



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 10, 2018 – 10:50 pm GMT

PDB ID : 4E5O
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 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 ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

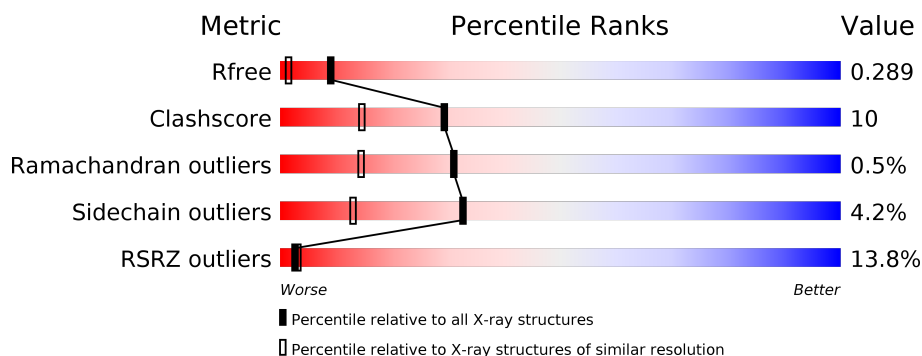
1 Overall quality at a glance

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}	111664	3793 (1.70-1.70)
Clashscore	122126	4167 (1.70-1.70)
Ramachandran outliers	120053	4100 (1.70-1.70)
Sidechain outliers	120020	4100 (1.70-1.70)
RSRZ outliers	108989	3718 (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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	<div> <div>7%</div> <div> <div></div> <div>75%</div> <div>15%</div> <div>•</div> <div>7%</div> </div> </div>
1	B	307	<div> <div>4%</div> <div> <div></div> <div>75%</div> <div>17%</div> <div>•</div> <div>6%</div> </div> </div>
1	C	307	<div> <div>5%</div> <div> <div></div> <div>78%</div> <div>11%</div> <div>•</div> <div>9%</div> </div> </div>
1	D	307	<div> <div>8%</div> <div> <div></div> <div>72%</div> <div>18%</div> <div>•</div> <div>8%</div> </div> </div>
1	E	307	<div> <div>34%</div> <div> <div></div> <div>66%</div> <div>23%</div> <div>•</div> <div>8%</div> </div> </div>
1	F	307	<div> <div>19%</div> <div> <div></div> <div>66%</div> <div>23%</div> <div>•</div> <div>9%</div> </div> </div>

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	F	502	-	-	X	-
3	BU1	C	503	-	-	X	-

2 Entry composition [i](#)

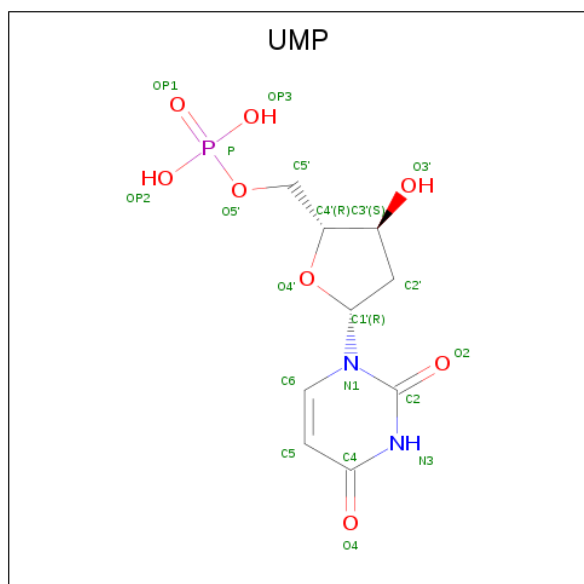
There are 4 unique types of molecules in this entry. The entry contains 15512 atoms, of which 0 are hydrogens and 0 are deuteriums.

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.

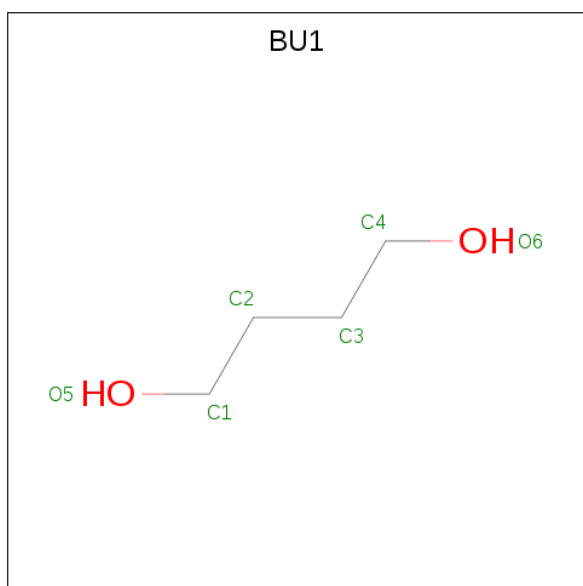
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	287	Total	C	N	O	S	0	3	0
			2346	1501	405	427	13			
1	B	288	Total	C	N	O	S	0	3	0
			2354	1505	409	427	13			
1	C	280	Total	C	N	O	S	0	2	0
			2275	1456	395	413	11			
1	D	283	Total	C	N	O	S	0	1	0
			2298	1472	399	415	12			
1	E	281	Total	C	N	O	S	0	6	0
			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 (three-letter code: 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 (three-letter code: BU1) (formula: C₄H₁₀O₂).



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		

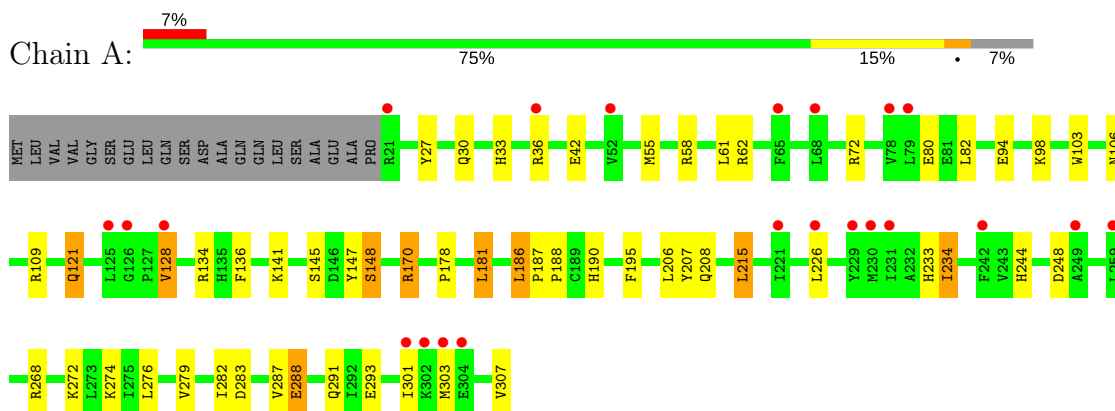
- Molecule 4 is water.

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

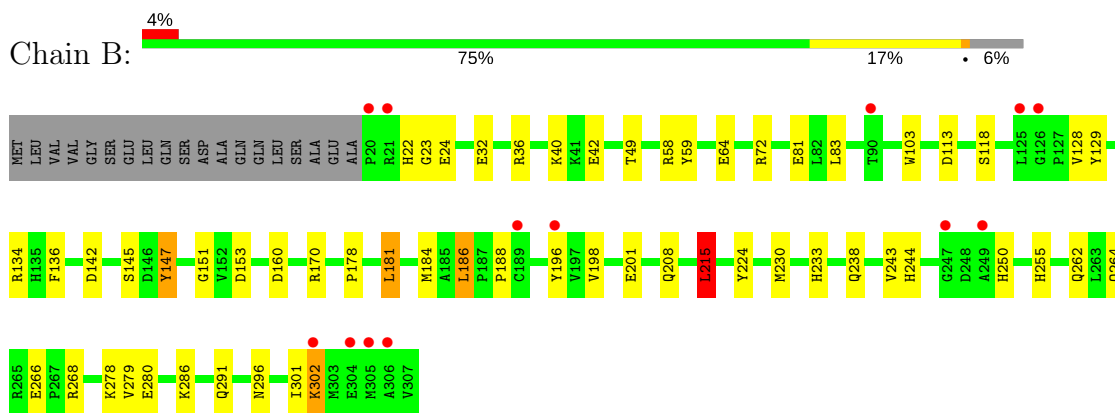
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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.

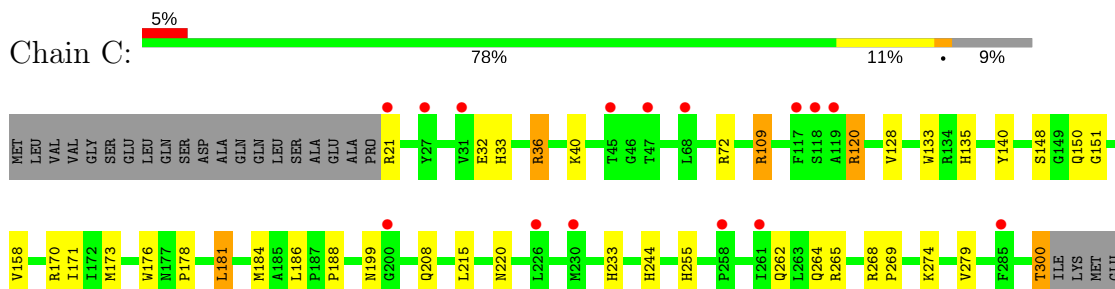
• Molecule 1: Thymidylate synthase



• Molecule 1: Thymidylate synthase




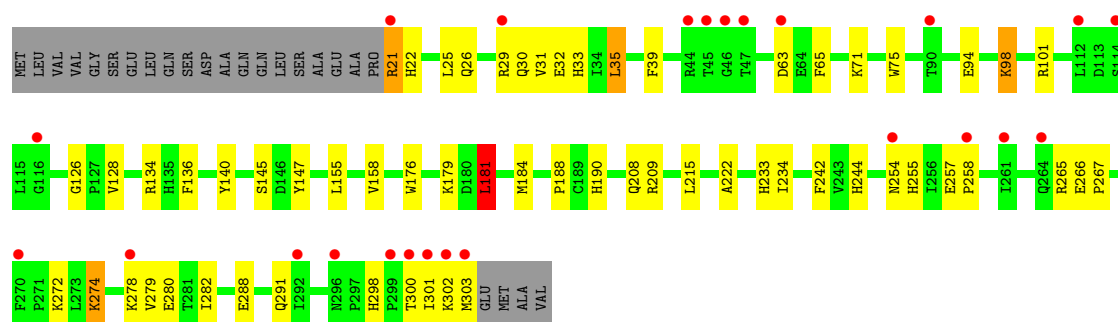
• Molecule 1: Thymidylate synthase



MET
ALA
VAL

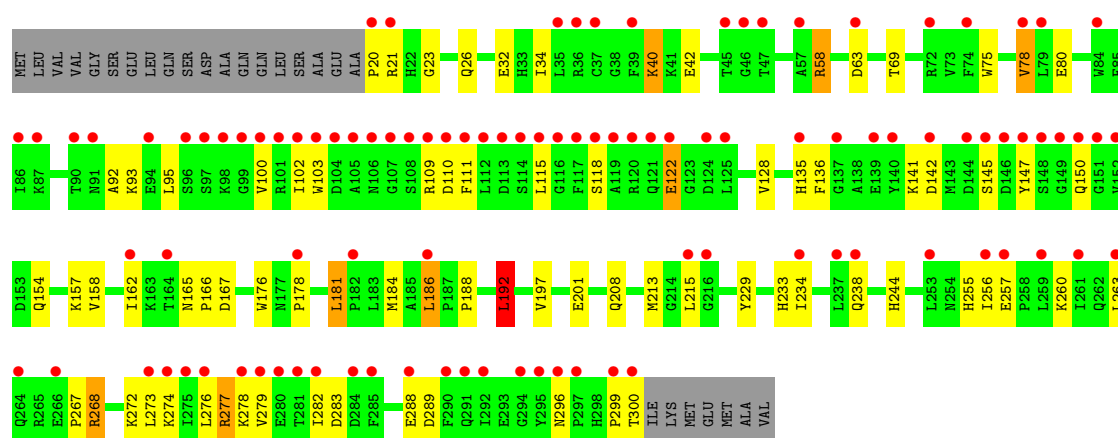
• Molecule 1: Thymidylate synthase

Chain D: 



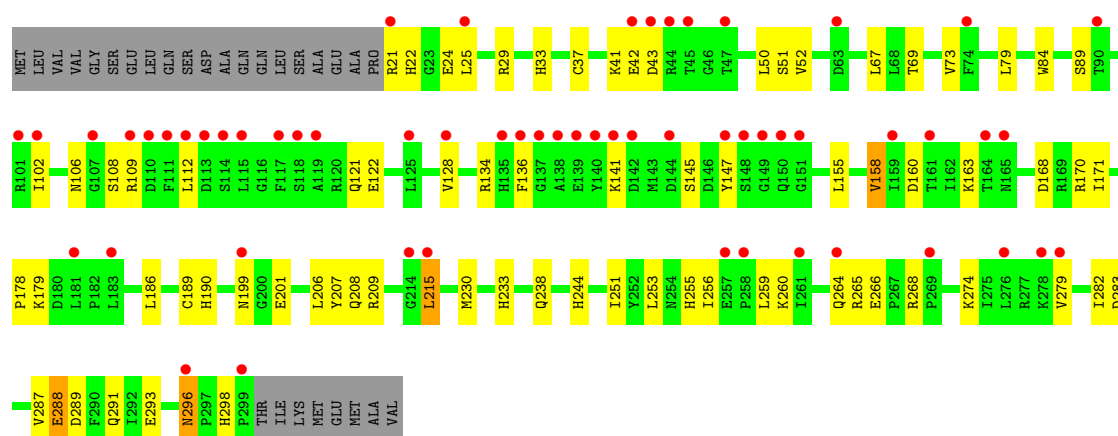
• Molecule 1: Thymidylate synthase

Chain E: 



• Molecule 1: Thymidylate synthase

Chain F: 



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) 98.6 (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)	0.36 , 58.0	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

5.1 Standard geometry

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	1.22	6/2405 (0.2%)	1.20	15/3248 (0.5%)
1	B	1.22	9/2414 (0.4%)	1.12	12/3261 (0.4%)
1	C	1.07	0/2337	1.01	3/3161 (0.1%)
1	D	0.99	1/2357 (0.0%)	0.94	2/3186 (0.1%)
1	E	0.78	0/2394	0.84	2/3237 (0.1%)
1	F	0.91	0/2336	0.92	4/3158 (0.1%)
All	All	1.05	16/14243 (0.1%)	1.01	38/19251 (0.2%)

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

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	64	GLU	CB-CG	-6.85	1.39	1.52
1	A	207	TYR	CE1-CZ	6.16	1.46	1.38
1	B	129	TYR	CE2-CZ	6.09	1.46	1.38
1	A	27	TYR	CE1-CZ	6.01	1.46	1.38
1	D	242	PHE	CE1-CZ	5.99	1.48	1.37

The worst 5 of 38 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	134	ARG	NE-CZ-NH1	9.12	124.86	120.30
1	A	109	ARG	NE-CZ-NH2	-8.45	116.08	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	72	ARG	NE-CZ-NH1	8.14	124.37	120.30
1	B	170	ARG	NE-CZ-NH1	7.70	124.15	120.30
1	A	268	ARG	NE-CZ-NH2	-7.59	116.51	120.30

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 ⓘ

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	42	0
1	B	2354	0	2320	35	1
1	C	2275	0	2238	50	0
1	D	2298	0	2268	57	0
1	E	2332	0	2288	57	0
1	F	2277	0	2238	55	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	8	0
3	C	18	0	30	9	0
4	A	344	0	0	11	1
4	B	315	0	0	7	0
4	C	279	0	0	18	0
4	D	242	0	0	16	0
4	E	116	0	0	10	0
4	F	176	0	0	13	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.

The worst 5 of 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)
2:F:502:UMP:C5	4:F:776:HOH:O	1.72	1.32
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
2:F:502:UMP:O4	4:F:774:HOH:O	1.64	1.16
1:D:188:PRO:HB2	4:D:642:HOH:O	1.47	1.11

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%)	24	9
1	B	289/307 (94%)	283 (98%)	5 (2%)	1 (0%)	43	25
1	C	280/307 (91%)	273 (98%)	6 (2%)	1 (0%)	36	19
1	D	282/307 (92%)	272 (96%)	9 (3%)	1 (0%)	36	19
1	E	285/307 (93%)	268 (94%)	15 (5%)	2 (1%)	24	9
1	F	279/307 (91%)	271 (97%)	7 (2%)	1 (0%)	36	19
All	All	1703/1842 (92%)	1646 (97%)	49 (3%)	8 (0%)	31	14

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	23	GLY

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Mol	Chain	Res	Type
1	A	148	SER
1	E	128	VAL
1	F	128	VAL
1	A	128	VAL

5.3.2 Protein sidechains ⓘ

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%)	244 (96%)	9 (4%)	38	17
1	B	254/266 (96%)	247 (97%)	7 (3%)	47	27
1	C	246/266 (92%)	239 (97%)	7 (3%)	47	27
1	D	248/266 (93%)	237 (96%)	11 (4%)	31	12
1	E	251/266 (94%)	234 (93%)	17 (7%)	17	4
1	F	245/266 (92%)	233 (95%)	12 (5%)	27	10
All	All	1497/1596 (94%)	1434 (96%)	63 (4%)	32	13

5 of 63 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	181	LEU
1	E	78	VAL
1	F	215	LEU
1	D	274	LYS
1	D	280	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 33 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	233	HIS
1	D	205	GLN
1	F	233	HIS
1	C	244	HIS

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Mol	Chain	Res	Type
1	C	264	GLN

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 carbohydrates 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	A	501	-	17,21,21	0.96	1 (5%)	23,31,31	2.02	2 (8%)
2	UMP	B	501	-	17,21,21	1.32	1 (5%)	23,31,31	2.16	2 (8%)
2	UMP	C	501	-	17,21,21	1.37	2 (11%)	23,31,31	2.20	4 (17%)
3	BU1	C	502	-	5,5,5	0.28	0	4,4,4	0.51	0
3	BU1	C	503	-	5,5,5	0.34	0	4,4,4	0.49	0
3	BU1	C	504	-	5,5,5	0.31	0	4,4,4	0.49	0
2	UMP	D	501	-	17,21,21	1.17	1 (5%)	23,31,31	1.94	2 (8%)
2	UMP	E	501	-	17,21,21	0.96	1 (5%)	23,31,31	2.03	2 (8%)
2	UMP	F	501	-	17,21,21	1.28	2 (11%)	23,31,31	1.77	2 (8%)
2	UMP	F	502	-	17,21,21	1.06	1 (5%)	23,31,31	2.28	4 (17%)

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

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

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	UMP	C6-N1	2.20	1.38	1.35
2	C	501	UMP	C4-N3	2.30	1.37	1.33
2	E	501	UMP	C4-N3	2.46	1.37	1.33
2	F	501	UMP	C6-N1	2.80	1.39	1.35
2	F	501	UMP	C4-N3	2.81	1.38	1.33

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	UMP	O4'-C1'-N1	-3.07	102.61	107.78
2	F	502	UMP	O4'-C1'-C2'	-2.49	101.50	106.25
2	E	501	UMP	O3'-C3'-C2'	-2.33	102.42	110.86
2	F	501	UMP	O4'-C1'-N1	-2.20	104.07	107.78
2	C	501	UMP	C5-C4-N3	-2.19	118.09	123.17

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 17 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	503	BU1	7	0
3	C	504	BU1	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	501	UMP	1	0
2	F	502	UMP	7	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

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

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

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	287/307 (93%)	0.55	22 (7%) 13 16	12, 20, 33, 43	0
1	B	288/307 (93%)	0.48	13 (4%) 33 38	13, 21, 31, 54	0
1	C	280/307 (91%)	0.56	15 (5%) 26 29	16, 24, 36, 43	0
1	D	283/307 (92%)	0.81	24 (8%) 11 12	18, 27, 44, 69	0
1	E	281/307 (91%)	1.99	103 (36%) 0 0	23, 39, 69, 86	0
1	F	279/307 (90%)	1.24	58 (20%) 1 0	20, 31, 50, 55	0
All	All	1698/1842 (92%)	0.94	235 (13%) 3 3	12, 26, 49, 86	0

The worst 5 of 235 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	117	PHE	12.5
1	E	112	LEU	12.4
1	E	119	ALA	10.4
1	E	100	VAL	10.1
1	E	115	LEU	9.9

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

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

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	UMP	F	502	20/20	0.70	0.30	23,41,46,46	20
3	BU1	C	504	6/6	0.75	0.26	40,47,51,54	0
3	BU1	C	502	6/6	0.83	0.26	56,57,57,58	0
3	BU1	C	503	6/6	0.85	0.15	37,45,47,48	0
2	UMP	F	501	20/20	0.86	0.16	24,31,32,34	0
2	UMP	D	501	20/20	0.92	0.10	21,24,29,29	0
2	UMP	E	501	20/20	0.93	0.19	23,29,35,36	0
2	UMP	C	501	20/20	0.95	0.07	19,22,29,30	0
2	UMP	B	501	20/20	0.98	0.09	13,17,21,23	0
2	UMP	A	501	20/20	0.98	0.07	13,16,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.