wwPDB X-ray Structure Validation Summary Report (i)

Oct 4, 2023 – 12:07 AM EDT

PDB ID	:	6P7E
Title	:	Structure of T7 DNA Polymerase Bound to a Primer/Template DNA and a Peptide that Mimics the C-terminal Tail of the Primase-Helicase
Authors	:	Foster, B.M.; Rosenberg, D.; Salvo, H.; Stephens, K.L.; Bintz, B.J.; Hammel, M.; Ellenberger, T.; Gainey, M.D.; Wallen, J.R.
Deposited on	:	2019-06-05
Resolution	:	3.00 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 (i)) were used in the production of this report:

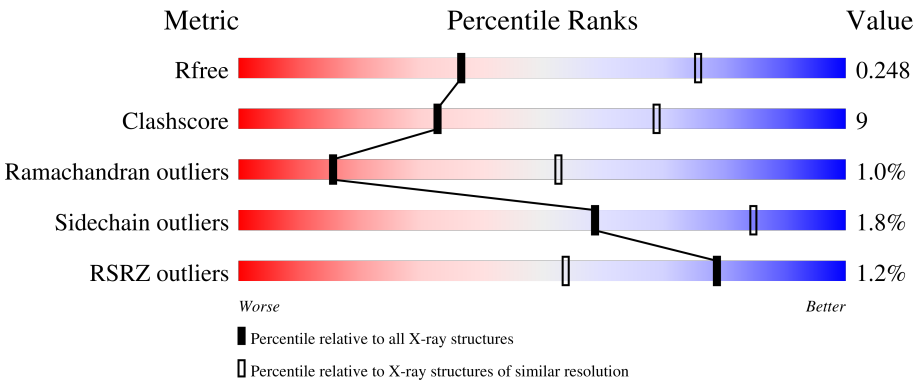
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 3.00 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}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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	704	80% 19% •
1	B	704	80% 19% ••
1	C	704	.% 74% 19% • 5%
1	D	704	.% 71% 20% • 9%

Continued on next page...

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Mol	Chain	Length	Quality of chain
2	E	109	75% 20%
2	F	109	72% 24%
2	G	109	8% 70% 26%
2	H	109	15% 71% 26%
3	I	21	62% 38%
3	K	21	67% 29% 5%
3	M	21	33% 62% 5%
3	O	21	38% 62%
4	J	25	36% 60%
4	L	25	36% 56% 8%
4	N	25	4% 28% 64%
4	P	25	40% 48% 8%
5	U	4	50% 50%
5	V	4	75% 25%
6	W	3	100%

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
8	MG	A	803	-	-	-	X
8	MG	C	804	-	-	-	X

2 Entry composition (i)

There are 9 unique types of molecules in this entry. The entry contains 28831 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 DNA-directed DNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	694	5531	3524	963	1020	24	0	0	0
1	B	697	5555	3537	969	1025	24	0	0	0
1	C	672	5368	3417	936	992	23	0	0	0
1	D	644	5140	3272	894	953	21	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	5	ALA	ASP	engineered mutation	UNP P00581
A	7	ALA	GLU	engineered mutation	UNP P00581
B	5	ALA	ASP	engineered mutation	UNP P00581
B	7	ALA	GLU	engineered mutation	UNP P00581
C	5	ALA	ASP	engineered mutation	UNP P00581
C	7	ALA	GLU	engineered mutation	UNP P00581
D	5	ALA	ASP	engineered mutation	UNP P00581
D	7	ALA	GLU	engineered mutation	UNP P00581

- Molecule 2 is a protein called TrxA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	105	802	518	129	152	3	0	0	0
2	F	105	802	518	129	152	3	0	0	0
2	G	105	802	518	129	152	3	0	0	0
2	H	105	802	518	129	152	3	0	0	0

- Molecule 3 is a DNA chain called DNA (5'-D(P*GP*GP*CP*AP*GP*GP*TP*GP*GP*TP*CP*TP*TP*GP*CP*CP*GP*GP*TP*GP*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	I	21	437	206	82	128	21	0	0	0
3	K	21	437	206	82	128	21	0	0	0
3	M	21	437	206	82	128	21	0	0	0
3	O	21	437	206	82	128	21	0	0	0

- Molecule 4 is a DNA chain called DNA (25-MER).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	J	25	501	237	93	146	25	0	0	0
4	L	23	463	219	87	134	23	0	0	0
4	N	24	482	228	90	140	24	0	0	0
4	P	23	463	219	87	134	23	0	0	0

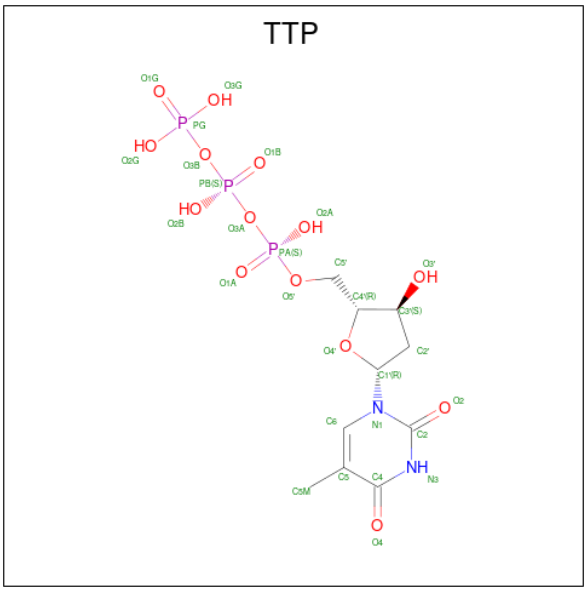
- Molecule 5 is a protein called ASP-THR-ASP-PHE peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	U	4	35	21	4	10	0	0	0
5	V	4	35	21	4	10	0	0	0

- Molecule 6 is a protein called THR-ASP-PHE peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
6	W	3	27	17	3	7	0	0	0

- Molecule 7 is THYMIDINE-5'-TRIPHOSPHATE (three-letter code: TTP) (formula: $C_{10}H_{17}N_2O_{14}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
7	A	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	A	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	B	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	B	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	C	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	C	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	D	1	29	10	2	14	3	0	0
			Total	C	N	O	P		
7	D	1	29	10	2	14	3	0	0

- Molecule 8 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
8	A	3	3	3	0	0
			Total	Mg		
8	B	3	3	3	0	0
			Total	Mg		
8	C	3	3	3	0	0
			Total	Mg		
8	D	3	3	3	0	0

- Molecule 9 is water.

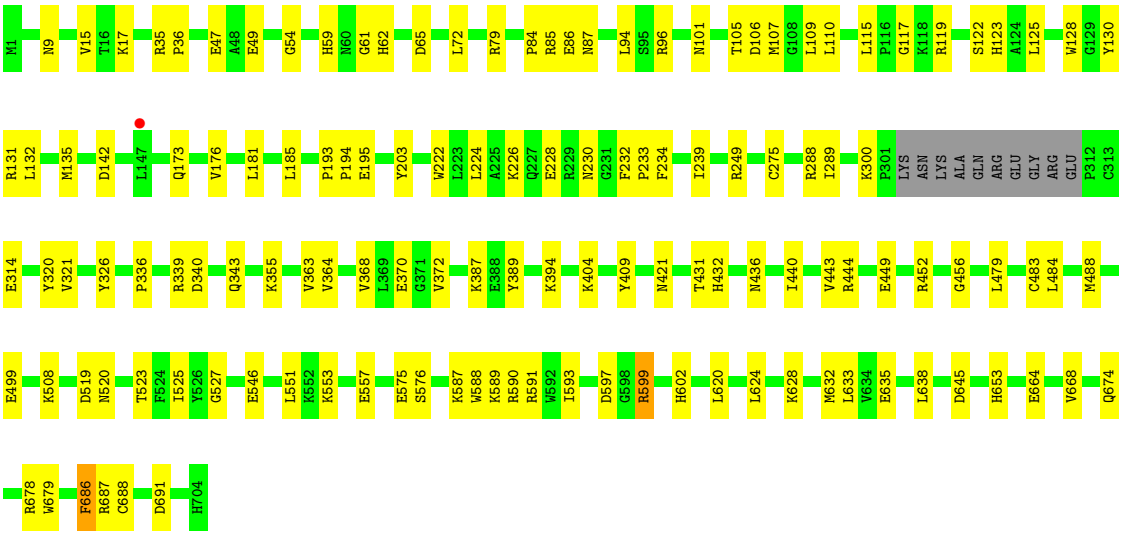
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	15	Total O 15 15	0	0
9	B	7	Total O 7 7	0	0
9	C	1	Total O 1 1	0	0
9	D	3	Total O 3 3	0	0
9	J	2	Total O 2 2	0	0
9	K	2	Total O 2 2	0	0
9	L	1	Total O 1 1	0	0

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.

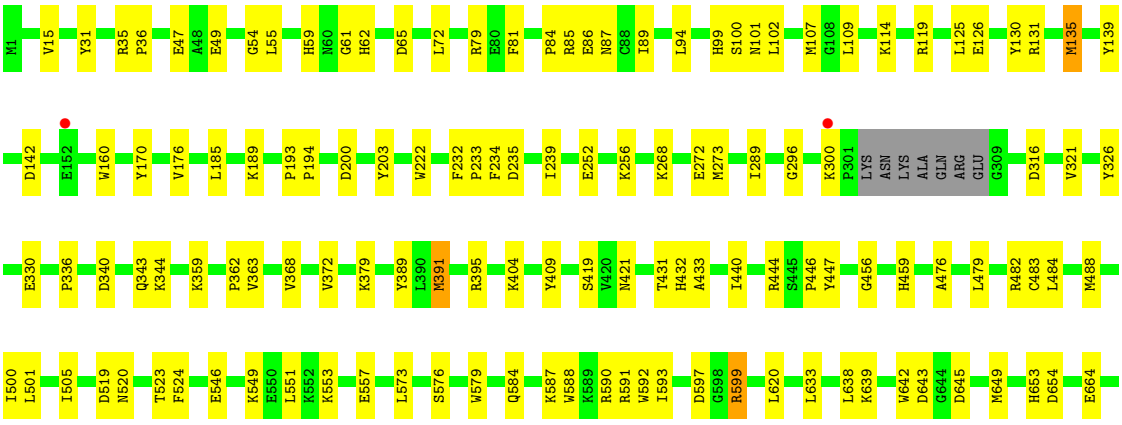
- Molecule 1: DNA-directed DNA polymerase

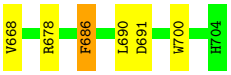
Chain A:



- Molecule 1: DNA-directed DNA polymerase

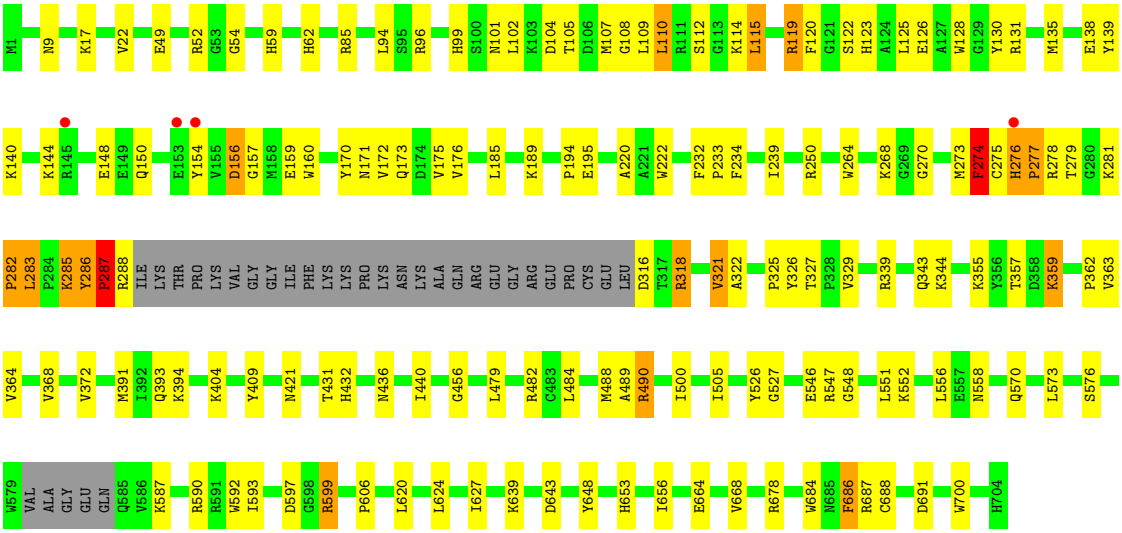
Chain B:





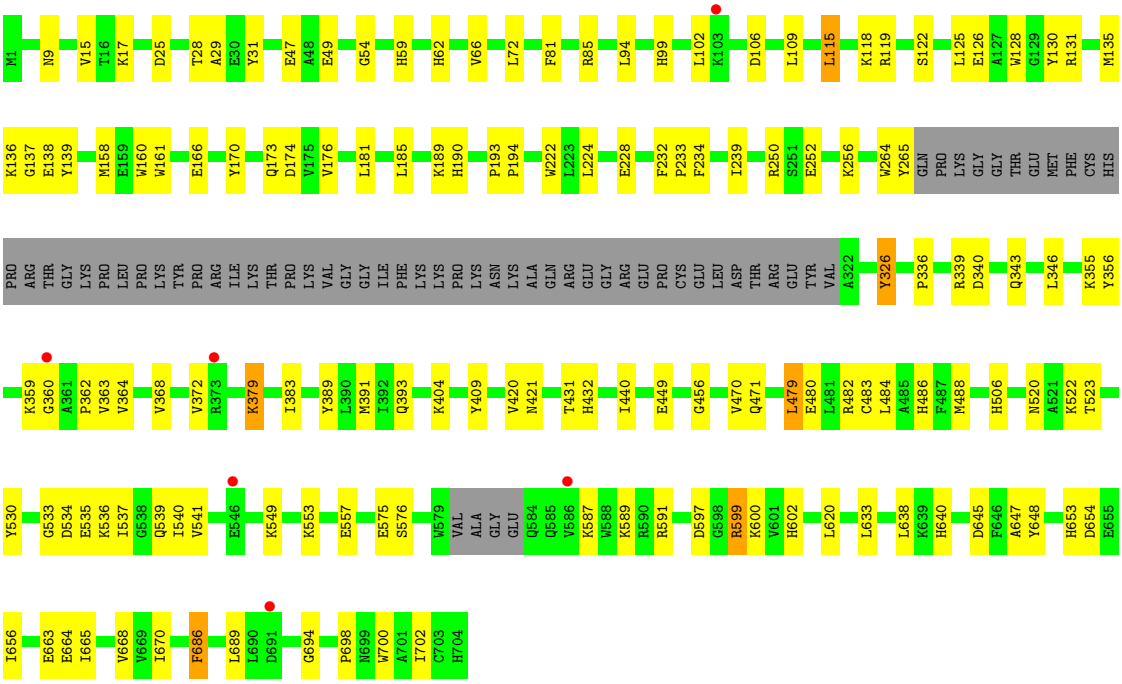
• Molecule 1: DNA-directed DNA polymerase

Chain C:



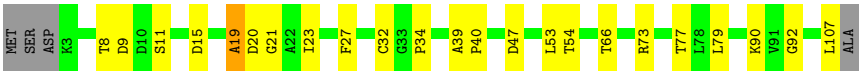
• Molecule 1: DNA-directed DNA polymerase

Chain D:



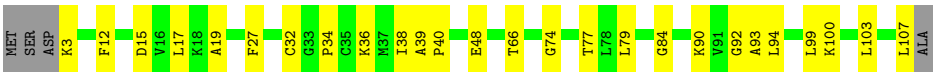
• Molecule 2: TrxA

Chain E:



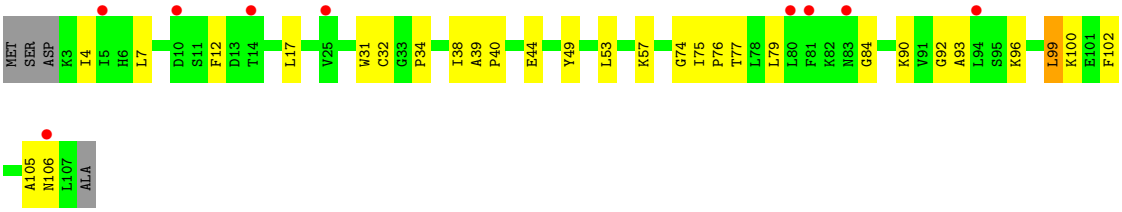
• Molecule 2: TrxA

Chain F:



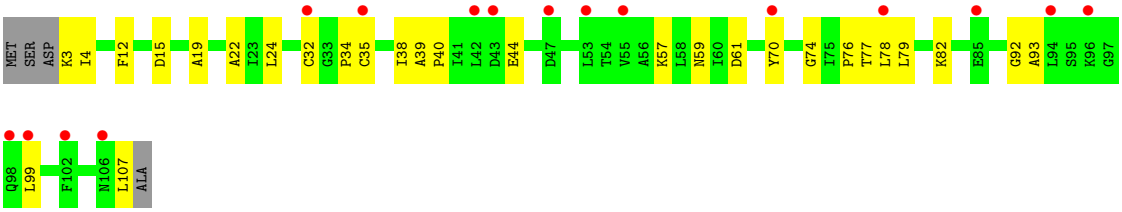
• Molecule 2: TrxA

Chain G:



• Molecule 2: TrxA

Chain H:

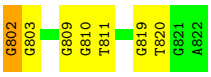


• Molecule 3: DNA (5'-D(P*GP*GP*CP*AP*GP*GP*TP*GP*GP*TP*CP*TP*TP*GP*CP*CP*GP*GP*TP*GP*A)-3')

Chain I:

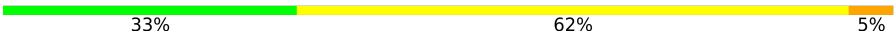
• Molecule 3: DNA (5'-D(P*GP*GP*CP*AP*GP*GP*TP*GP*GP*TP*CP*TP*TP*GP*CP*CP*GP*GP*TP*GP*A)-3')

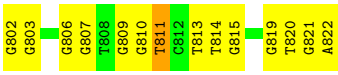
Chain K:



• Molecule 3: DNA (5'-D(P*GP*GP*CP*AP*GP*GP*TP*GP*GP*TP*CP*TP*TP*GP*CP*CP*GP*GP*TP*GP*A)-3')

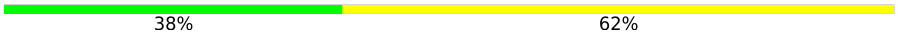
Chain M:





• Molecule 3: DNA (5'-D(P*GP*GP*CP*AP*GP*GP*TP*GP*GP*TP*CP*TP*TP*GP*CP*CP*GP*GP*TP*GP*A)-3')

Chain O:

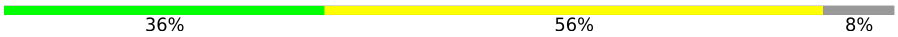


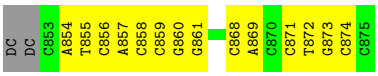
• Molecule 4: DNA (25-MER)

Chain J:

• Molecule 4: DNA (25-MER)

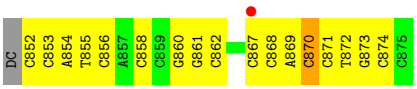
Chain L:





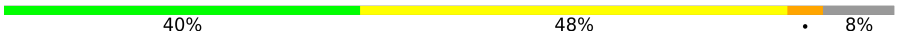
• Molecule 4: DNA (25-MER)

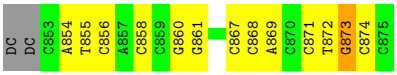
Chain N:



• Molecule 4: DNA (25-MER)

Chain P:





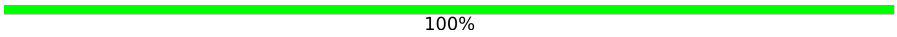
• Molecule 5: ASP-THR-ASP-PHE peptide

Chain U:

• Molecule 5: ASP-THR-ASP-PHE peptide

Chain V:

- Molecule 6: THR-ASP-PHE peptide

Chain W: 

There are no outlier residues recorded for this chain.

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	100.72Å 102.70Å 148.88Å 91.36° 96.83° 113.11°	Depositor
Resolution (Å)	49.13 – 3.00 49.13 – 3.00	Depositor EDS
% Data completeness (in resolution range)	98.8 (49.13-3.00) 98.8 (49.13-3.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.40 (at 3.01Å)	Xtriage
Refinement program	PHENIX (1.14_3260)	Depositor
R, R_{free}	0.214 , 0.248 0.214 , 0.248	Depositor DCC
R_{free} test set	5354 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	58.6	Xtriage
Anisotropy	0.106	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 49.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	28831	wwPDB-VP
Average B, all atoms (Å^2)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.53% 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 (i)

5.1 Standard geometry (i)

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

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	0.33	0/5669	0.63	1/7668 (0.0%)
1	B	0.32	0/5693	0.63	2/7700 (0.0%)
1	C	0.31	0/5501	0.64	4/7441 (0.1%)
1	D	0.30	0/5264	0.61	1/7120 (0.0%)
2	E	0.30	0/817	0.70	0/1108
2	F	0.33	0/817	0.65	0/1108
2	G	0.27	0/817	0.64	0/1108
2	H	0.27	0/817	0.62	0/1108
3	I	0.76	0/490	1.04	0/756
3	K	0.80	0/490	1.10	1/756 (0.1%)
3	M	0.74	0/490	1.08	1/756 (0.1%)
3	O	0.76	0/490	1.05	0/756
4	J	0.83	1/560 (0.2%)	0.99	1/858 (0.1%)
4	L	0.78	0/518	0.92	0/794
4	N	0.74	0/539	0.88	1/826 (0.1%)
4	P	0.77	0/518	0.97	1/794 (0.1%)
5	U	0.32	0/35	0.40	0/45
5	V	0.37	0/35	0.54	0/45
6	W	0.31	0/27	0.44	0/34
All	All	0.41	1/29587 (0.0%)	0.70	13/40781 (0.0%)

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	C	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	J	851	DC	C1'-N1	6.30	1.57	1.49

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	115	LEU	CB-CG-CD1	-8.44	96.65	111.00
1	C	115	LEU	CA-CB-CG	7.61	132.80	115.30
1	D	115	LEU	CA-CB-CG	6.83	131.01	115.30
4	J	873	DG	P-O3'-C3'	6.54	127.55	119.70
4	P	873	DG	P-O3'-C3'	6.28	127.24	119.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	287	PRO	Peptide

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	5531	0	5432	82	0
1	B	5555	0	5453	82	0
1	C	5368	0	5251	106	0
1	D	5140	0	5024	93	0
2	E	802	0	816	15	0
2	F	802	0	816	21	0
2	G	802	0	816	23	0
2	H	802	0	816	16	0
3	I	437	0	235	5	0
3	K	437	0	235	6	0
3	M	437	0	235	9	0
3	O	437	0	235	8	0
4	J	501	0	278	12	0
4	L	463	0	256	10	0
4	N	482	0	267	12	0
4	P	463	0	256	11	0
5	U	35	0	26	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	V	35	0	26	1	0
6	W	27	0	22	0	0
7	A	58	0	26	0	0
7	B	58	0	26	1	0
7	C	58	0	26	1	0
7	D	58	0	26	3	0
8	A	3	0	0	0	0
8	B	3	0	0	0	0
8	C	3	0	0	0	0
8	D	3	0	0	0	0
9	A	15	0	0	0	0
9	B	7	0	0	0	0
9	C	1	0	0	0	0
9	D	3	0	0	0	0
9	J	2	0	0	0	0
9	K	2	0	0	0	0
9	L	1	0	0	0	0
All	All	28831	0	26599	480	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 9.

The worst 5 of 480 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)
3:O:803:DG:H2"	3:O:804:DC:H5"	1.52	0.92
1:C:250:ARG:CD	1:C:393:GLN:OE1	2.21	0.88
1:C:273:MET:HG2	1:C:274:PHE:H	1.40	0.86
4:P:867:DC:H2"	4:P:868:DC:H5"	1.59	0.85
1:C:250:ARG:HD2	1:C:393:GLN:OE1	1.78	0.84

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	690/704 (98%)	666 (96%)	20 (3%)	4 (1%)	25	64
1	B	693/704 (98%)	666 (96%)	22 (3%)	5 (1%)	22	60
1	C	666/704 (95%)	631 (95%)	21 (3%)	14 (2%)	7	33
1	D	638/704 (91%)	619 (97%)	15 (2%)	4 (1%)	25	64
2	E	103/109 (94%)	99 (96%)	2 (2%)	2 (2%)	8	36
2	F	103/109 (94%)	100 (97%)	3 (3%)	0	100	100
2	G	103/109 (94%)	94 (91%)	8 (8%)	1 (1%)	15	53
2	H	103/109 (94%)	99 (96%)	4 (4%)	0	100	100
5	U	2/4 (50%)	2 (100%)	0	0	100	100
5	V	2/4 (50%)	1 (50%)	1 (50%)	0	100	100
6	W	1/3 (33%)	1 (100%)	0	0	100	100
All	All	3104/3263 (95%)	2978 (96%)	96 (3%)	30 (1%)	15	53

5 of 30 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	135	MET
1	C	276	HIS
1	C	282	PRO
1	C	287	PRO
1	C	359	LYS

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	574/582 (99%)	566 (99%)	8 (1%)	67	88
1	B	576/582 (99%)	567 (98%)	9 (2%)	62	86
1	C	556/582 (96%)	540 (97%)	16 (3%)	42	76

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	531/582 (91%)	522 (98%)	9 (2%)	60	85
2	E	85/88 (97%)	83 (98%)	2 (2%)	49	79
2	F	85/88 (97%)	85 (100%)	0	100	100
2	G	85/88 (97%)	84 (99%)	1 (1%)	71	90
2	H	85/88 (97%)	83 (98%)	2 (2%)	49	79
5	U	4/4 (100%)	4 (100%)	0	100	100
5	V	4/4 (100%)	4 (100%)	0	100	100
6	W	3/3 (100%)	3 (100%)	0	100	100
All	All	2588/2691 (96%)	2541 (98%)	47 (2%)	59	85

5 of 47 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	316	ASP
1	D	232	PHE
1	C	391	MET
1	C	686	PHE
1	D	340	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	101	ASN
1	A	171	ASN
1	A	602	HIS
1	D	602	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 20 ligands modelled in this entry, 12 are monoatomic - leaving 8 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	$\#\|Z\| > 2$
7	TTP	B	805	8	26,30,30	1.20	5 (19%)	39,47,47	2.10	9 (23%)
7	TTP	D	805	8	26,30,30	1.28	3 (11%)	39,47,47	2.04	9 (23%)
7	TTP	B	801	-	26,30,30	1.27	6 (23%)	39,47,47	2.18	12 (30%)
7	TTP	A	805	8	26,30,30	1.22	6 (23%)	39,47,47	2.03	9 (23%)
7	TTP	C	801	-	26,30,30	1.23	5 (19%)	39,47,47	2.05	8 (20%)
7	TTP	A	801	-	26,30,30	1.22	5 (19%)	39,47,47	1.88	8 (20%)
7	TTP	C	805	8	26,30,30	1.28	5 (19%)	39,47,47	1.96	10 (25%)
7	TTP	D	801	-	26,30,30	1.23	5 (19%)	39,47,47	2.01	10 (25%)

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
7	TTP	B	805	8	-	5/22/34/34	0/2/2/2
7	TTP	D	805	8	-	4/22/34/34	0/2/2/2
7	TTP	B	801	-	-	7/22/34/34	0/2/2/2
7	TTP	A	805	8	-	4/22/34/34	0/2/2/2
7	TTP	C	801	-	-	5/22/34/34	0/2/2/2
7	TTP	A	801	-	-	3/22/34/34	0/2/2/2
7	TTP	C	805	8	-	4/22/34/34	0/2/2/2
7	TTP	D	801	-	-	4/22/34/34	0/2/2/2

The worst 5 of 40 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	D	805	TTP	C6-C5	3.15	1.39	1.34
7	B	801	TTP	C6-C5	3.01	1.39	1.34
7	C	805	TTP	C6-C5	2.98	1.39	1.34
7	B	805	TTP	C6-C5	2.82	1.39	1.34
7	C	801	TTP	C6-C5	2.76	1.39	1.34

The worst 5 of 75 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	B	801	TTP	N3-C2-N1	5.38	122.03	114.89
7	C	801	TTP	C4-N3-C2	-5.23	120.58	127.35
7	D	805	TTP	C4-N3-C2	-5.19	120.64	127.35
7	B	801	TTP	C4-N3-C2	-5.16	120.67	127.35
7	C	805	TTP	N3-C2-N1	5.13	121.70	114.89

There are no chirality outliers.

5 of 36 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	B	801	TTP	C5'-O5'-PA-O1A
7	B	801	TTP	C5'-O5'-PA-O2A
7	C	801	TTP	O4'-C4'-C5'-O5'
7	C	801	TTP	C3'-C4'-C5'-O5'
7	D	801	TTP	O4'-C4'-C5'-O5'

There are no ring outliers.

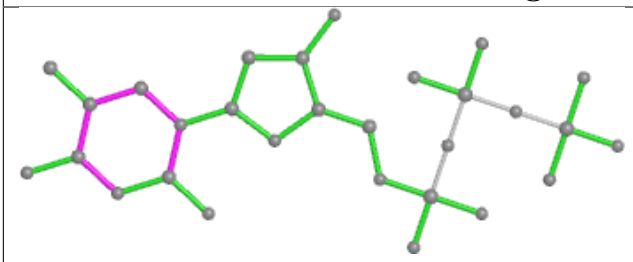
4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	D	805	TTP	2	0
7	B	801	TTP	1	0
7	C	805	TTP	1	0
7	D	801	TTP	1	0

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 TTP B 805



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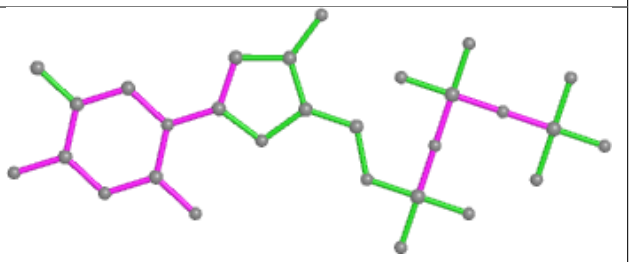
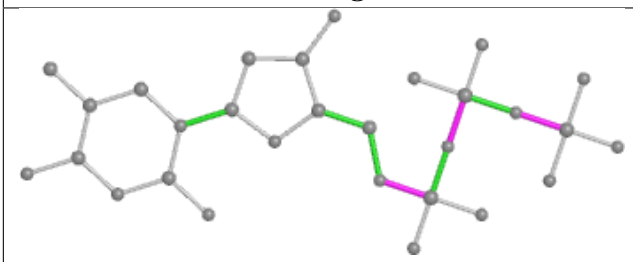
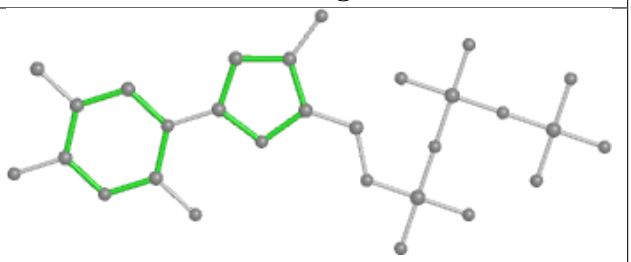


Bond angles

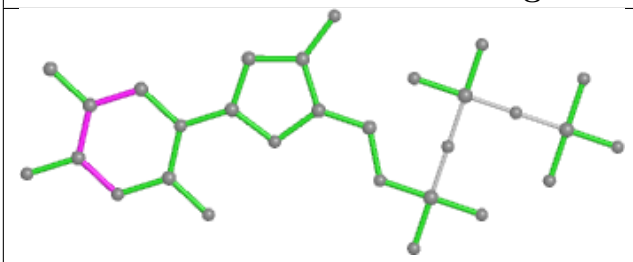


Torsions



Rings

Ligand TTP D 805



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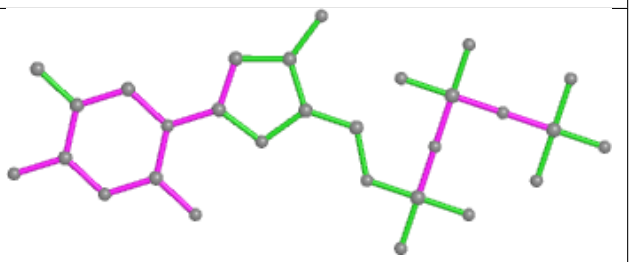

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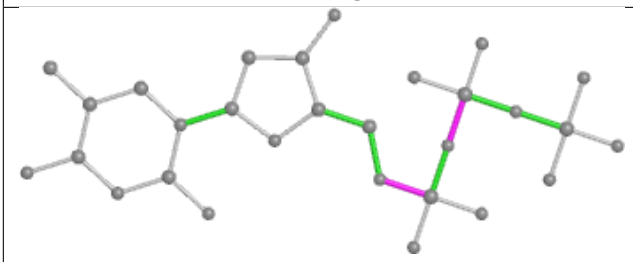

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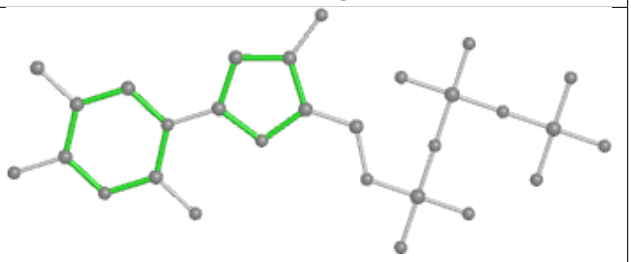

Rings

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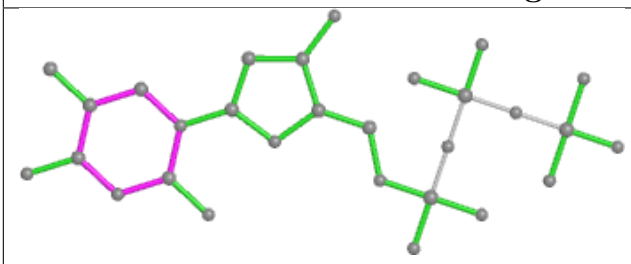

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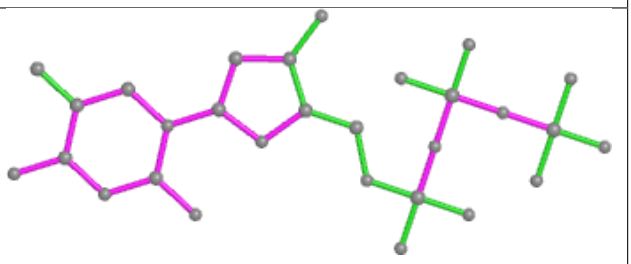

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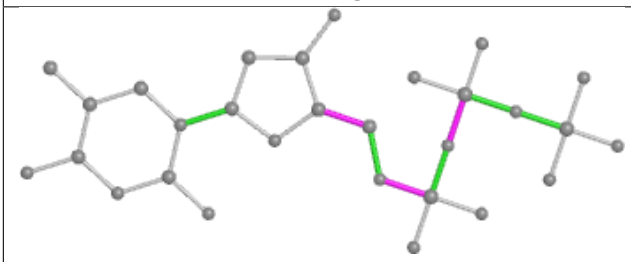

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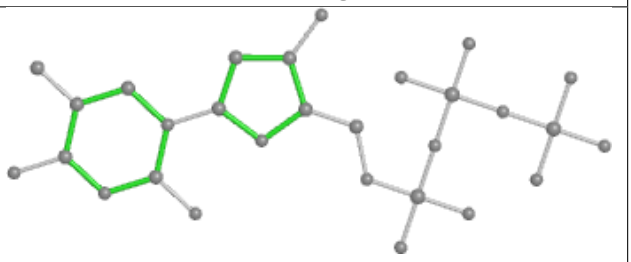

Rings

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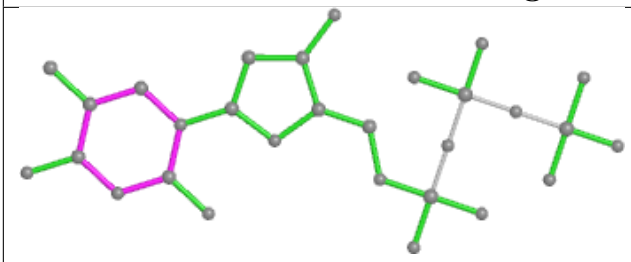

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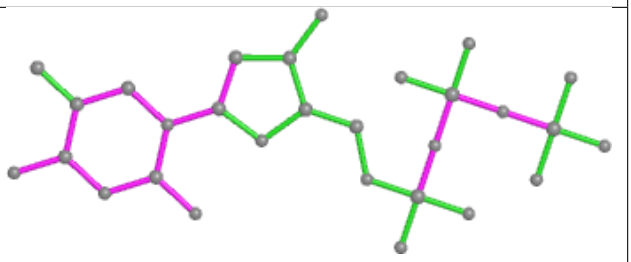

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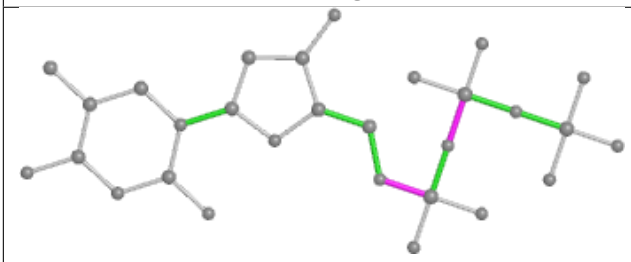

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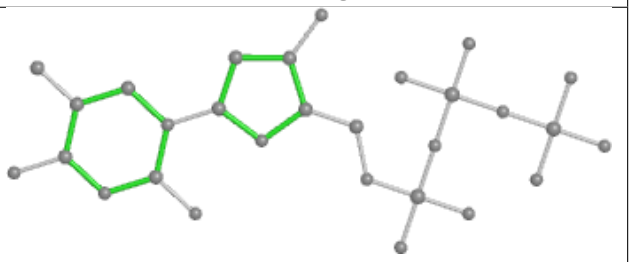

Rings

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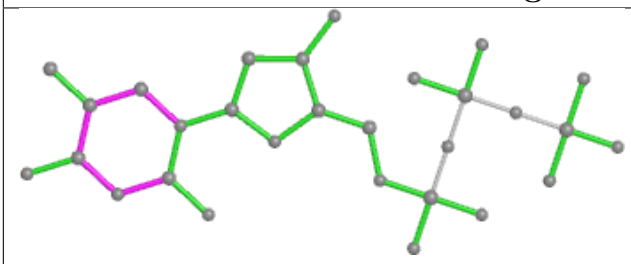

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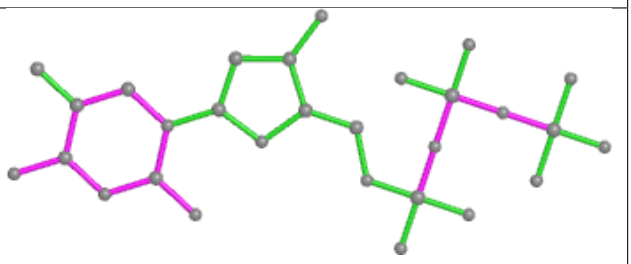

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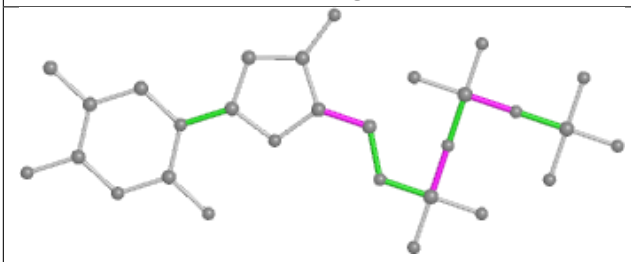

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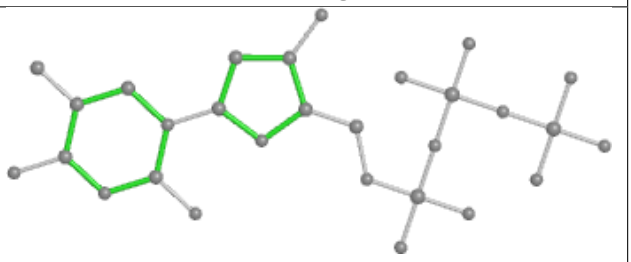

Rings

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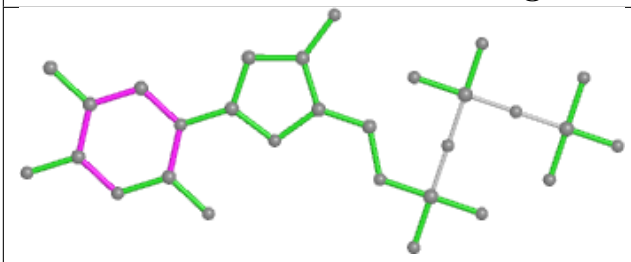

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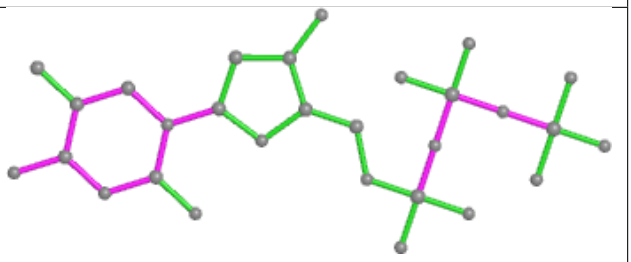

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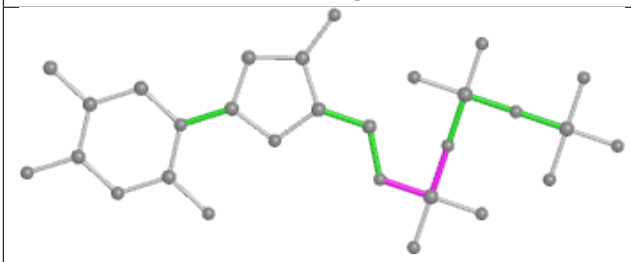

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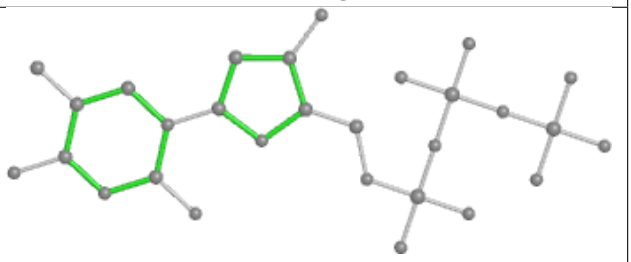
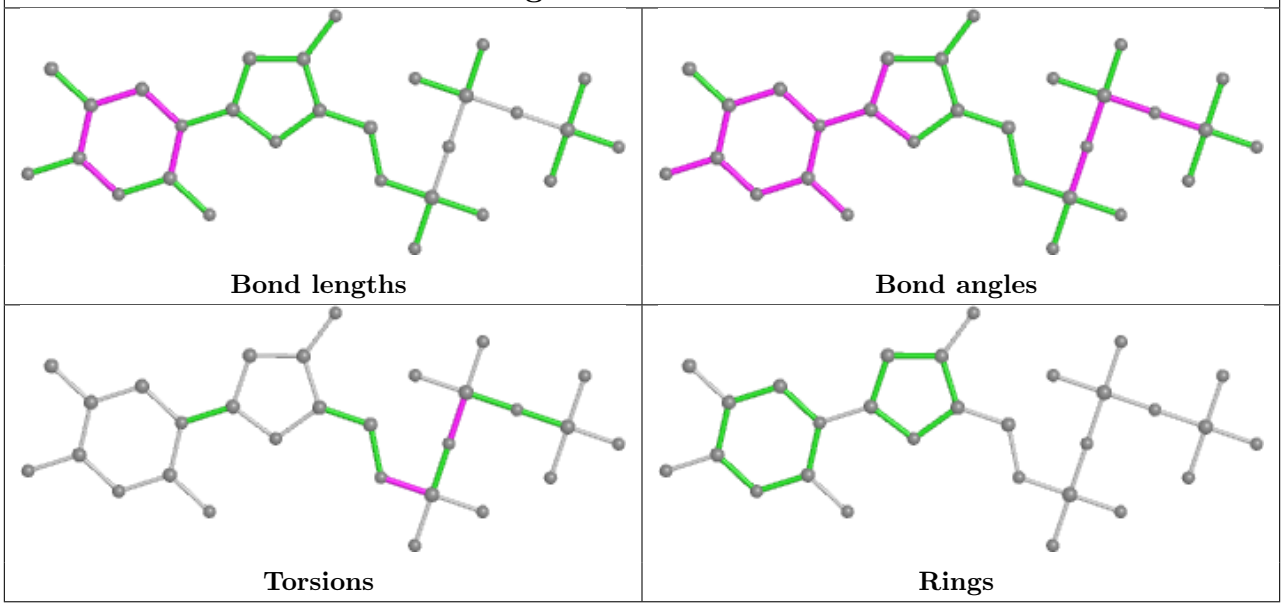
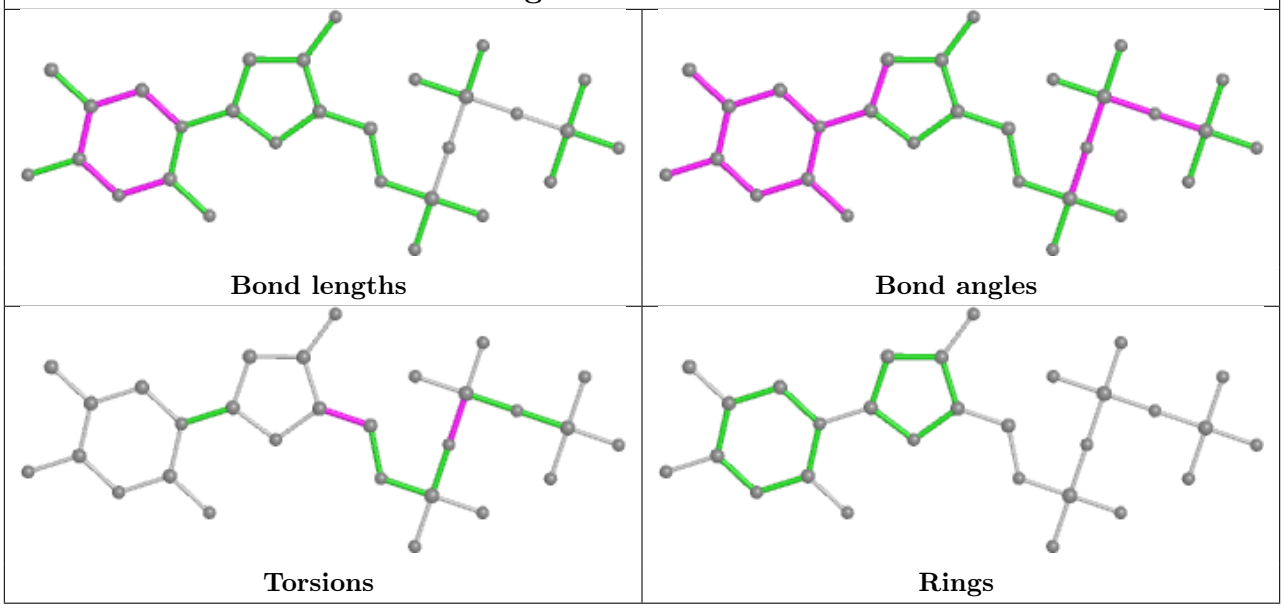


Rings

Ligand TTP C 805



Ligand TTP D 801



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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, 95th 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	694/704 (98%)	-0.37	1 (0%)	95	89	18, 42, 78, 117	0
1	B	697/704 (99%)	-0.41	2 (0%)	94	84	23, 40, 76, 123	0
1	C	672/704 (95%)	-0.24	4 (0%)	89	72	36, 60, 105, 136	0
1	D	644/704 (91%)	-0.11	6 (0%)	84	63	36, 74, 110, 135	0
2	E	105/109 (96%)	-0.32	0	100	100	38, 58, 85, 95	0
2	F	105/109 (96%)	-0.25	0	100	100	45, 67, 97, 106	0
2	G	105/109 (96%)	0.56	9 (8%)	10	3	63, 107, 131, 141	0
2	H	105/109 (96%)	0.91	16 (15%)	2	1	81, 122, 141, 151	0
3	I	21/21 (100%)	-0.29	0	100	100	26, 51, 68, 81	0
3	K	21/21 (100%)	-0.31	0	100	100	26, 60, 74, 88	0
3	M	21/21 (100%)	-0.23	0	100	100	38, 70, 82, 84	0
3	O	21/21 (100%)	-0.26	0	100	100	61, 78, 88, 90	0
4	J	25/25 (100%)	-0.26	0	100	100	22, 51, 66, 86	0
4	L	23/25 (92%)	-0.25	0	100	100	24, 45, 75, 79	0
4	N	24/25 (96%)	0.00	1 (4%)	36	14	38, 73, 94, 110	0
4	P	23/25 (92%)	-0.28	0	100	100	56, 75, 94, 100	0
5	U	4/4 (100%)	-0.41	0	100	100	54, 69, 95, 109	0
5	V	4/4 (100%)	-0.29	0	100	100	54, 73, 86, 95	0
6	W	3/3 (100%)	-0.04	0	100	100	74, 74, 81, 84	0
All	All	3317/3447 (96%)	-0.22	39 (1%)	79	54	18, 56, 113, 151	0

The worst 5 of 39 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	276	HIS	4.8

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Mol	Chain	Res	Type	RSRZ
2	H	106	ASN	3.7
2	H	42	LEU	3.6
1	C	153	GLU	3.4
2	G	10	ASP	3.4

6.2 Non-standard residues in protein, DNA, RNA chains (i)

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

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, 95th 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
8	MG	A	803	1/1	0.62	0.51	56,56,56,56	0
8	MG	C	804	1/1	0.79	0.55	61,61,61,61	0
8	MG	D	803	1/1	0.83	0.15	90,90,90,90	0
8	MG	C	803	1/1	0.84	0.33	79,79,79,79	0
8	MG	D	804	1/1	0.85	0.10	68,68,68,68	0
7	TTP	D	801	29/29	0.89	0.14	45,73,125,136	0
7	TTP	C	801	29/29	0.89	0.16	53,93,147,157	0
7	TTP	B	801	29/29	0.91	0.20	38,69,137,142	0
8	MG	B	803	1/1	0.92	0.37	64,64,64,64	0
7	TTP	A	801	29/29	0.93	0.20	44,60,137,146	0
8	MG	D	802	1/1	0.94	0.11	85,85,85,85	0
7	TTP	D	805	29/29	0.96	0.17	47,67,92,96	0
8	MG	B	804	1/1	0.97	0.34	38,38,38,38	0
8	MG	B	802	1/1	0.97	0.15	36,36,36,36	0
7	TTP	C	805	29/29	0.97	0.21	40,50,59,62	0
8	MG	A	804	1/1	0.98	0.26	33,33,33,33	0
7	TTP	B	805	29/29	0.98	0.18	20,28,39,45	0
8	MG	A	802	1/1	0.98	0.19	38,38,38,38	0
7	TTP	A	805	29/29	0.98	0.19	22,32,45,54	0

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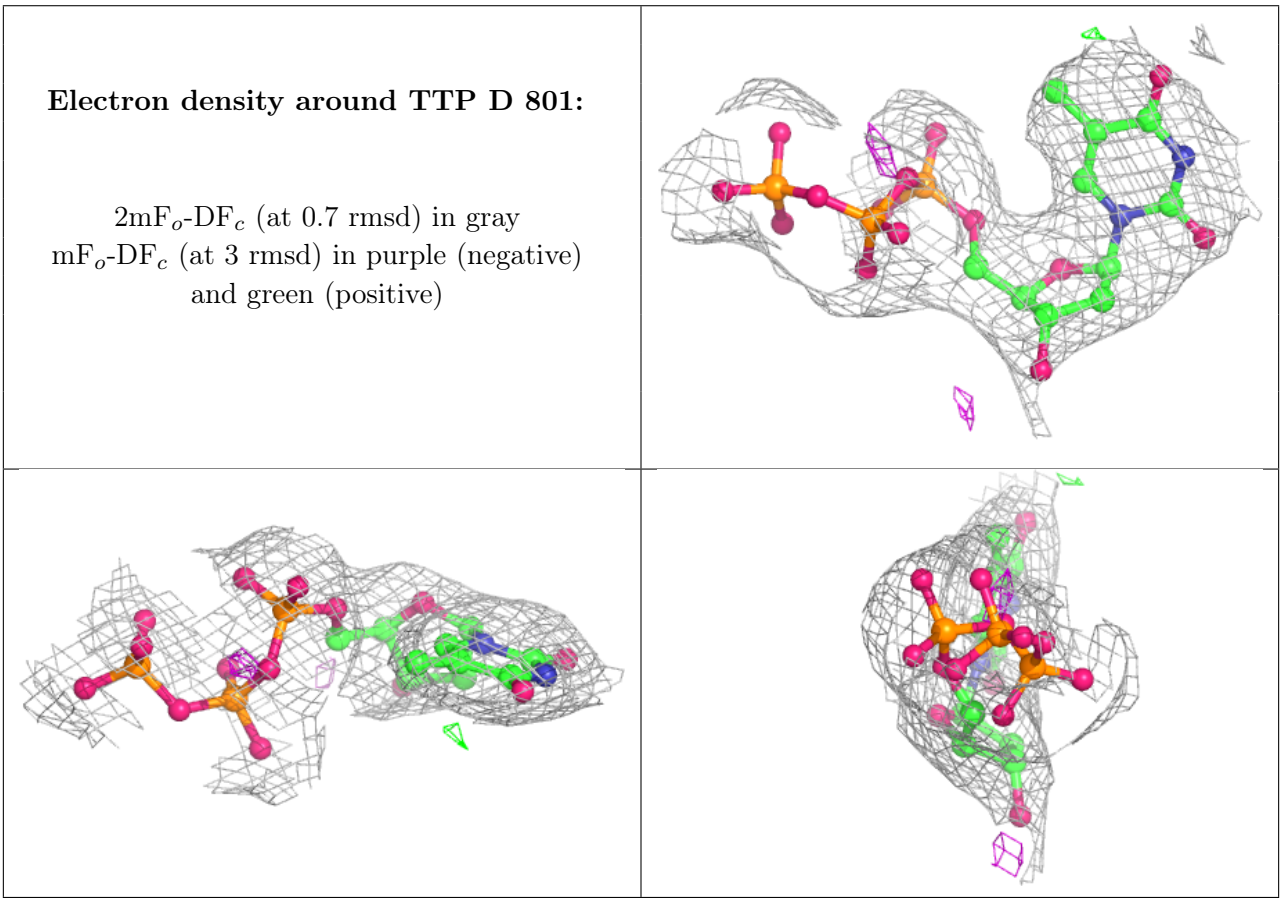
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
8	MG	C	802	1/1	0.98	0.21	43,43,43,43	0

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.

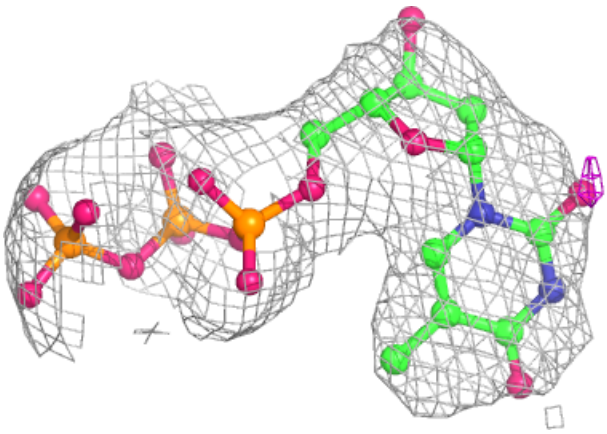
Electron density around TTP D 801:

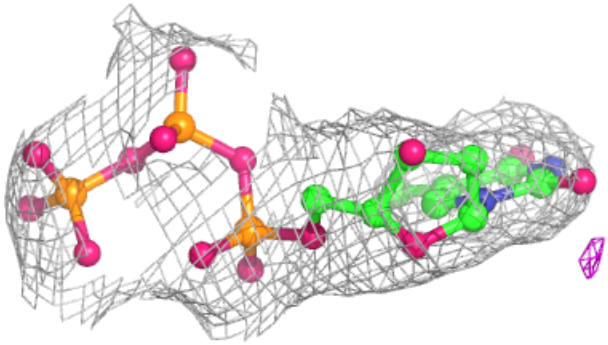
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)

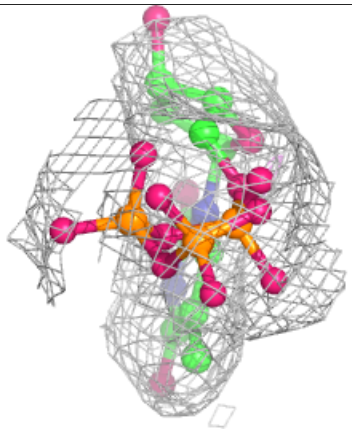


Electron density around TTP C 801:

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

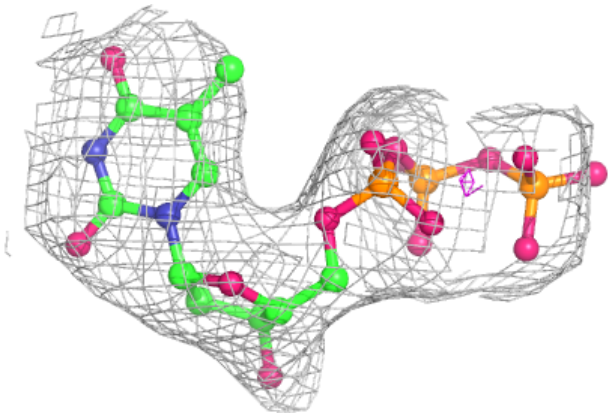


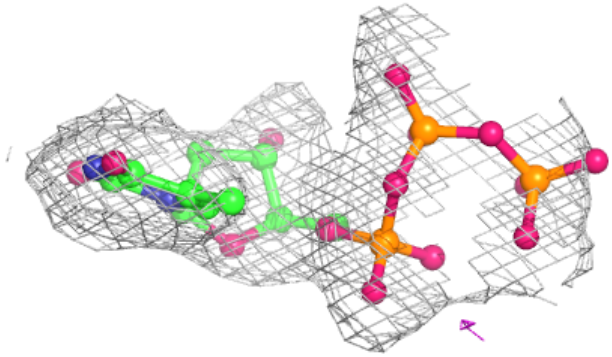


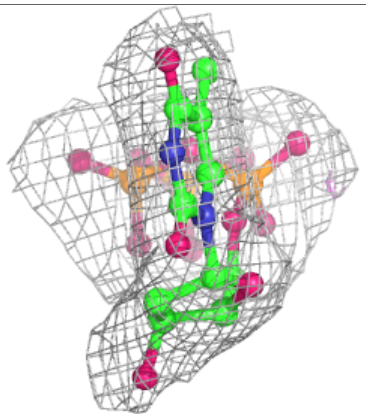


Electron density around TTP B 801:

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

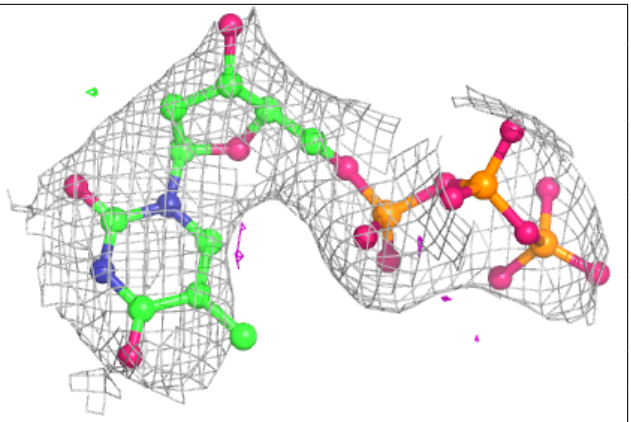


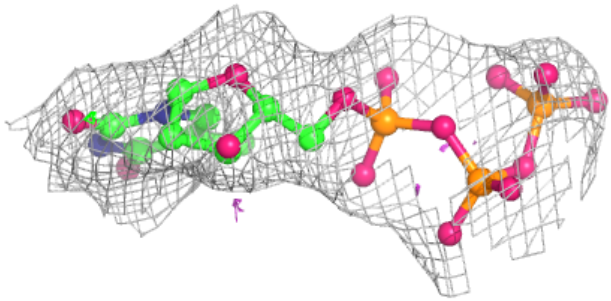


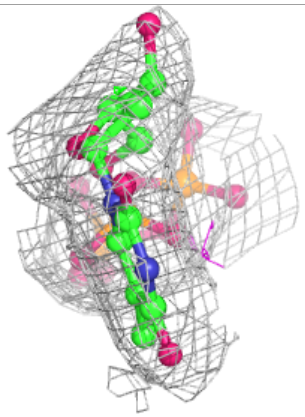


Electron density around TTP A 801:

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







Electron density around TTP D 805:

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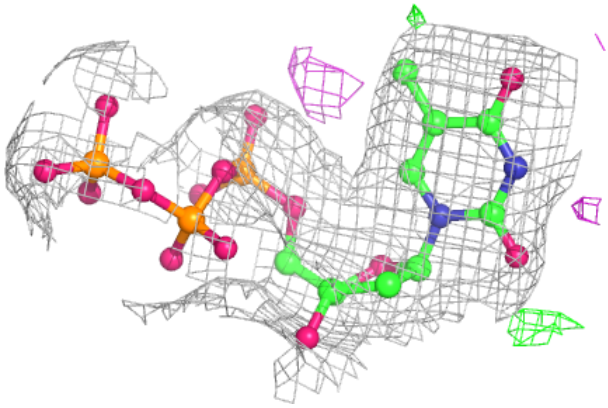
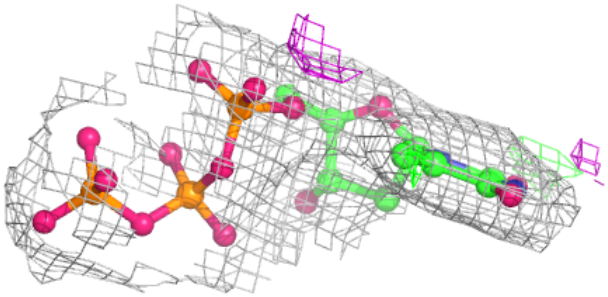
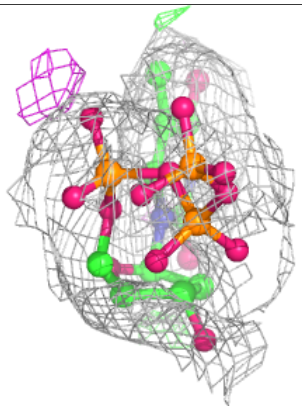
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

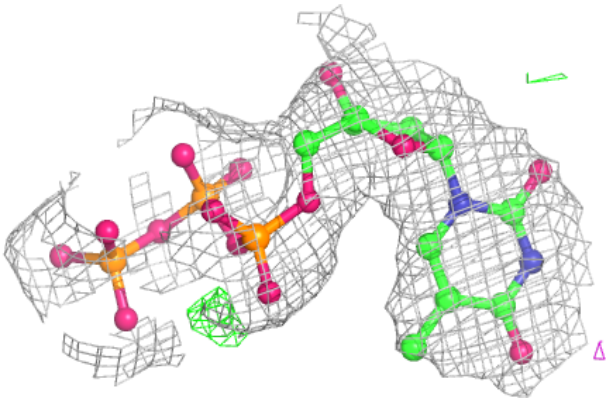


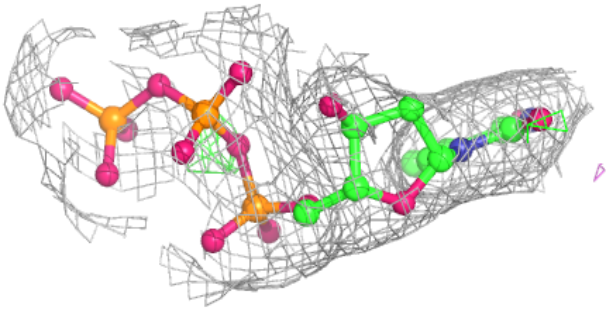


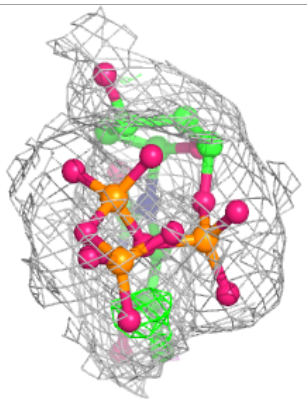


Electron density around TTP C 805:

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

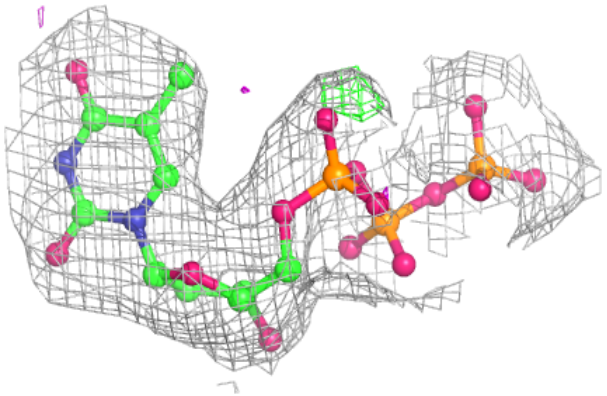


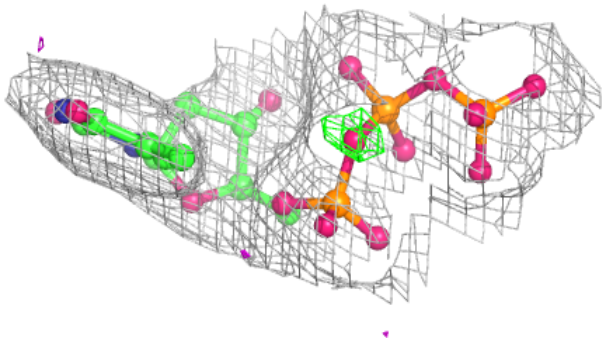


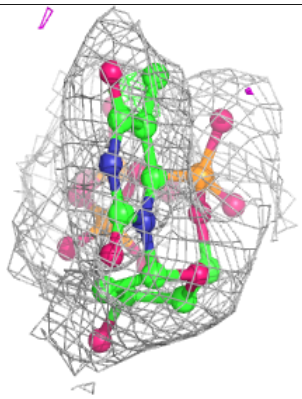


Electron density around TTP B 805:

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

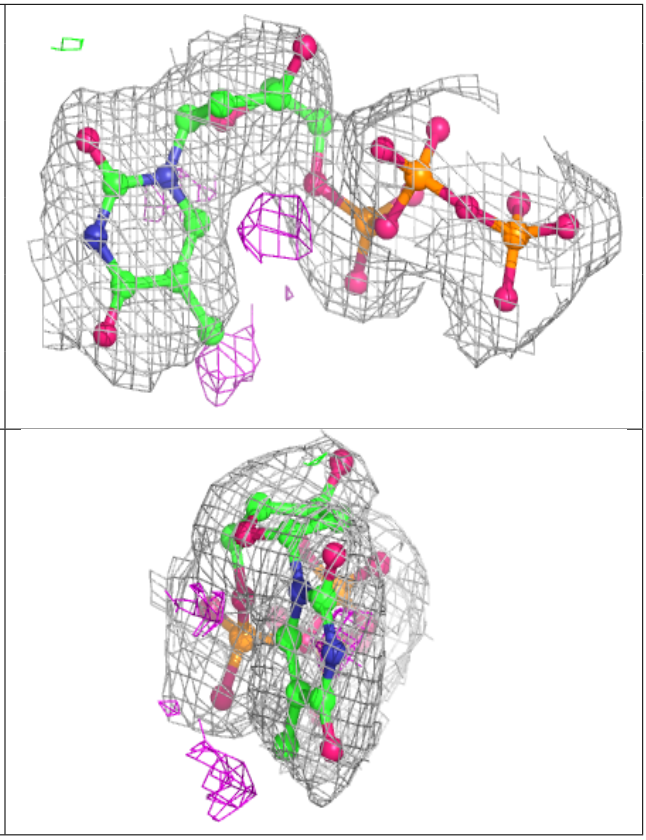






Electron density around TTP A 805:

$2mF_o$-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.