



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 23, 2026 – 09:35 PM UTC

PDB ID : 4E5O / pdb_00004e5o
Title : Crystal structure of mouse thymidylate synthase in complex with dUMP
Authors : Dowiercial, A.; Jarmula, A.; Rypniewski, W.; Sokolowska, M.; Fraczyk, T.; Ciesla, J.; Rode, W.
Deposited on : 2012-03-14
Resolution : 1.70 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	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

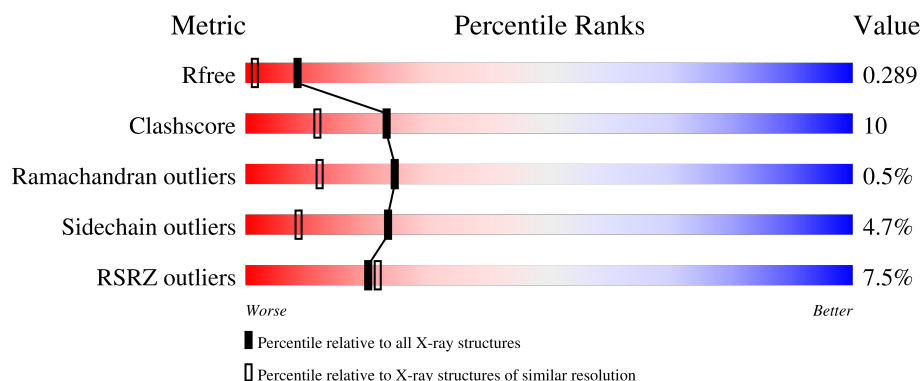
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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 $\leq 5\%$. 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	307	4% 76% 14% • 7%
1	B	307	3% 76% 16% • 6%
1	C	307	3% 77% 12% • 9%
1	D	307	5% 72% 18% • 8%
1	E	307	20% 65% 23% • 8%

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Mol	Chain	Length	Quality of chain
1	F	307	

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
3	BU1	C	503	-	-	X	-

2 Entry composition [i](#)

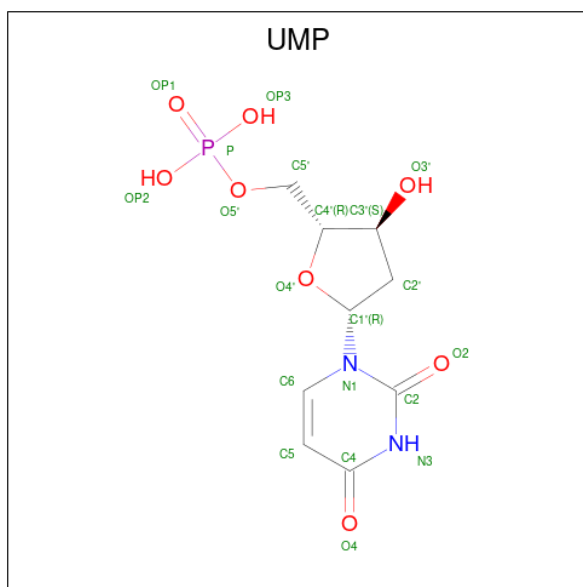
There are 4 unique types of molecules in this entry. The entry contains 15512 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Thymidylate synthase.

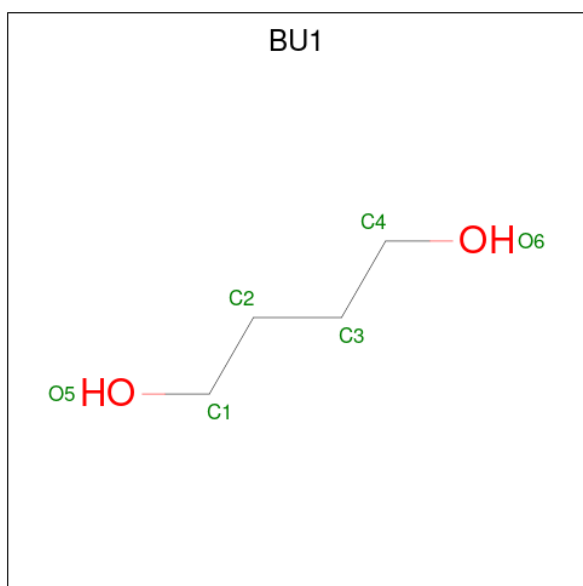
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	287	Total	C	N	O	S	0	3	0
			2346	1501	405	427	13			
1	B	288	Total	C	N	O	S	0	3	0
			2354	1505	409	427	13			
1	C	280	Total	C	N	O	S	0	2	0
			2275	1456	395	413	11			
1	D	283	Total	C	N	O	S	0	1	0
			2298	1472	399	415	12			
1	E	281	Total	C	N	O	S	0	6	0
			2332	1493	407	421	11			
1	F	279	Total	C	N	O	S	0	2	0
			2277	1457	397	412	11			

- Molecule 2 is 2'-DEOXYURIDINE 5'-MONOPHOSPHATE (CCD ID: UMP) (formula: C₉H₁₃N₂O₈P).



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

- Molecule 3 is 1,4-BUTANEDIOL (CCD ID: BU1) (formula: $C_4H_{10}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	C	1	Total	C	O	0	0
			6	4	2		
3	C	1	Total	C	O	0	0
			6	4	2		
3	C	1	Total	C	O	0	0
			6	4	2		

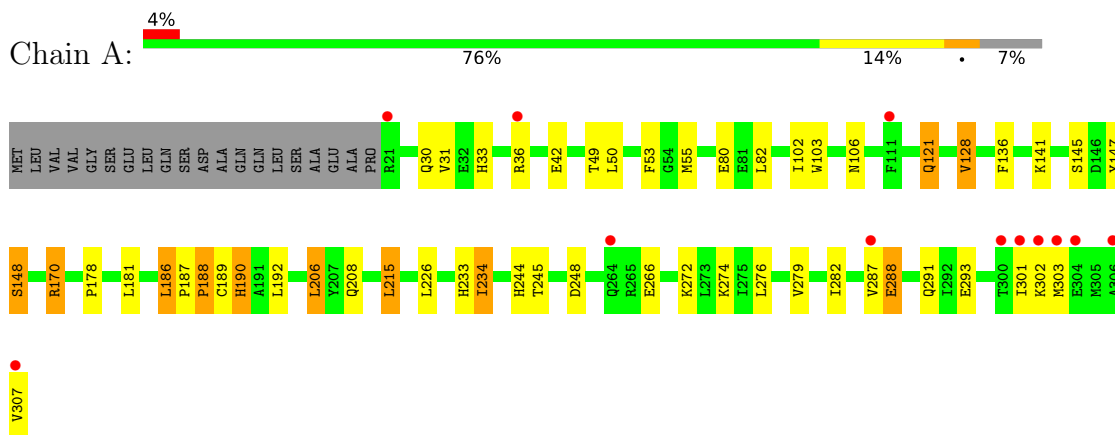
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	344	Total 344	O 344	0	0
4	B	315	Total 315	O 315	0	0
4	C	279	Total 279	O 279	0	0
4	D	242	Total 242	O 242	0	0
4	E	116	Total 116	O 116	0	0
4	F	176	Total 176	O 176	0	0

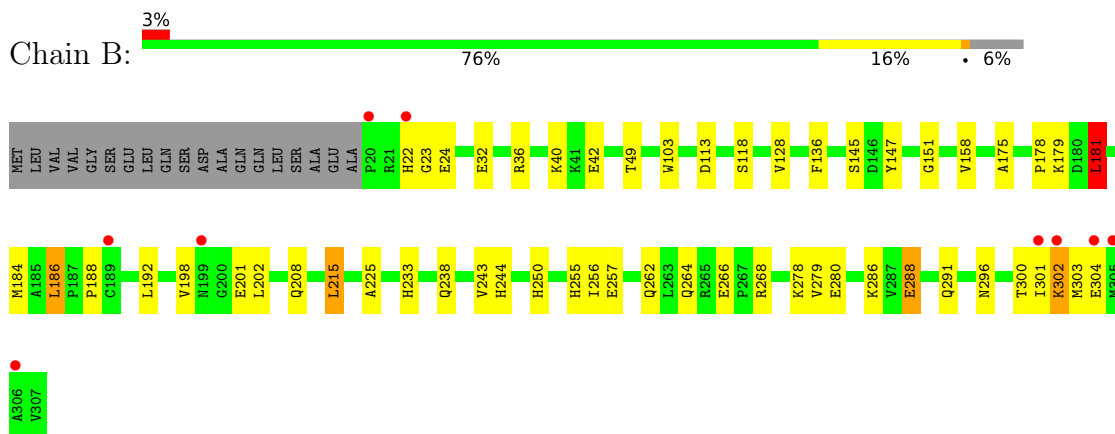
3 Residue-property plots [i](#)

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.

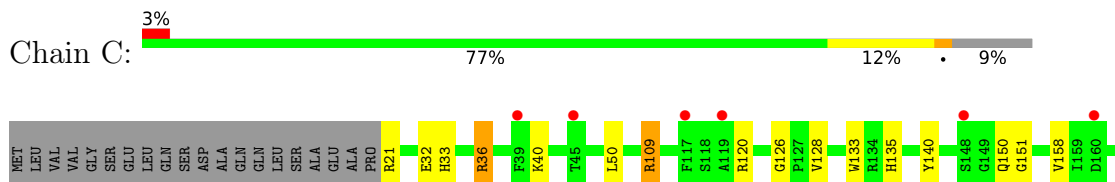
- Molecule 1: Thymidylate synthase

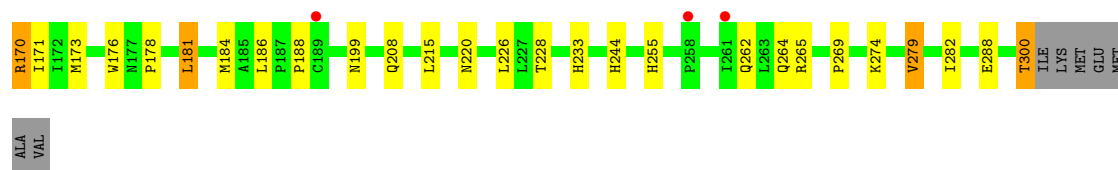


- Molecule 1: Thymidylate synthase

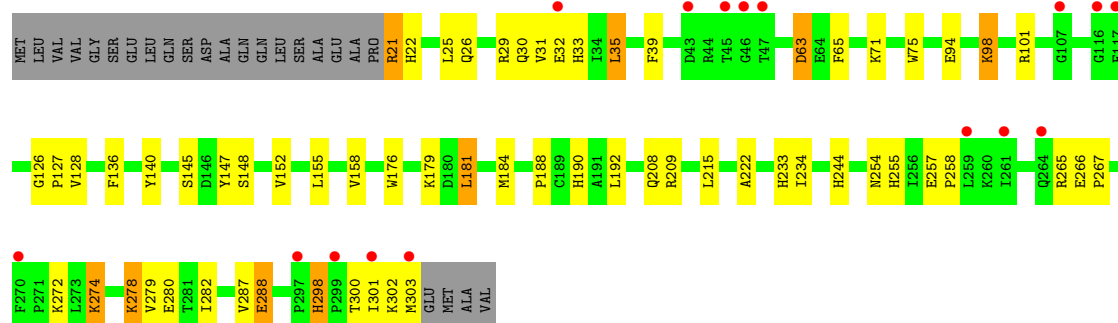


- Molecule 1: Thymidylate synthase

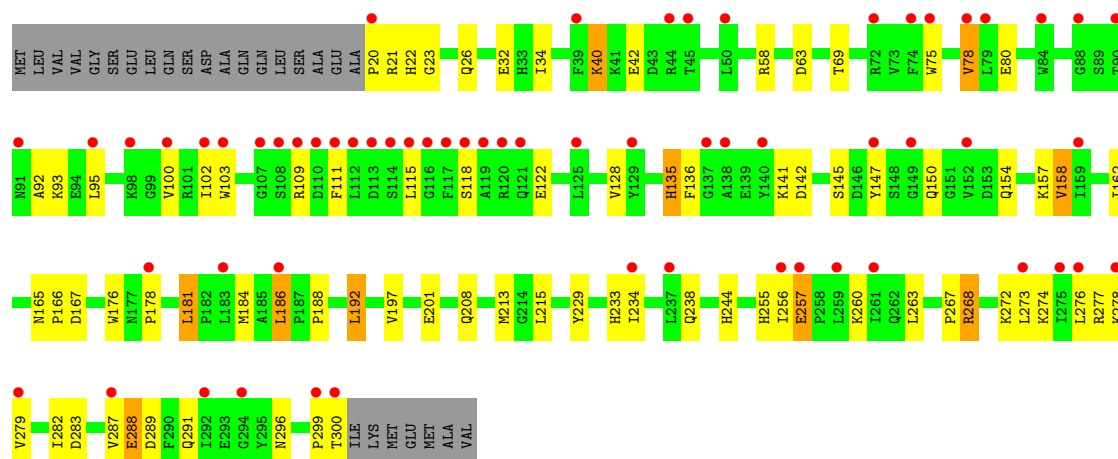




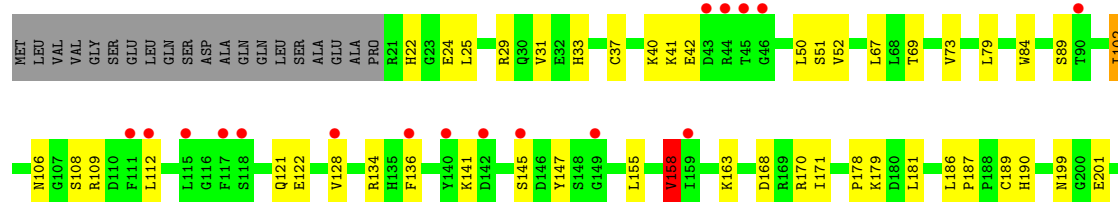
• Molecule 1: Thymidylate synthase



• Molecule 1: Thymidylate synthase



• Molecule 1: Thymidylate synthase





4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	160.35Å 88.54Å 136.76Å 90.00° 95.99° 90.00°	Depositor
Resolution (Å)	19.95 – 1.70 19.95 – 1.70	Depositor EDS
% Data completeness (in resolution range)	98.6 (19.95-1.70) 98.5 (19.95-1.70)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.86 (at 1.70Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.235 , 0.292 0.233 , 0.289	Depositor DCC
R_{free} test set	4109 reflections (2.00%)	wwPDB-VP
Wilson B-factor (Å ²)	25.6	Xtriage
Anisotropy	0.054	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 53.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	15512	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 40.64 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.6537e-04.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: BU1, UMP

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	1.43	9/2405 (0.4%)	1.31	9/3248 (0.3%)
1	B	1.43	7/2414 (0.3%)	1.27	3/3261 (0.1%)
1	C	1.27	2/2337 (0.1%)	1.18	2/3161 (0.1%)
1	D	1.19	2/2357 (0.1%)	1.15	4/3186 (0.1%)
1	E	0.94	2/2394 (0.1%)	1.02	4/3237 (0.1%)
1	F	1.11	3/2336 (0.1%)	1.13	1/3158 (0.0%)
All	All	1.24	25/14243 (0.2%)	1.18	23/19251 (0.1%)

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	D	0	1

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	128	VAL	CA-CB	8.03	1.65	1.54
1	A	190	HIS	C-O	6.68	1.32	1.23
1	B	181	LEU	CA-C	6.45	1.59	1.52
1	F	256	ILE	CA-CB	6.22	1.61	1.54
1	A	248	ASP	N-CA	6.21	1.54	1.46
1	B	202	LEU	N-CA	6.10	1.53	1.46
1	B	225	ALA	CA-CB	-6.05	1.43	1.53
1	C	226	LEU	C-O	-5.99	1.17	1.24
1	F	158	VAL	CA-CB	5.80	1.61	1.54
1	E	158	VAL	CA-CB	5.75	1.61	1.54
1	D	152	VAL	CA-CB	5.66	1.60	1.54
1	A	189	CYS	N-CA	5.59	1.53	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	243	VAL	CA-CB	-5.56	1.47	1.54
1	A	53	PHE	C-O	-5.42	1.17	1.24
1	D	192	LEU	C-O	5.41	1.30	1.23
1	C	126	GLY	N-CA	5.37	1.52	1.44
1	E	287	VAL	CA-CB	5.35	1.60	1.54
1	B	179	LYS	C-O	5.29	1.30	1.24
1	F	31	VAL	CA-CB	-5.24	1.48	1.54
1	B	158	VAL	CA-C	5.21	1.59	1.52
1	A	206	LEU	N-CA	5.14	1.52	1.46
1	A	49	THR	CA-CB	5.14	1.62	1.53
1	A	245	THR	C-O	-5.14	1.17	1.24
1	A	170	ARG	CA-CB	5.09	1.60	1.53
1	B	198	VAL	C-O	-5.06	1.18	1.23

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	234	ILE	CB-CA-C	-8.47	100.71	112.14
1	D	298	HIS	CA-C-N	6.48	126.45	120.03
1	D	298	HIS	C-N-CA	6.48	126.45	120.03
1	A	102	ILE	N-CA-C	6.21	118.82	111.05
1	D	63	ASP	N-CA-C	6.17	120.05	111.90
1	C	50	LEU	N-CA-C	-5.93	100.03	109.76
1	D	287	VAL	N-CA-C	5.89	117.34	110.62
1	E	257	GLU	CA-C-N	-5.83	112.86	119.28
1	E	257	GLU	C-N-CA	-5.83	112.86	119.28
1	A	31	VAL	N-CA-C	-5.71	104.94	110.42
1	A	189	CYS	N-CA-CB	5.60	118.92	110.30
1	B	256	ILE	N-CA-C	5.56	115.76	110.42
1	F	187	PRO	O-C-N	5.50	123.73	121.15
1	C	228	THR	N-CA-C	-5.47	105.40	111.36
1	A	50	LEU	N-CA-C	-5.32	101.02	109.59
1	A	188	PRO	CA-C-O	-5.28	115.58	121.23
1	E	22	HIS	N-CA-C	5.25	117.05	110.91
1	A	234	ILE	CB-CG1-CD1	-5.23	102.81	113.80
1	A	272	LYS	CB-CG-CD	5.20	123.26	111.30
1	B	300	THR	N-CA-C	-5.18	103.69	110.53
1	B	175	ALA	N-CA-C	-5.17	107.02	113.38
1	A	170	ARG	CB-CA-C	-5.11	103.20	111.28
1	E	291	GLN	N-CA-C	5.04	116.63	108.26

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	300	THR	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	2346	0	2312	45	0
1	B	2354	0	2320	38	1
1	C	2275	0	2238	46	0
1	D	2298	0	2268	61	0
1	E	2332	0	2288	58	0
1	F	2277	0	2238	54	0
2	A	20	0	11	0	0
2	B	20	0	11	0	0
2	C	20	0	11	0	0
2	D	20	0	11	0	0
2	E	20	0	11	0	0
2	F	40	0	22	2	0
3	C	18	0	30	9	0
4	A	344	0	0	10	1
4	B	315	0	0	7	0
4	C	279	0	0	14	0
4	D	242	0	0	17	0
4	E	116	0	0	10	0
4	F	176	0	0	9	0
All	All	15512	0	13771	287	1

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 10.

All (287) 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:D:65:PHE:CE2	4:D:654:HOH:O	1.93	1.20
1:F:136:PHE:HE2	4:F:620:HOH:O	1.28	1.16

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:188:PRO:HB2	4:D:642:HOH:O	1.47	1.11
1:D:65:PHE:CZ	4:D:654:HOH:O	1.98	1.08
1:C:135:HIS:CE1	3:C:503:BU1:H11	1.93	1.04
1:C:109:ARG:HH11	1:C:109:ARG:CG	1.72	1.03
1:C:199[A]:ASN:OD1	1:D:39:PHE:CD2	2.11	1.03
1:C:109:ARG:HH11	1:C:109:ARG:HG3	0.90	1.02
1:B:264[B]:GLN:HA	1:B:264[B]:GLN:NE2	1.76	1.00
1:C:233:HIS:HE1	1:C:279:VAL:H	1.01	1.00
1:B:42:GLU:OE1	4:B:729:HOH:O	1.79	0.99
1:C:109:ARG:HG3	1:C:109:ARG:NH1	1.75	0.96
1:E:20:PRO:HG3	1:E:58:ARG:O	1.66	0.95
1:B:233:HIS:HE1	1:B:279:VAL:H	1.02	0.95
1:A:274:LYS:HD2	4:A:863:HOH:O	1.68	0.94
1:F:22:HIS:HD2	1:F:24:GLU:H	1.11	0.93
1:F:233:HIS:HE1	1:F:279:VAL:H	1.16	0.92
1:C:233:HIS:CE1	1:C:279:VAL:H	1.88	0.92
1:A:233:HIS:HE1	1:A:279:VAL:H	1.11	0.91
1:C:135:HIS:HE1	3:C:503:BU1:H11	1.26	0.90
1:A:274:LYS:HE2	1:A:293[B]:GLU:OE1	1.77	0.84
1:C:215:LEU:HG	4:C:798:HOH:O	1.79	0.83
1:D:233:HIS:HE1	1:D:279:VAL:H	1.23	0.83
1:A:274:LYS:CD	4:A:863:HOH:O	2.24	0.82
1:B:233:HIS:CE1	1:B:279:VAL:H	1.94	0.81
1:D:272:LYS:HE3	1:D:274:LYS:HZ3	1.46	0.80
1:C:199[A]:ASN:OD1	1:D:39:PHE:HD2	1.62	0.79
1:C:140:TYR:CE2	4:C:684:HOH:O	2.35	0.79
1:B:264[B]:GLN:HA	1:B:264[B]:GLN:HE21	1.45	0.79
1:C:135:HIS:HE1	3:C:503:BU1:C1	1.96	0.76
1:F:141:LYS:HE2	1:F:145:SER:HB3	1.68	0.76
1:D:272:LYS:HE3	1:D:274:LYS:NZ	2.01	0.75
1:C:120:ARG:NH2	4:C:684:HOH:O	2.20	0.74
1:F:288:GLU:CD	1:F:288:GLU:H	1.96	0.74
1:D:176:TRP:CZ2	1:D:181:LEU:HD21	2.24	0.73
1:D:257:GLU:HB2	1:D:258:PRO:HD3	1.70	0.73
1:E:192:LEU:HD21	1:F:207:TYR:CD2	2.23	0.73
1:E:109:ARG:HB2	1:E:122:GLU:OE1	1.89	0.71
1:A:106:ASN:OD1	4:A:869:HOH:O	2.07	0.71
1:A:233:HIS:CE1	1:A:279:VAL:H	2.03	0.71
1:A:30:GLN:HB3	1:A:55:MET:HE1	1.70	0.71
1:E:162:ILE:HA	4:E:648:HOH:O	1.91	0.71
1:A:274:LYS:HG2	1:A:293[A]:GLU:CD	2.15	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:178:PRO:HA	1:C:181:LEU:HD22	1.72	0.70
1:A:33:HIS:HD2	4:A:868:HOH:O	1.74	0.69
1:C:133:TRP:CE2	1:C:173:MET:HE3	2.27	0.69
1:D:258:PRO:HG2	1:D:303:MET:HA	1.71	0.69
1:F:163:LYS:NZ	4:F:734:HOH:O	2.25	0.68
1:D:233:HIS:CE1	1:D:279:VAL:H	2.11	0.68
1:D:254:ASN:HB2	4:D:732:HOH:O	1.94	0.68
1:C:135:HIS:CE1	3:C:503:BU1:H32	2.29	0.68
1:D:188:PRO:CB	4:D:642:HOH:O	2.20	0.68
1:C:140:TYR:HE2	4:C:684:HOH:O	1.76	0.67
1:A:274:LYS:CG	1:A:293[A]:GLU:OE2	2.43	0.67
1:A:215:LEU:HD12	4:A:718:HOH:O	1.96	0.66
1:E:109:ARG:NH2	1:E:118:SER:O	2.29	0.66
1:D:75:TRP:HZ3	4:D:654:HOH:O	1.80	0.65
1:E:278[B]:LYS:HD2	1:E:278[B]:LYS:N	2.13	0.64
1:C:199[A]:ASN:OD1	1:D:39:PHE:CE2	2.51	0.64
1:F:136:PHE:CE2	4:F:620:HOH:O	2.17	0.64
1:B:103:TRP:CZ3	1:B:186:LEU:HD21	2.33	0.64
1:B:264[B]:GLN:HE21	1:B:264[B]:GLN:CA	2.10	0.64
1:F:134:ARG:NH2	1:F:283:ASP:OD1	2.31	0.63
1:E:178:PRO:HD2	1:F:136:PHE:CZ	2.34	0.63
1:D:71:LYS:HE2	1:D:303:MET:SD	2.39	0.62
1:B:208:GLN:OE1	1:B:244:HIS:HE1	1.83	0.62
1:C:32:GLU:HG2	1:C:36:ARG:NH2	2.15	0.61
1:A:190:HIS:HB3	1:A:206:LEU:HD11	1.82	0.61
1:F:233:HIS:CE1	1:F:279:VAL:H	2.07	0.61
1:A:234:ILE:HD11	1:A:282:ILE:HB	1.81	0.61
1:F:208:GLN:OE1	1:F:244:HIS:HE1	1.83	0.61
1:C:151:GLY:O	3:C:504:BU1:H22	2.01	0.61
1:C:233:HIS:HE1	1:C:279:VAL:N	1.85	0.61
1:E:208:GLN:OE1	1:E:244:HIS:HE1	1.84	0.61
1:F:189:CYS:SG	2:F:501:UMP:C6	2.94	0.61
1:A:141[A]:LYS:HE3	1:A:145:SER:HB3	1.82	0.60
1:F:22:HIS:CD2	1:F:24:GLU:H	2.04	0.60
1:F:274:LYS:HE3	1:F:293:GLU:OE1	2.01	0.60
1:E:167:ASP:OD2	1:F:42:GLU:HG2	2.01	0.59
1:B:278:LYS:NZ	1:B:280:GLU:OE2	2.28	0.59
1:F:190:HIS:HB3	1:F:206:LEU:HD11	1.84	0.59
1:E:95:LEU:HD12	4:E:695:HOH:O	2.02	0.58
1:A:288:GLU:CD	1:A:288:GLU:H	2.11	0.58
1:F:108:SER:O	1:F:112:LEU:HD13	2.03	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:42:GLU:OE2	4:A:858:HOH:O	2.17	0.58
1:D:65:PHE:HE2	4:D:654:HOH:O	1.51	0.58
1:D:65:PHE:HZ	4:D:654:HOH:O	1.61	0.58
1:E:277:ARG:HD3	1:E:289:ASP:OD1	2.03	0.58
1:B:22:HIS:CD2	4:B:897:HOH:O	2.57	0.57
1:D:222:ALA:HB1	4:D:654:HOH:O	2.04	0.57
1:A:274:LYS:HG2	1:A:293[A]:GLU:OE2	2.03	0.57
1:E:20:PRO:HB2	1:E:26[B]:GLN:NE2	2.19	0.57
1:A:274:LYS:HG3	1:A:293[A]:GLU:OE2	2.05	0.57
1:E:244:HIS:HD2	4:E:633:HOH:O	1.86	0.57
1:E:197:VAL:HG21	4:E:648:HOH:O	2.04	0.57
1:D:188:PRO:C	4:D:642:HOH:O	2.47	0.56
1:B:233:HIS:HE1	1:B:279:VAL:N	1.87	0.56
1:E:166:PRO:HA	4:E:648:HOH:O	2.05	0.56
1:C:215:LEU:HD13	1:C:255:HIS:CE1	2.41	0.56
1:B:291:GLN:HG3	1:E:21:ARG:HE	1.69	0.56
1:C:300:THR:O	1:C:300:THR:OG1	2.23	0.55
1:D:155:LEU:HD21	1:D:282:ILE:HG12	1.89	0.55
1:B:22:HIS:HB2	4:B:897:HOH:O	2.06	0.55
1:E:256:ILE:CG2	1:E:260:LYS:HE3	2.37	0.55
1:F:233:HIS:HE1	1:F:279:VAL:N	1.96	0.55
1:E:154:GLN:O	1:E:158:VAL:HG13	2.07	0.55
1:E:165:ASN:HB2	4:E:620:HOH:O	2.06	0.55
1:F:141:LYS:HE2	1:F:145:SER:CB	2.35	0.54
1:A:301:ILE:HD12	1:A:301:ILE:O	2.07	0.54
1:F:141:LYS:CE	1:F:145:SER:HB3	2.35	0.54
1:F:51:SER:HB3	4:F:684:HOH:O	2.07	0.54
1:B:22:HIS:HD2	4:B:897:HOH:O	1.89	0.54
1:C:135:HIS:HE1	3:C:503:BU1:H32	1.70	0.54
1:E:63:ASP:O	1:E:272:LYS:HD3	2.08	0.53
1:E:135:HIS:HB3	1:E:150:GLN:O	2.09	0.53
1:E:80:GLU:HB3	4:E:695:HOH:O	2.07	0.53
1:A:208:GLN:OE1	1:A:244:HIS:HE1	1.91	0.53
1:A:233:HIS:HD2	4:A:922:HOH:O	1.91	0.53
1:C:274:LYS:HG3	4:C:745:HOH:O	2.08	0.53
1:E:278[B]:LYS:N	1:E:278[B]:LYS:CD	2.73	0.52
1:E:296:ASN:ND2	4:E:704:HOH:O	2.37	0.52
1:B:40:LYS:NZ	1:B:42:GLU:OE2	2.40	0.52
1:E:93:LYS:NZ	1:E:122:GLU:HG2	2.24	0.52
1:E:257:GLU:OE1	1:E:257:GLU:HA	2.09	0.52
1:E:234:ILE:HD11	1:E:282:ILE:HA	1.92	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:208:GLN:OE1	1:D:244:HIS:HE1	1.92	0.52
1:C:135:HIS:HE1	3:C:503:BU1:C2	2.22	0.52
1:C:140:TYR:CD2	4:C:684:HOH:O	2.60	0.52
1:D:155:LEU:O	1:D:158:VAL:HG22	2.10	0.52
1:B:244:HIS:HD2	4:B:613:HOH:O	1.92	0.52
1:E:40:LYS:NZ	1:E:42:GLU:OE2	2.43	0.52
1:C:208:GLN:OE1	1:C:244:HIS:HE1	1.92	0.52
1:A:291:GLN:NE2	1:A:293[A]:GLU:OE2	2.43	0.51
1:C:220:ASN:ND2	4:C:682:HOH:O	2.43	0.51
1:E:178:PRO:HA	1:E:181:LEU:HD22	1.91	0.51
1:A:301:ILE:HD12	1:A:301:ILE:C	2.35	0.51
1:B:215:LEU:HD13	1:B:255:HIS:CE1	2.46	0.51
1:C:170:ARG:HG3	1:D:209:ARG:NH1	2.25	0.51
1:C:176:TRP:CZ2	1:C:181:LEU:HD21	2.45	0.51
1:D:190:HIS:N	4:D:642:HOH:O	2.44	0.51
1:D:288:GLU:CD	1:D:288:GLU:H	2.17	0.51
1:D:98:LYS:HD2	1:D:98:LYS:N	2.25	0.51
1:A:30:GLN:CD	1:A:55:MET:HE3	2.36	0.51
1:A:244:HIS:HD2	4:A:606:HOH:O	1.95	0.50
1:C:244:HIS:HD2	4:C:614:HOH:O	1.93	0.50
1:F:244:HIS:HD2	4:F:612:HOH:O	1.94	0.50
1:A:274:LYS:CG	1:A:293[A]:GLU:CD	2.82	0.50
1:D:265:ARG:NH1	1:D:298:HIS:HB3	2.26	0.50
1:F:41:LYS:HG3	4:F:684:HOH:O	2.11	0.50
1:F:215:LEU:HD22	1:F:255:HIS:CE1	2.47	0.50
1:D:234:ILE:HD11	1:D:282:ILE:HA	1.95	0.49
1:D:244:HIS:HD2	4:D:603:HOH:O	1.94	0.49
1:A:186:LEU:HD23	1:A:186:LEU:N	2.27	0.49
1:B:22:HIS:NE2	1:B:268:ARG:O	2.45	0.49
1:E:192:LEU:HD21	1:F:207:TYR:CE2	2.48	0.49
1:B:178:PRO:HA	1:B:181:LEU:HD22	1.95	0.49
1:D:21:ARG:NH2	4:D:686:HOH:O	2.46	0.49
1:F:22:HIS:HE1	1:F:268:ARG:O	1.96	0.49
1:A:121:GLN:HG3	4:A:745:HOH:O	2.13	0.49
1:A:186:LEU:N	1:A:186:LEU:CD2	2.76	0.49
1:A:80:GLU:OE2	1:A:287:VAL:HG21	2.13	0.48
1:B:296:ASN:HB3	1:F:37:CYS:HB2	1.94	0.48
1:F:158:VAL:HB	1:F:171:ILE:CG2	2.43	0.48
1:C:178:PRO:HD2	1:D:136:PHE:CZ	2.48	0.48
1:C:32:GLU:HG2	1:C:36:ARG:HH21	1.77	0.48
1:F:145:SER:HB2	1:F:147:TYR:CZ	2.49	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:176:TRP:CZ2	1:E:181:LEU:HD21	2.49	0.48
1:E:215:LEU:HG	1:E:255:HIS:CE1	2.48	0.48
1:D:302:LYS:HG3	1:D:303:MET:N	2.29	0.48
1:F:268:ARG:HD3	1:F:296:ASN:O	2.14	0.48
1:E:20:PRO:HB3	1:E:58:ARG:HB3	1.95	0.48
1:A:147:TYR:O	1:A:148:SER:C	2.56	0.47
1:D:265:ARG:HD3	1:D:298:HIS:CG	2.49	0.47
1:D:215:LEU:HG	1:D:255:HIS:CE1	2.50	0.47
1:E:111:PHE:HZ	1:E:186:LEU:HD13	1.79	0.47
1:C:33:HIS:HE1	4:C:806:HOH:O	1.96	0.47
1:C:135:HIS:HD2	1:C:150:GLN:O	1.97	0.47
1:D:126:GLY:HA2	1:D:140:TYR:CE2	2.49	0.47
1:F:51:SER:CB	4:F:684:HOH:O	2.62	0.47
1:A:145:SER:HB2	1:A:147:TYR:CZ	2.50	0.47
1:E:63:ASP:O	1:E:272:LYS:CD	2.63	0.47
1:B:184:MET:SD	1:B:188:PRO:HD3	2.56	0.46
1:E:136:PHE:CZ	1:F:178:PRO:HD2	2.50	0.46
1:E:256:ILE:HG22	1:E:260:LYS:HE3	1.97	0.46
1:F:121:GLN:HG2	1:F:122:GLU:N	2.29	0.46
1:D:179:LYS:HD3	4:D:671:HOH:O	2.15	0.46
1:E:92:ALA:HB1	1:E:103[B]:TRP:O	2.15	0.46
1:D:21:ARG:HD2	1:D:29:ARG:HH22	1.79	0.46
1:F:84:TRP:CD1	1:F:89:SER:HB3	2.51	0.46
1:F:102:ILE:HB	2:F:502:UMP:H3'	1.97	0.46
1:D:258:PRO:CG	1:D:303:MET:HA	2.42	0.46
1:E:145:SER:HB2	1:E:147:TYR:CZ	2.51	0.46
1:B:151:GLY:HA2	4:B:712:HOH:O	2.14	0.46
1:D:26[A]:GLN:O	1:D:30:GLN:HG3	2.16	0.46
1:D:94:GLU:O	1:D:98:LYS:HD3	2.16	0.46
1:D:127:PRO:O	1:D:184:MET:HE2	2.16	0.46
1:E:20:PRO:HB2	1:E:26[B]:GLN:HE22	1.80	0.46
1:E:201:GLU:HA	1:E:238:GLN:O	2.15	0.46
1:E:75:TRP:HA	1:E:78:VAL:HG13	1.98	0.46
1:D:21:ARG:HH22	1:D:26[A]:GLN:HG3	1.82	0.45
1:F:67:LEU:HD11	1:F:73:VAL:HB	1.97	0.45
1:F:168:ASP:OD1	1:F:170:ARG:HB2	2.16	0.45
1:B:145:SER:HB2	1:B:147:TYR:CZ	2.52	0.45
1:A:234:ILE:HD13	1:A:234:ILE:HG21	1.39	0.45
1:A:276:LEU:HD11	1:A:291:GLN:HB2	1.98	0.45
1:C:120:ARG:CZ	4:C:684:HOH:O	2.63	0.45
1:E:34:ILE:HD12	1:E:213:MET:HG3	1.96	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:40:LYS:HD3	4:C:733:HOH:O	2.16	0.45
1:A:178:PRO:HD2	1:B:136:PHE:CZ	2.52	0.45
1:F:33:HIS:HE1	4:F:634:HOH:O	1.99	0.45
1:A:80:GLU:CD	1:A:287:VAL:HG21	2.42	0.45
1:C:135:HIS:HE1	3:C:503:BU1:C3	2.29	0.44
1:E:229:TYR:CD2	1:E:273:LEU:HD23	2.52	0.44
1:D:22:HIS:CD2	1:D:267:PRO:HB2	2.51	0.44
1:E:274:LYS:HG3	1:E:276:LEU:HD22	1.99	0.44
1:B:262:GLN:HB2	1:B:301:ILE:CD1	2.48	0.44
1:D:31:VAL:HG12	1:D:35:LEU:HD22	2.00	0.44
1:D:33:HIS:HE1	4:D:753:HOH:O	2.00	0.44
1:B:192:LEU:C	1:B:192:LEU:HD12	2.43	0.44
1:D:190:HIS:C	4:D:642:HOH:O	2.59	0.44
1:D:234:ILE:HD11	1:D:282:ILE:CA	2.47	0.44
1:D:266:GLU:HA	1:D:266:GLU:OE1	2.18	0.44
1:F:121:GLN:HG2	1:F:122:GLU:H	1.83	0.43
1:B:208:GLN:OE1	1:B:244:HIS:CE1	2.68	0.43
1:C:264:GLN:NE2	4:C:665:HOH:O	2.50	0.43
1:D:145:SER:HB2	1:D:147:TYR:CZ	2.53	0.43
3:C:504:BU1:H32	4:C:675:HOH:O	2.18	0.43
1:E:32:GLU:HG2	1:E:263:LEU:CD2	2.49	0.43
1:E:267:PRO:HD2	4:E:604:HOH:O	2.18	0.43
1:B:257:GLU:HB3	1:B:303:MET:HE1	2.00	0.43
1:A:291:GLN:HE21	1:A:293[A]:GLU:CD	2.25	0.43
1:A:136:PHE:CD1	1:A:136:PHE:C	2.96	0.43
1:F:251:ILE:HG23	1:F:259:LEU:HD12	2.01	0.43
1:F:260:LYS:O	1:F:264:GLN:HG3	2.19	0.43
1:F:69:THR:HG21	1:F:268:ARG:O	2.19	0.42
1:B:22:HIS:CE1	1:B:24:GLU:HB2	2.54	0.42
1:B:233:HIS:HD2	4:B:777:HOH:O	2.01	0.42
1:F:158:VAL:HB	1:F:171:ILE:HG22	2.01	0.42
1:B:302:LYS:HD3	1:B:302:LYS:HA	1.75	0.42
1:B:49:THR:HB	1:B:250:HIS:HB2	2.02	0.42
1:A:187:PRO:HA	1:A:188:PRO:HD3	1.91	0.42
1:B:288:GLU:CD	1:B:288:GLU:H	2.26	0.42
1:E:93:LYS:HZ1	1:E:122:GLU:HG2	1.85	0.42
1:C:178:PRO:HD2	1:D:136:PHE:CE1	2.54	0.42
1:B:22:HIS:ND1	1:B:23:GLY:N	2.68	0.42
1:B:103:TRP:HZ3	1:B:186:LEU:HD21	1.84	0.42
1:D:32:GLU:HG3	4:D:646:HOH:O	2.19	0.42
1:D:184:MET:SD	1:D:188:PRO:HD3	2.59	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:79:LEU:HD23	1:F:287:VAL:HG23	2.02	0.42
1:F:155:LEU:HD21	1:F:282:ILE:HG12	2.02	0.42
1:B:186:LEU:N	1:B:186:LEU:HD23	2.35	0.41
1:F:106:ASN:ND2	1:F:186:LEU:HG	2.35	0.41
1:A:82:LEU:HD23	1:A:226:LEU:HG	2.03	0.41
1:A:170:ARG:NH2	4:A:769:HOH:O	2.34	0.41
1:E:257:GLU:OE1	1:E:260:LYS:HD2	2.21	0.41
1:A:103:TRP:CZ3	1:A:186:LEU:HD21	2.55	0.41
1:D:265:ARG:HH11	1:D:298:HIS:HB3	1.83	0.41
1:F:22:HIS:CE1	1:F:268:ARG:O	2.74	0.41
1:A:186:LEU:HD23	1:A:186:LEU:H	1.84	0.41
1:C:170:ARG:HG3	1:D:209:ARG:CZ	2.50	0.41
1:B:201:GLU:HA	1:B:238:GLN:O	2.21	0.41
1:D:302:LYS:HG3	1:D:303:MET:H	1.84	0.41
1:E:69:THR:HB	1:E:268:ARG:HG2	2.02	0.41
1:E:299:PRO:O	1:E:300:THR:HB	2.21	0.41
1:F:25:LEU:HD13	1:F:29:ARG:NH2	2.35	0.41
1:D:255:HIS:C	1:D:258:PRO:HD2	2.45	0.41
1:F:253:LEU:HD23	1:F:256:ILE:HD11	2.02	0.41
1:A:192:LEU:HD12	1:A:192:LEU:C	2.46	0.41
1:B:113:ASP:OD1	1:B:118:SER:HA	2.21	0.41
1:C:40:LYS:CD	4:C:733:HOH:O	2.69	0.41
1:D:21:ARG:NH1	1:D:29:ARG:NH1	2.69	0.41
1:D:278:LYS:HD3	1:D:278:LYS:C	2.46	0.41
1:E:288[A]:GLU:CD	1:E:288[A]:GLU:H	2.28	0.41
1:F:179:LYS:HE2	4:F:762:HOH:O	2.20	0.41
1:F:265:ARG:HG2	1:F:298:HIS:ND1	2.35	0.41
1:E:167:ASP:OD2	1:F:42:GLU:CG	2.69	0.41
1:F:201:GLU:HA	1:F:238:GLN:O	2.21	0.41
1:C:262:GLN:HA	1:C:265:ARG:HD2	2.03	0.40
1:E:184:MET:SD	1:E:188:PRO:HD3	2.61	0.40
1:E:95:LEU:CD1	4:E:695:HOH:O	2.65	0.40
1:C:184:MET:SD	1:C:188:PRO:HD3	2.62	0.40
1:A:121:GLN:HE21	1:A:121:GLN:HA	1.87	0.40
1:C:158:VAL:HG13	1:C:171:ILE:CG2	2.51	0.40
1:D:21:ARG:HG2	1:D:25:LEU:HD12	2.02	0.40
1:E:100:VAL:HG12	1:E:102:ILE:HG12	2.04	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:36[B]:ARG:NH1	4:A:858:HOH:O[4_545]	2.00	0.20

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	288/307 (94%)	279 (97%)	7 (2%)	2 (1%)	18	7
1	B	289/307 (94%)	283 (98%)	5 (2%)	1 (0%)	36	22
1	C	280/307 (91%)	273 (98%)	6 (2%)	1 (0%)	30	16
1	D	282/307 (92%)	272 (96%)	9 (3%)	1 (0%)	30	16
1	E	285/307 (93%)	268 (94%)	15 (5%)	2 (1%)	18	7
1	F	279/307 (91%)	271 (97%)	7 (2%)	1 (0%)	30	16
All	All	1703/1842 (92%)	1646 (97%)	49 (3%)	8 (0%)	24	12

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	23	GLY
1	A	148	SER
1	E	128	VAL
1	F	128	VAL
1	A	128	VAL
1	B	128	VAL
1	D	128	VAL
1	C	128	VAL

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	253/266 (95%)	243 (96%)	10 (4%)	28	12
1	B	254/266 (96%)	245 (96%)	9 (4%)	32	15
1	C	246/266 (92%)	235 (96%)	11 (4%)	24	9
1	D	248/266 (93%)	236 (95%)	12 (5%)	23	8
1	E	251/266 (94%)	236 (94%)	15 (6%)	17	5
1	F	245/266 (92%)	232 (95%)	13 (5%)	20	7
All	All	1497/1596 (94%)	1427 (95%)	70 (5%)	23	9

All (70) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	36	ARG
1	A	121	GLN
1	A	181	LEU
1	A	186	LEU
1	A	215	LEU
1	A	266	GLU
1	A	288	GLU
1	A	302	LYS
1	A	303	MET
1	A	307	VAL
1	B	32	GLU
1	B	181	LEU
1	B	186	LEU
1	B	215	LEU
1	B	266	GLU
1	B	286	LYS
1	B	288	GLU
1	B	302	LYS
1	B	304	GLU
1	C	21	ARG
1	C	36	ARG
1	C	109	ARG
1	C	170	ARG
1	C	181	LEU
1	C	186	LEU
1	C	269	PRO
1	C	279	VAL

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Mol	Chain	Res	Type
1	C	282	ILE
1	C	288	GLU
1	C	300	THR
1	D	21	ARG
1	D	35	LEU
1	D	63	ASP
1	D	98	LYS
1	D	101	ARG
1	D	148	SER
1	D	181	LEU
1	D	274	LYS
1	D	278	LYS
1	D	280	GLU
1	D	288	GLU
1	D	301	ILE
1	E	40	LYS
1	E	78	VAL
1	E	115	LEU
1	E	135	HIS
1	E	141	LYS
1	E	142	ASP
1	E	157	LYS
1	E	181	LEU
1	E	186	LEU
1	E	192	LEU
1	E	268	ARG
1	E	279	VAL
1	E	283	ASP
1	E	288[A]	GLU
1	E	288[B]	GLU
1	F	40	LYS
1	F	50	LEU
1	F	52	VAL
1	F	102	ILE
1	F	109	ARG
1	F	158	VAL
1	F	181	LEU
1	F	199	ASN
1	F	215	LEU
1	F	265	ARG
1	F	266	GLU
1	F	288	GLU

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Mol	Chain	Res	Type
1	F	291	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (34) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	33	HIS
1	A	56	GLN
1	A	121	GLN
1	A	156	GLN
1	A	205	GLN
1	A	233	HIS
1	A	244	HIS
1	A	296	ASN
1	B	33	HIS
1	B	205	GLN
1	B	233	HIS
1	B	244	HIS
1	C	33	HIS
1	C	135	HIS
1	C	156	GLN
1	C	233	HIS
1	C	244	HIS
1	D	30	GLN
1	D	33	HIS
1	D	150	GLN
1	D	233	HIS
1	D	244	HIS
1	E	33	HIS
1	E	233	HIS
1	E	244	HIS
1	E	255	HIS
1	F	22	HIS
1	F	33	HIS
1	F	106	ASN
1	F	121	GLN
1	F	156	GLN
1	F	233	HIS
1	F	244	HIS
1	F	255	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

10 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	$\# Z > 2$
2	UMP	C	501	-	21,21,21	1.20	2 (9%)	30,31,31	1.90	6 (20%)
3	BU1	C	502	-	5,5,5	0.28	0	4,4,4	0.52	0
2	UMP	F	502	-	21,21,21	0.90	1 (4%)	30,31,31	2.13	8 (26%)
3	BU1	C	504	-	5,5,5	0.30	0	4,4,4	0.49	0
2	UMP	F	501	-	21,21,21	1.02	1 (4%)	30,31,31	1.79	5 (16%)
2	UMP	D	501	-	21,21,21	0.98	1 (4%)	30,31,31	1.52	4 (13%)
3	BU1	C	503	-	5,5,5	0.34	0	4,4,4	0.52	0
2	UMP	B	501	-	21,21,21	1.18	1 (4%)	30,31,31	1.56	6 (20%)
2	UMP	A	501	-	21,21,21	0.98	1 (4%)	30,31,31	1.78	7 (23%)
2	UMP	E	501	-	21,21,21	0.90	2 (9%)	30,31,31	1.46	4 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	UMP	C	501	-	-	1/10/22/22	0/2/2/2
3	BU1	C	502	-	-	2/3/3/3	-
2	UMP	F	502	-	-	6/10/22/22	0/2/2/2
3	BU1	C	504	-	-	0/3/3/3	-
2	UMP	F	501	-	-	1/10/22/22	0/2/2/2
2	UMP	D	501	-	-	0/10/22/22	0/2/2/2
3	BU1	C	503	-	-	0/3/3/3	-
2	UMP	B	501	-	-	1/10/22/22	0/2/2/2
2	UMP	A	501	-	-	1/10/22/22	0/2/2/2
2	UMP	E	501	-	-	2/10/22/22	0/2/2/2

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	UMP	C6-C5	3.16	1.42	1.35
2	C	501	UMP	C6-C5	2.94	1.41	1.35
2	A	501	UMP	C6-C5	2.75	1.41	1.35
2	F	501	UMP	C6-C5	2.48	1.40	1.35
2	D	501	UMP	C6-C5	2.22	1.40	1.35
2	E	501	UMP	C5-C4	-2.09	1.39	1.43
2	E	501	UMP	C6-C5	2.09	1.39	1.35
2	F	502	UMP	C6-C5	2.03	1.39	1.35
2	C	501	UMP	P-OP3	-2.01	1.47	1.54

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	UMP	N3-C2-N1	5.73	122.34	114.89
2	F	502	UMP	O4'-C1'-N1	5.53	117.68	107.86
2	F	501	UMP	C4-N3-C2	-5.15	120.22	126.61
2	F	502	UMP	C4-N3-C2	-5.14	120.24	126.61
2	C	501	UMP	C4-N3-C2	-4.40	121.15	126.61
2	D	501	UMP	C4-N3-C2	-4.37	121.19	126.61
2	F	502	UMP	N3-C2-N1	4.32	120.51	114.89
2	A	501	UMP	N3-C2-N1	4.21	120.38	114.89
2	F	501	UMP	C5-C4-N3	4.21	120.70	114.80
2	A	501	UMP	C4-N3-C2	-4.04	121.60	126.61
2	E	501	UMP	C4-N3-C2	-4.02	121.62	126.61
2	B	501	UMP	C5-C4-N3	3.98	120.38	114.80
2	E	501	UMP	N3-C2-N1	3.86	119.92	114.89
2	A	501	UMP	C5-C4-N3	3.86	120.21	114.80
2	F	501	UMP	N3-C2-N1	3.59	119.56	114.89

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	UMP	O2-C2-N3	-3.53	114.98	121.49
2	D	501	UMP	N3-C2-N1	3.49	119.44	114.89
2	B	501	UMP	C4-N3-C2	-3.43	122.35	126.61
2	D	501	UMP	C5-C4-N3	3.33	119.46	114.80
2	F	502	UMP	C5-C4-N3	3.18	119.26	114.80
2	B	501	UMP	O2-C2-N3	-2.97	116.01	121.49
2	C	501	UMP	O4'-C1'-N1	-2.96	102.61	107.86
2	E	501	UMP	C5-C4-N3	2.89	118.84	114.80
2	A	501	UMP	OP3-P-O5'	2.80	113.96	106.67
2	B	501	UMP	N3-C2-N1	2.76	118.49	114.89
2	B	501	UMP	O4-C4-N3	-2.73	115.31	119.27
2	B	501	UMP	C6-C5-C4	-2.72	116.06	119.53
2	F	502	UMP	O2-C2-N1	-2.71	119.27	122.80
2	F	501	UMP	O4-C4-C5	-2.66	120.57	125.16
2	C	501	UMP	O2-C2-N1	-2.62	119.39	122.80
2	F	502	UMP	O5'-P-OP1	2.61	113.50	106.44
2	D	501	UMP	O2-C2-N3	-2.56	116.77	121.49
2	F	502	UMP	O4'-C1'-C2'	-2.54	101.50	106.25
2	C	501	UMP	C6-N1-C2	-2.47	117.99	121.00
2	A	501	UMP	O4-C4-N3	-2.44	115.74	119.27
2	F	502	UMP	O4-C4-C5	-2.43	120.97	125.16
2	E	501	UMP	O3'-C3'-C2'	-2.43	102.42	110.88
2	C	501	UMP	C5-C4-N3	2.35	118.09	114.80
2	A	501	UMP	C6-C5-C4	-2.31	116.58	119.53
2	F	501	UMP	O4'-C1'-N1	-2.14	104.07	107.86

There are no chirality outliers.

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	F	502	UMP	C3'-C4'-C5'-O5'
2	F	502	UMP	C2'-C1'-N1-C2
2	F	502	UMP	O4'-C4'-C5'-O5'
2	F	502	UMP	C2'-C1'-N1-C6
3	C	502	BU1	C2-C3-C4-O6
3	C	502	BU1	O5-C1-C2-C3
2	F	502	UMP	O4'-C1'-N1-C6
2	F	502	UMP	O4'-C1'-N1-C2
2	A	501	UMP	O4'-C4'-C5'-O5'
2	E	501	UMP	O4'-C4'-C5'-O5'
2	B	501	UMP	O4'-C4'-C5'-O5'
2	F	501	UMP	O4'-C4'-C5'-O5'

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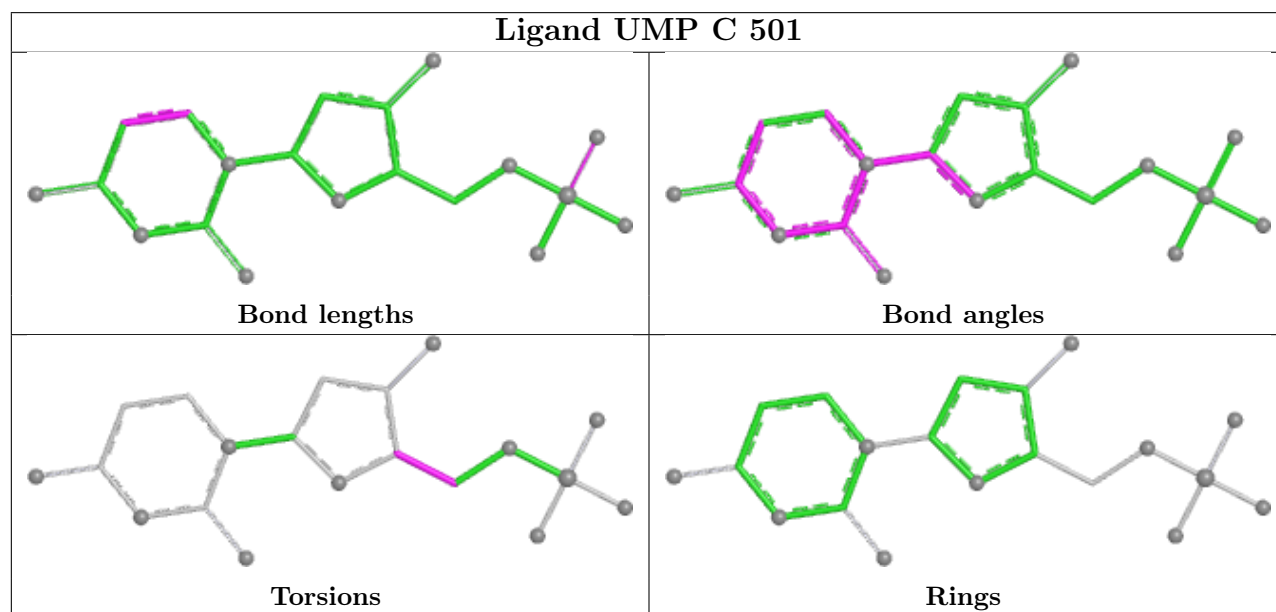
Mol	Chain	Res	Type	Atoms
2	C	501	UMP	O4'-C4'-C5'-O5'
2	E	501	UMP	C3'-C4'-C5'-O5'

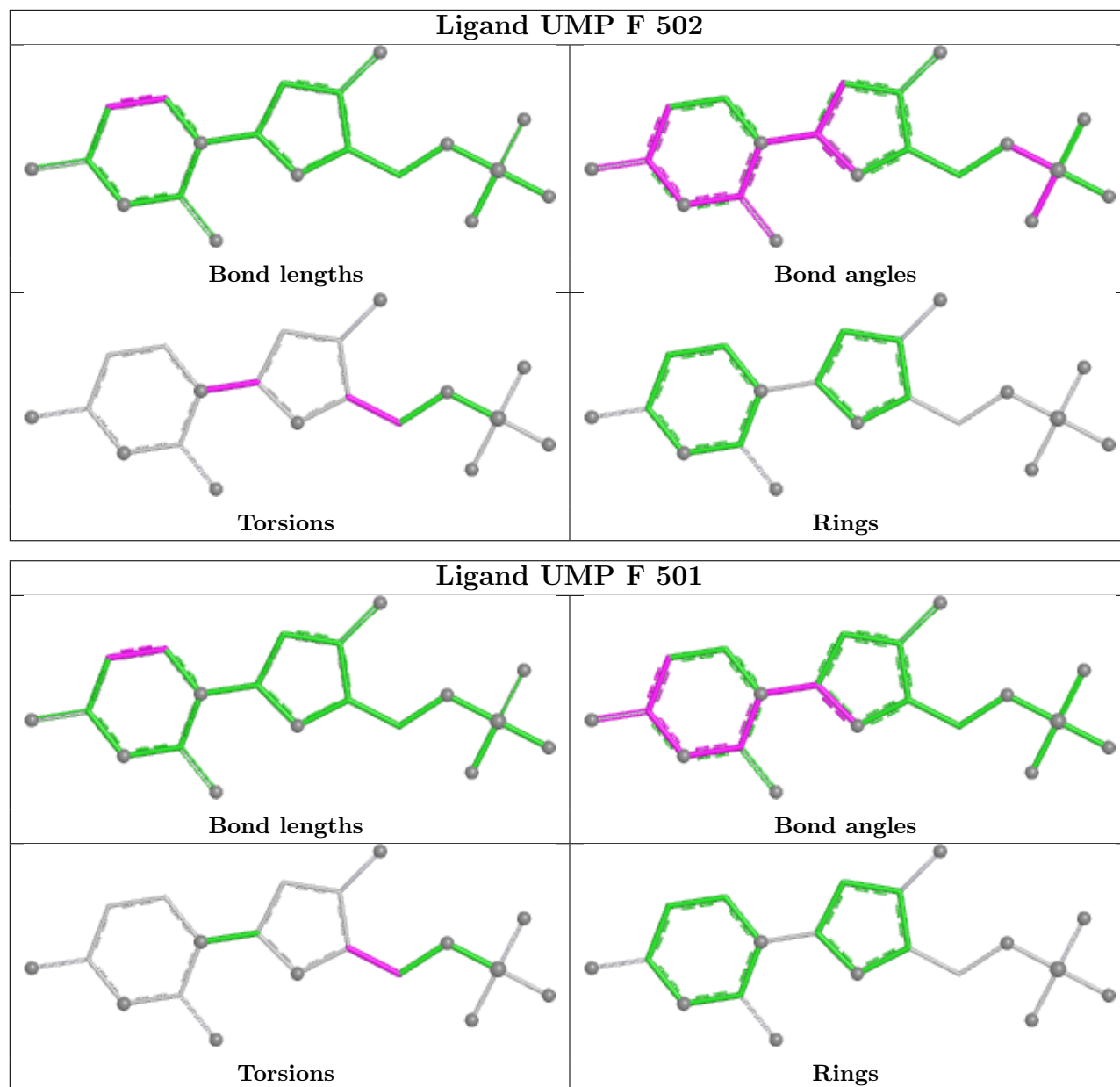
There are no ring outliers.

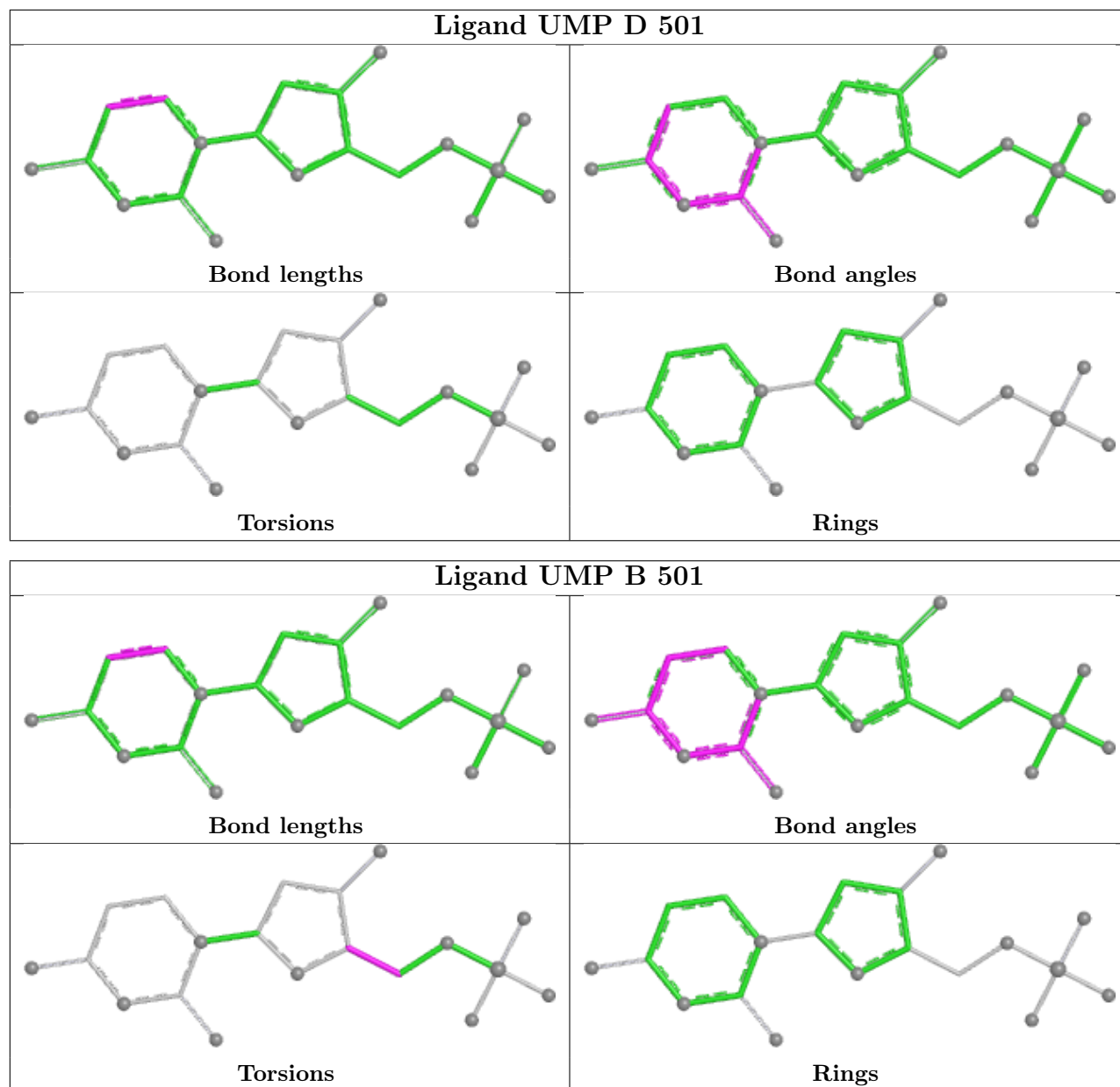
4 monomers are involved in 11 short contacts:

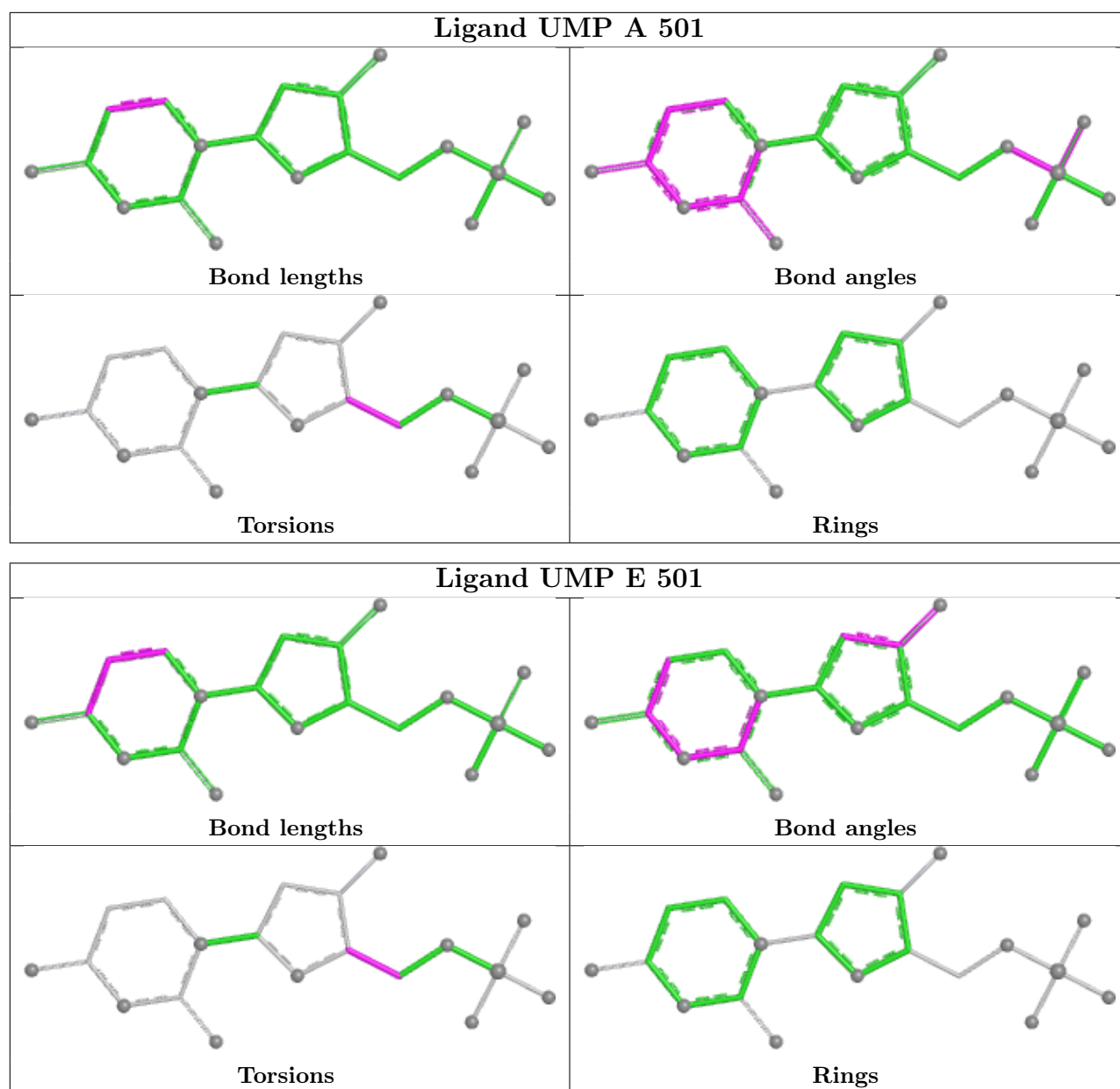
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	502	UMP	1	0
3	C	504	BU1	2	0
2	F	501	UMP	1	0
3	C	503	BU1	7	0

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 than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









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

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, 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	287/307 (93%)	0.18	12 (4%) 40 45	12, 20, 33, 43	3 (1%)
1	B	288/307 (93%)	0.15	9 (3%) 51 55	12, 20, 31, 54	3 (1%)
1	C	280/307 (91%)	0.58	9 (3%) 50 54	13, 24, 36, 43	2 (0%)
1	D	283/307 (92%)	0.81	16 (5%) 29 32	14, 27, 44, 69	1 (0%)
1	E	281/307 (91%)	1.40	62 (22%) 2 2	17, 39, 69, 86	6 (2%)
1	F	279/307 (90%)	0.85	20 (7%) 21 23	19, 31, 50, 55	2 (0%)
All	All	1698/1842 (92%)	0.66	128 (7%) 20 22	12, 26, 49, 86	17 (1%)

All (128) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	117	PHE	6.5
1	E	100	VAL	6.1
1	E	112	LEU	6.0
1	E	116	GLY	4.4
1	E	103[A]	TRP	4.2
1	A	303	MET	4.0
1	E	111	PHE	3.9
1	E	102	ILE	3.8
1	D	301	ILE	3.8
1	A	302	LYS	3.7
1	A	301	ILE	3.6
1	D	45	THR	3.5
1	B	20	PRO	3.5
1	E	137	GLY	3.5
1	E	115	LEU	3.5
1	B	22	HIS	3.4
1	E	20	PRO	3.4
1	B	304	GLU	3.3
1	E	39	PHE	3.3

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Mol	Chain	Res	Type	RSRZ
1	F	111	PHE	3.3
1	E	261	ILE	3.2
1	E	152	VAL	3.2
1	F	115	LEU	3.1
1	E	121[A]	GLN	3.1
1	A	306	ALA	3.1
1	E	45	THR	3.1
1	E	79	LEU	3.0
1	C	45	THR	3.0
1	E	125	LEU	3.0
1	E	149	GLY	2.9
1	E	178	PRO	2.9
1	E	119	ALA	2.8
1	F	299	PRO	2.8
1	D	261	ILE	2.8
1	E	278[A]	LYS	2.8
1	E	186	LEU	2.8
1	F	44[A]	ARG	2.7
1	F	117	PHE	2.7
1	E	108	SER	2.7
1	E	95	LEU	2.7
1	E	279	VAL	2.7
1	E	287	VAL	2.7
1	F	112	LEU	2.7
1	E	107	GLY	2.7
1	E	113	ASP	2.7
1	D	297	PRO	2.6
1	E	118	SER	2.6
1	C	117	PHE	2.6
1	F	136	PHE	2.6
1	B	301	ILE	2.6
1	D	46	GLY	2.6
1	D	116	GLY	2.6
1	E	276	LEU	2.6
1	E	114	SER	2.6
1	D	303	MET	2.6
1	B	306	ALA	2.6
1	E	72[A]	ARG	2.6
1	A	307	VAL	2.5
1	D	259	LEU	2.5
1	C	160	ASP	2.5
1	E	294	GLY	2.5

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Mol	Chain	Res	Type	RSRZ
1	E	109	ARG	2.5
1	F	45	THR	2.5
1	E	159	ILE	2.4
1	E	259	LEU	2.4
1	A	300	THR	2.4
1	D	47	THR	2.4
1	D	270	PHE	2.4
1	F	140	TYR	2.4
1	E	84	TRP	2.3
1	B	189	CYS	2.3
1	C	119	ALA	2.3
1	E	129	TYR	2.3
1	F	46	GLY	2.3
1	C	189	CYS	2.3
1	D	117	PHE	2.3
1	F	145	SER	2.3
1	B	302	LYS	2.3
1	E	98	LYS	2.3
1	E	256	ILE	2.3
1	A	287	VAL	2.3
1	A	264	GLN	2.2
1	E	257	GLU	2.2
1	E	91	ASN	2.2
1	E	237	LEU	2.2
1	E	234	ILE	2.2
1	D	32	GLU	2.2
1	A	36	ARG	2.2
1	E	90	THR	2.2
1	E	50	LEU	2.2
1	A	304	GLU	2.2
1	E	140	TYR	2.2
1	D	43	ASP	2.2
1	F	43	ASP	2.2
1	E	88	GLY	2.2
1	E	120	ARG	2.2
1	F	258	PRO	2.2
1	E	78	VAL	2.1
1	E	75	TRP	2.1
1	E	273	LEU	2.1
1	B	199	ASN	2.1
1	F	118	SER	2.1
1	D	299	PRO	2.1

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Mol	Chain	Res	Type	RSRZ
1	E	275	ILE	2.1
1	E	292	ILE	2.1
1	F	256	ILE	2.1
1	F	128	VAL	2.1
1	F	149	GLY	2.1
1	E	110	ASP	2.1
1	A	111	PHE	2.1
1	C	39	PHE	2.1
1	E	147	TYR	2.1
1	D	107	GLY	2.1
1	E	138	ALA	2.1
1	B	305	MET	2.1
1	F	90	THR	2.1
1	E	74	PHE	2.1
1	C	261	ILE	2.1
1	A	21	ARG	2.0
1	E	183	LEU	2.0
1	E	300	THR	2.0
1	C	258	PRO	2.0
1	E	299	PRO	2.0
1	D	264	GLN	2.0
1	E	44	ARG	2.0
1	F	159	ILE	2.0
1	F	142	ASP	2.0
1	C	148[A]	SER	2.0

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 ⓘ

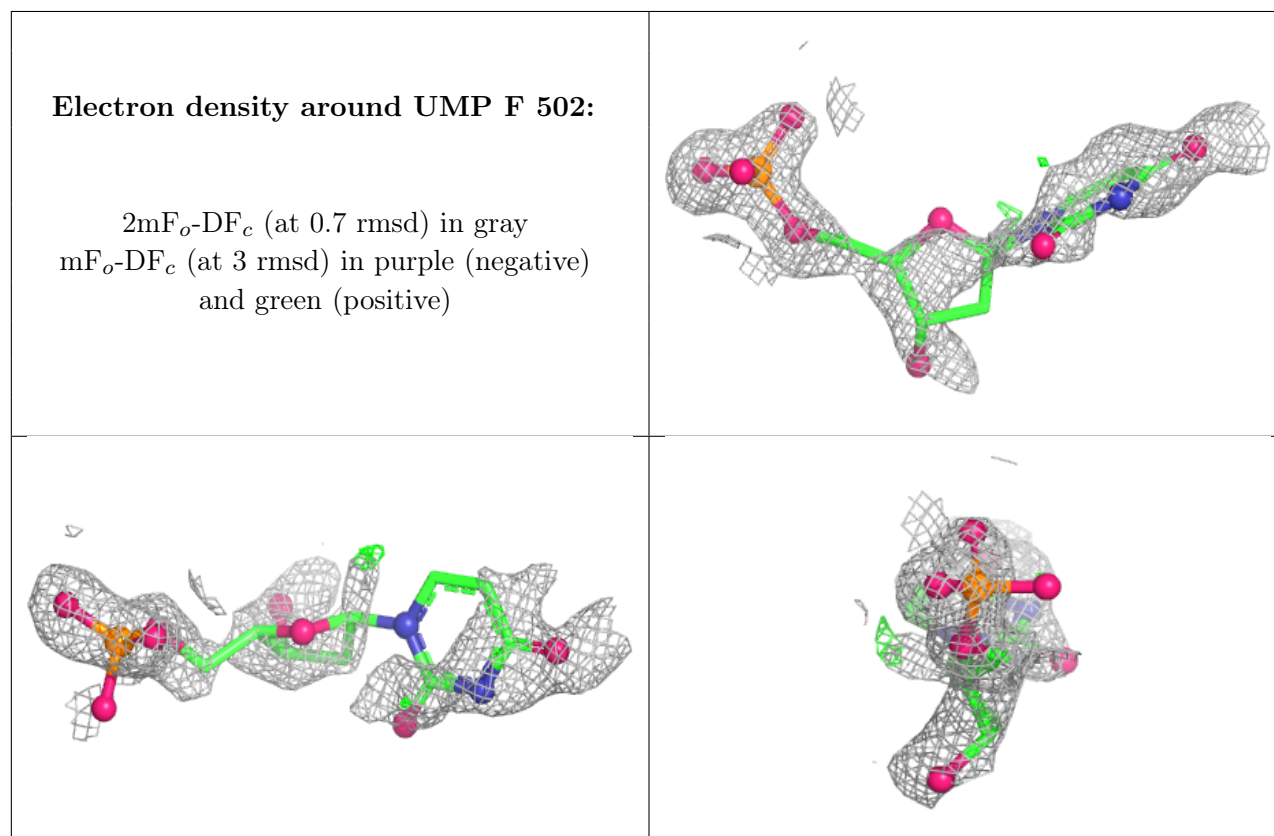
There are no oligosaccharides in this entry.

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, 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.

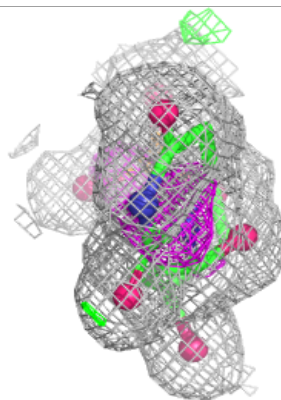
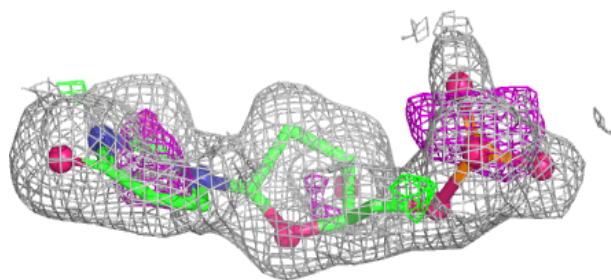
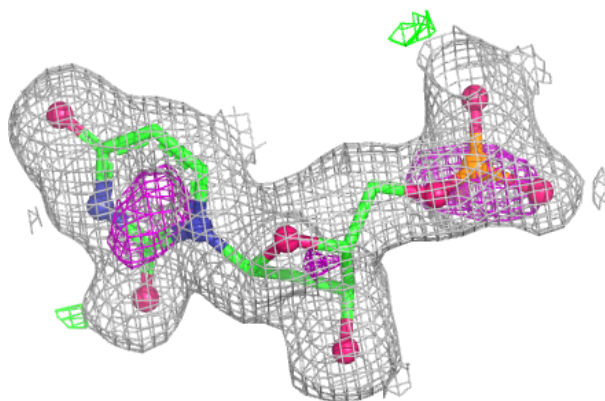
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	UMP	F	502	20/20	0.68	0.25	23,41,46,46	20
3	BU1	C	502	6/6	0.72	0.12	56,57,57,58	0
3	BU1	C	504	6/6	0.72	0.17	40,47,51,54	0
3	BU1	C	503	6/6	0.74	0.14	37,45,47,48	0
2	UMP	F	501	20/20	0.84	0.12	24,31,32,34	0
2	UMP	D	501	20/20	0.92	0.09	21,24,29,29	0
2	UMP	E	501	20/20	0.93	0.08	23,29,35,36	0
2	UMP	C	501	20/20	0.93	0.08	19,22,29,30	0
2	UMP	B	501	20/20	0.97	0.06	13,17,21,23	0
2	UMP	A	501	20/20	0.98	0.04	13,16,24,24	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.

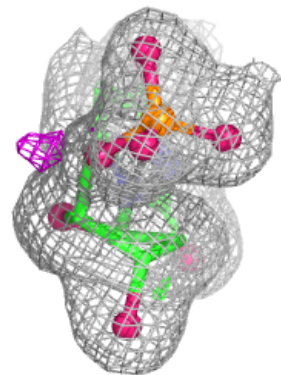
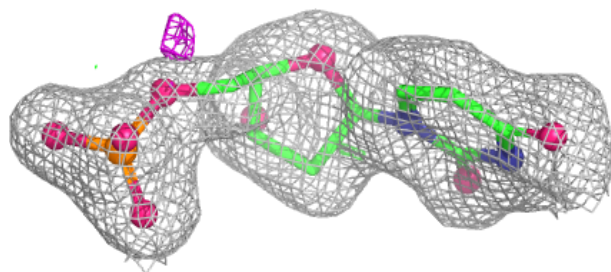
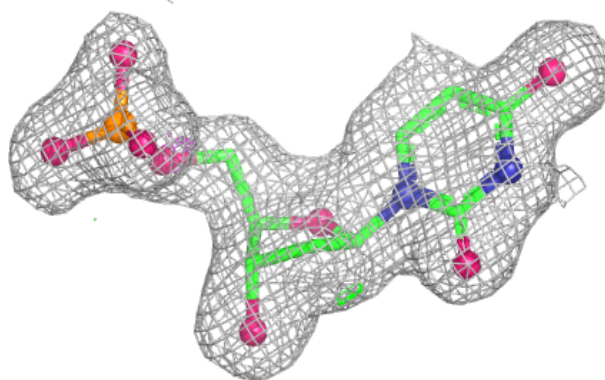


Electron density around UMP F 501:

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

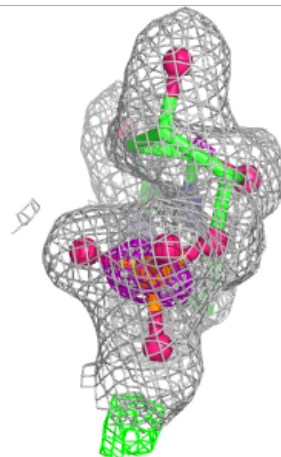
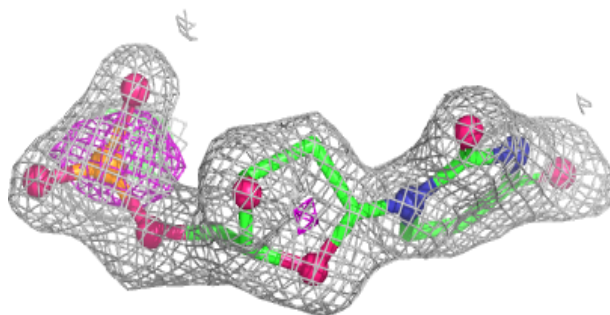
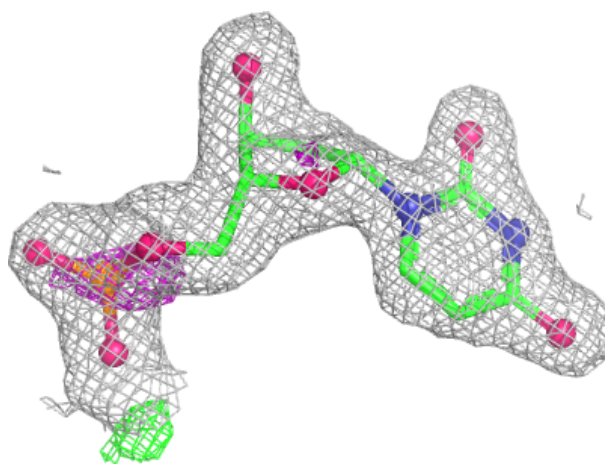
**Electron density around UMP D 501:**

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



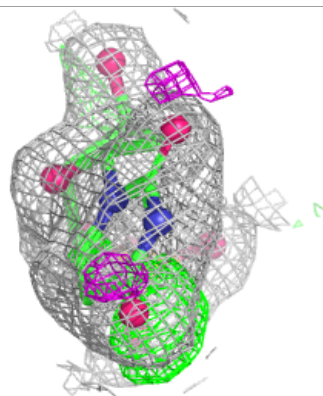
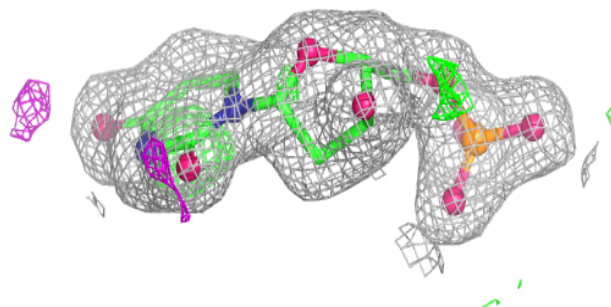
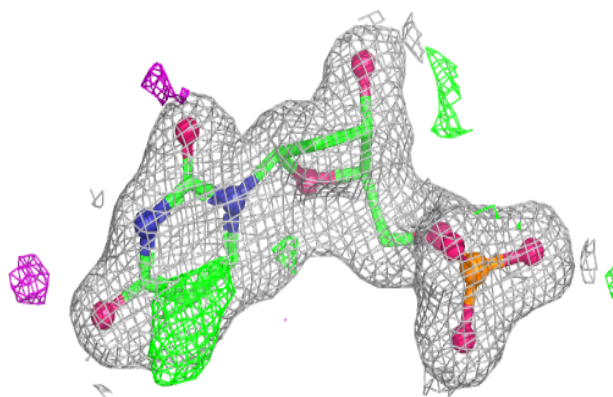
Electron density around UMP E 501:

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

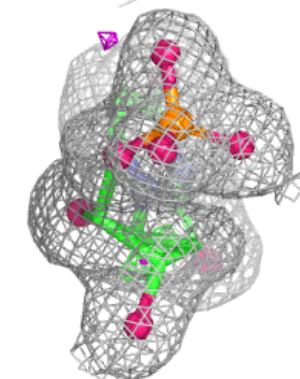
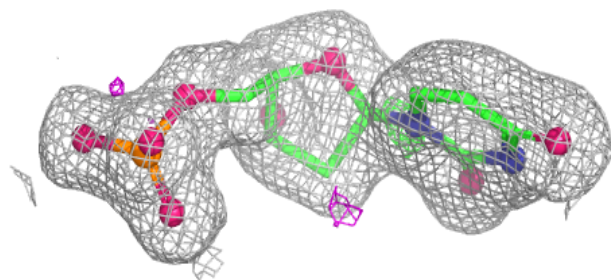
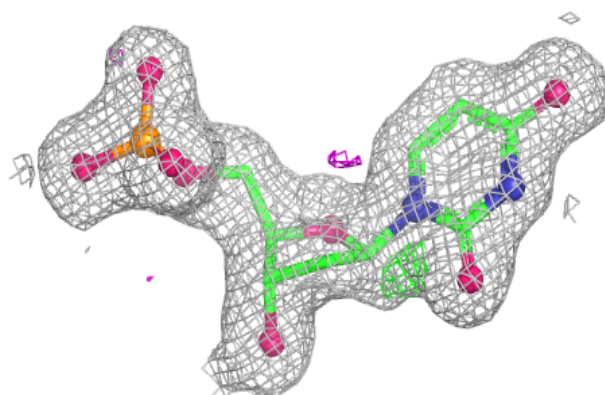


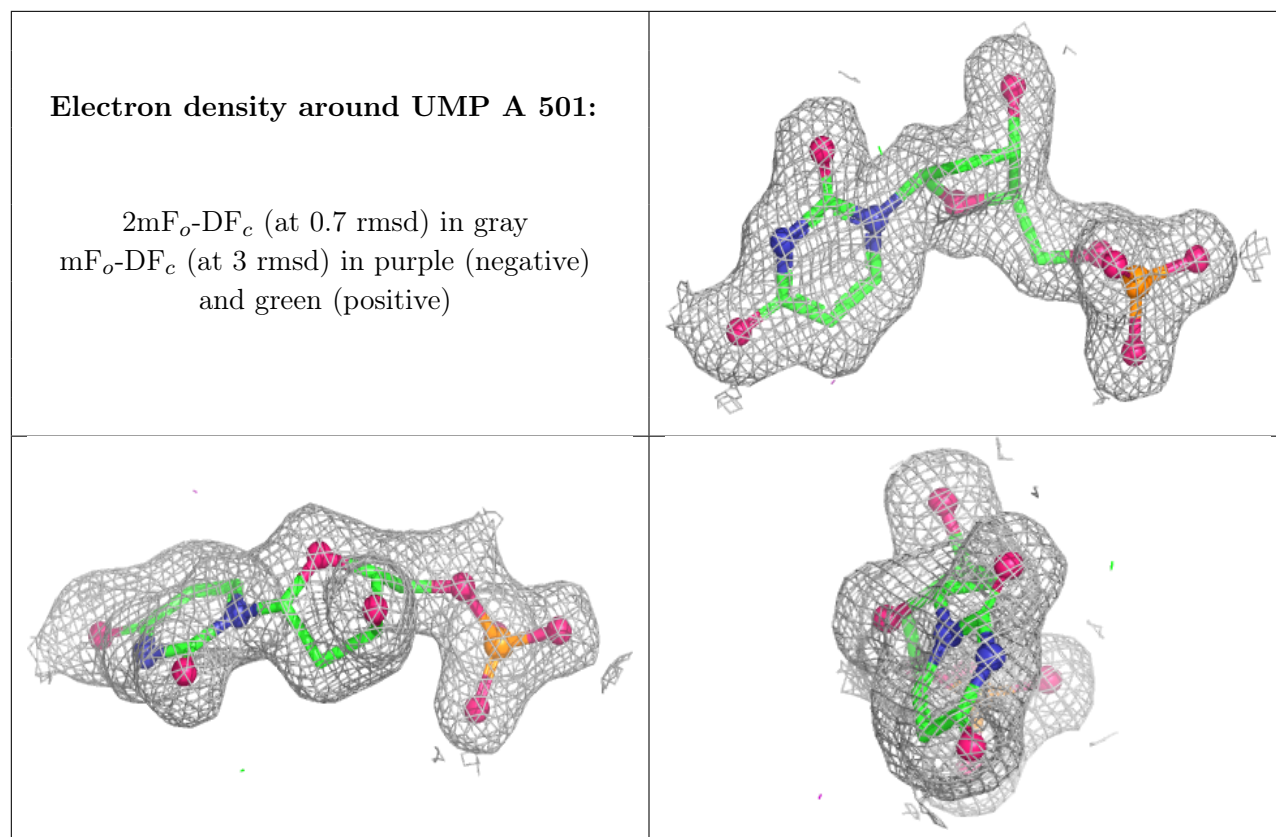
Electron density around UMP C 501:

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

**Electron density around UMP B 501:**

$2mF_o-DF_c$ (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.