wwPDB X-ray Structure Validation Summary Report (i)

Oct 4, 2023 – 06:35 PM EDT

PDB ID	:	6PF4
Title	:	Crystal structure of human thymidylate synthase Delta (7-29) in complex with dUMP and 2-(2-(4-((2-amino-4-oxo-4,7-dihydro-3H-pyrrolo[2,3-d]pyrimidin-5-yl)methyl)benzamido)phenyl)acetic acid
Authors	:	Czyzyk, D.J.; Valhondo, M.; Jorgensen, W.L.; Anderson, K.S.
Deposited on	:	2019-06-21
Resolution	:	2.85 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (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 (1)) 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 2.85 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 9198 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.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	284	Total	C	N	O	S	0	0	0
			2234	1429	386	406	13			
1	A	284	Total	C	N	O	S	0	0	0
			2243	1436	387	407	13			
1	C	284	Total	C	N	O	S	0	0	0
			2251	1439	386	413	13			
1	D	284	Total	C	N	O	S	0	0	0
			2240	1432	385	410	13			

There are 92 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	GLU	deletion	UNP P04818
B	?	-	LEU	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	ARG	deletion	UNP P04818
B	?	-	ARG	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	LEU	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	ALA	deletion	UNP P04818
B	?	-	ALA	deletion	UNP P04818
B	?	-	GLN	deletion	UNP P04818
B	?	-	GLU	deletion	UNP P04818
B	?	-	ARG	deletion	UNP P04818
B	?	-	ASP	deletion	UNP P04818
B	?	-	ALA	deletion	UNP P04818
B	?	-	GLU	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	ARG	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818
B	?	-	PRO	deletion	UNP P04818

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Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	HIS	deletion	UNP P04818
B	?	-	GLY	deletion	UNP P04818
A	?	-	GLU	deletion	UNP P04818
A	?	-	LEU	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	ARG	deletion	UNP P04818
A	?	-	ARG	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	LEU	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	ALA	deletion	UNP P04818
A	?	-	ALA	deletion	UNP P04818
A	?	-	GLN	deletion	UNP P04818
A	?	-	GLU	deletion	UNP P04818
A	?	-	ARG	deletion	UNP P04818
A	?	-	ASP	deletion	UNP P04818
A	?	-	ALA	deletion	UNP P04818
A	?	-	GLU	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	ARG	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	PRO	deletion	UNP P04818
A	?	-	HIS	deletion	UNP P04818
A	?	-	GLY	deletion	UNP P04818
C	?	-	GLU	deletion	UNP P04818
C	?	-	LEU	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	ARG	deletion	UNP P04818
C	?	-	ARG	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	LEU	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	ALA	deletion	UNP P04818
C	?	-	ALA	deletion	UNP P04818
C	?	-	GLN	deletion	UNP P04818
C	?	-	GLU	deletion	UNP P04818
C	?	-	ARG	deletion	UNP P04818
C	?	-	ASP	deletion	UNP P04818
C	?	-	ALA	deletion	UNP P04818
C	?	-	GLU	deletion	UNP P04818

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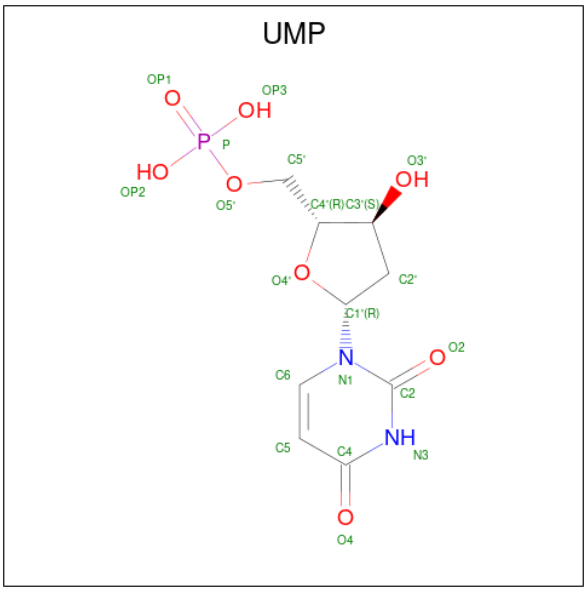
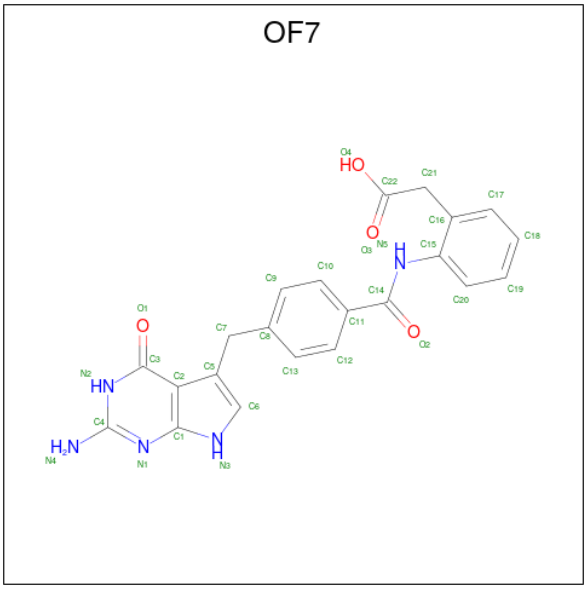
Chain	Residue	Modelled	Actual	Comment	Reference
C	?	-	PRO	deletion	UNP P04818
C	?	-	ARG	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	PRO	deletion	UNP P04818
C	?	-	HIS	deletion	UNP P04818
C	?	-	GLY	deletion	UNP P04818
D	?	-	GLU	deletion	UNP P04818
D	?	-	LEU	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	ARG	deletion	UNP P04818
D	?	-	ARG	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	LEU	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	ALA	deletion	UNP P04818
D	?	-	ALA	deletion	UNP P04818
D	?	-	GLN	deletion	UNP P04818
D	?	-	GLU	deletion	UNP P04818
D	?	-	ARG	deletion	UNP P04818
D	?	-	ASP	deletion	UNP P04818
D	?	-	ALA	deletion	UNP P04818
D	?	-	GLU	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	ARG	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	PRO	deletion	UNP P04818
D	?	-	HIS	deletion	UNP P04818
D	?	-	GLY	deletion	UNP P04818

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



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
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		
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 [2-({4-[(2-amino-4-oxo-4,7-dihydro-3H-pyrrolo[2,3-d]pyrimidin-5-yl)methyl]benzene-1-carbonyl}amino)phenyl]acetic acid (three-letter code: OF7) (formula: $C_{22}H_{19}N_5O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total C N O 31 22 5 4	0	0
3	A	1	Total C N O 31 22 5 4	0	0
3	C	1	Total C N O 31 22 5 4	0	0
3	D	1	Total C N O 31 22 5 4	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	6	Total O 6 6	0	0
4	A	10	Total O 10 10	0	0
4	C	6	Total O 6 6	0	0
4	D	4	Total O 4 4	0	0

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 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	92.19Å 96.44Å 135.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.55 – 2.85	Depositor
% Data completeness (in resolution range)	98.1 (47.55-2.85)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.18	Depositor
$< I/\sigma(I) >$ [1]	1.08 (at 2.86Å)	Xtriage
Refinement program	PHENIX (1.15.2_3472: 000)	Depositor
R, R_{free}	0.239 , 0.254	Depositor
Wilson B-factor (Å^2)	41.4	Xtriage
Anisotropy	0.953	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.000 for k,h,-l	Xtriage
Total number of atoms	9198	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 48.29 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.7823e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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.

4 Model quality

4.1 Standard geometry

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

4.2 Too-close contacts

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

4.3 Torsion angles

4.3.1 Protein backbone

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

4.3.2 Protein sidechains

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

4.3.3 RNA

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

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

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

4.5 Carbohydrates

There are no monosaccharides in this entry.

4.6 Ligand geometry

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	OF7	B	601	-	33,34,34	1.29	2 (6%)	37,48,48	0.97	4 (10%)
2	UMP	A	600	-	21,21,21	1.05	2 (9%)	31,31,31	1.15	2 (6%)
3	OF7	A	601	-	33,34,34	1.33	2 (6%)	37,48,48	0.85	2 (5%)
2	UMP	B	600	-	21,21,21	1.30	2 (9%)	31,31,31	1.24	1 (3%)
3	OF7	C	601	-	33,34,34	1.35	3 (9%)	37,48,48	0.95	2 (5%)
2	UMP	C	600	-	21,21,21	1.27	2 (9%)	31,31,31	1.16	1 (3%)
3	OF7	D	601	-	33,34,34	1.33	3 (9%)	37,48,48	1.05	3 (8%)
2	UMP	D	600	-	21,21,21	1.26	1 (4%)	31,31,31	1.23	2 (6%)

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	OF7	B	601	-	-	3/16/16/16	0/4/4/4
2	UMP	A	600	-	-	1/10/22/22	0/2/2/2
3	OF7	A	601	-	-	0/16/16/16	0/4/4/4
2	UMP	B	600	-	-	1/10/22/22	0/2/2/2
3	OF7	C	601	-	-	4/16/16/16	0/4/4/4
2	UMP	C	600	-	-	1/10/22/22	0/2/2/2
3	OF7	D	601	-	-	4/16/16/16	0/4/4/4
2	UMP	D	600	-	-	2/10/22/22	0/2/2/2

The worst 5 of 17 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	600	UMP	P-OP1	3.79	1.62	1.50
2	B	600	UMP	P-OP1	3.71	1.62	1.50
2	D	600	UMP	P-OP1	3.69	1.62	1.50
3	C	601	OF7	C2-C1	-3.68	1.36	1.42
3	D	601	OF7	C2-C1	-3.45	1.37	1.42

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	600	UMP	OP2-P-O5'	3.75	116.70	106.73
2	D	600	UMP	OP2-P-O5'	3.60	116.31	106.73
2	C	600	UMP	OP2-P-O5'	3.27	115.45	106.73
2	A	600	UMP	O5'-P-OP1	3.04	115.01	106.47
3	D	601	OF7	N4-C4-N2	-2.33	111.76	116.71

There are no chirality outliers.

5 of 16 torsion outliers are listed below:

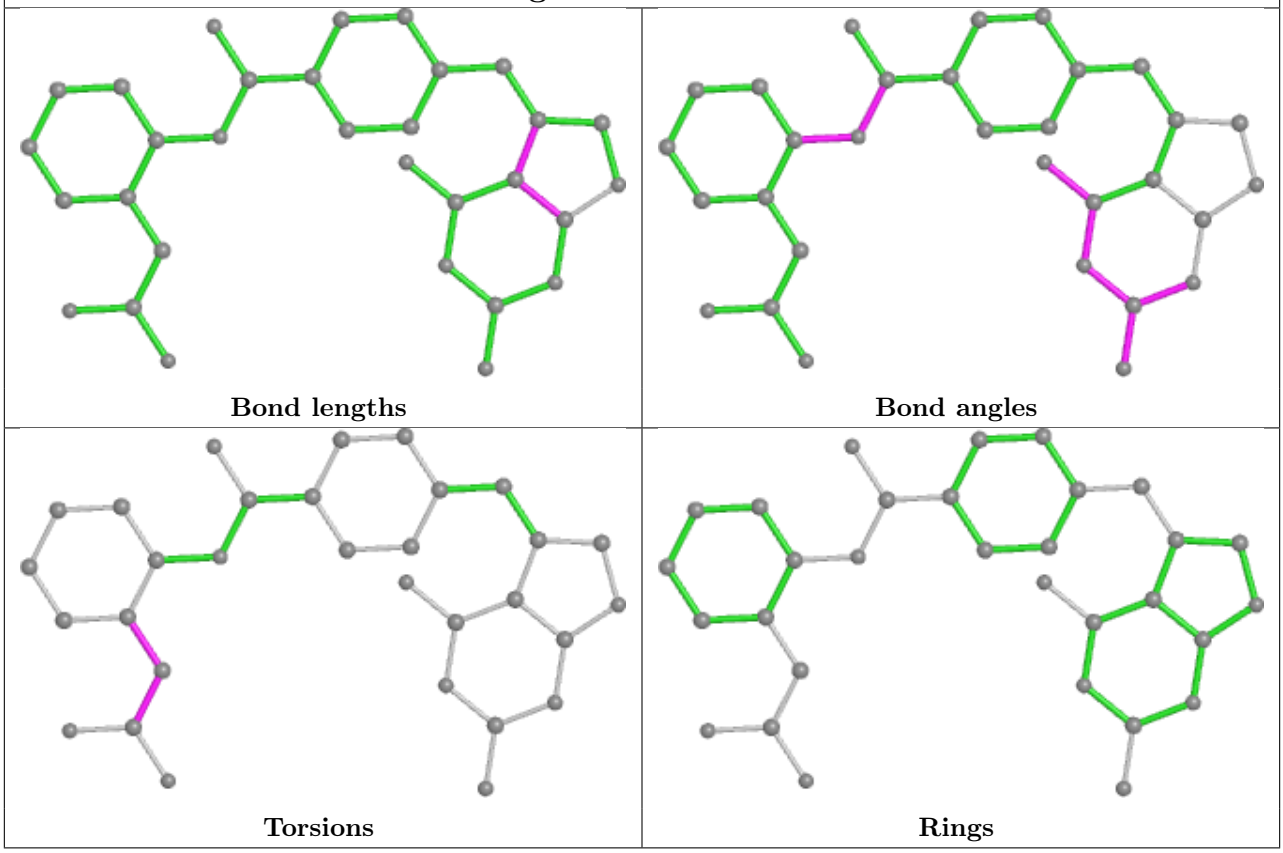
Mol	Chain	Res	Type	Atoms
3	C	601	OF7	C15-C16-C21-C22
3	D	601	OF7	C15-C16-C21-C22
3	B	601	OF7	C15-C16-C21-C22
3	C	601	OF7	C17-C16-C21-C22
3	D	601	OF7	C17-C16-C21-C22

There are no ring outliers.

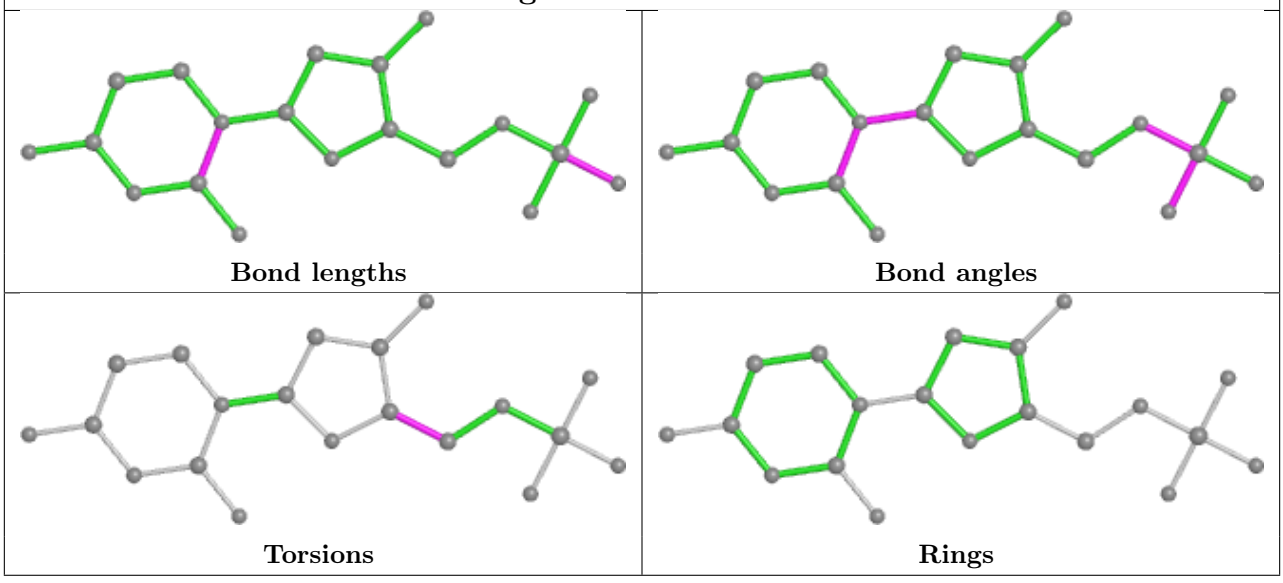
No monomer is involved in short contacts.

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.

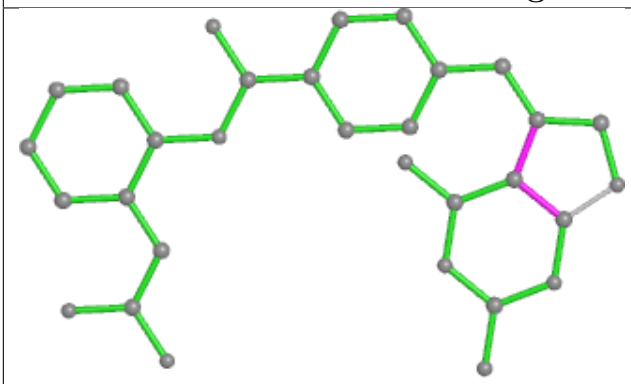
Ligand OF7 B 601



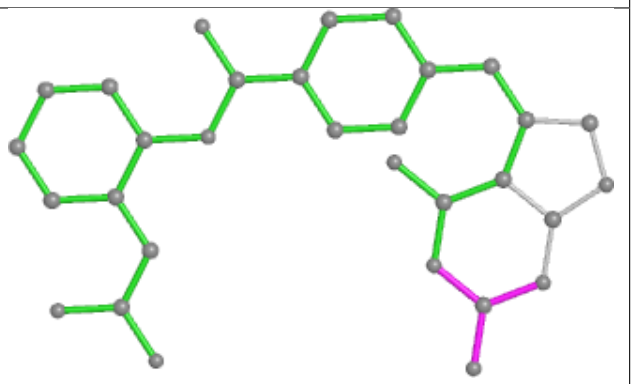
Ligand UMP A 600



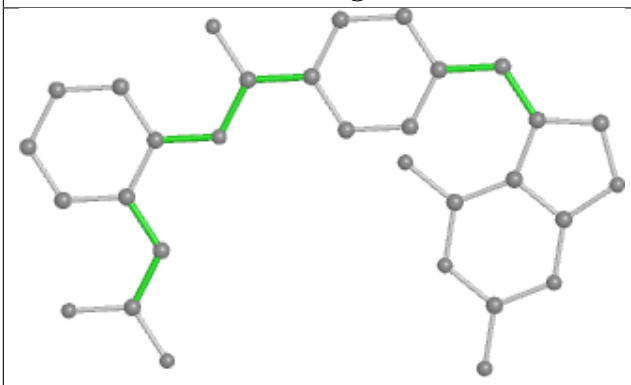
Ligand OF7 A 601



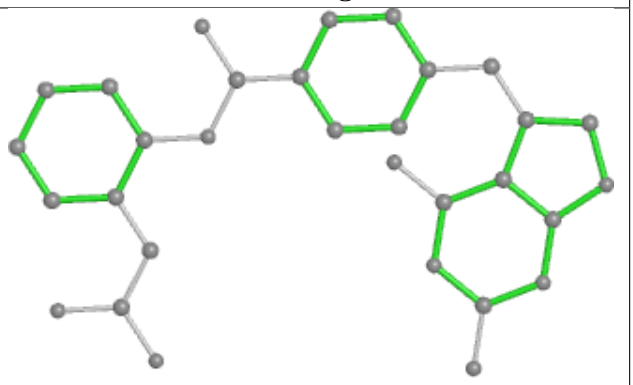
Bond lengths



Bond angles

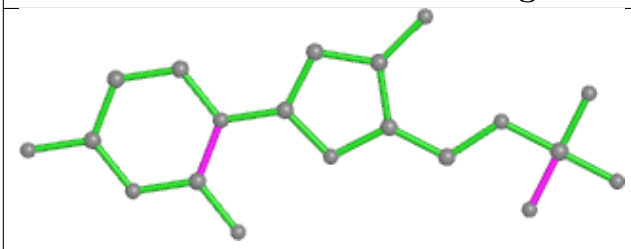


Torsions

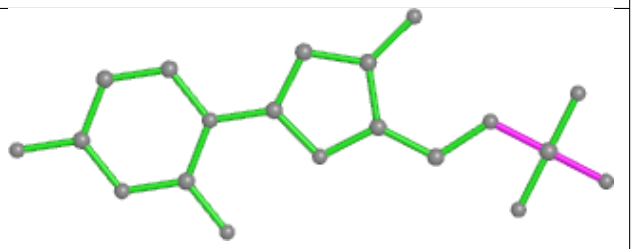


Rings

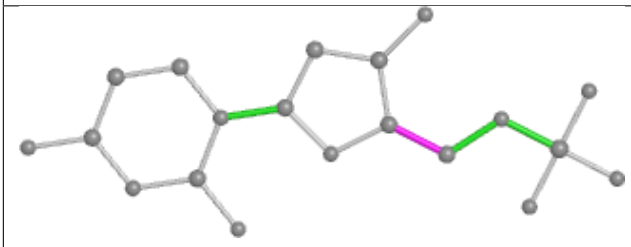
Ligand UMP B 600



Bond lengths



Bond angles



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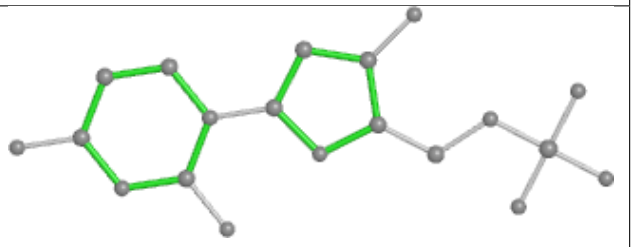
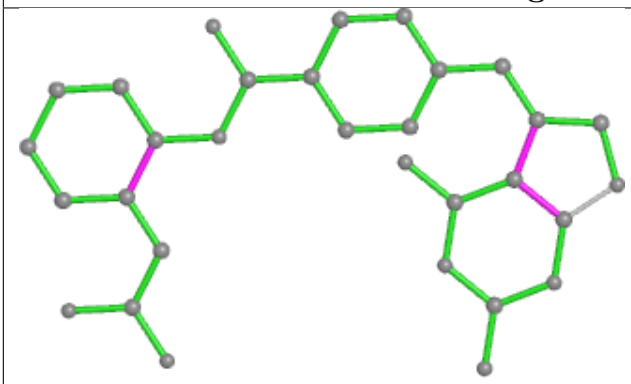
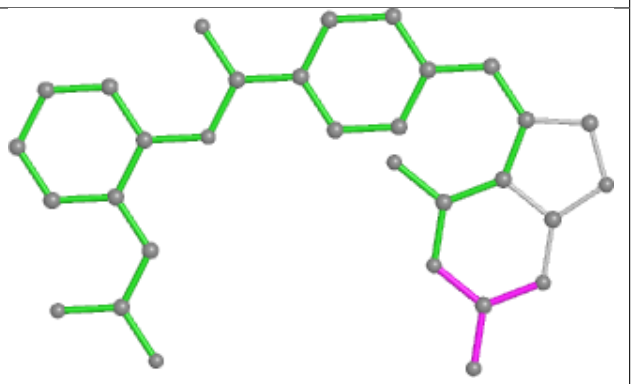


Rings

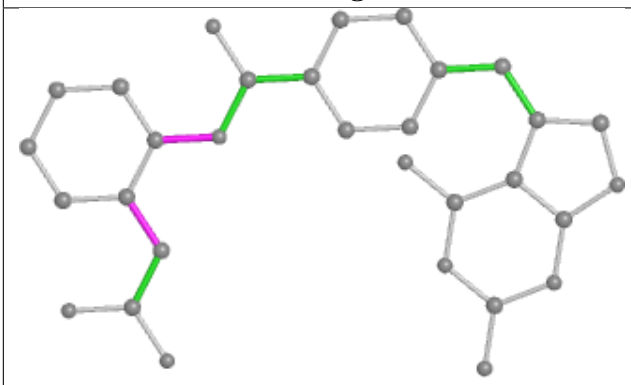
Ligand OF7 C 601



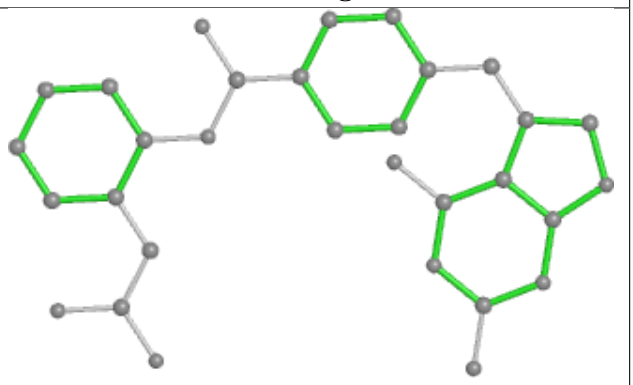
Bond lengths



Bond angles

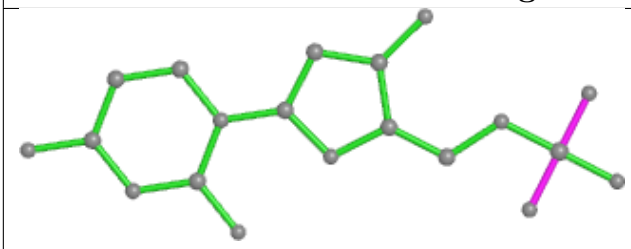


Torsions

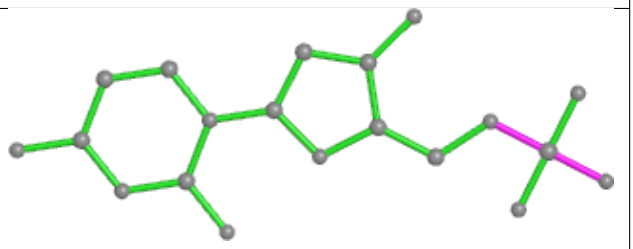


Rings

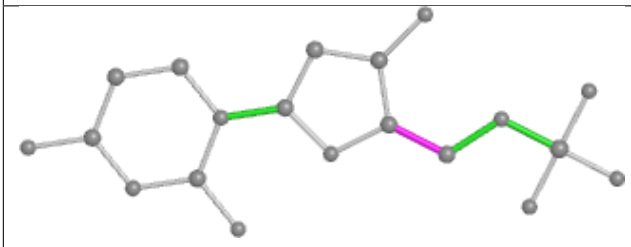
Ligand UMP C 600



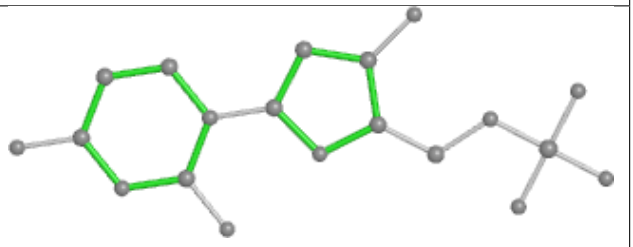
Bond lengths



Bond angles

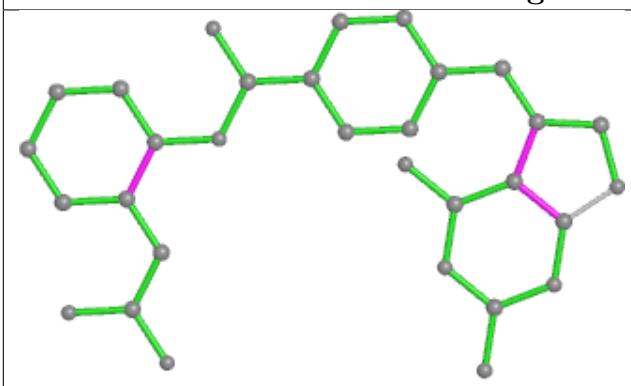


Torsions



Rings

Ligand OF7 D 601



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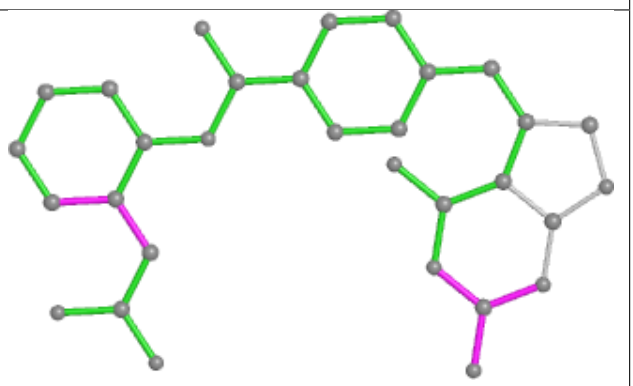
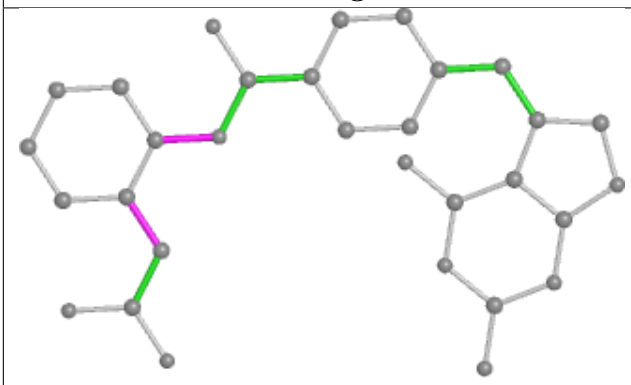
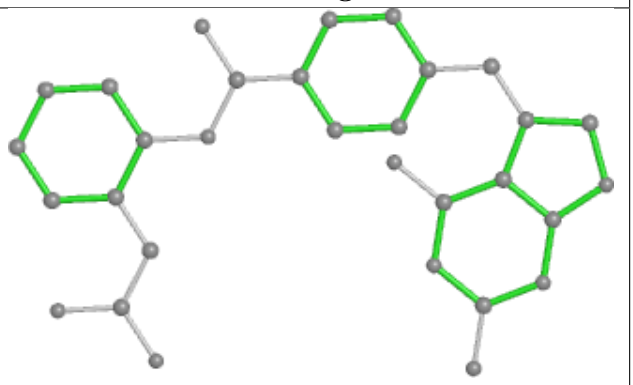


Bond angles

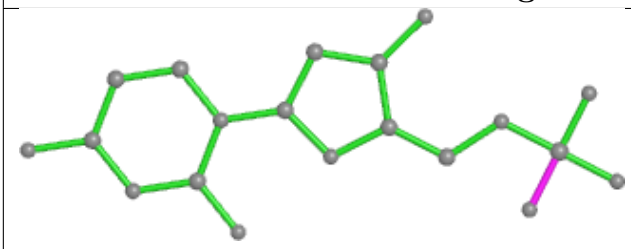


Torsions

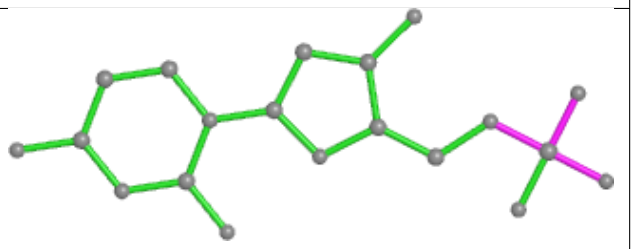


Rings

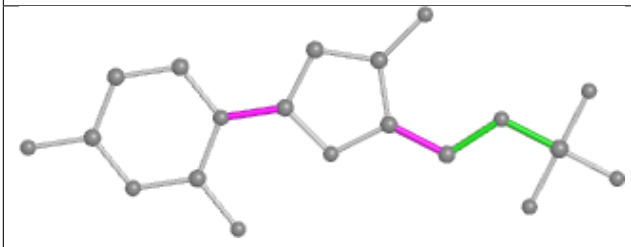
Ligand UMP D 600



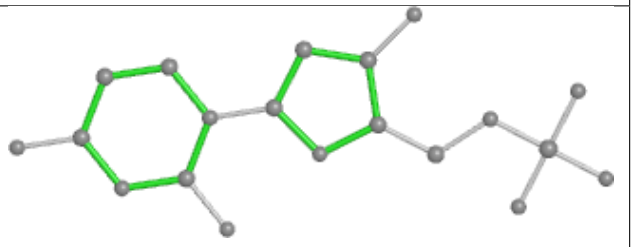
Bond lengths



Bond angles



Torsions



Rings

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

5.1 Protein, DNA and RNA chains

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

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

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

5.3 Carbohydrates

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

5.4 Ligands

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

5.5 Other polymers

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