wwPDB X-ray Structure Validation Summary Report (i)

Mar 8, 2026 – 11:49 AM UTC

PDB ID	:	1QZF / pdb_00001qzf
Title	:	Crystal structure of DHFR-TS from Cryptosporidium hominis
Authors	:	O'Neil, R.H.; Lilien, R.H.; Donald, B.R.; Stroud, R.M.; Anderson, A.C.
Deposited on	:	2003-09-16
Resolution	:	2.80 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:

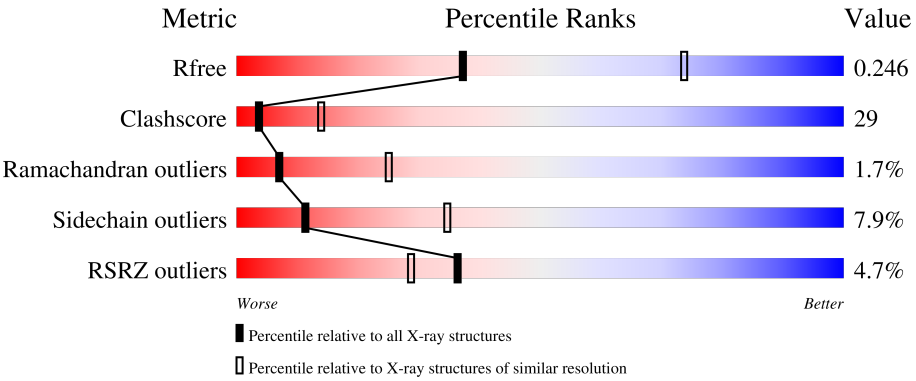
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

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 2.80 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}	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	521	6% 52% 40% 6%
1	B	521	5% 52% 40% 7%
1	C	521	4% 50% 41% 7%
1	D	521	5% 50% 42% 7%
1	E	521	4% 52% 39% 7%

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
2	UMP	A	603	-	-	X	-
2	UMP	B	607	-	-	X	-
2	UMP	C	611	-	-	X	-
3	CB3	A	604	X	-	-	-
3	CB3	B	608	X	-	-	-
3	CB3	C	612	X	-	-	-
3	CB3	D	616	X	-	-	-
3	CB3	E	620	X	-	-	-
4	FOL	A	605	-	-	X	-
4	FOL	D	617	-	-	X	-
4	FOL	E	621	-	-	X	-

2 Entry composition

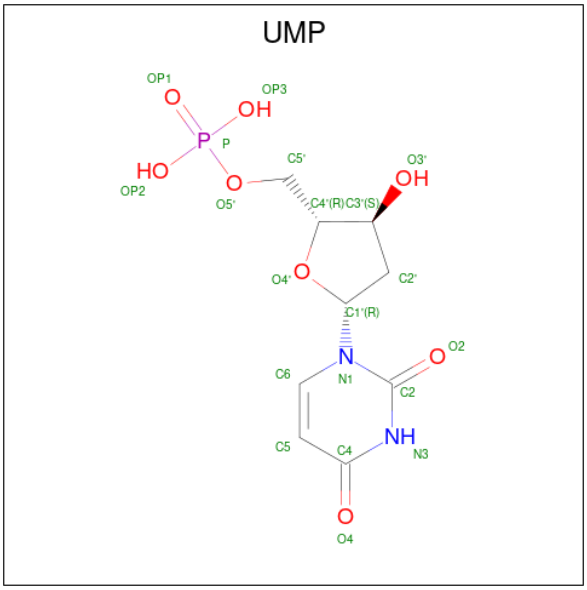
There are 6 unique types of molecules in this entry. The entry contains 22196 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 bifunctional dihydrofolate reductase-thymidylate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	519	Total	C	N	O	S	0	0	0
			4223	2694	713	793	23			
1	B	519	Total	C	N	O	S	0	0	0
			4223	2694	713	793	23			
1	C	519	Total	C	N	O	S	0	0	0
			4223	2694	713	793	23			
1	D	519	Total	C	N	O	S	0	0	0
			4223	2694	713	793	23			
1	E	519	Total	C	N	O	S	0	0	0
			4223	2694	713	793	23			

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



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

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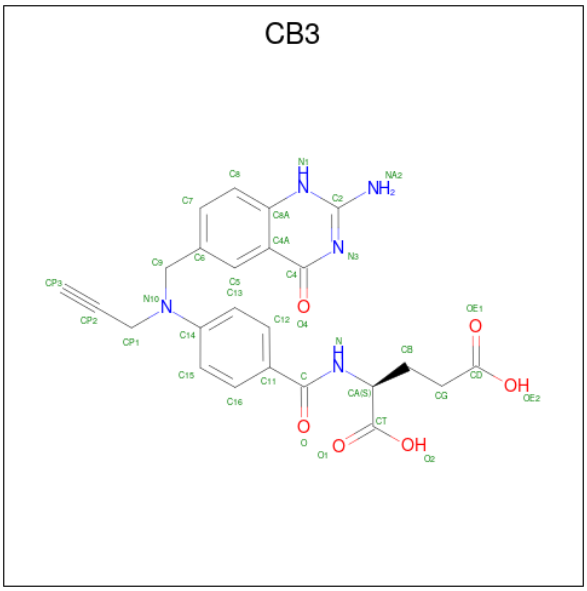
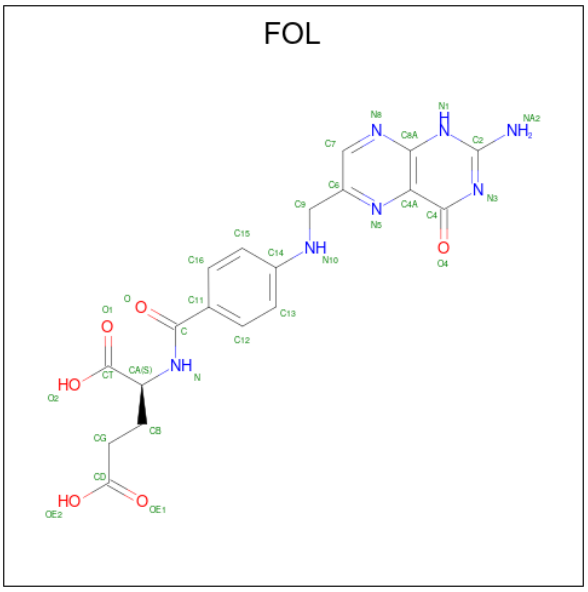
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	C	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	D	1	Total	C	N	O	P	0	0
			20	9	2	8	1		
2	E	1	Total	C	N	O	P	0	0
			20	9	2	8	1		

- Molecule 3 is 10-PROPARGYL-5,8-DIDEAZAFOLIC ACID (CCD ID: CB3) (formula: $C_{24}H_{23}N_5O_6$).



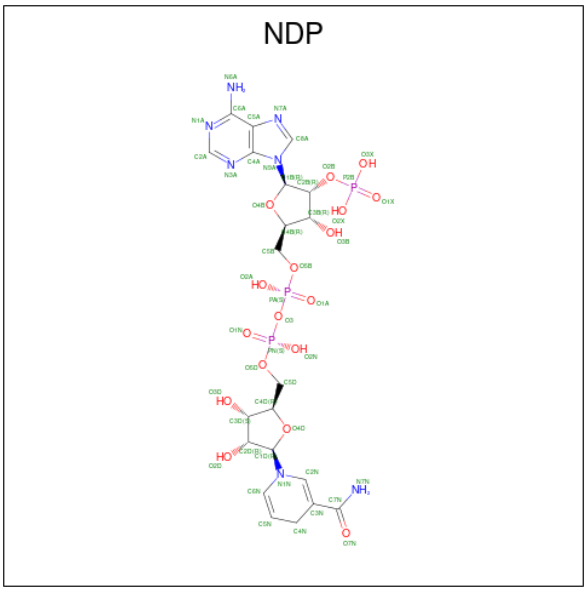
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			35	24	5	6		
3	B	1	Total	C	N	O	0	0
			35	24	5	6		
3	C	1	Total	C	N	O	0	0
			35	24	5	6		
3	D	1	Total	C	N	O	0	0
			35	24	5	6		
3	E	1	Total	C	N	O	0	0
			35	24	5	6		

- Molecule 4 is FOLIC ACID (CCD ID: FOL) (formula: $C_{19}H_{19}N_7O_6$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O 32 19 7 6	0	0
4	B	1	Total C N O 32 19 7 6	0	0
4	C	1	Total C N O 32 19 7 6	0	0
4	D	1	Total C N O 32 19 7 6	0	0
4	E	1	Total C N O 32 19 7 6	0	0

- Molecule 5 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (CCD ID: NDP) (formula: $C_{21}H_{30}N_7O_{17}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
5	B	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
5	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
5	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
5	E	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 6 is water.

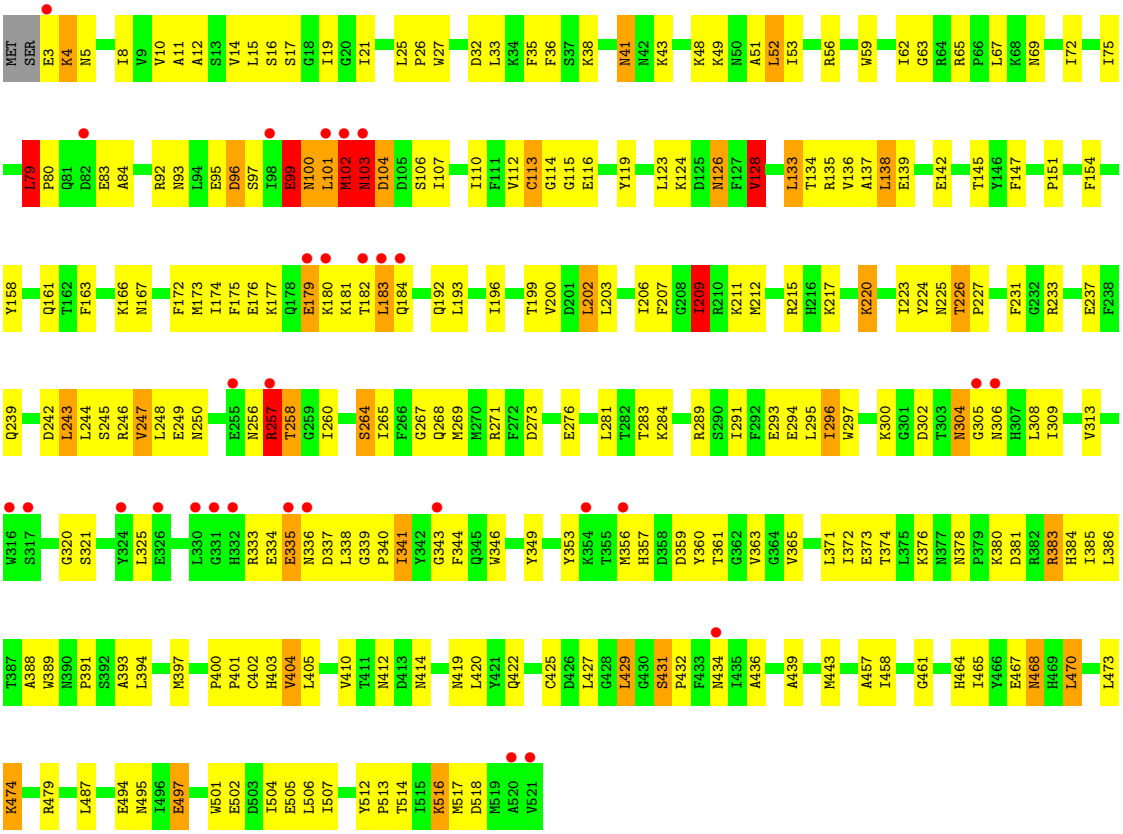
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	101	Total	O	0	0
			101	101		
6	B	116	Total	O	0	0
			116	116		
6	C	83	Total	O	0	0
			83	83		
6	D	71	Total	O	0	0
			71	71		
6	E	35	Total	O	0	0
			35	35		

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.

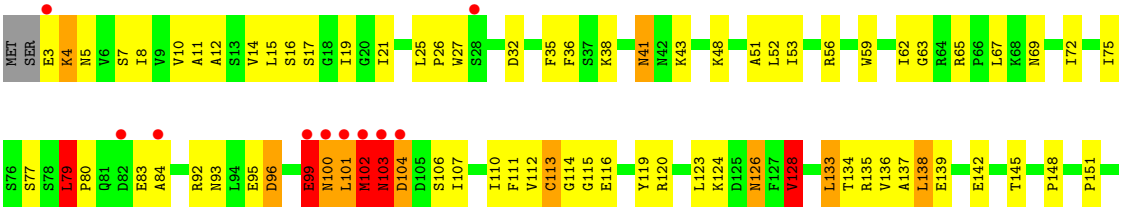
• Molecule 1: bifunctional dihydrofolate reductase-thymidylate synthase

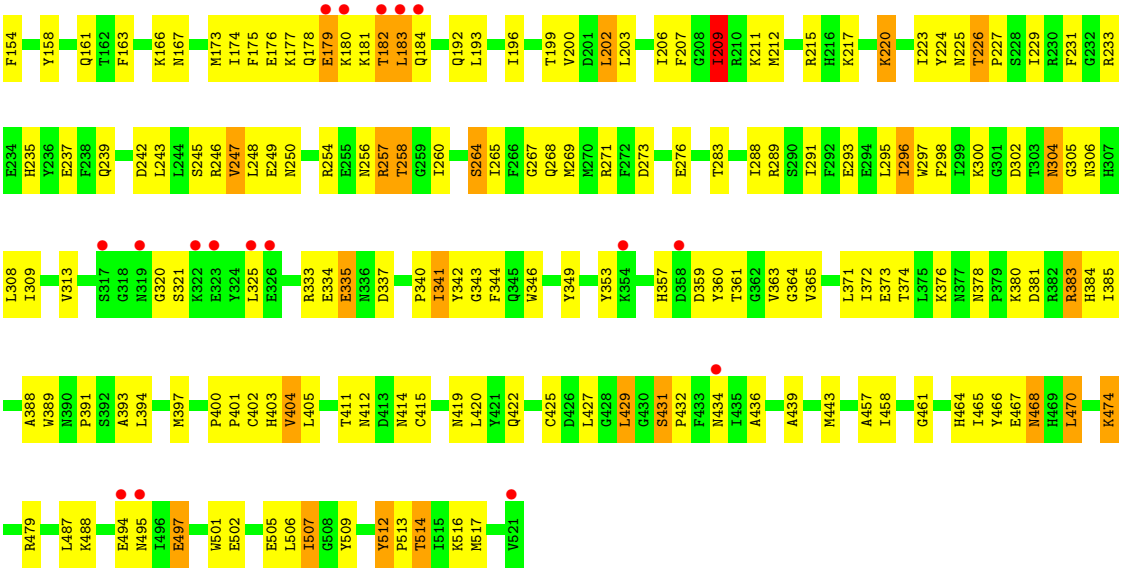
Chain A:



• Molecule 1: bifunctional dihydrofolate reductase-thymidylate synthase

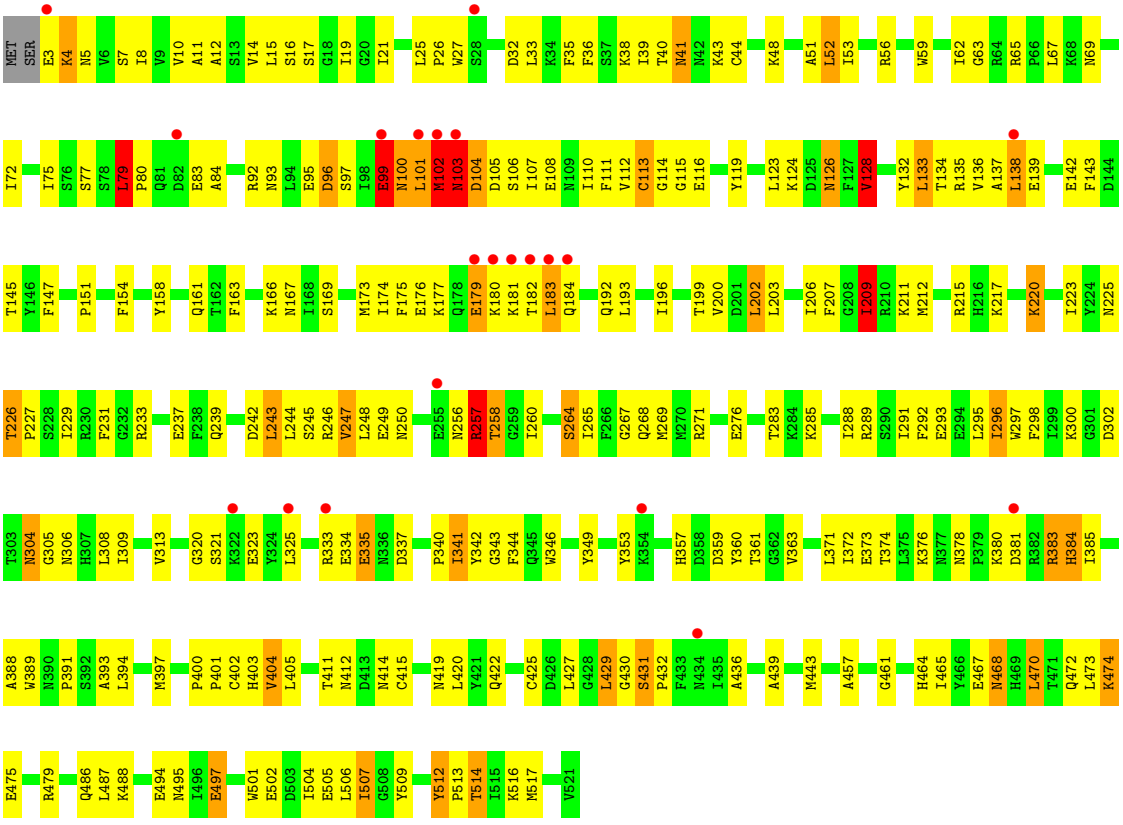
Chain B:





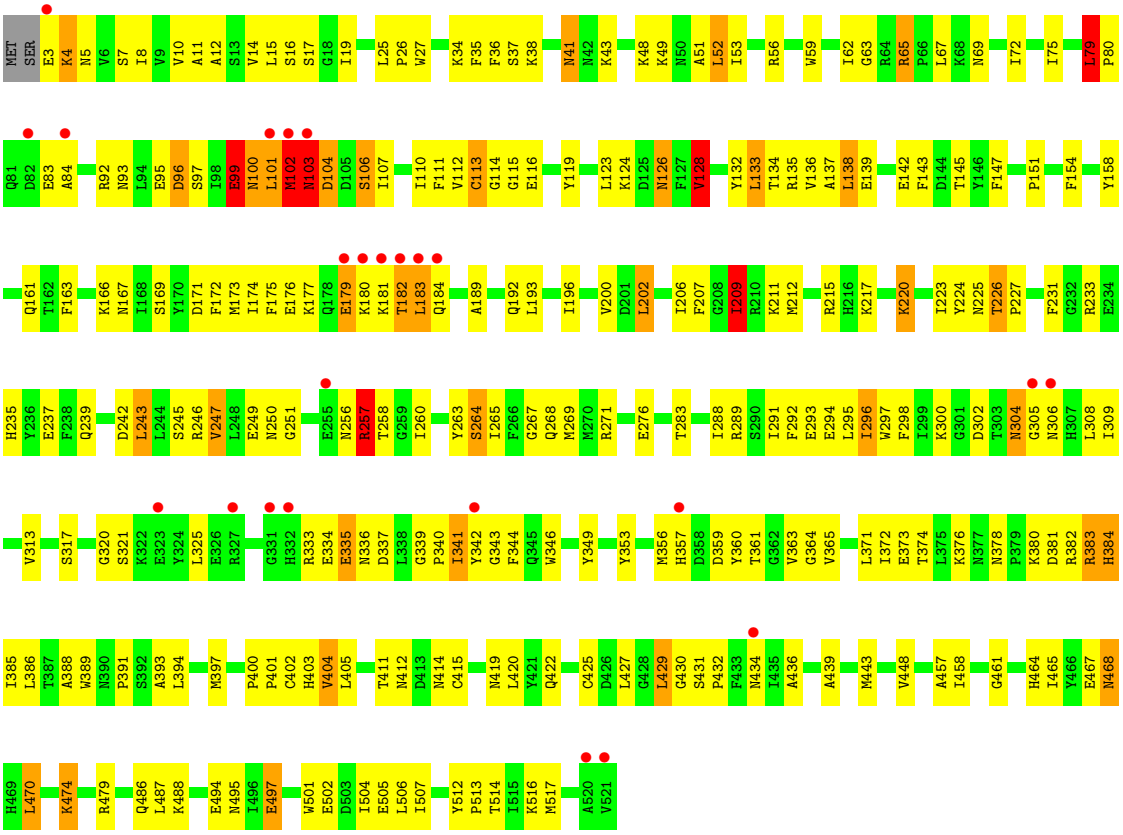
• Molecule 1: bifunctional dihydrofolate reductase-thymidylate synthase

Chain C:



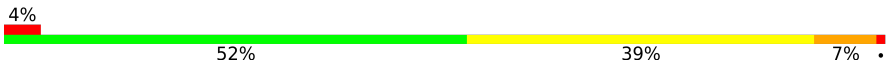
• Molecule 1: bifunctional dihydrofolate reductase-thymidylate synthase

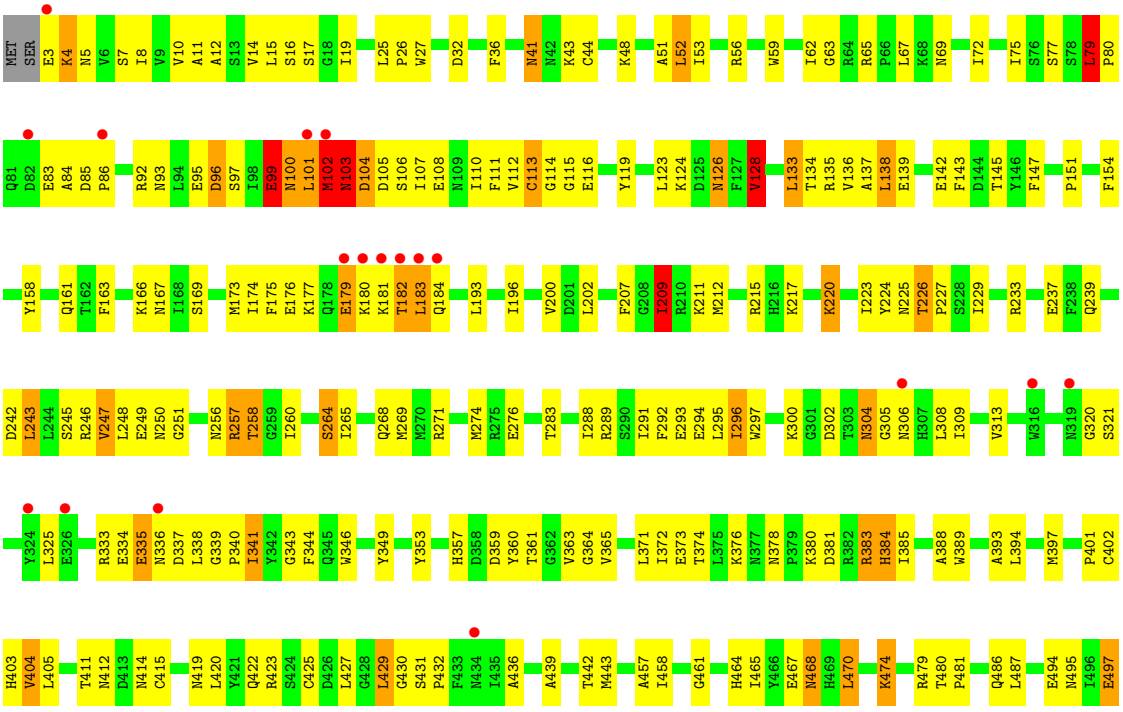
Chain D:

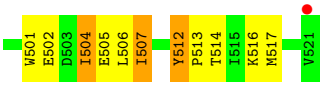


• Molecule 1: bifunctional dihydrofolate reductase-thymidylate synthase

Chain E:






W501
E502
D503
I504
E505
L506
I507
Y512
P513
T514
I515
K516
M517
V521

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	214.90Å 116.30Å 219.70Å 90.00° 95.23° 90.00°	Depositor
Resolution (Å)	29.80 – 2.80 29.80 – 2.80	Depositor EDS
% Data completeness (in resolution range)	83.6 (29.80-2.80) 83.6 (29.80-2.80)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.39 (at 2.76Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.225 , 0.245 0.227 , 0.246	Depositor DCC
R_{free} test set	5618 reflections (4.74%)	wwPDB-VP
Wilson B-factor (Å^2)	36.5	Xtriage
Anisotropy	0.527	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 46.8	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	0.90	EDS
Total number of atoms	22196	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.69% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: UMP, NDP, CB3, FOL

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	0.53	1/4320 (0.0%)	1.04	28/5838 (0.5%)
1	B	0.53	1/4320 (0.0%)	1.04	28/5838 (0.5%)
1	C	0.51	0/4320	1.05	30/5838 (0.5%)
1	D	0.51	1/4320 (0.0%)	1.04	30/5838 (0.5%)
1	E	0.50	1/4320 (0.0%)	1.05	31/5838 (0.5%)
All	All	0.52	4/21600 (0.0%)	1.05	147/29190 (0.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	102	MET	SD-CE	6.45	1.95	1.79
1	E	102	MET	SD-CE	5.54	1.93	1.79
1	B	102	MET	SD-CE	5.29	1.92	1.79
1	A	102	MET	SD-CE	5.26	1.92	1.79

The worst 5 of 147 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	404	VAL	N-CA-C	11.26	121.23	110.30
1	E	404	VAL	N-CA-C	11.05	121.02	110.30
1	B	404	VAL	N-CA-C	10.89	120.86	110.30
1	D	404	VAL	N-CA-C	10.82	120.79	110.30
1	A	404	VAL	N-CA-C	10.58	120.56	110.30

There are no chirality outliers.

There are no planarity outliers.

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	4223	0	4159	257	0
1	B	4223	0	4159	245	0
1	C	4223	0	4159	255	0
1	D	4223	0	4159	253	0
1	E	4223	0	4159	237	0
2	A	20	0	11	7	0
2	B	20	0	11	8	0
2	C	20	0	11	7	0
2	D	20	0	11	3	0
2	E	20	0	11	6	0
3	A	35	0	21	3	0
3	B	35	0	21	3	0
3	C	35	0	21	3	0
3	D	35	0	21	3	0
3	E	35	0	21	4	0
4	A	32	0	17	9	0
4	B	32	0	17	8	0
4	C	32	0	17	8	0
4	D	32	0	17	9	0
4	E	32	0	17	10	0
5	A	48	0	26	10	0
5	B	48	0	26	7	0
5	C	48	0	26	9	0
5	D	48	0	26	10	0
5	E	48	0	26	10	0
6	A	101	0	0	7	0
6	B	116	0	0	3	0
6	C	83	0	0	1	0
6	D	71	0	0	6	0
6	E	35	0	0	2	0
All	All	22196	0	21170	1244	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 29.

The worst 5 of 1244 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:269:MET:HE2	1:B:269:MET:HE2	1.09	1.07
1:C:269:MET:HE2	1:D:269:MET:HE2	1.11	1.04
1:A:434:ASN:HD21	2:A:603:UMP:HN3	0.98	0.97
4:D:617:FOL:C7	5:D:618:NDP:H42N	1.94	0.96
4:E:621:FOL:N5	4:E:621:FOL:H13	1.81	0.96

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	517/521 (99%)	468 (90%)	40 (8%)	9 (2%)	7	25
1	B	517/521 (99%)	466 (90%)	43 (8%)	8 (2%)	8	28
1	C	517/521 (99%)	466 (90%)	42 (8%)	9 (2%)	7	25
1	D	517/521 (99%)	466 (90%)	42 (8%)	9 (2%)	7	25
1	E	517/521 (99%)	468 (90%)	40 (8%)	9 (2%)	7	25
All	All	2585/2605 (99%)	2334 (90%)	207 (8%)	44 (2%)	7	25

5 of 44 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	84	ALA
1	A	102	MET
1	A	103	ASN
1	B	84	ALA
1	B	102	MET

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	468/470 (100%)	430 (92%)	38 (8%)	11	33
1	B	468/470 (100%)	432 (92%)	36 (8%)	12	36
1	C	468/470 (100%)	430 (92%)	38 (8%)	11	33
1	D	468/470 (100%)	432 (92%)	36 (8%)	12	36
1	E	468/470 (100%)	432 (92%)	36 (8%)	12	36
All	All	2340/2350 (100%)	2156 (92%)	184 (8%)	11	35

5 of 184 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	96	ASP
1	D	474	LYS
1	D	104	ASP
1	D	209	ILE
1	E	79	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 120 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	216	HIS
1	E	319	ASN
1	D	5	ASN
1	E	306	ASN
1	E	476	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

20 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	CB3	C	612	-	37,37,37	2.32	8 (21%)	50,51,51	1.05	3 (6%)
3	CB3	E	620	-	37,37,37	2.39	10 (27%)	50,51,51	1.03	3 (6%)
4	FOL	A	605	-	34,34,34	2.02	9 (26%)	43,47,47	1.87	10 (23%)
3	CB3	B	608	-	37,37,37	2.35	8 (21%)	50,51,51	1.04	2 (4%)
3	CB3	A	604	-	37,37,37	2.43	9 (24%)	50,51,51	0.98	1 (2%)
5	NDP	B	610	-	51,52,52	1.81	11 (21%)	71,80,80	1.93	22 (30%)
5	NDP	C	614	-	51,52,52	1.73	11 (21%)	71,80,80	1.88	21 (29%)
5	NDP	D	618	-	51,52,52	1.73	11 (21%)	71,80,80	1.90	22 (30%)
4	FOL	D	617	-	34,34,34	2.01	9 (26%)	43,47,47	1.89	10 (23%)
4	FOL	B	609	-	34,34,34	2.01	9 (26%)	43,47,47	1.86	10 (23%)
2	UMP	A	603	-	21,21,21	3.05	7 (33%)	30,31,31	2.29	9 (30%)
5	NDP	A	606	-	51,52,52	1.88	12 (23%)	71,80,80	1.92	23 (32%)
5	NDP	E	622	-	51,52,52	1.80	12 (23%)	71,80,80	1.95	24 (33%)
2	UMP	D	615	-	21,21,21	3.11	7 (33%)	30,31,31	2.29	9 (30%)
2	UMP	E	619	-	21,21,21	3.03	6 (28%)	30,31,31	2.33	9 (30%)
4	FOL	E	621	-	34,34,34	2.02	9 (26%)	43,47,47	1.85	10 (23%)
3	CB3	D	616	-	37,37,37	2.37	9 (24%)	50,51,51	1.03	3 (6%)
2	UMP	C	611	-	21,21,21	2.99	5 (23%)	30,31,31	2.30	9 (30%)
2	UMP	B	607	-	21,21,21	2.99	5 (23%)	30,31,31	2.33	9 (30%)
4	FOL	C	613	-	34,34,34	2.01	9 (26%)	43,47,47	1.86	10 (23%)

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	CB3	C	612	-	1/1/5/6	7/27/28/28	0/3/3/3
3	CB3	E	620	-	1/1/5/6	7/27/28/28	0/3/3/3
4	FOL	A	605	-	-	6/22/22/22	0/3/3/3
3	CB3	B	608	-	1/1/5/6	7/27/28/28	0/3/3/3
3	CB3	A	604	-	1/1/5/6	7/27/28/28	0/3/3/3
5	NDP	B	610	-	-	6/34/77/77	0/5/5/5
5	NDP	C	614	-	-	6/34/77/77	0/5/5/5
5	NDP	D	618	-	-	6/34/77/77	0/5/5/5
4	FOL	D	617	-	-	6/22/22/22	0/3/3/3
4	FOL	B	609	-	-	6/22/22/22	0/3/3/3
2	UMP	A	603	-	-	2/10/22/22	0/2/2/2
5	NDP	A	606	-	-	6/34/77/77	0/5/5/5
5	NDP	E	622	-	-	5/34/77/77	0/5/5/5
2	UMP	D	615	-	-	3/10/22/22	0/2/2/2
2	UMP	E	619	-	-	3/10/22/22	0/2/2/2
4	FOL	E	621	-	-	6/22/22/22	0/3/3/3
3	CB3	D	616	-	1/1/5/6	7/27/28/28	0/3/3/3
2	UMP	C	611	-	-	2/10/22/22	0/2/2/2
2	UMP	B	607	-	-	3/10/22/22	0/2/2/2
4	FOL	C	613	-	-	6/22/22/22	0/3/3/3

The worst 5 of 176 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	615	UMP	C6-C5	8.66	1.55	1.35
2	E	619	UMP	C6-C5	8.49	1.54	1.35
2	A	603	UMP	C6-C5	8.46	1.54	1.35
2	C	611	UMP	C6-C5	8.46	1.54	1.35
2	B	607	UMP	C6-C5	8.44	1.54	1.35

The worst 5 of 219 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	D	617	FOL	C6-C9-N10	7.46	129.50	113.13
4	B	609	FOL	C6-C9-N10	7.33	129.22	113.13

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	C	613	FOL	C6-C9-N10	7.32	129.21	113.13
4	A	605	FOL	C6-C9-N10	7.31	129.19	113.13
4	E	621	FOL	C6-C9-N10	7.24	129.02	113.13

All (5) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	604	CB3	CA
3	B	608	CB3	CA
3	C	612	CB3	CA
3	D	616	CB3	CA
3	E	620	CB3	CA

5 of 107 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	605	FOL	C6-C9-N10-C14
4	B	609	FOL	C6-C9-N10-C14
4	C	613	FOL	C6-C9-N10-C14
4	D	617	FOL	C6-C9-N10-C14
4	E	621	FOL	C6-C9-N10-C14

There are no ring outliers.

20 monomers are involved in 119 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	612	CB3	3	0
3	E	620	CB3	4	0
4	A	605	FOL	9	0
3	B	608	CB3	3	0
3	A	604	CB3	3	0
5	B	610	NDP	7	0
5	C	614	NDP	9	0
5	D	618	NDP	10	0
4	D	617	FOL	9	0
4	B	609	FOL	8	0
2	A	603	UMP	7	0
5	A	606	NDP	10	0
5	E	622	NDP	10	0
2	D	615	UMP	3	0
2	E	619	UMP	6	0
4	E	621	FOL	10	0

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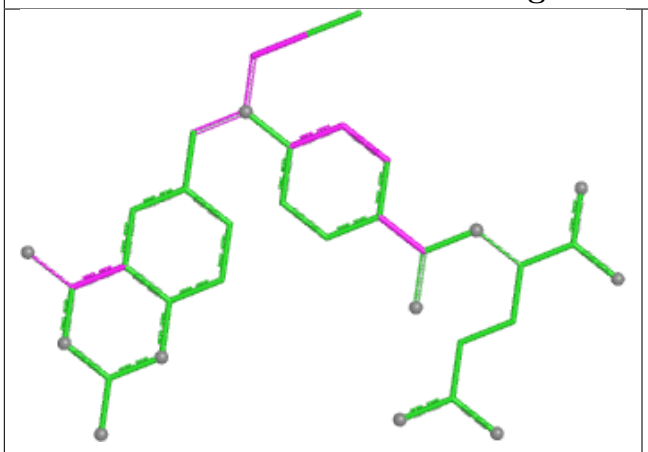
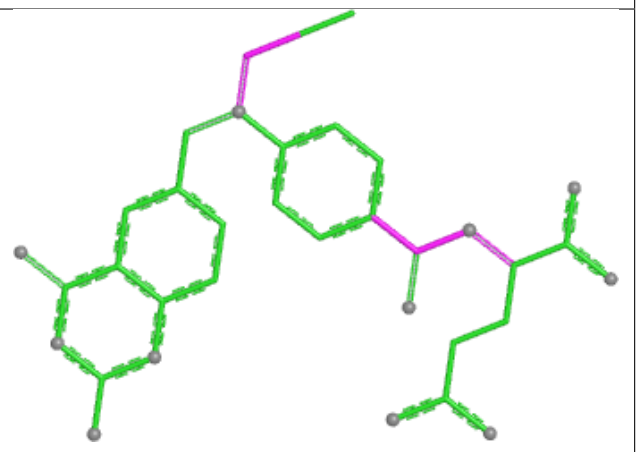
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	616	CB3	3	0
2	C	611	UMP	7	0
2	B	607	UMP	8	0
4	C	613	FOL	8	0

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.

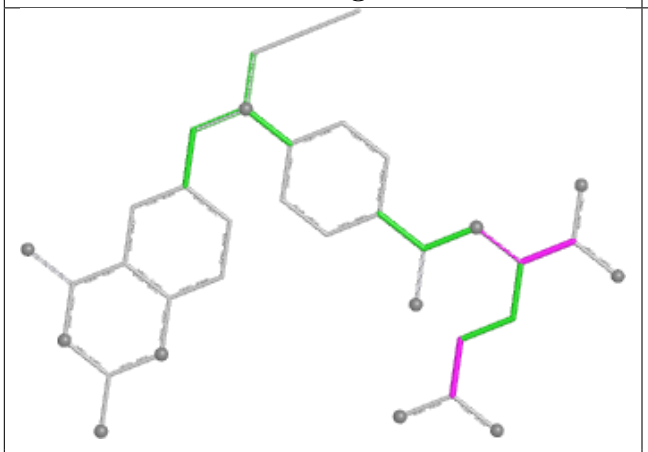
Ligand CB3 C 612



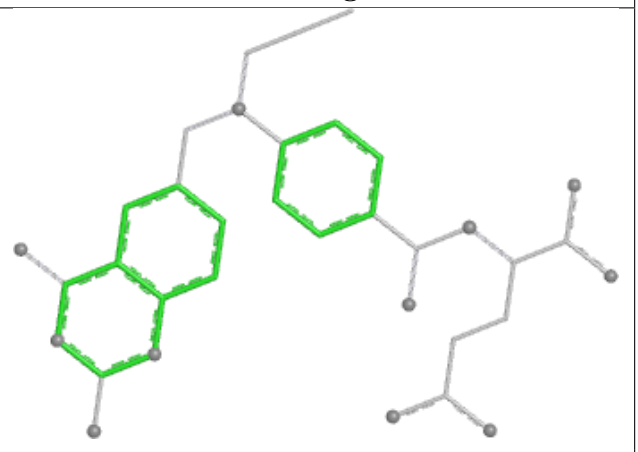
Bond lengths



Bond angles

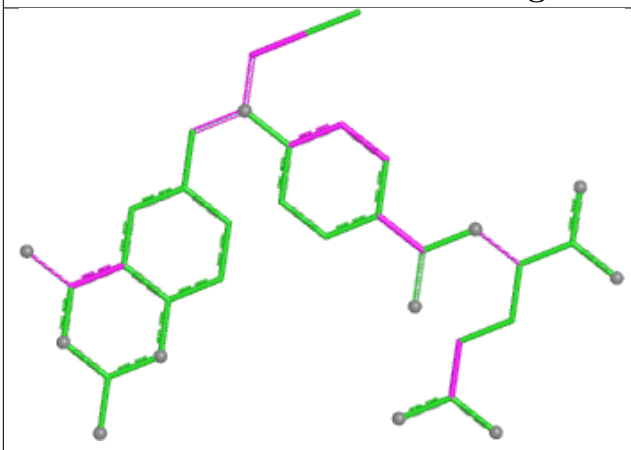


Torsions

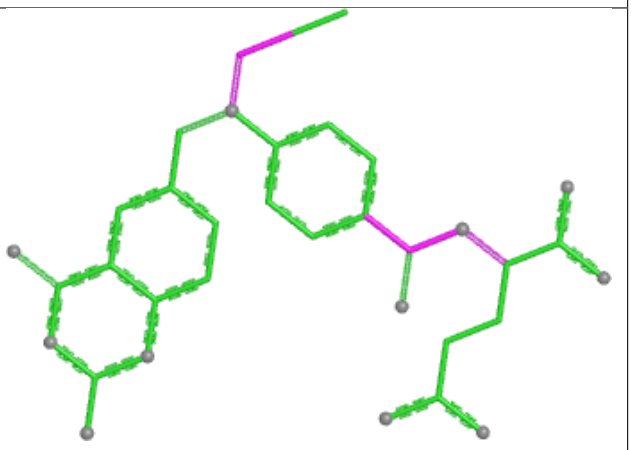


Rings

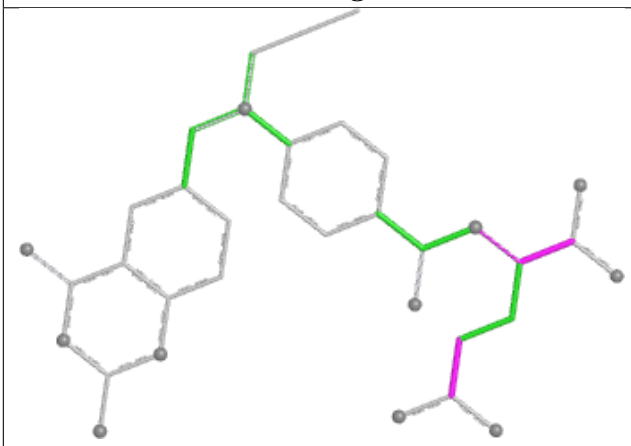
Ligand CB3 E 620



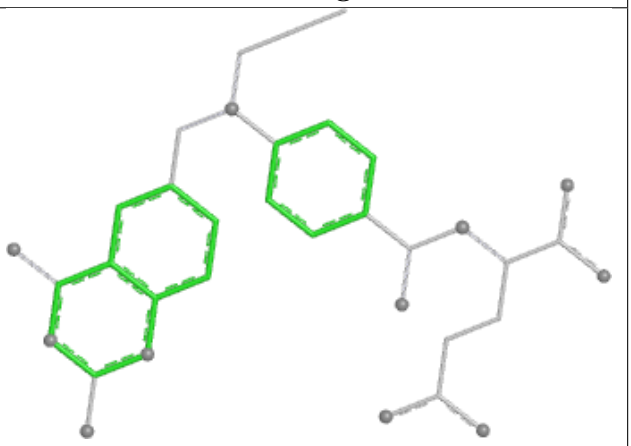
Bond lengths



Bond angles

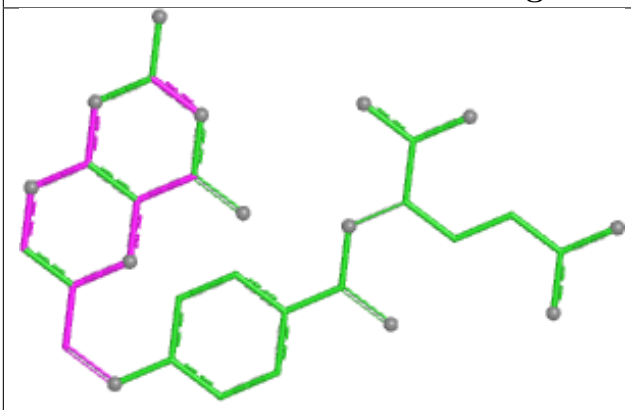


Torsions

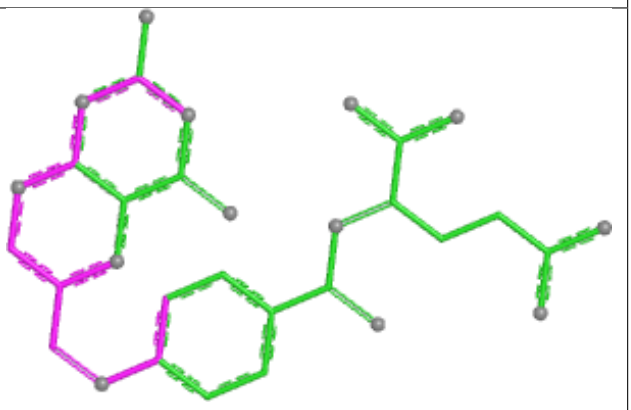


Rings

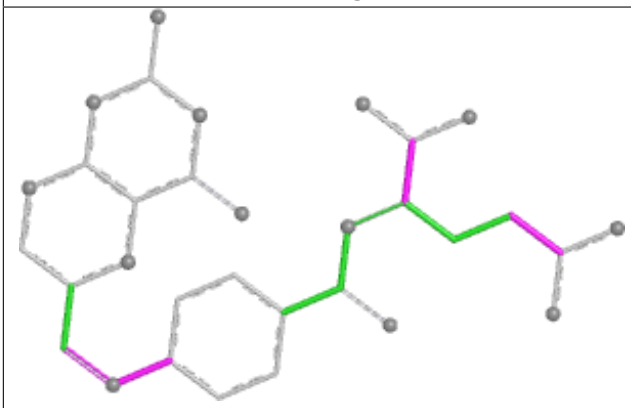
Ligand FOL A 605



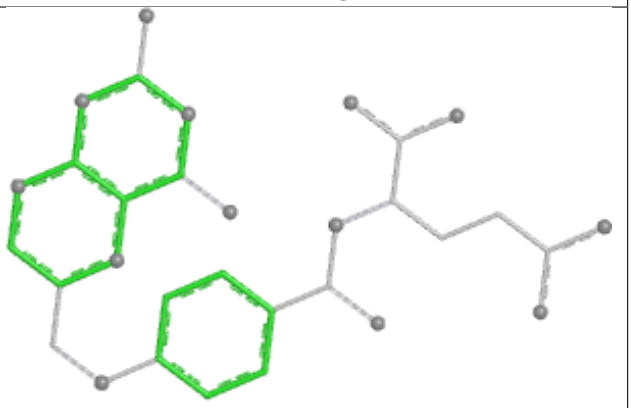
Bond lengths



Bond angles

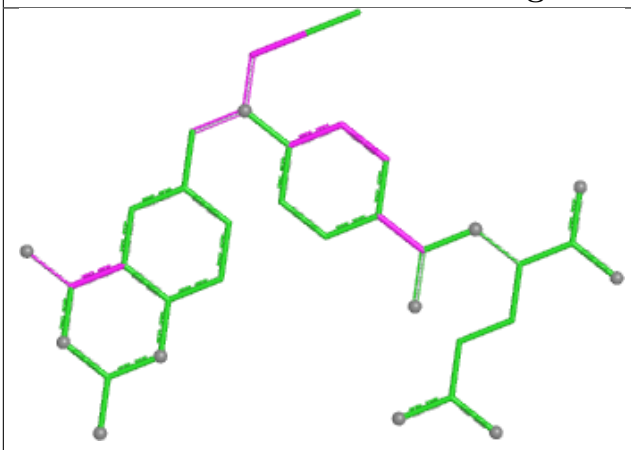


Torsions

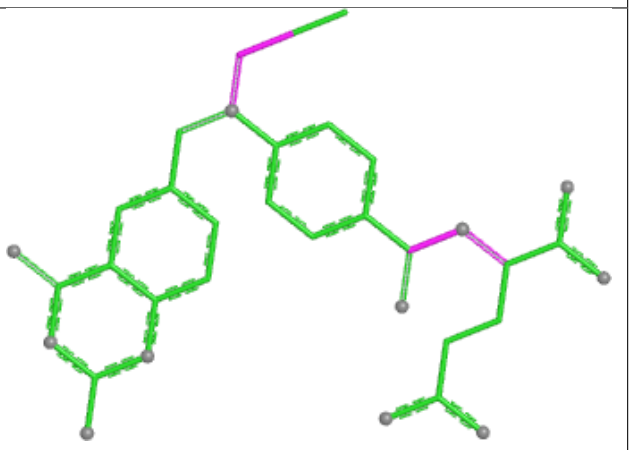


Rings

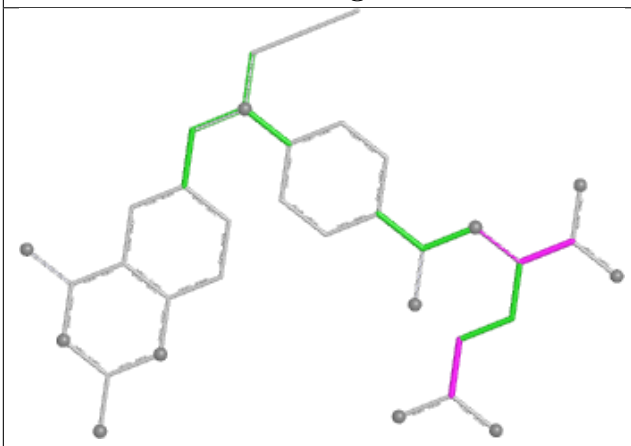
Ligand CB3 B 608



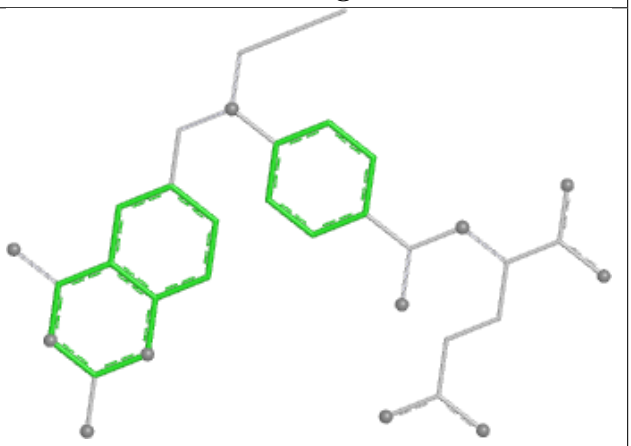
Bond lengths



Bond angles

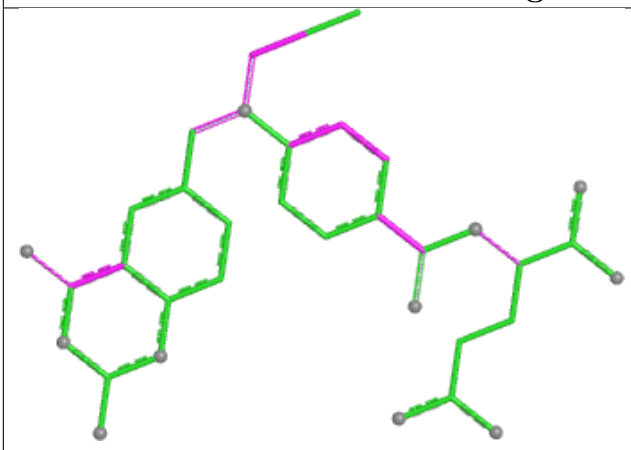


Torsions

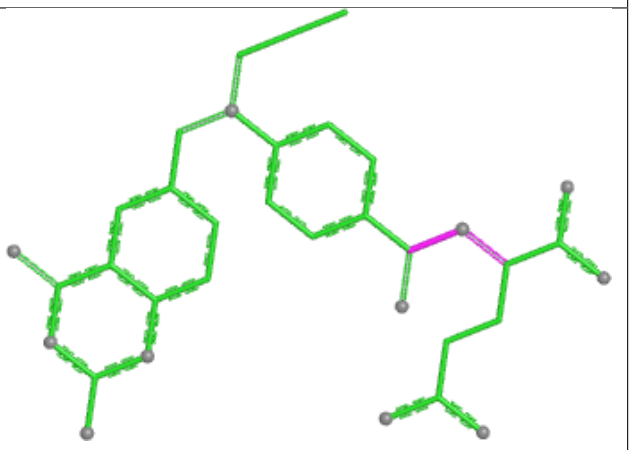


Rings

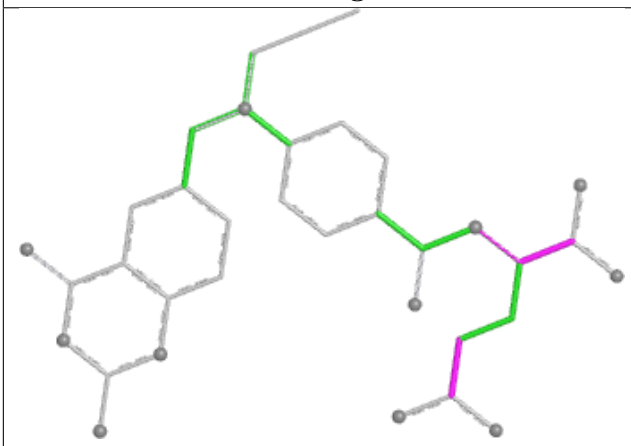
Ligand CB3 A 604



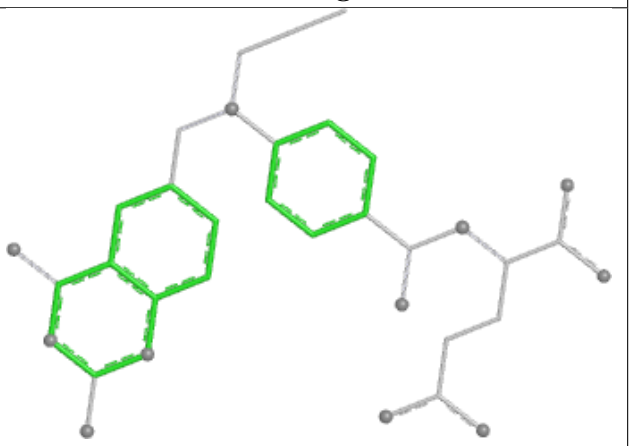
Bond lengths



Bond angles

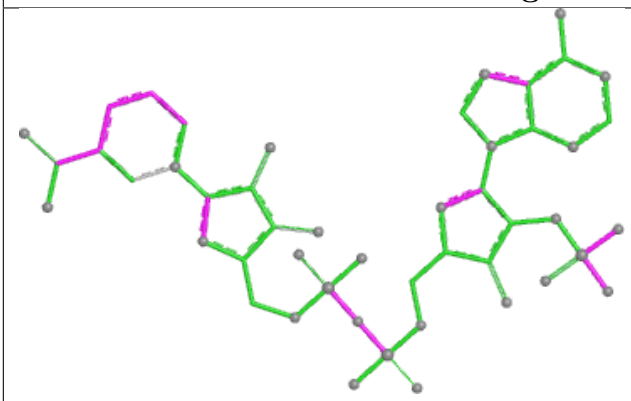


Torsions



Rings

Ligand NDP B 610



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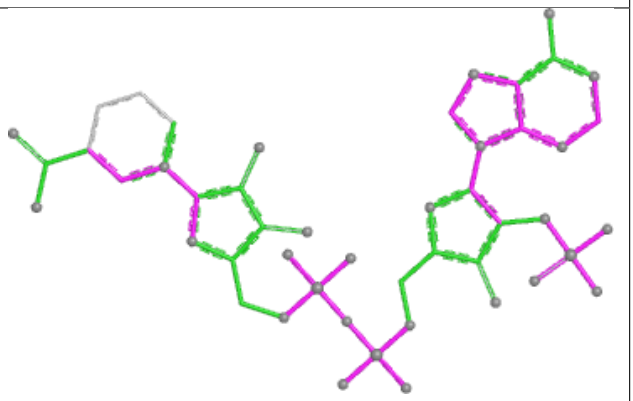
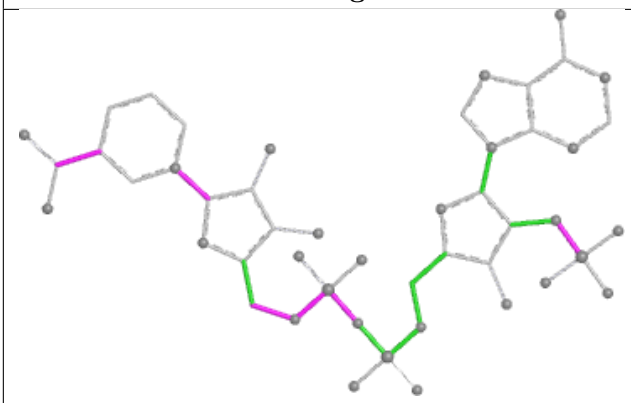
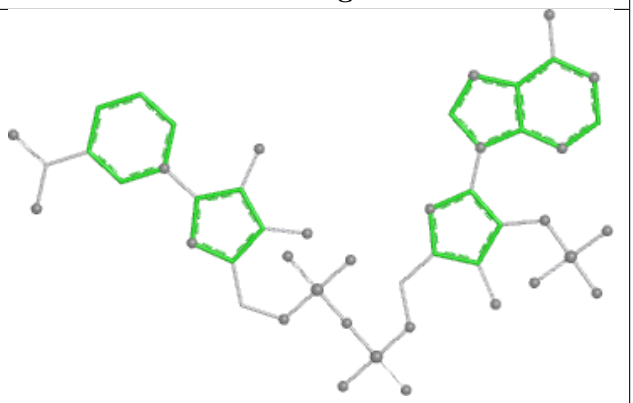


Bond angles

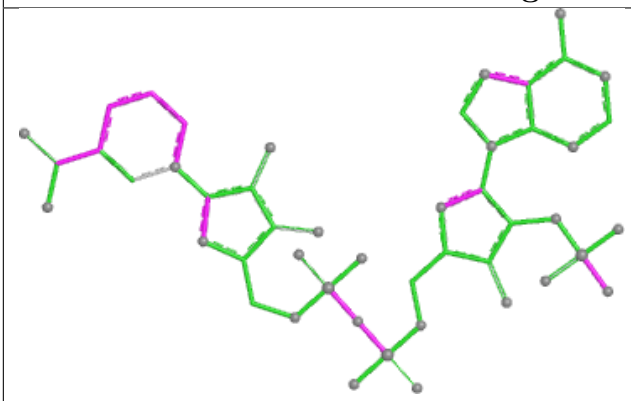


Torsions

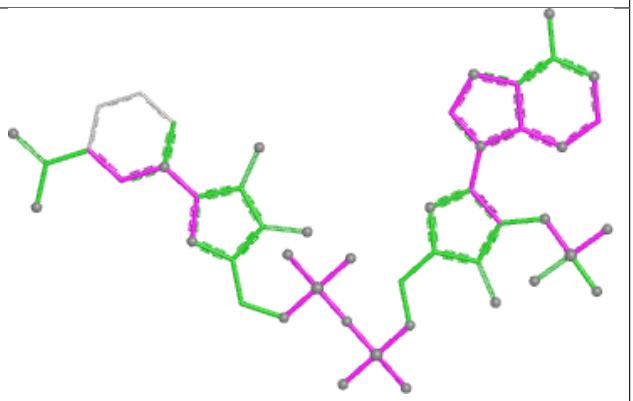


Rings

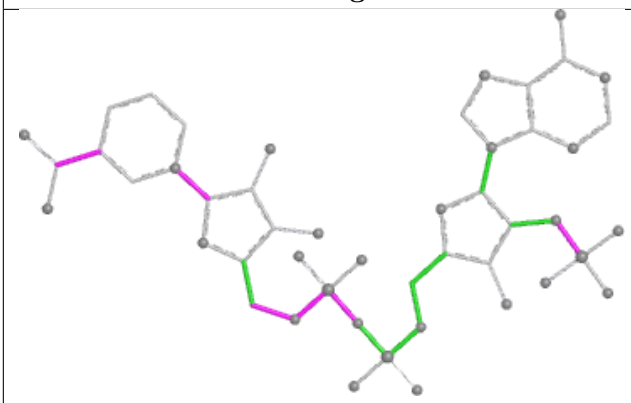
Ligand NDP C 614



Bond lengths



Bond angles



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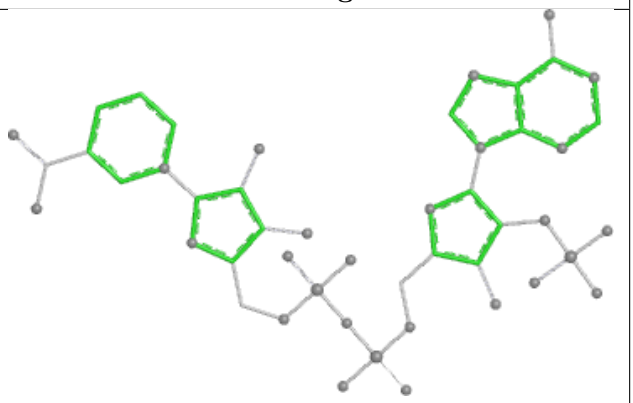
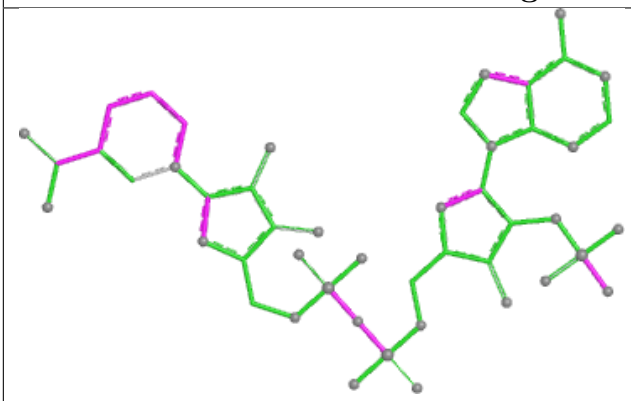


Rings

Ligand NDP D 618



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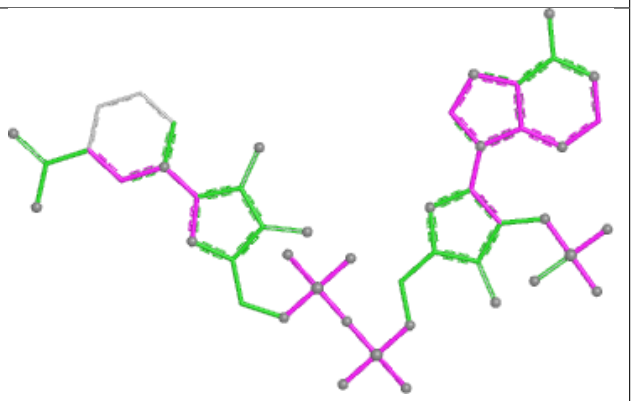
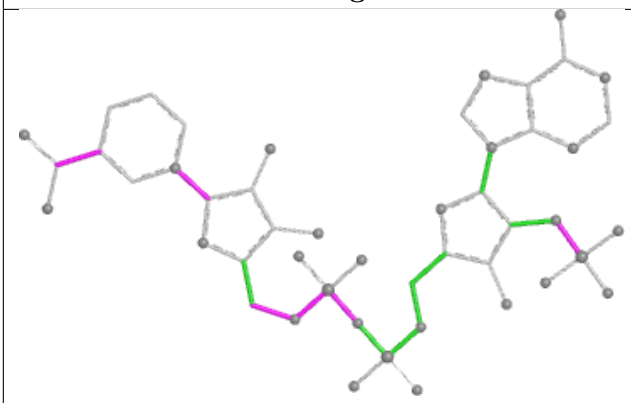


Bond angles



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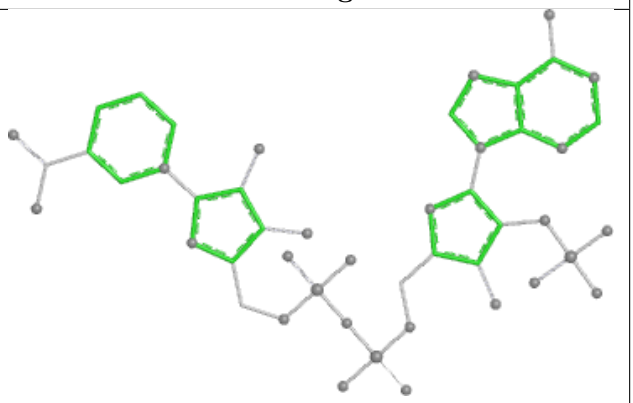
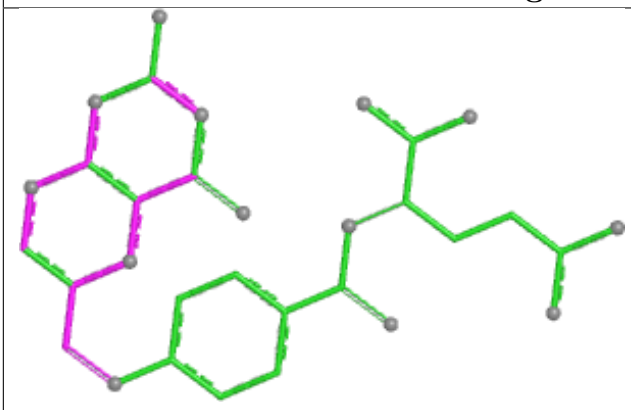
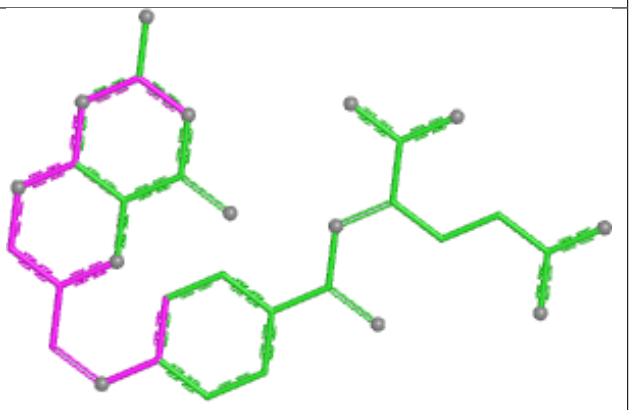


Rings

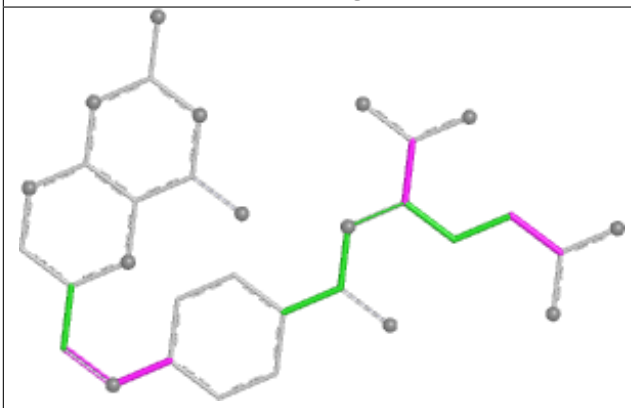
Ligand FOL D 617



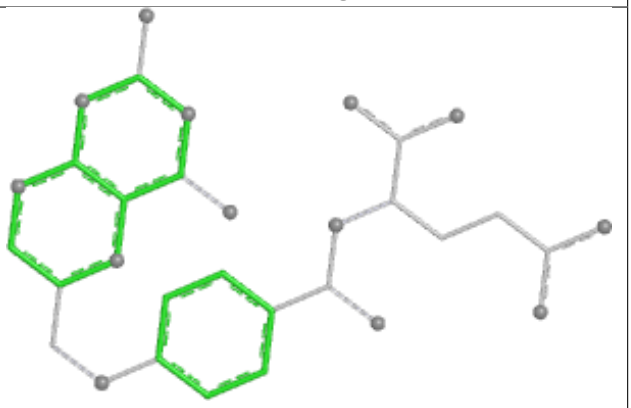
Bond lengths



Bond angles

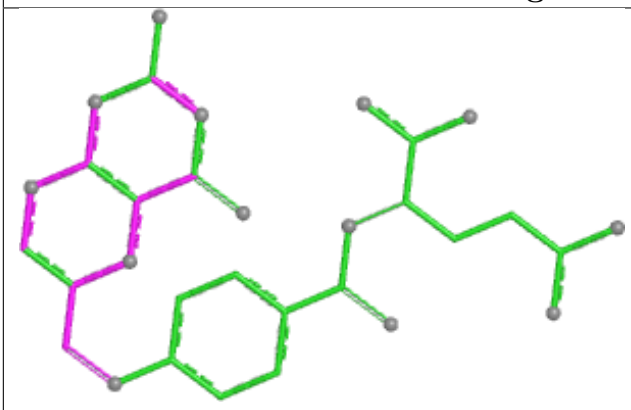


Torsions

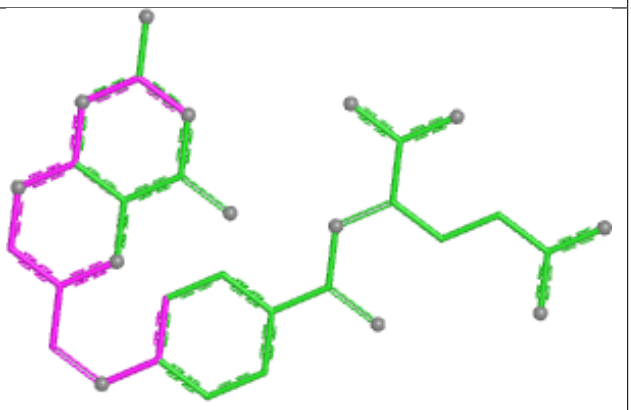


Rings

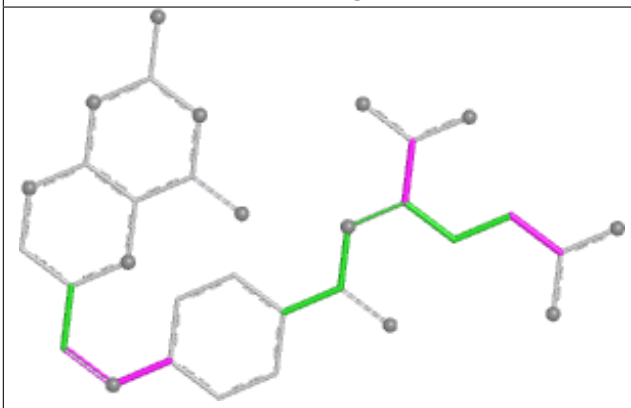
Ligand FOL B 609



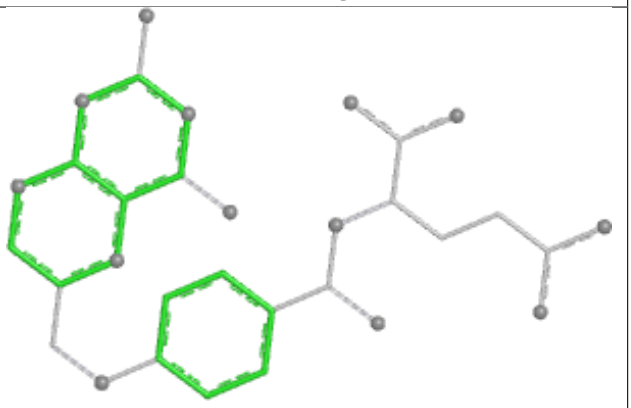
Bond lengths



Bond angles

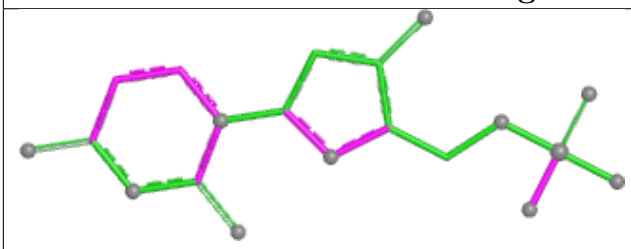


Torsions

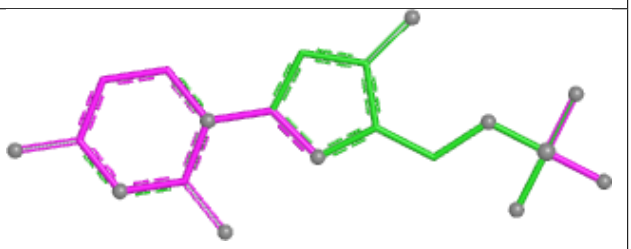


Rings

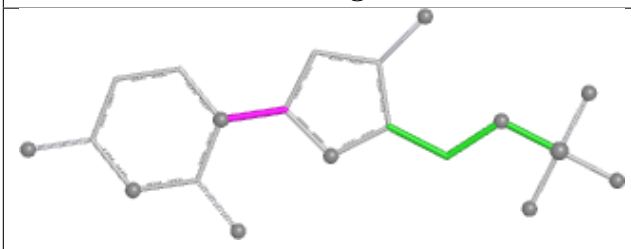
Ligand UMP A 603



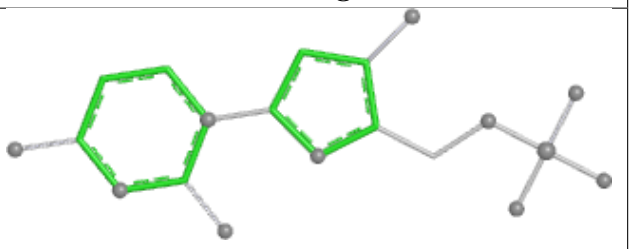
Bond lengths



Bond angles

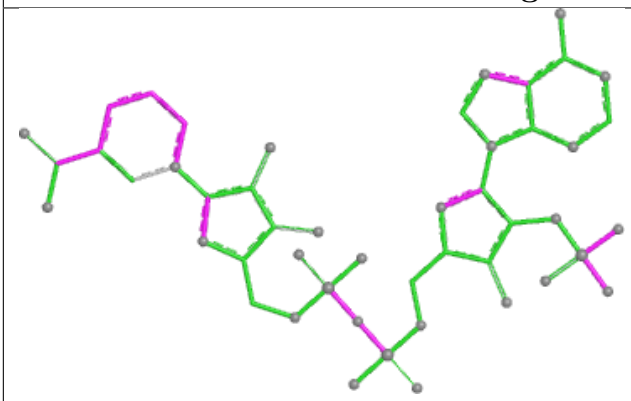


Torsions

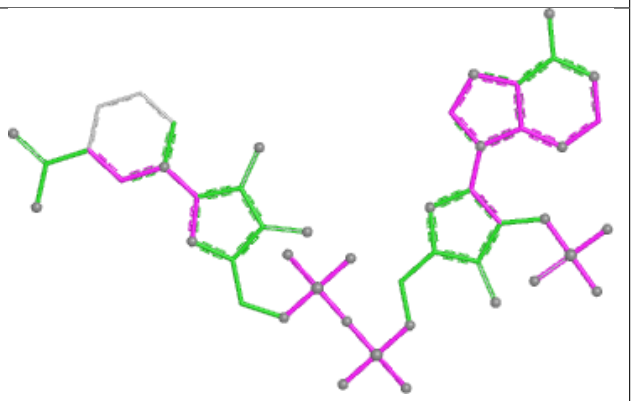


Rings

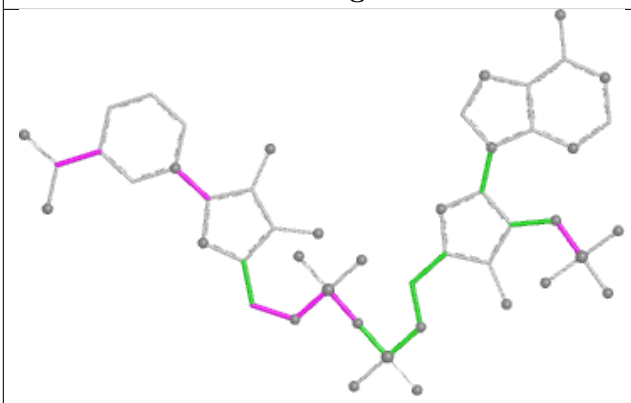
Ligand NDP A 606



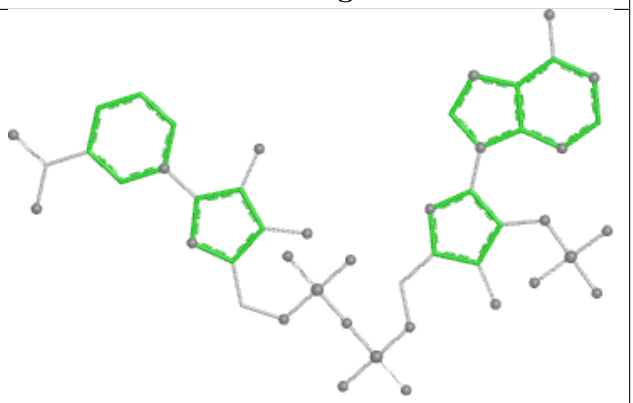
Bond lengths



Bond angles

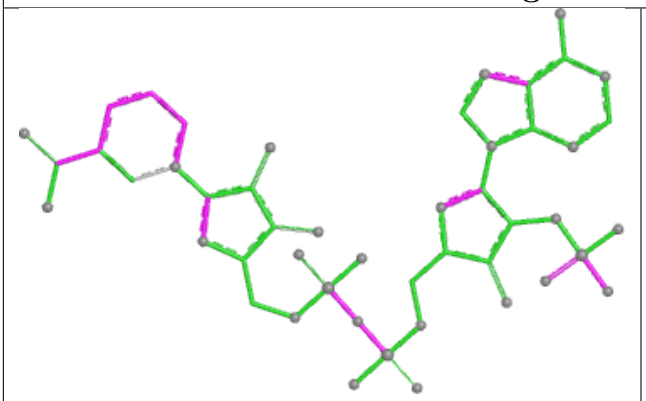


Torsions

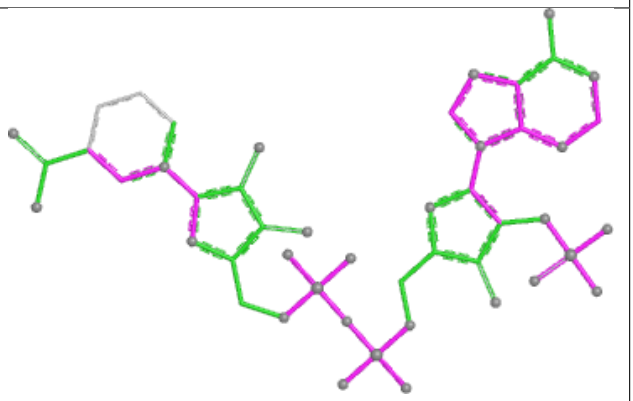


Rings

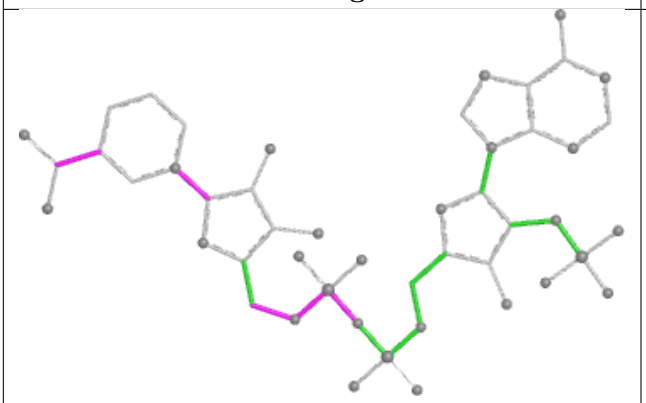
Ligand NDP E 622



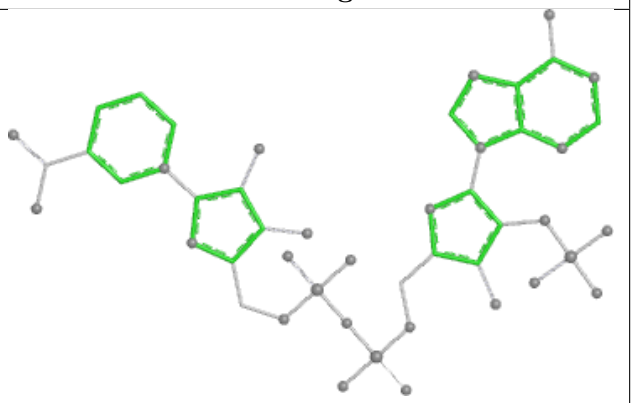
Bond lengths



Bond angles

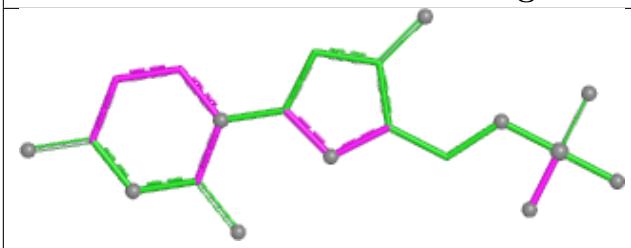


Torsions

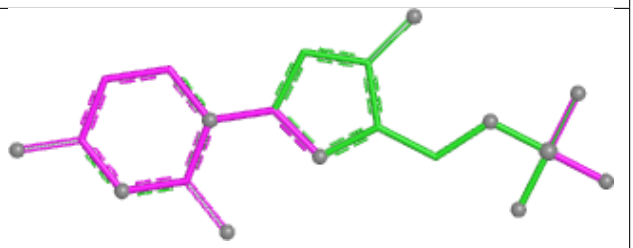


Rings

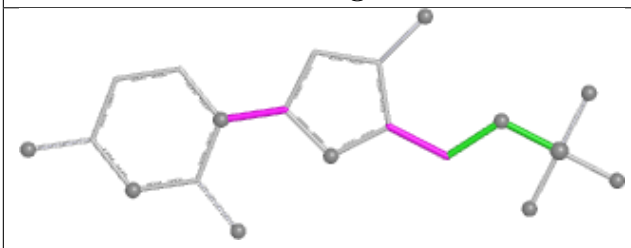
Ligand UMP D 615



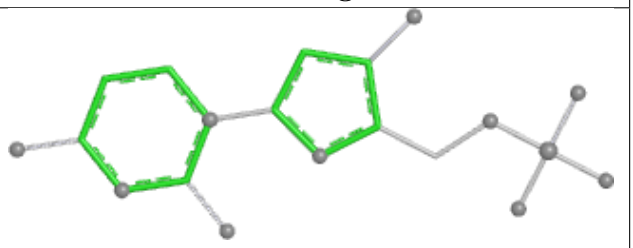
Bond lengths



Bond angles

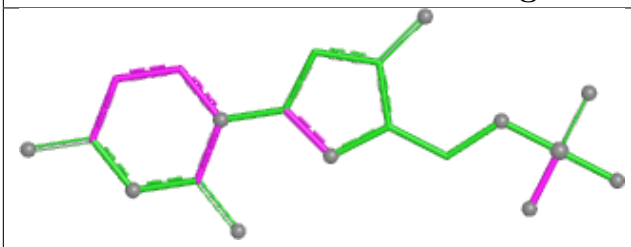


Torsions

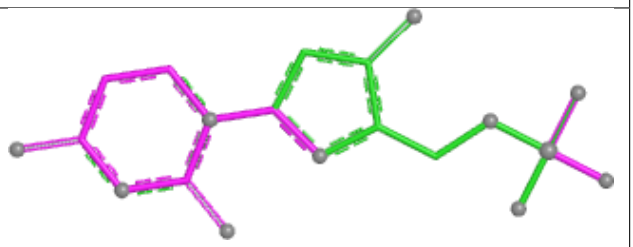


Rings

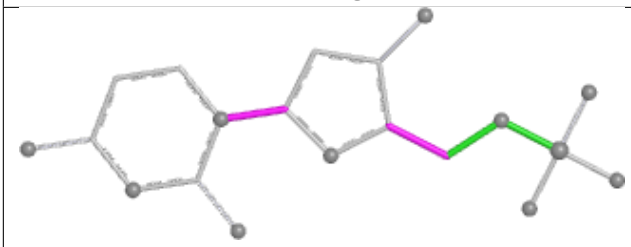
Ligand UMP E 619



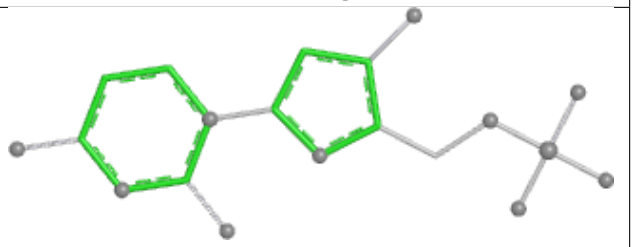
Bond lengths



Bond angles

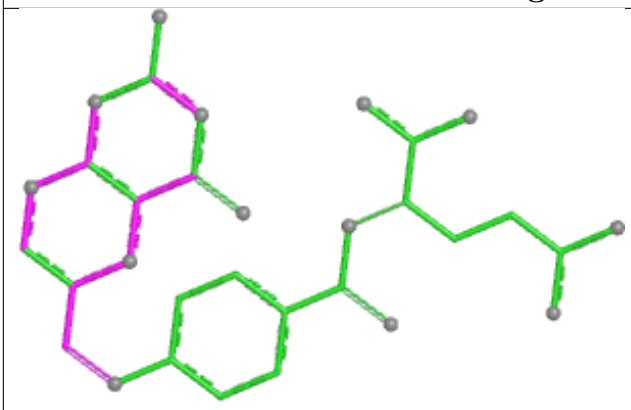


Torsions

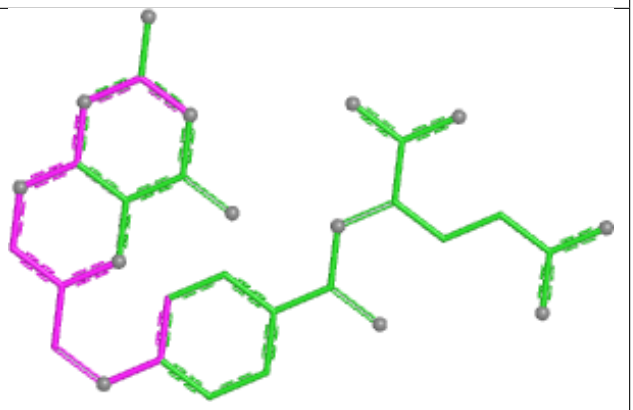


Rings

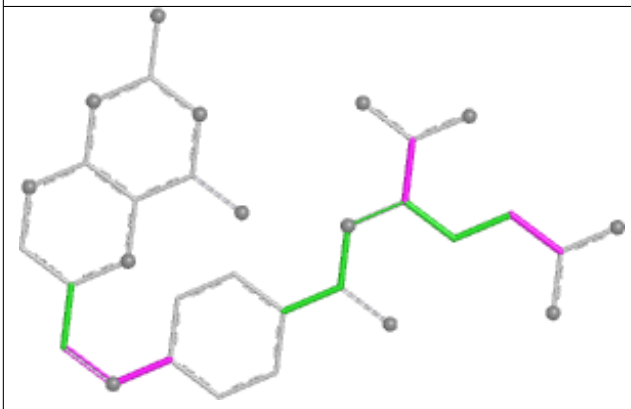
Ligand FOL E 621



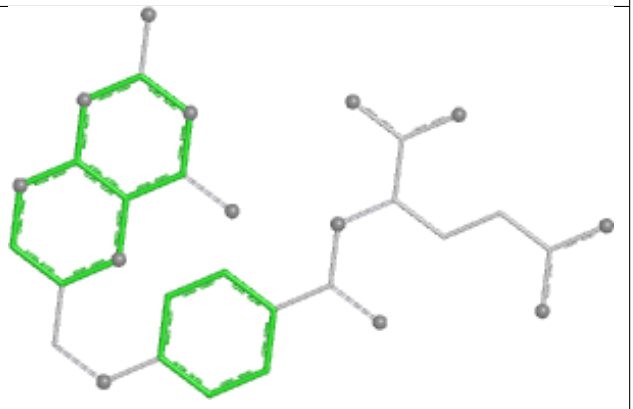
Bond lengths



Bond angles

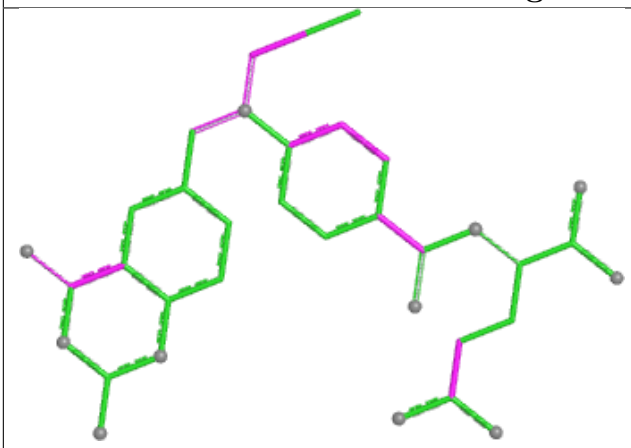


Torsions

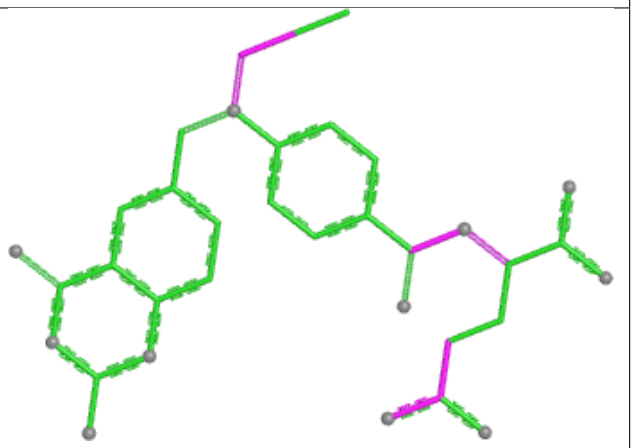


Rings

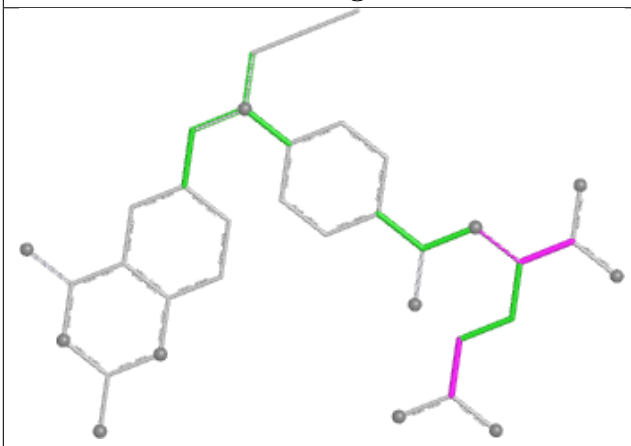
Ligand CB3 D 616



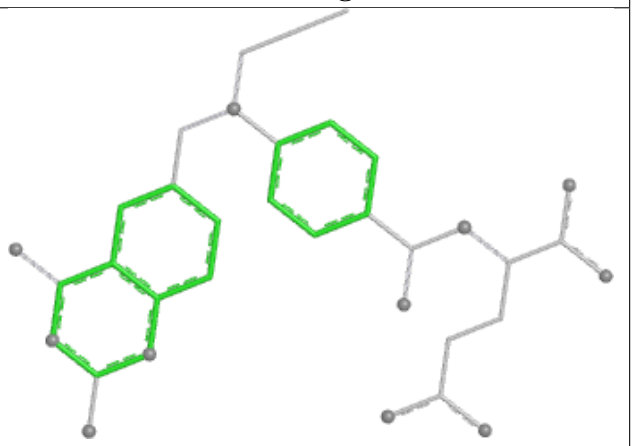
Bond lengths



Bond angles

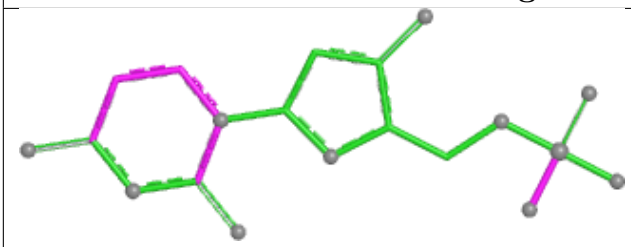


Torsions

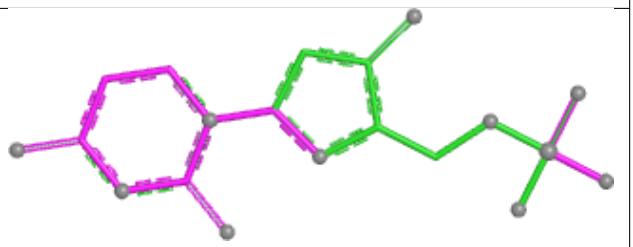


Rings

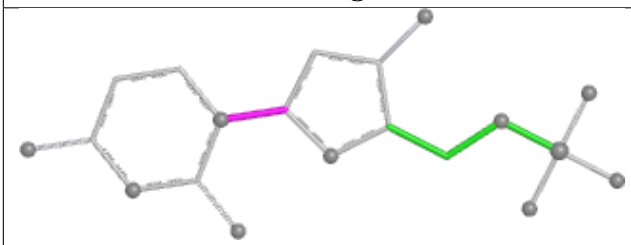
Ligand UMP C 611



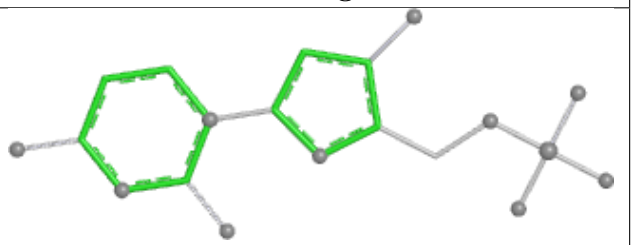
Bond lengths



Bond angles

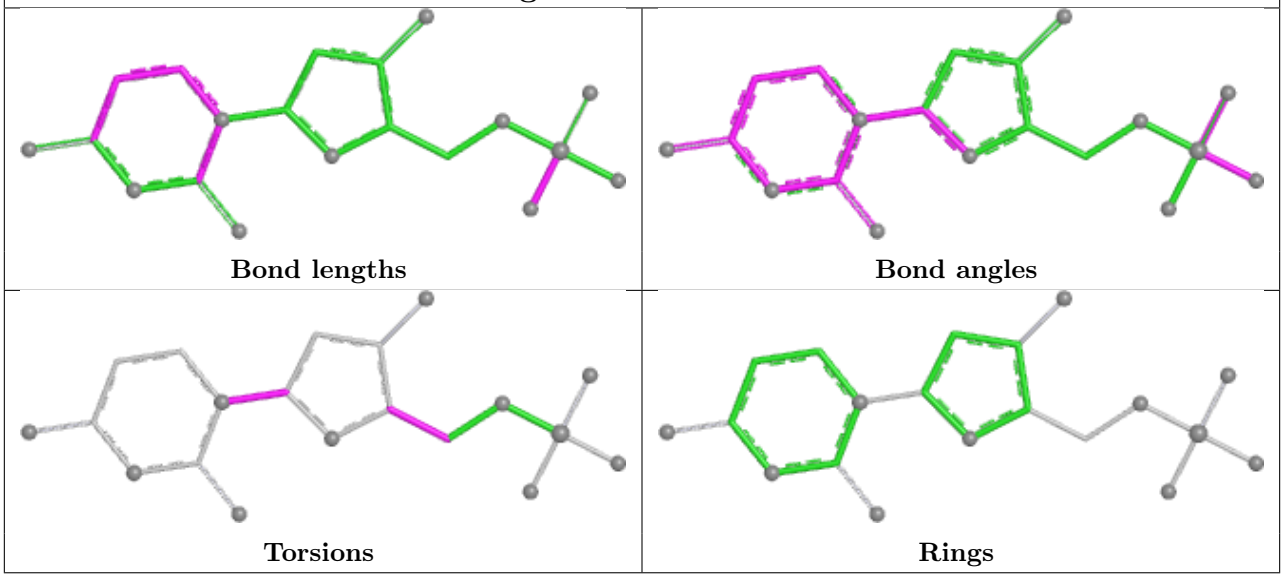


Torsions

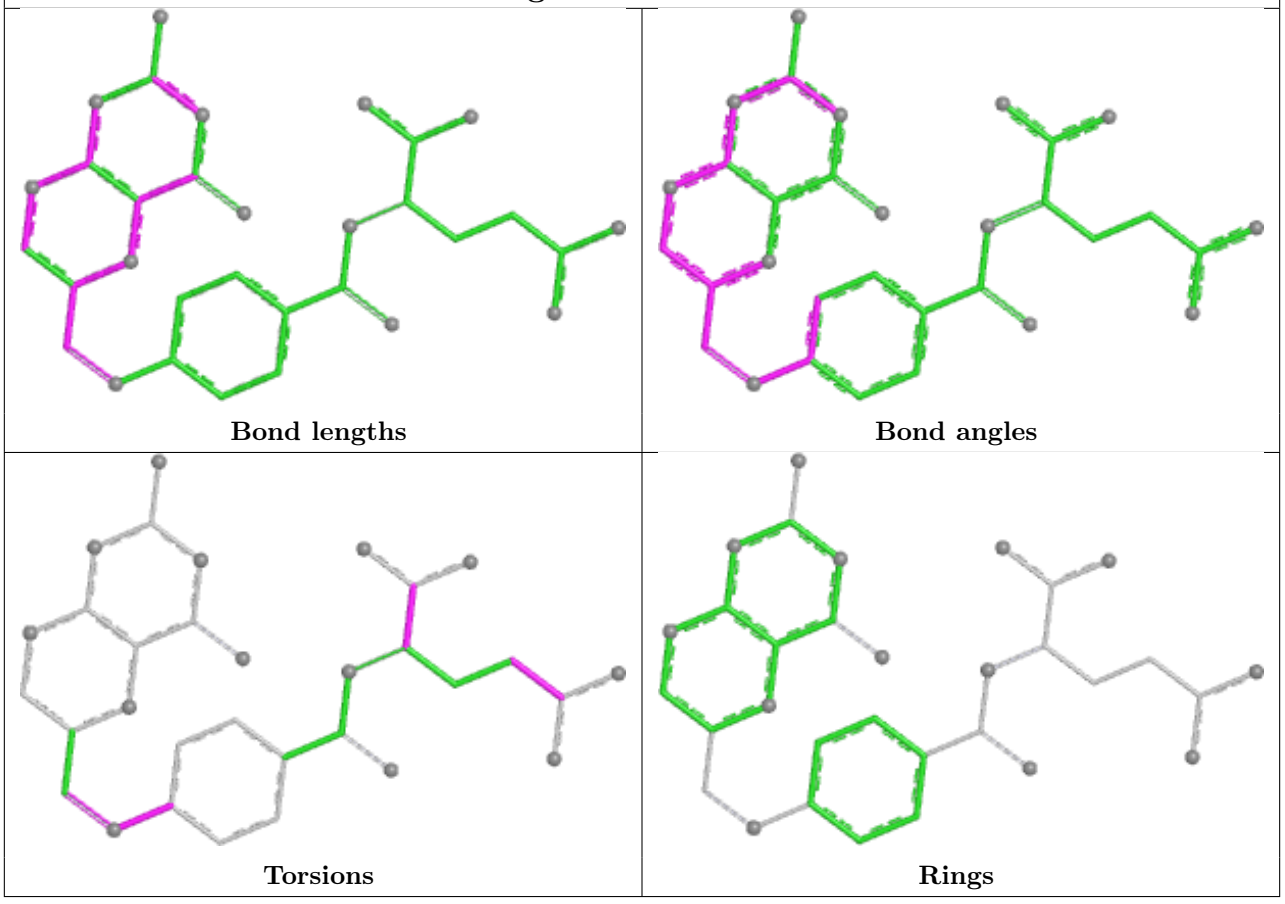


Rings

Ligand UMP B 607



Ligand FOL C 613



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95^{th} 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	519/521 (99%)	0.23	30 (5%)	29	22	21, 35, 59, 82	0
1	B	519/521 (99%)	0.29	27 (5%)	33	25	21, 34, 56, 81	0
1	C	519/521 (99%)	0.17	21 (4%)	42	33	22, 36, 57, 82	0
1	D	519/521 (99%)	0.17	24 (4%)	37	29	24, 36, 60, 82	0
1	E	519/521 (99%)	0.30	19 (3%)	45	36	25, 38, 60, 82	0
All	All	2595/2605 (99%)	0.23	121 (4%)	36	29	21, 36, 59, 82	0

The worst 5 of 121 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	182	THR	5.8
1	E	521	VAL	5.1
1	D	182	THR	4.8
1	A	331	GLY	4.7
1	B	82	ASP	4.6

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

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

6.3 Carbohydrates

There are no oligosaccharides in this entry.

6.4 Ligands

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,

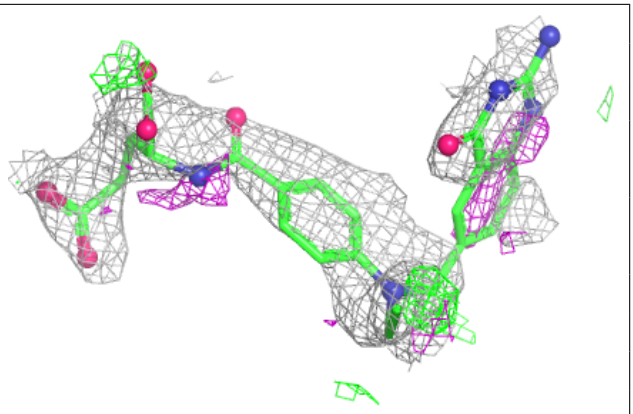
median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

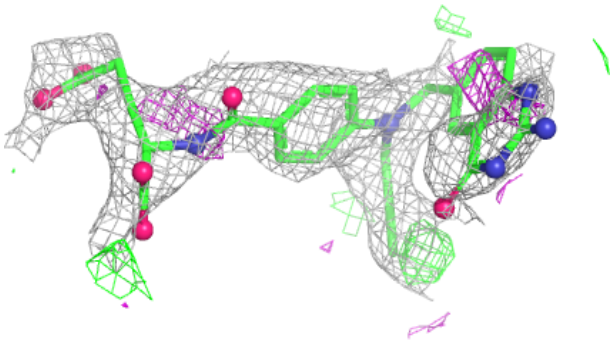
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	CB3	D	616	35/35	0.72	0.21	66,71,77,78	0
2	UMP	A	603	20/20	0.78	0.21	55,68,73,73	0
3	CB3	E	620	35/35	0.78	0.18	67,71,76,77	0
3	CB3	A	604	35/35	0.79	0.19	66,71,77,78	0
2	UMP	D	615	20/20	0.80	0.21	57,69,74,74	0
2	UMP	C	611	20/20	0.80	0.22	55,66,73,73	0
2	UMP	E	619	20/20	0.82	0.18	60,70,74,74	0
3	CB3	C	612	35/35	0.83	0.20	65,69,76,76	0
2	UMP	B	607	20/20	0.85	0.23	52,66,72,72	0
4	FOL	E	621	32/32	0.85	0.15	40,45,47,47	0
3	CB3	B	608	35/35	0.86	0.20	63,69,76,76	0
4	FOL	C	613	32/32	0.87	0.15	37,44,47,47	0
4	FOL	D	617	32/32	0.88	0.14	37,43,47,48	0
4	FOL	B	609	32/32	0.91	0.15	36,43,44,45	0
4	FOL	A	605	32/32	0.91	0.14	34,43,44,44	0
5	NDP	E	622	48/48	0.93	0.12	40,48,57,58	0
5	NDP	C	614	48/48	0.94	0.10	39,48,57,58	0
5	NDP	D	618	48/48	0.95	0.10	40,48,56,57	0
5	NDP	B	610	48/48	0.96	0.10	37,43,53,55	0
5	NDP	A	606	48/48	0.96	0.10	36,43,52,54	0

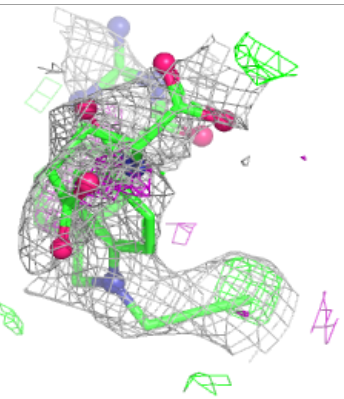
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around CB3 D 616:

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

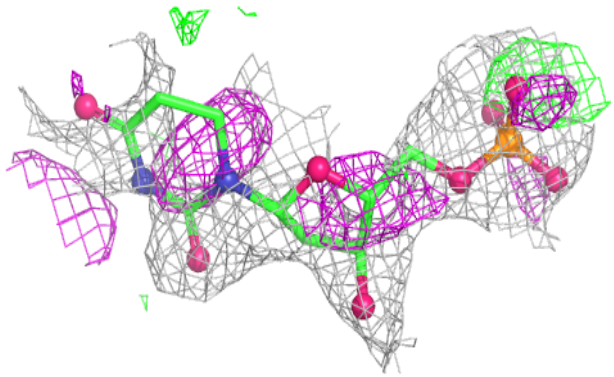


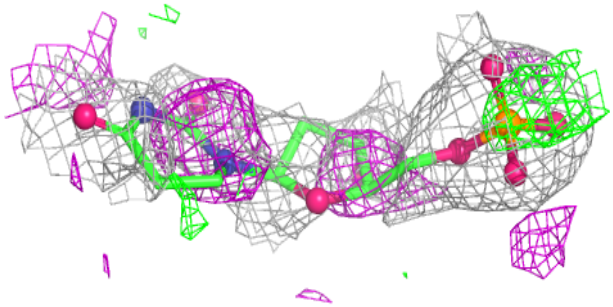


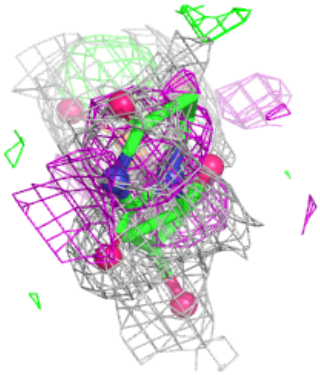


Electron density around UMP A 603:

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

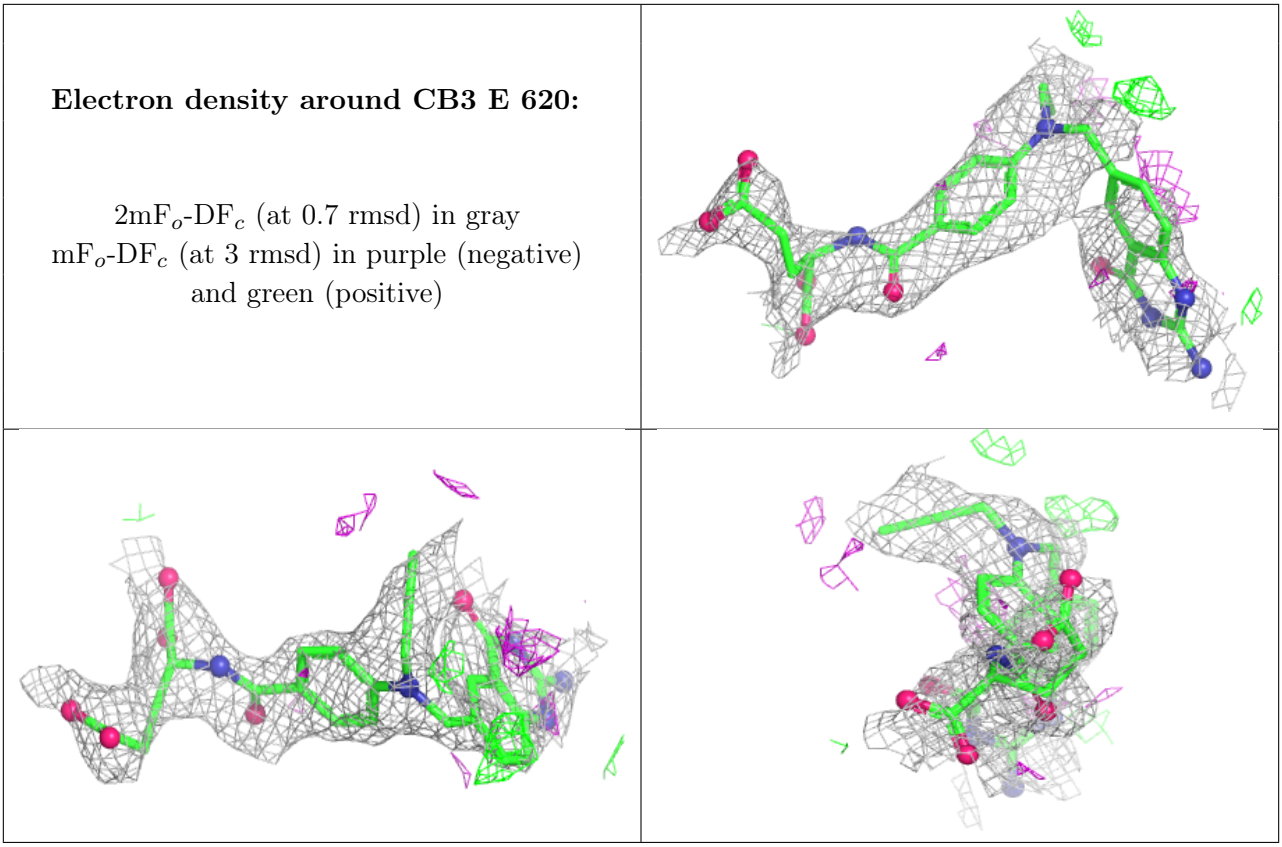






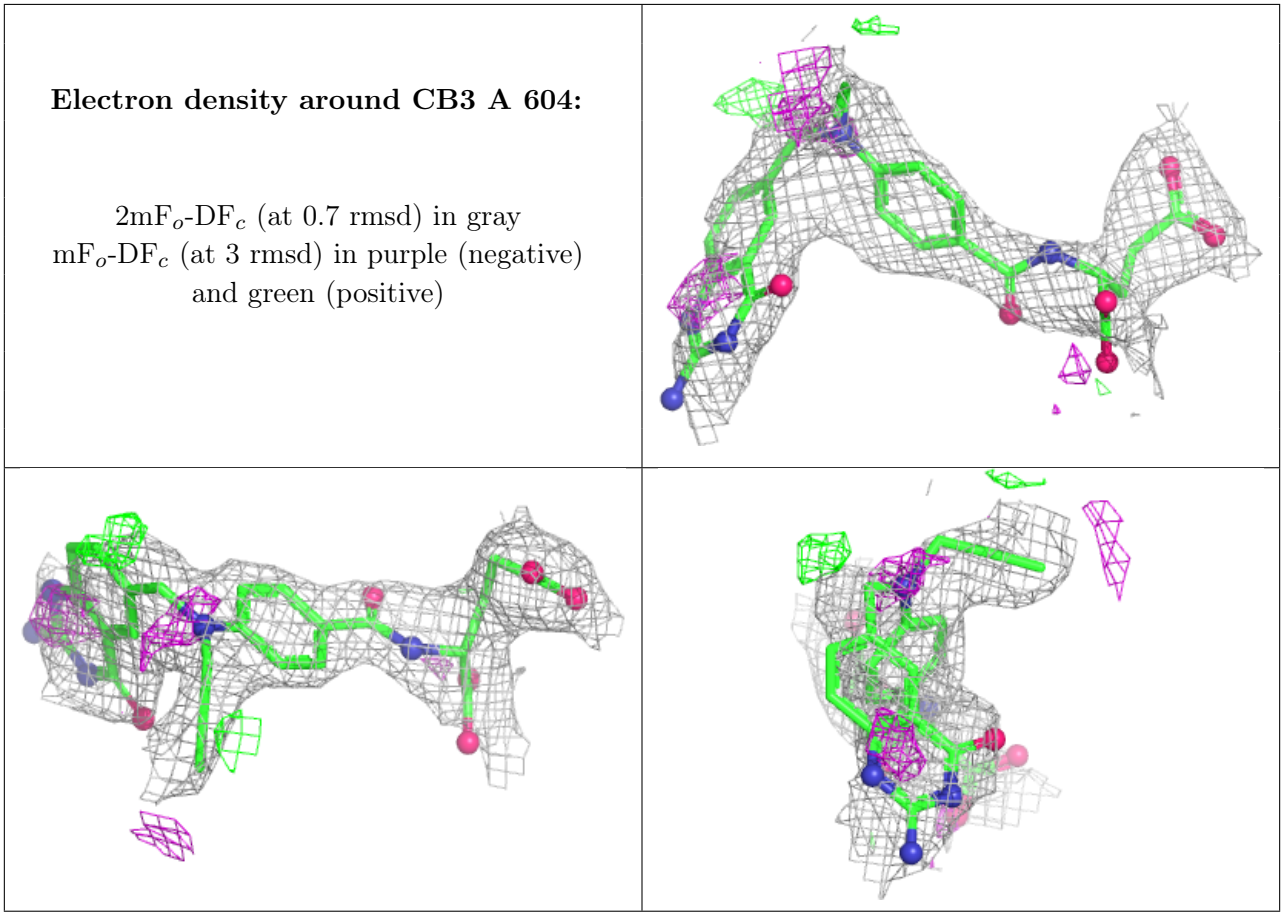
Electron density around CB3 E 620:

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



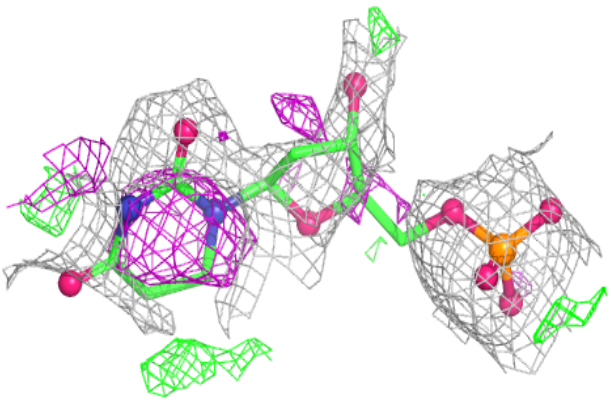
Electron density around CB3 A 604:

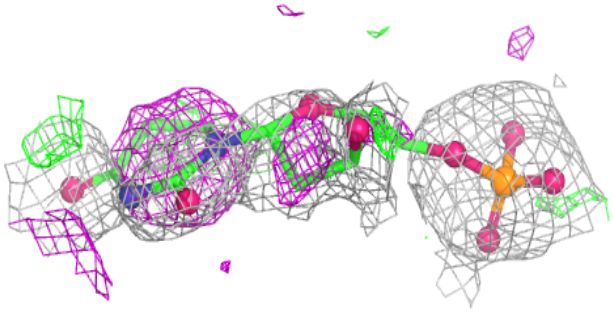
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

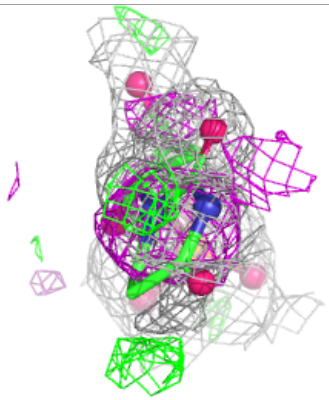


Electron density around UMP D 615:

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

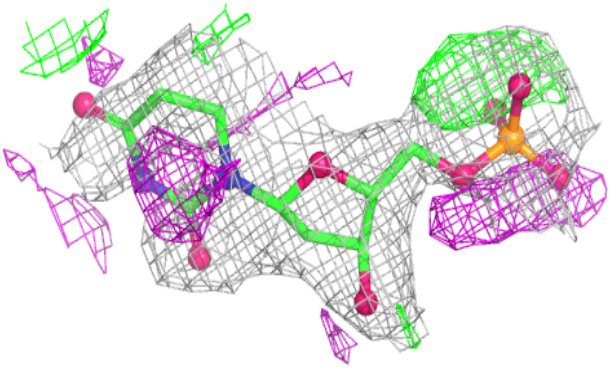


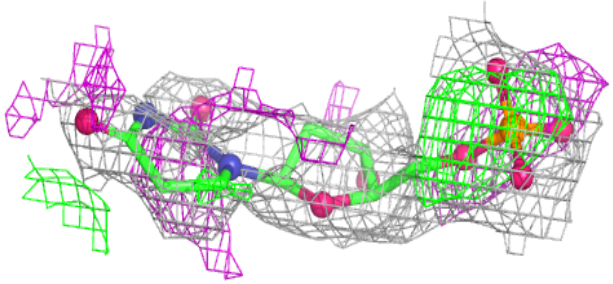


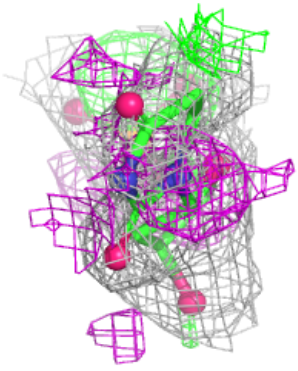


Electron density around UMP C 611:

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

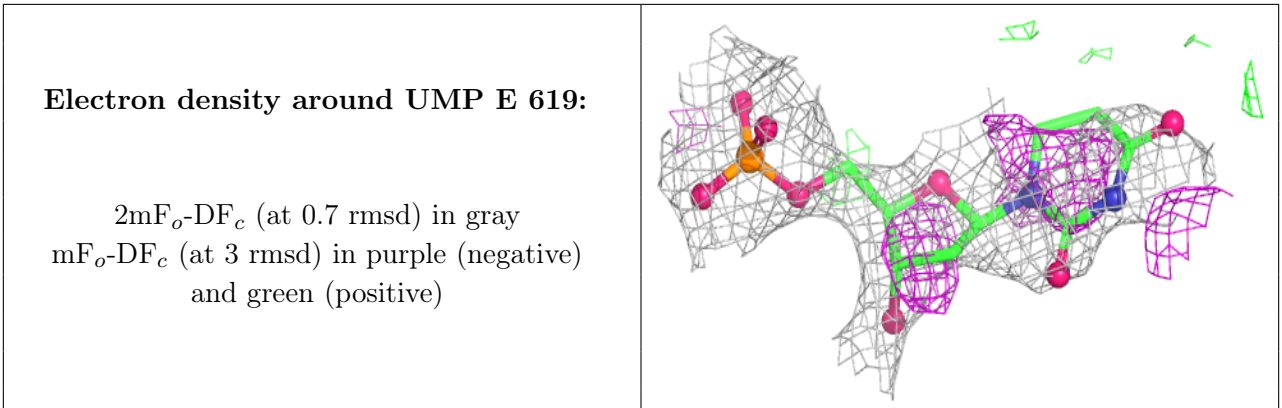






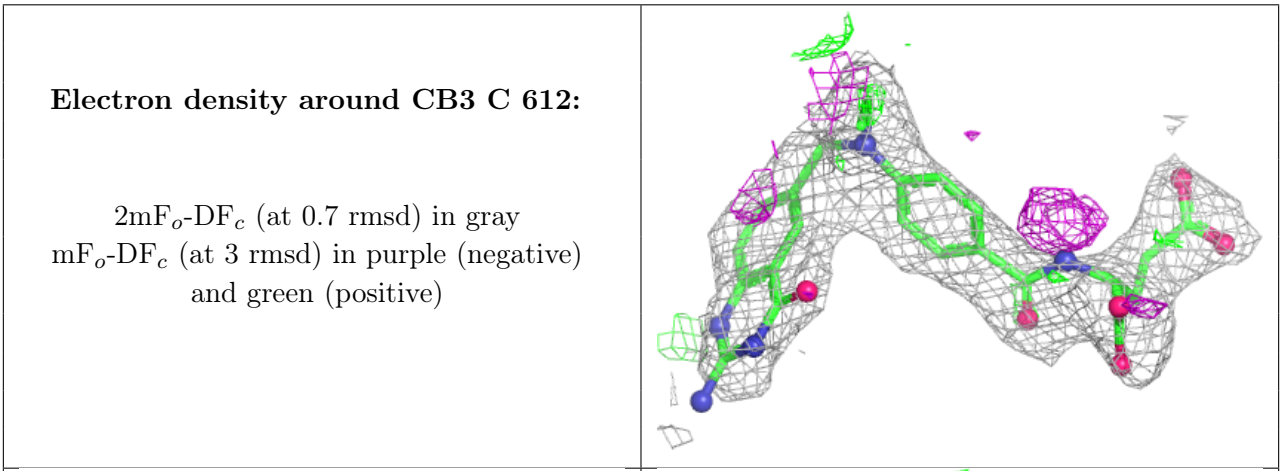
Electron density around UMP E 619:

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



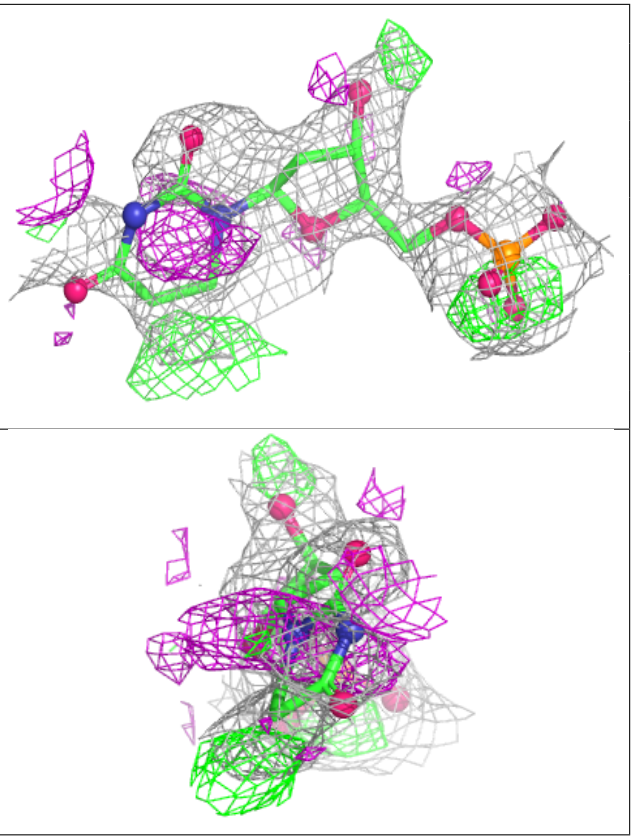
Electron density around CB3 C 612:

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



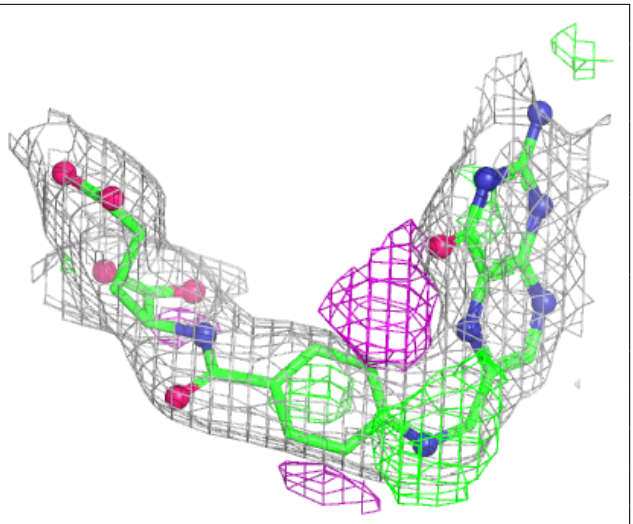
Electron density around UMP B 607:

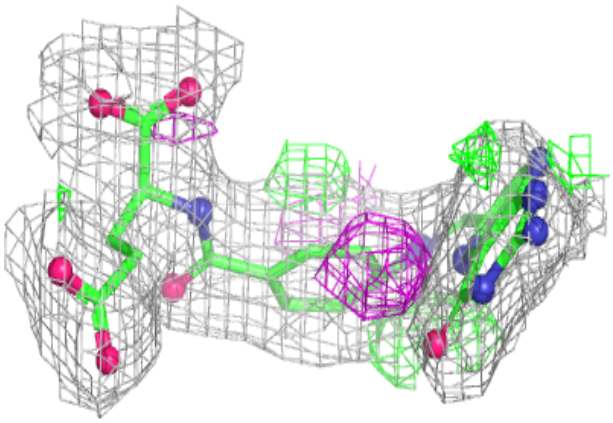
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

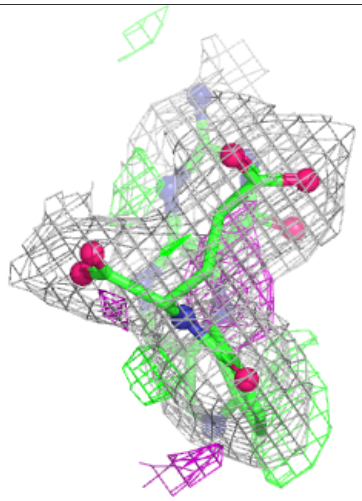


Electron density around FOL E 621:

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

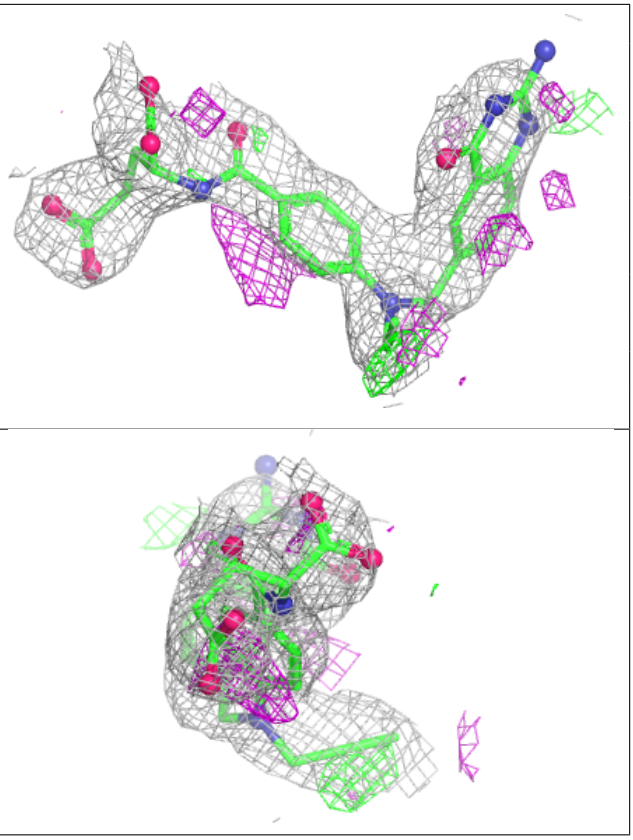






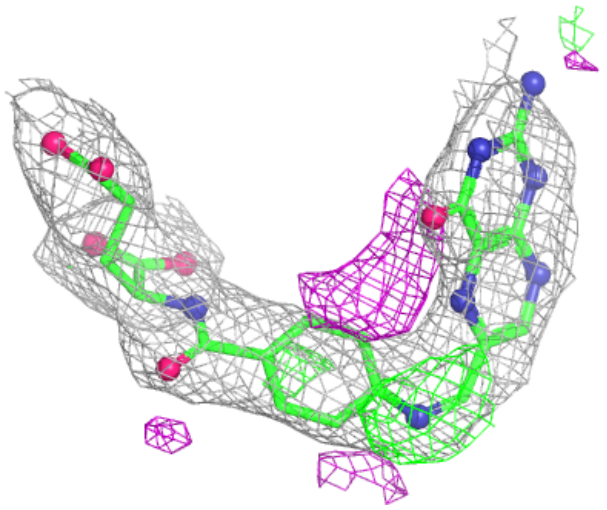
Electron density around CB3 B 608:

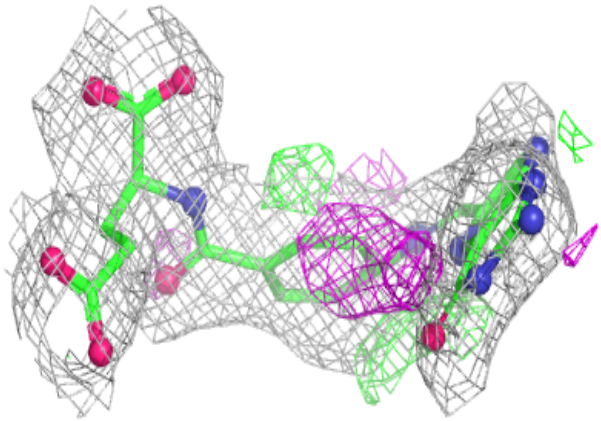
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

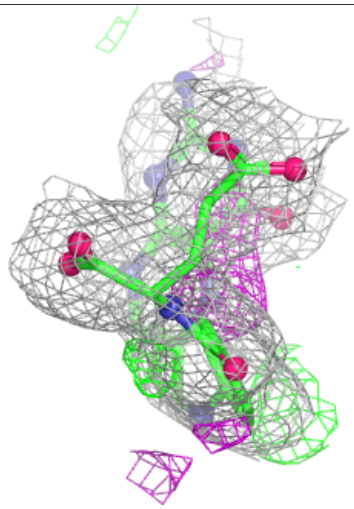


Electron density around FOL C 613:

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

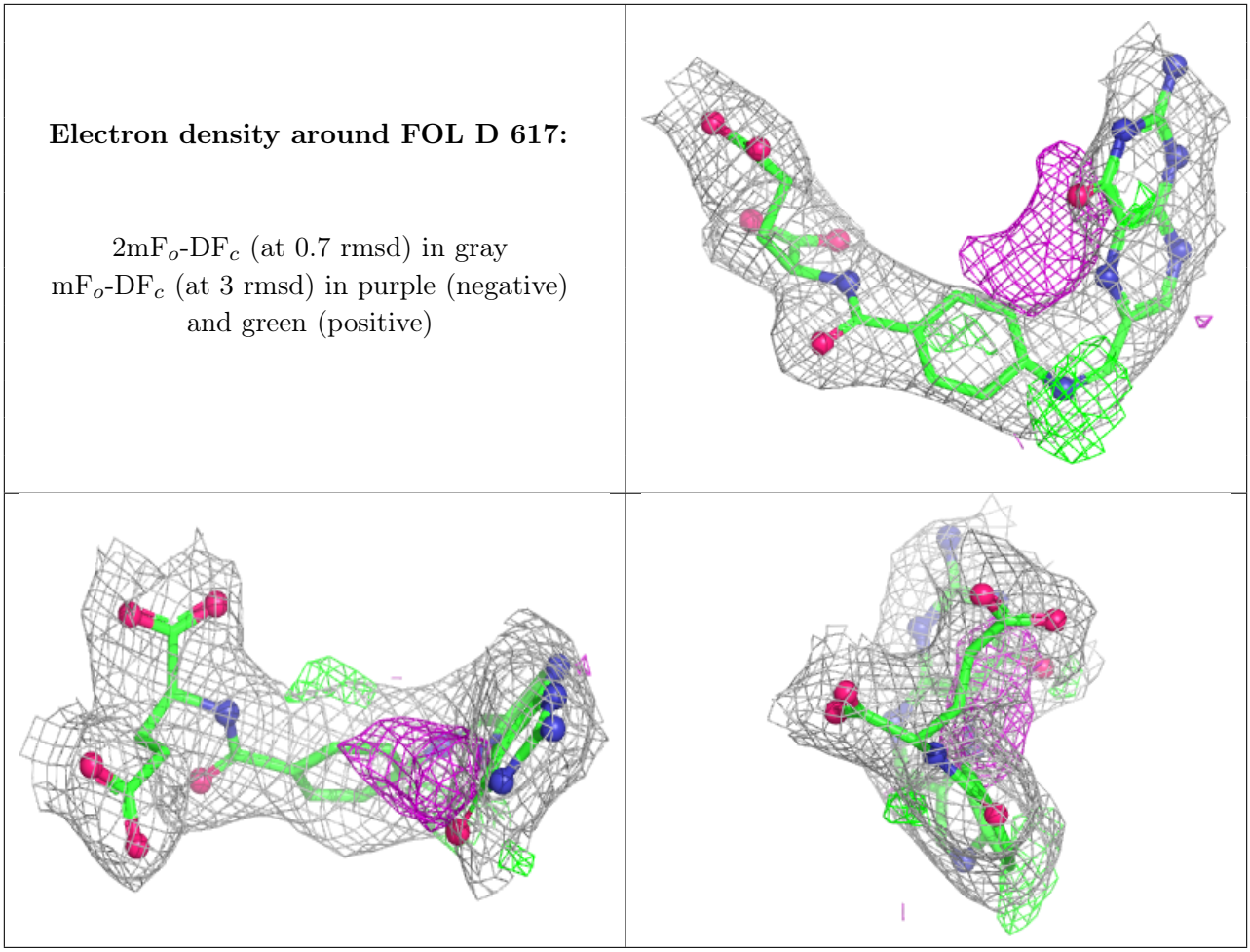






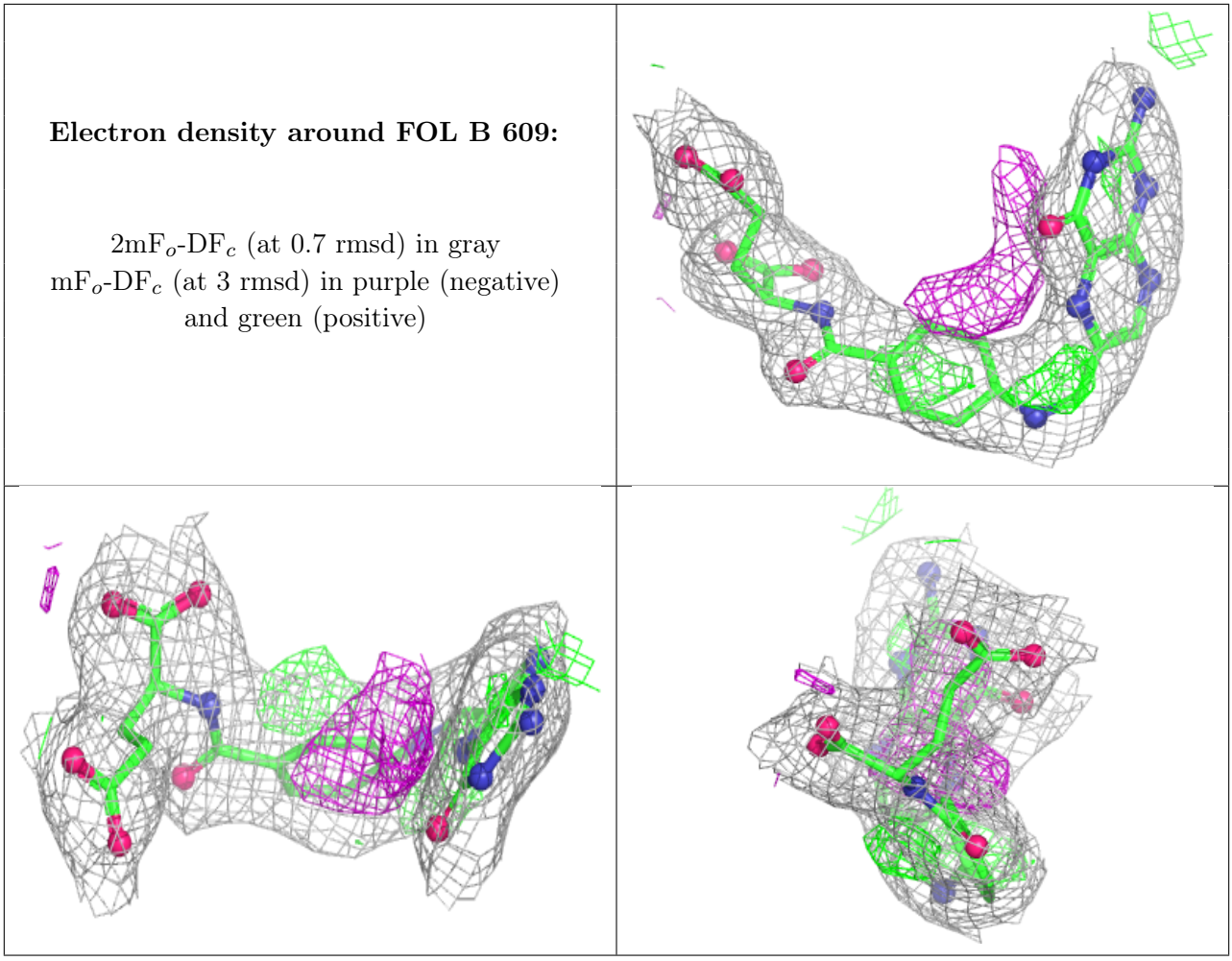
Electron density around FOL D 617:

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



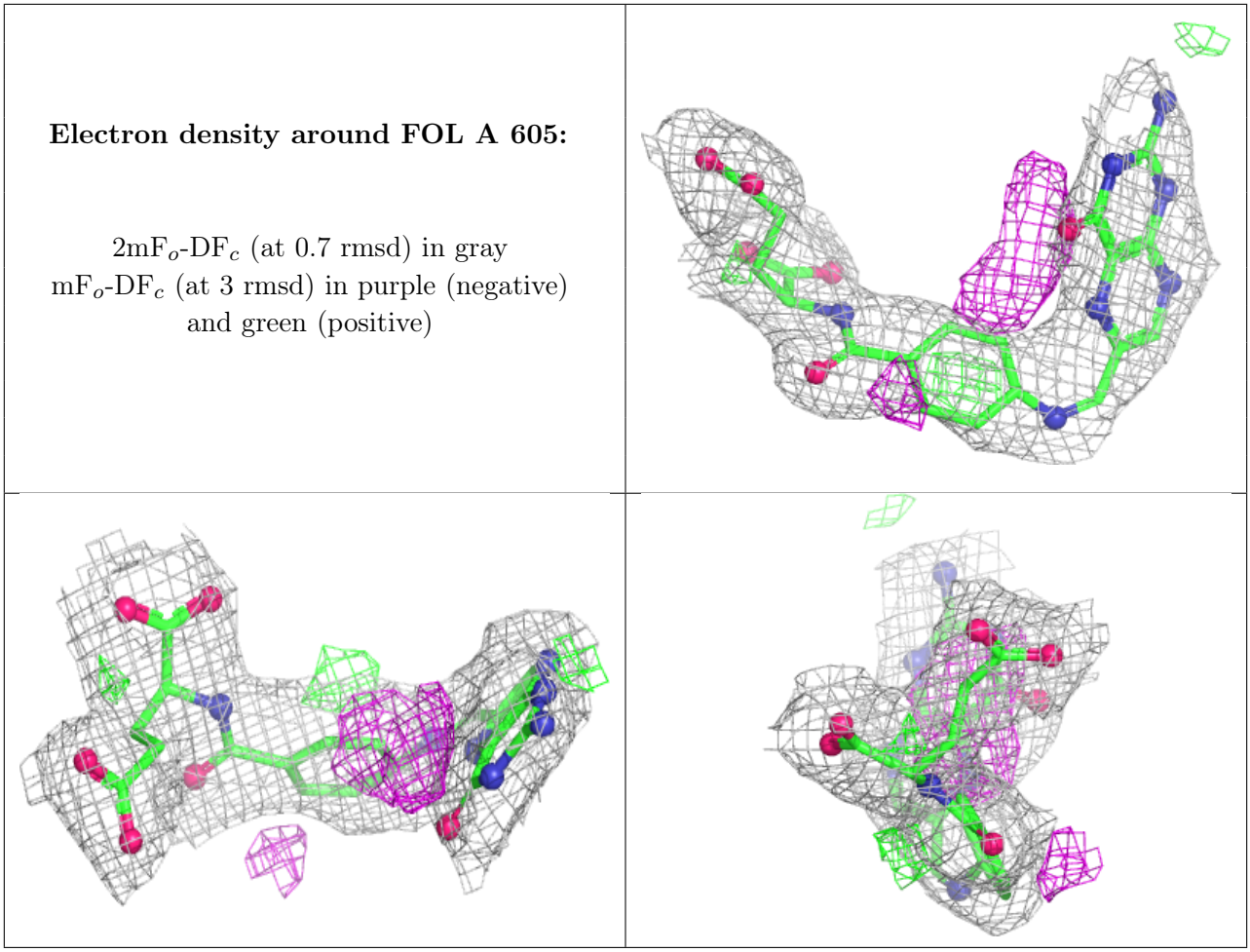
Electron density around FOL B 609:

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



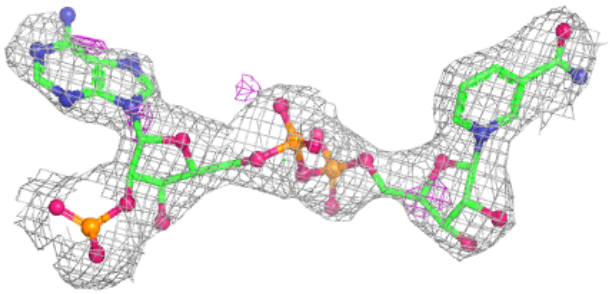
Electron density around FOL A 605:

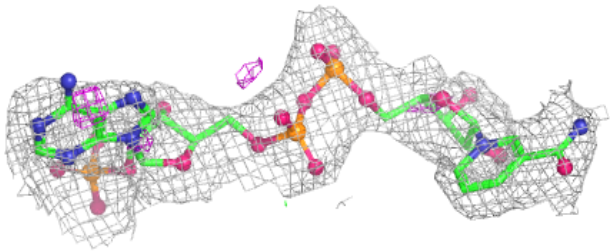
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

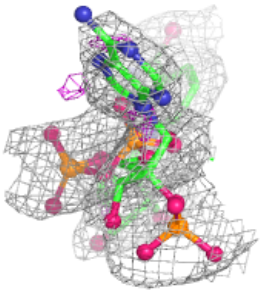


Electron density around NDP E 622:

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

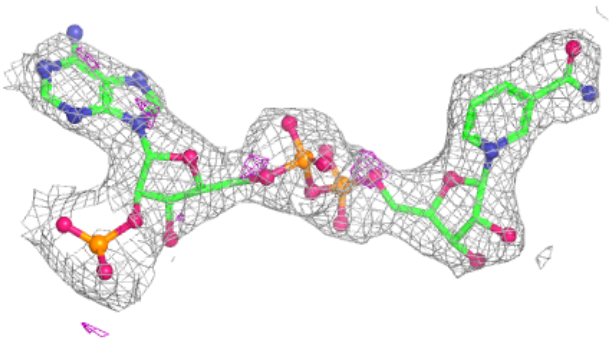


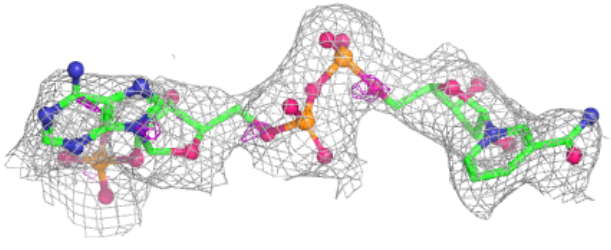


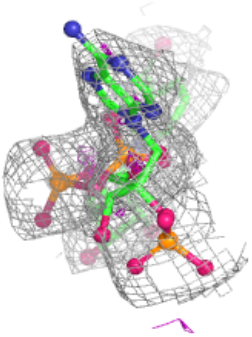


Electron density around NDP C 614:

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

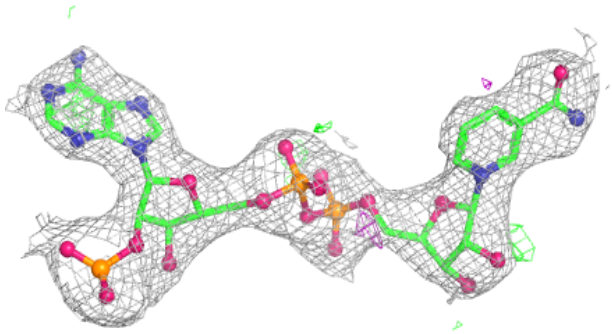


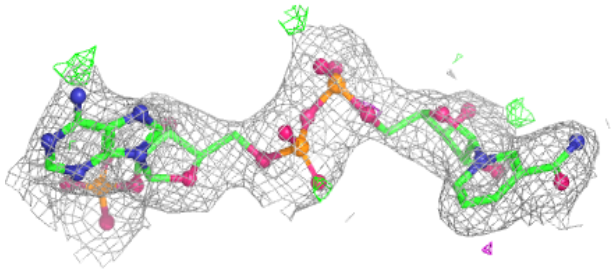


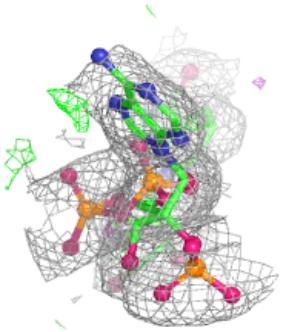


Electron density around NDP D 618:

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

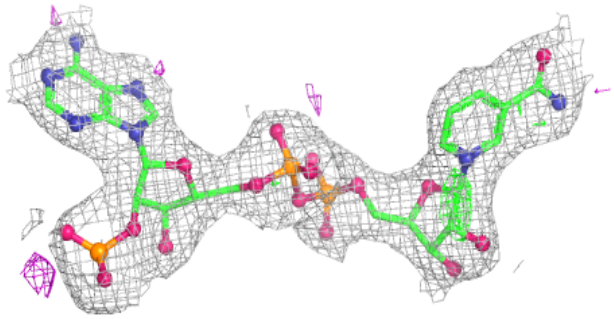


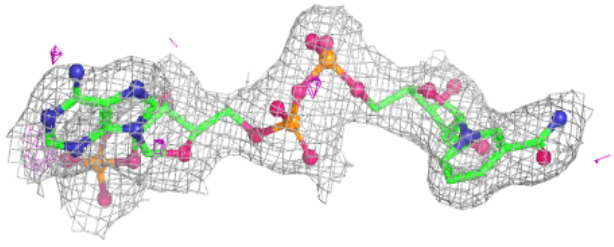


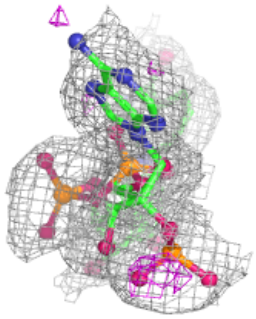


Electron density around NDP B 610:

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

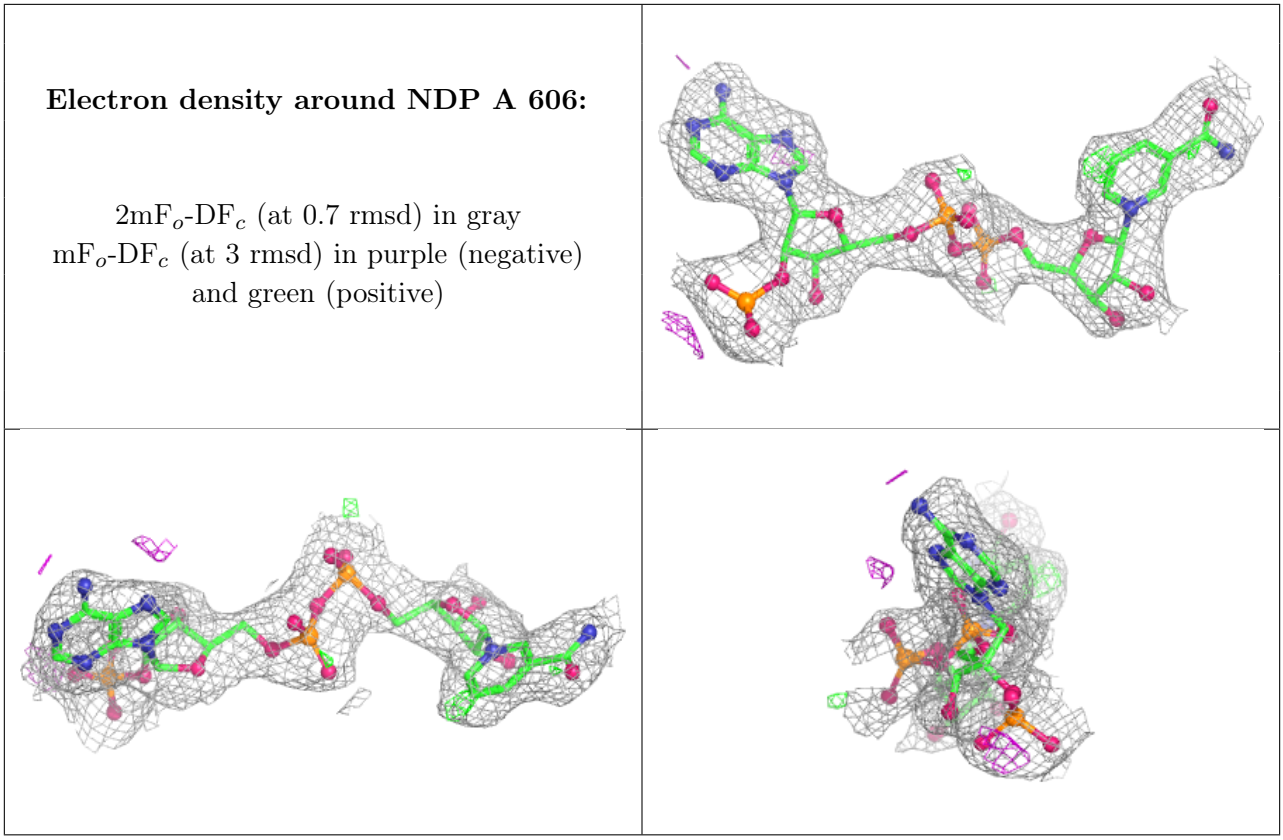






Electron density around NDP A 606:

$2mF_o$-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.