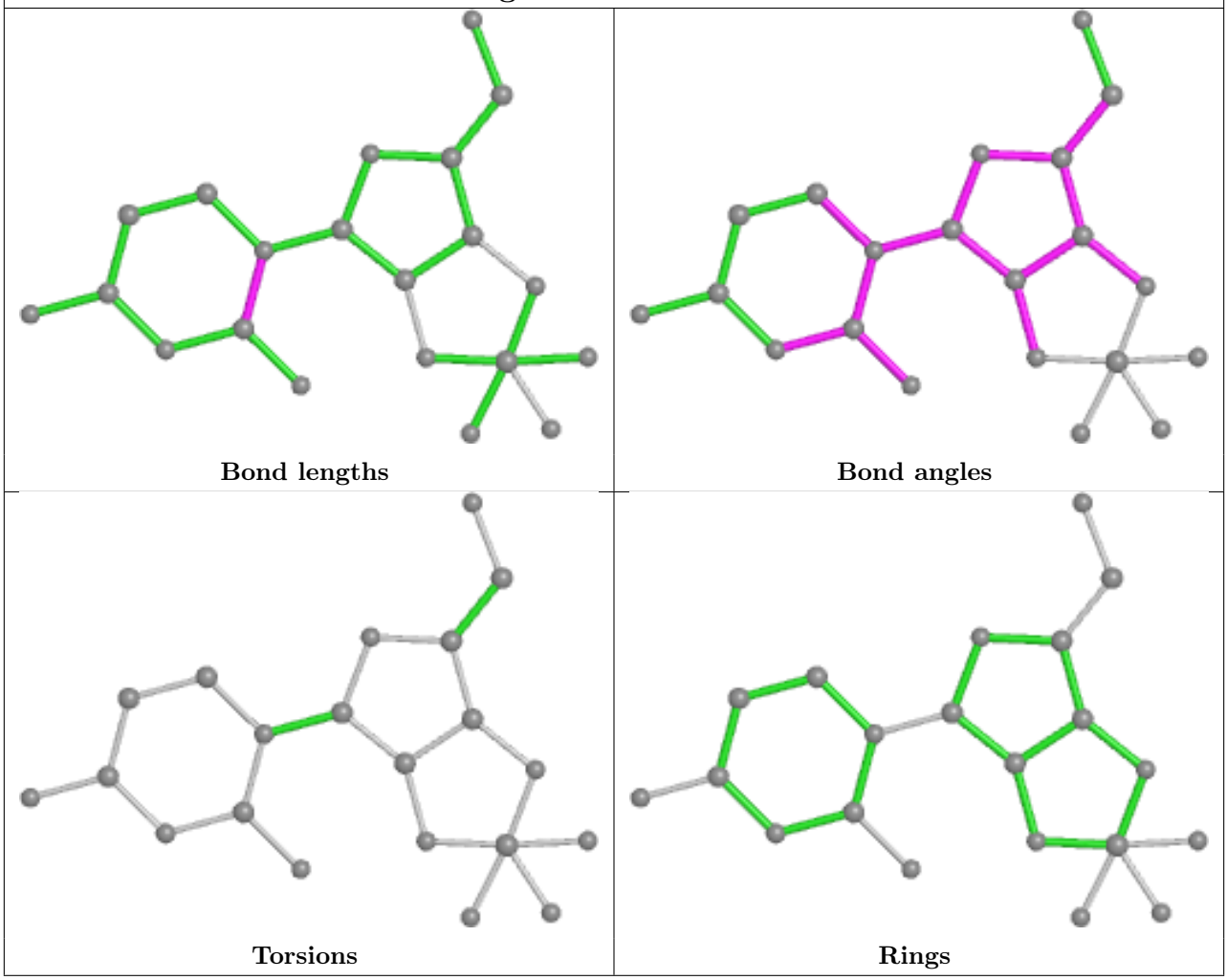
There are no torsion outliers.

There are no ring outliers.

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 UVC A 125



6.7 Other polymers (i)

There are no such molecules in this entry.

6.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

7 Chemical shift validation (i)

No chemical shift data were provided