



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 3, 2023 – 08:03 AM EDT

PDB ID : 6OJU
Title : Crystal structure of human thymidylate synthase Delta (7-29) in complex with dUMP and 2-amino-4-oxo-4,7-dihydro-pyrrolo[2,3-d]pyrimidine-methyl-phenyl-L-D-glutamic acid
Authors : Czyzyk, D.J.; Anderson, K.S.; Valhondo, M.; Jorgensen, W.L.
Deposited on : 2019-04-12
Resolution : 2.88 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 : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : **FAILED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35.1

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 2.88 Å.

There are no overall percentile quality scores available for this entry.

MolProbity and EDS failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition [i](#)

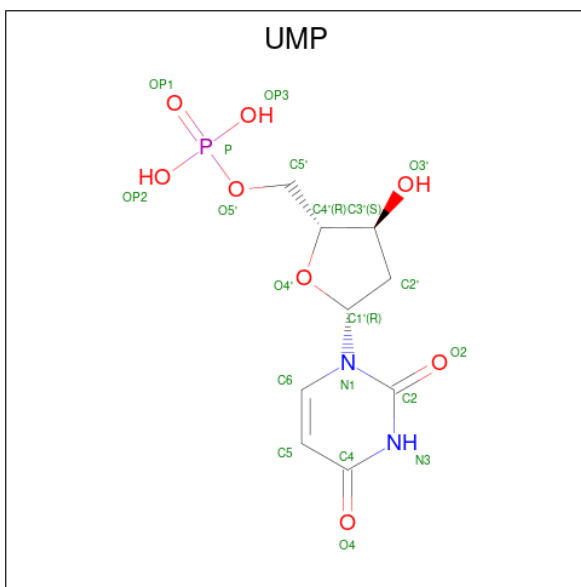
There are 4 unique types of molecules in this entry. The entry contains 8992 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Thymidylate synthase, Thymidylate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	285	Total	C	N	O	S	0	0	0
			2161	1383	371	395	12			
1	A	285	Total	C	N	O	S	0	0	0
			2217	1418	379	407	13			
1	C	285	Total	C	N	O	S	0	0	0
			2169	1389	368	400	12			
1	D	285	Total	C	N	O	S	0	0	0
			2211	1416	376	406	13			

- Molecule 2 is 2'-DEOXYURIDINE 5'-MONOPHOSPHATE (three-letter code: UMP) (formula: $C_9H_{13}N_2O_8P$).



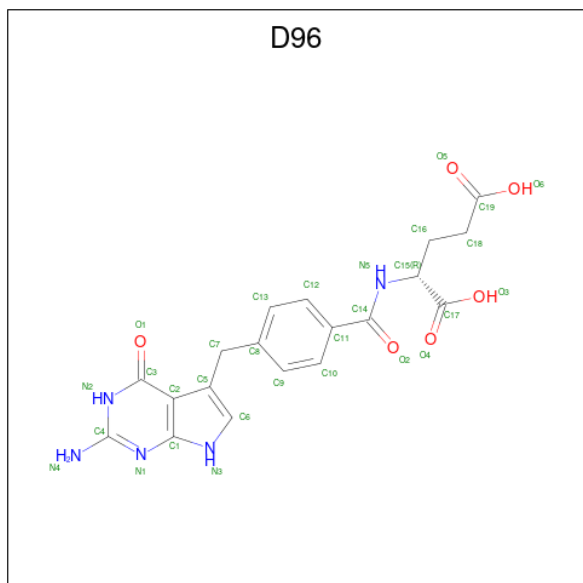
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	B	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	A	1	Total	C	N	O	P	0	0
			20	9	2	8	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	C	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	D	1	Total	C	N	O	P	0	0
			20	9	2	8	1		

- Molecule 3 is N-{4-[(2-amino-4-oxo-4,7-dihydro-3H-pyrrolo[2,3-d]pyrimidin-5-yl)methyl]benzene-1-carbonyl}-D-glutamic acid (three-letter code: D96) (formula: C₁₉H₁₉N₅O₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			30	19	5	6		
3	A	1	Total	C	N	O	0	0
			30	19	5	6		
3	C	1	Total	C	N	O	0	0
			30	19	5	6		
3	D	1	Total	C	N	O	0	0
			30	19	5	6		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	7	Total	O	0	0
			7	7		
4	A	7	Total	O	0	0
			7	7		
4	C	10	Total	O	0	0
			10	10		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	10	Total	O	0	0
			10	10		

MolProbity and EDS failed to run properly - this section is therefore empty.

3 Data and refinement statistics i

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	62.10Å 124.85Å 80.36Å 90.00° 92.12° 90.00°	Depositor
Resolution (Å)	49.29 – 2.88	Depositor
% Data completeness (in resolution range)	98.4 (49.29-2.88)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.23	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.92 (at 2.91Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155)	Depositor
R, R_{free}	0.213 , 0.249	Depositor
Wilson B-factor (Å ²)	53.6	Xtrriage
Anisotropy	0.890	Xtrriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.022 for h,-k,-l	Xtrriage
Total number of atoms	8992	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.08% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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.

4 Model quality [i](#)

4.1 Standard geometry [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.2 Too-close contacts [i](#)

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4.3 Torsion angles [i](#)

4.3.1 Protein backbone [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.2 Protein sidechains [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

4.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

4.6 Ligand geometry [i](#)

8 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
3	D96	C	601	-	31,32,32	1.50	3 (9%)	34,45,45	1.88	8 (23%)
3	D96	D	601	-	31,32,32	1.51	3 (9%)	34,45,45	2.03	7 (20%)
2	UMP	B	600	-	21,21,21	1.30	3 (14%)	31,31,31	1.22	2 (6%)
2	UMP	A	600	-	21,21,21	1.29	2 (9%)	31,31,31	1.28	3 (9%)
3	D96	B	601	-	31,32,32	1.50	3 (9%)	34,45,45	1.94	9 (26%)
2	UMP	C	600	-	21,21,21	1.11	3 (14%)	31,31,31	1.32	2 (6%)
2	UMP	D	600	-	21,21,21	1.09	2 (9%)	31,31,31	1.28	3 (9%)
3	D96	A	601	-	31,32,32	1.48	3 (9%)	34,45,45	1.83	6 (17%)

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
3	D96	C	601	-	-	3/21/21/21	0/3/3/3
3	D96	D	601	-	-	5/21/21/21	0/3/3/3
2	UMP	B	600	-	-	2/10/22/22	0/2/2/2
2	UMP	A	600	-	-	1/10/22/22	0/2/2/2
3	D96	B	601	-	-	3/21/21/21	0/3/3/3
2	UMP	C	600	-	-	5/10/22/22	0/2/2/2
2	UMP	D	600	-	-	4/10/22/22	0/2/2/2
3	D96	A	601	-	-	0/21/21/21	0/3/3/3

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	601	D96	C4-N4	5.21	1.46	1.34
3	A	601	D96	C4-N4	5.17	1.46	1.34
3	C	601	D96	C4-N4	5.15	1.46	1.34
3	B	601	D96	C4-N4	5.11	1.46	1.34
3	B	601	D96	O4-C17	4.68	1.36	1.22
3	C	601	D96	O4-C17	4.62	1.36	1.22
3	D	601	D96	O4-C17	4.62	1.36	1.22
3	A	601	D96	O4-C17	4.61	1.36	1.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	600	UMP	P-OP1	3.71	1.62	1.50
2	A	600	UMP	P-OP1	3.70	1.62	1.50
3	B	601	D96	O3-C17	-2.29	1.23	1.30
3	D	601	D96	O3-C17	-2.26	1.23	1.30
3	C	601	D96	O3-C17	-2.22	1.23	1.30
3	A	601	D96	O3-C17	-2.21	1.23	1.30
2	C	600	UMP	C2-N1	2.20	1.42	1.38
2	D	600	UMP	C2-N1	2.19	1.42	1.38
2	B	600	UMP	C2-N1	2.07	1.41	1.38
2	A	600	UMP	C2-N1	2.06	1.41	1.38
2	D	600	UMP	P-OP2	2.04	1.62	1.54
2	B	600	UMP	P-OP3	2.02	1.62	1.54
2	C	600	UMP	P-OP3	2.00	1.62	1.54
2	C	600	UMP	P-OP2	2.00	1.62	1.54

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	601	D96	C2-C3-N2	-5.81	110.44	115.36
3	A	601	D96	C2-C3-N2	-5.76	110.49	115.36
3	B	601	D96	C2-C3-N2	-5.73	110.51	115.36
3	D	601	D96	C2-C3-N2	-5.61	110.61	115.36
3	A	601	D96	O3-C17-C15	4.38	127.95	113.40
3	D	601	D96	O3-C17-C15	4.29	127.67	113.40
3	C	601	D96	O3-C17-C15	4.27	127.61	113.40
3	D	601	D96	C5-C7-C8	-4.19	104.75	114.22
3	B	601	D96	O3-C17-C15	4.13	127.14	113.40
3	D	601	D96	O4-C17-C15	-4.10	108.79	122.26
3	A	601	D96	O4-C17-C15	-4.06	108.94	122.26
3	C	601	D96	O4-C17-C15	-3.93	109.37	122.26
3	B	601	D96	O4-C17-C15	-3.91	109.43	122.26
2	A	600	UMP	OP2-P-O5'	3.81	116.86	106.73
2	B	600	UMP	OP2-P-O5'	3.68	116.51	106.73
2	D	600	UMP	O5'-P-OP1	3.56	116.46	106.47
2	C	600	UMP	O5'-P-OP1	3.52	116.36	106.47
3	B	601	D96	C5-C7-C8	-3.24	106.89	114.22
3	D	601	D96	C11-C14-N5	-3.23	110.87	117.06
3	B	601	D96	C11-C14-N5	-3.20	110.92	117.06
3	A	601	D96	C11-C14-N5	-2.72	111.85	117.06
3	C	601	D96	C11-C14-N5	-2.63	112.02	117.06
2	C	600	UMP	C1'-N1-C2	2.56	122.69	117.64
3	C	601	D96	C15-N5-C14	2.53	127.80	121.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	601	D96	C15-N5-C14	2.49	127.70	121.60
3	D	601	D96	O1-C3-C2	2.42	129.04	123.98
3	A	601	D96	O1-C3-C2	2.38	128.96	123.98
3	C	601	D96	C5-C7-C8	-2.37	108.85	114.22
3	B	601	D96	C18-C16-C15	-2.35	108.76	113.16
3	B	601	D96	C15-N5-C14	2.35	127.35	121.60
3	C	601	D96	C18-C16-C15	-2.32	108.81	113.16
2	A	600	UMP	OP3-P-OP2	2.28	116.35	107.64
3	C	601	D96	O1-C3-C2	2.24	128.66	123.98
3	B	601	D96	O2-C14-C11	2.22	124.90	120.94
3	B	601	D96	O1-C3-C2	2.16	128.50	123.98
2	A	600	UMP	OP3-P-OP1	-2.04	102.69	110.68
2	B	600	UMP	OP3-P-OP2	2.04	115.43	107.64
3	A	601	D96	C5-C7-C8	-2.04	109.62	114.22
2	D	600	UMP	P-O5'-C5'	2.03	123.89	118.30
2	D	600	UMP	C1'-N1-C2	2.01	121.59	117.64

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	600	UMP	C5'-O5'-P-OP1
2	C	600	UMP	C5'-O5'-P-OP2
2	C	600	UMP	C5'-O5'-P-OP3
2	D	600	UMP	C5'-O5'-P-OP2
2	D	600	UMP	C5'-O5'-P-OP3
3	D	601	D96	C17-C15-N5-C14
3	C	601	D96	N5-C15-C17-O4
2	C	600	UMP	C2'-C1'-N1-C2
3	C	601	D96	N5-C15-C17-O3
3	D	601	D96	C17-C15-C16-C18
2	C	600	UMP	C2'-C1'-N1-C6
3	B	601	D96	C15-C16-C18-C19
3	D	601	D96	N5-C15-C17-O4
3	D	601	D96	N5-C15-C16-C18
3	D	601	D96	N5-C15-C17-O3
3	B	601	D96	N5-C15-C16-C18
3	C	601	D96	C17-C15-N5-C14
3	B	601	D96	C17-C15-N5-C14
2	B	600	UMP	O4'-C4'-C5'-O5'
2	D	600	UMP	C5'-O5'-P-OP1
2	B	600	UMP	C4'-C5'-O5'-P

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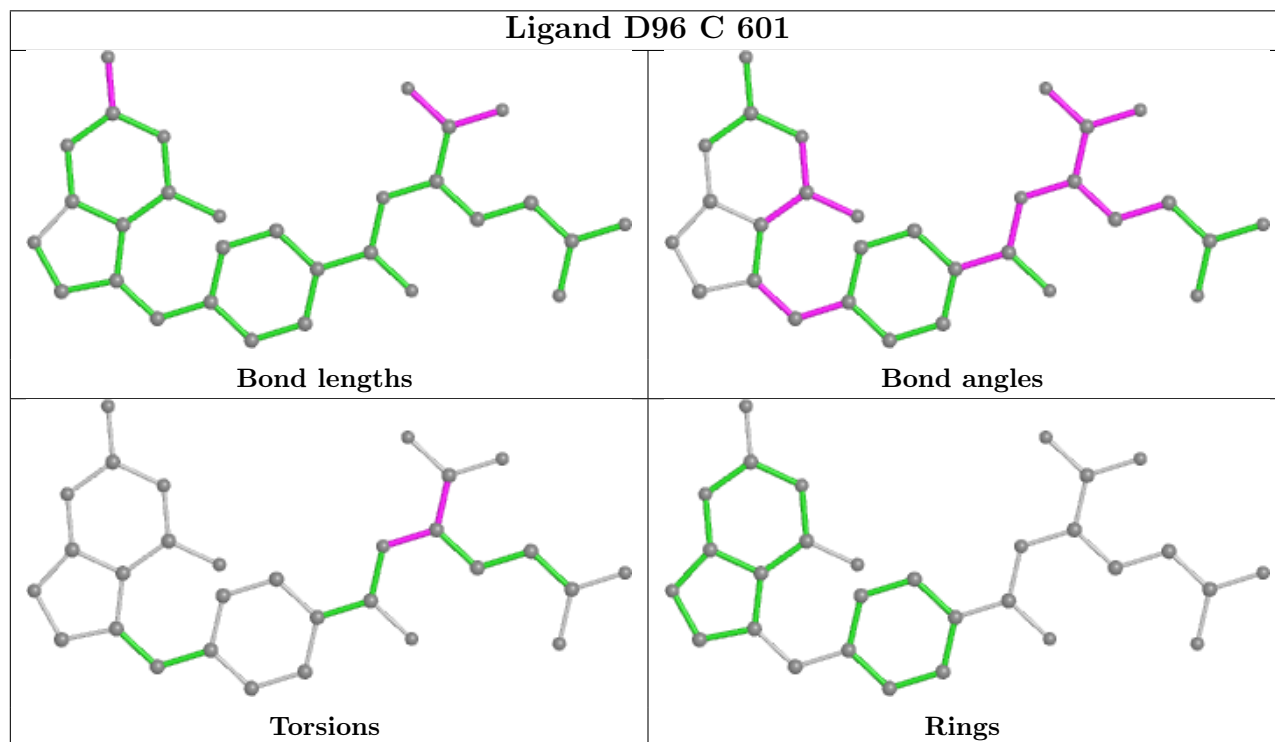
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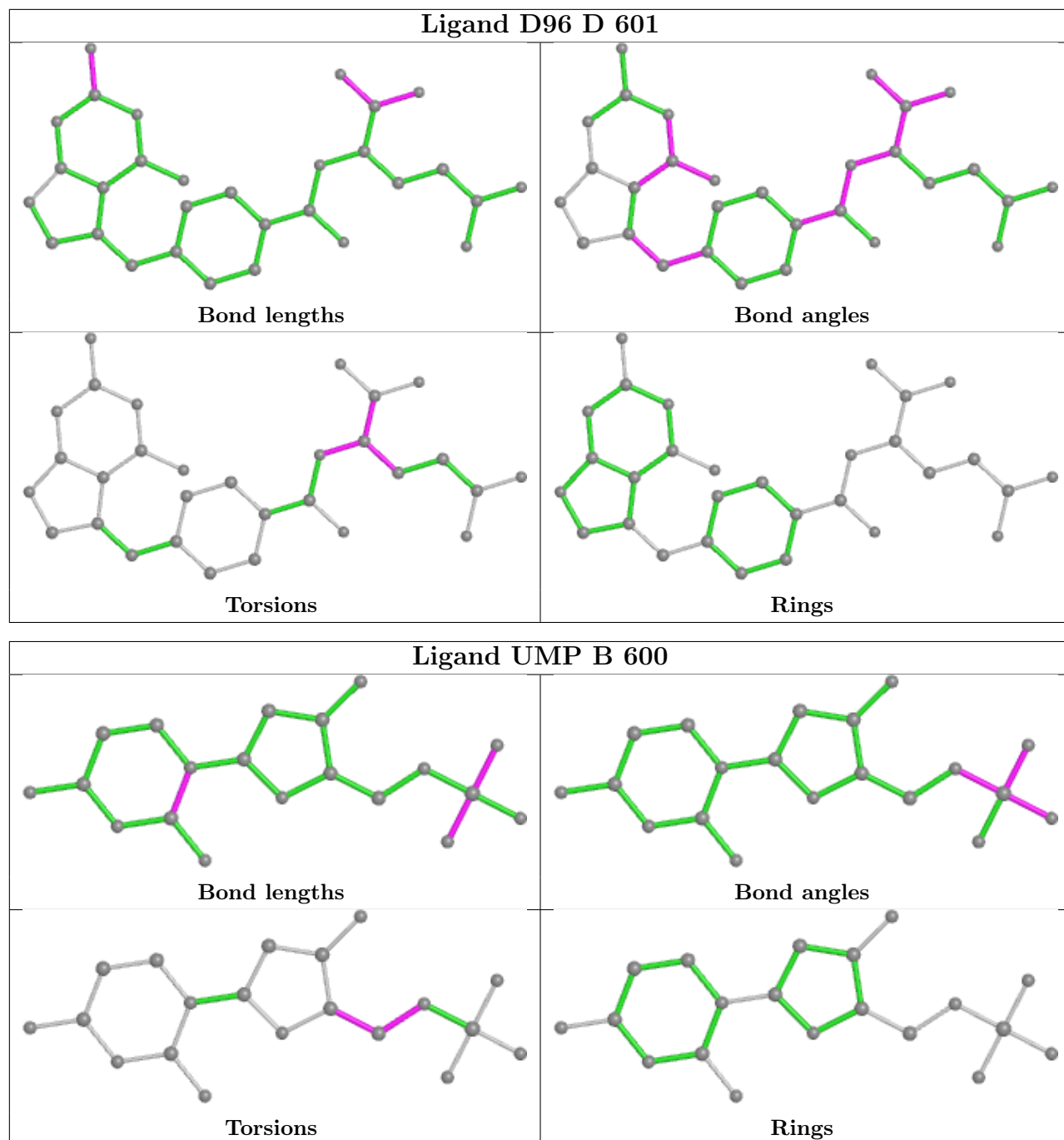
Mol	Chain	Res	Type	Atoms
2	A	600	UMP	O4'-C4'-C5'-O5'
2	D	600	UMP	C2'-C1'-N1-C2

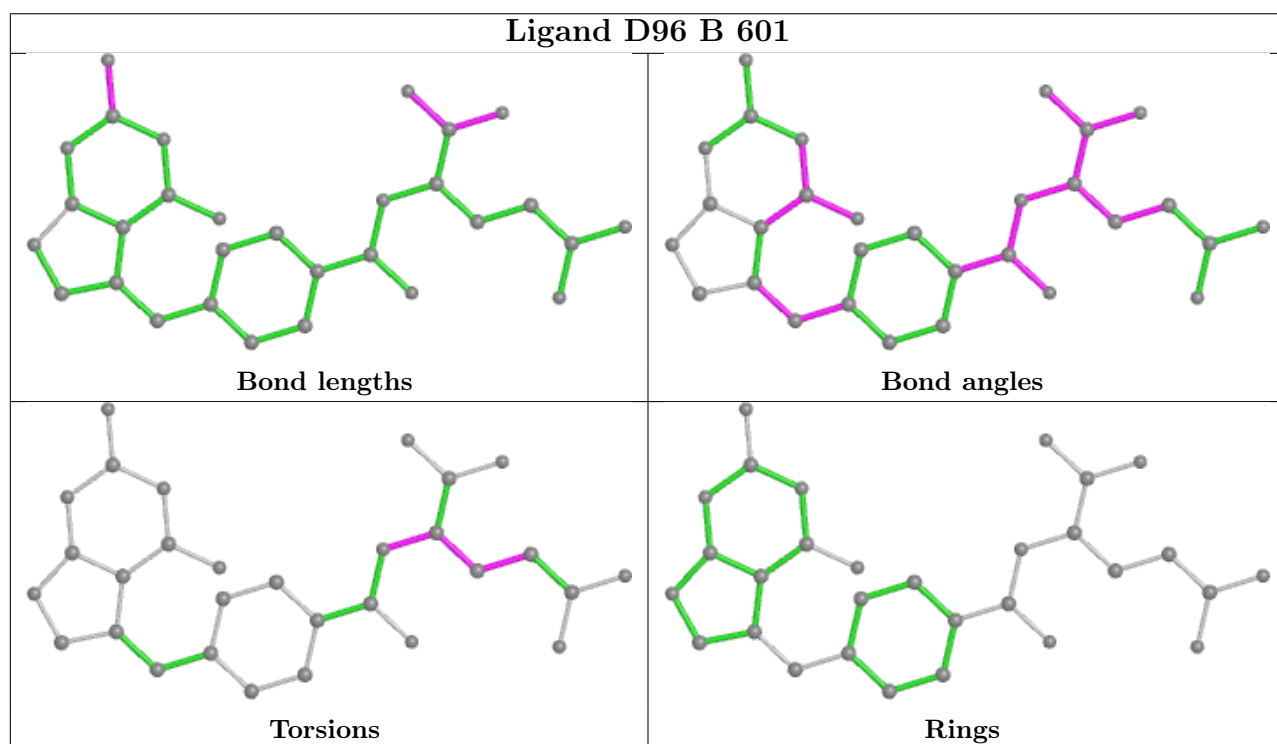
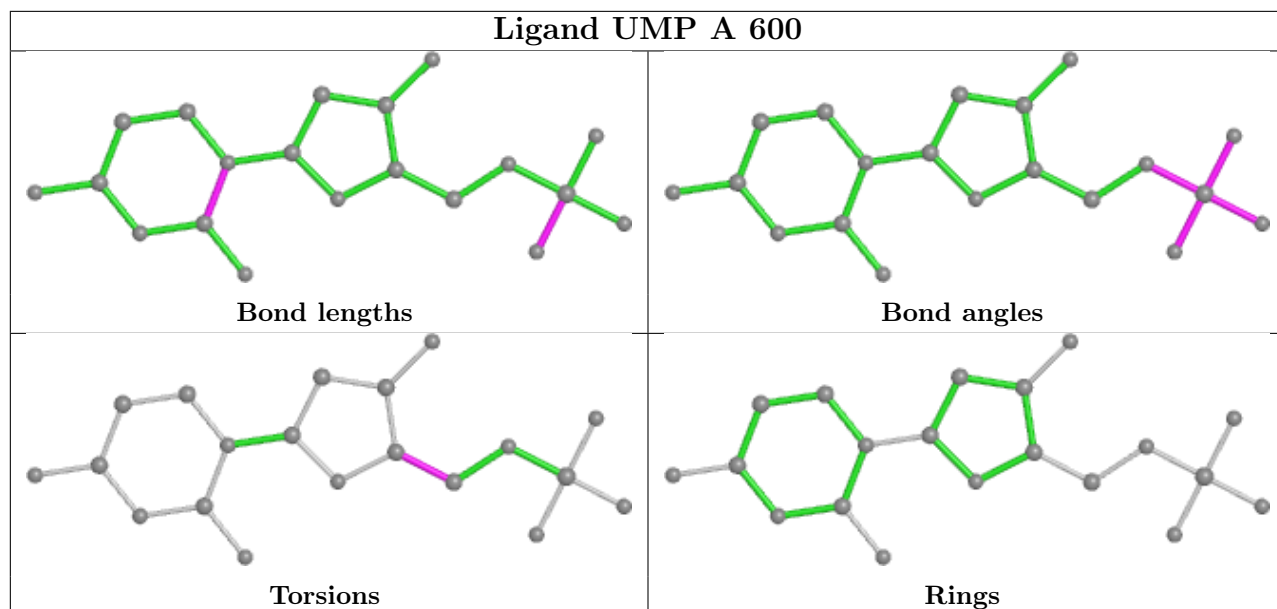
There are no ring outliers.

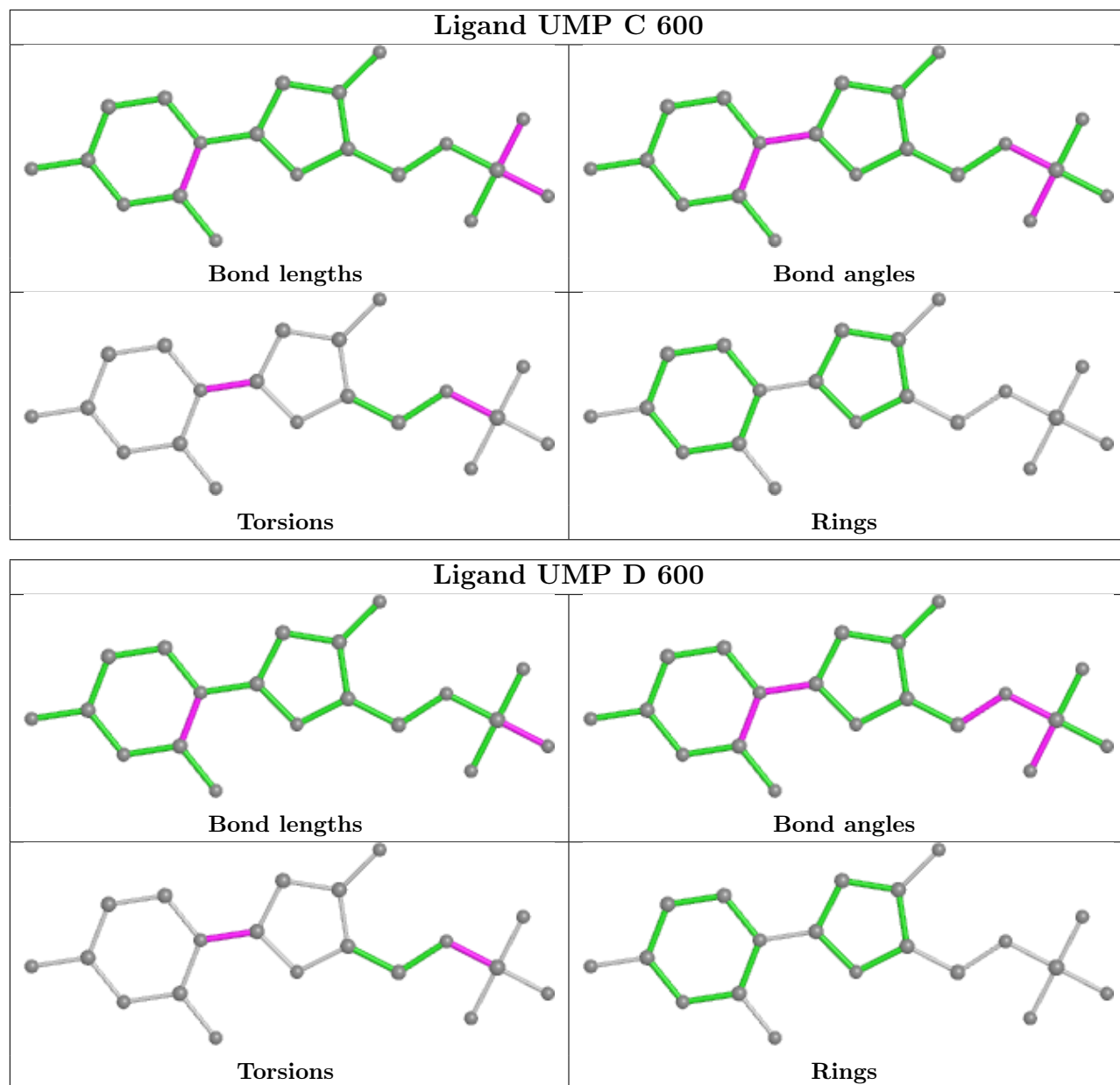
No monomer is involved in short contacts.

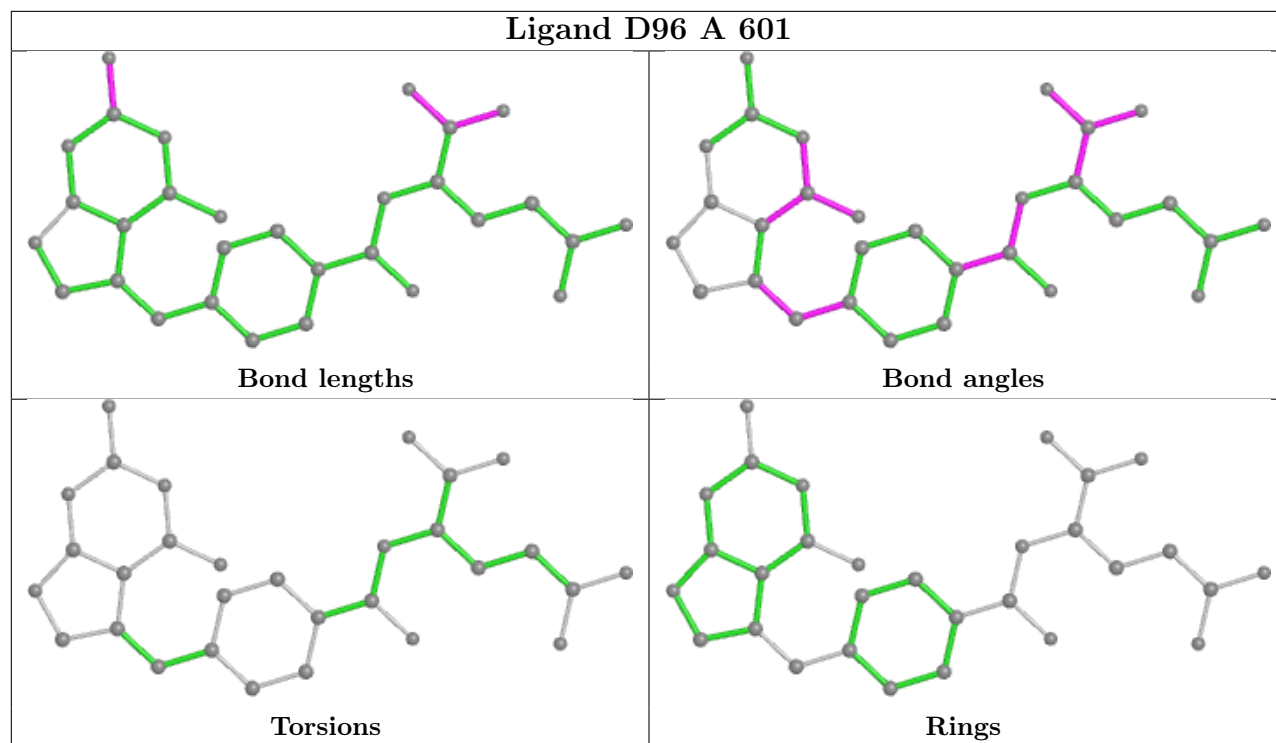
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.











4.7 Other polymers [i](#)

There are no such residues in this entry.

4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

5 Fit of model and data [i](#)

5.1 Protein, DNA and RNA chains [i](#)

EDS failed to run properly - this section is therefore empty.

5.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS failed to run properly - this section is therefore empty.

5.3 Carbohydrates [i](#)

EDS failed to run properly - this section is therefore empty.

5.4 Ligands [i](#)

EDS failed to run properly - this section is therefore empty.

5.5 Other polymers [i](#)

EDS failed to run properly - this section is therefore empty.