



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 23, 2024 – 04:12 AM EDT

PDB ID : 6RK5
Title : Inter-dimeric interface controls function and stability of S-methionine adenosyltransferase from *U. urealiticum*
Authors : Shahar, A.; Zarivach, R.; Bershtein, S.; Kleiner, D.; Shmulevich, F.
Deposited on : 2019-04-30
Resolution : 2.60 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 : 4.02b-467
Xtriage (Phenix) : 1.20.1
EDS : 2.37.1
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

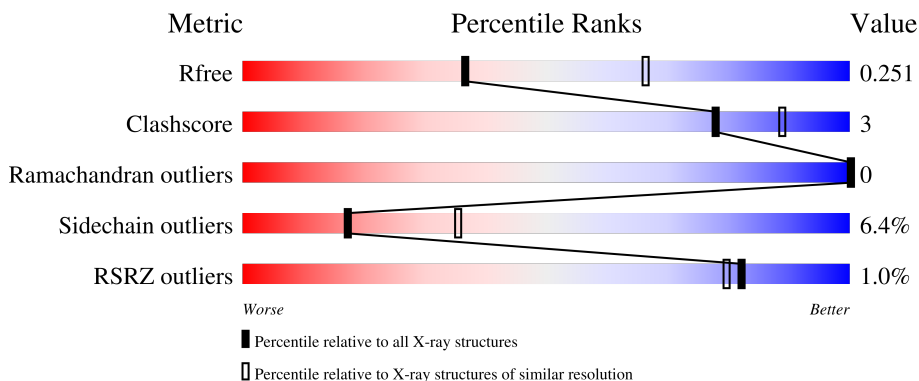
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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	382	<div style="display: flex; align-items: center;"> <div style="width: 2%; height: 10px; background-color: red; margin-right: 2px;"></div> <div style="width: 83%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 12%; height: 10px; background-color: yellow; margin-right: 2px;"></div> <div style="width: 3%; height: 10px; background-color: orange; margin-right: 2px;"></div> <div style="width: 2%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center; margin-top: 5px;">83% 12% • •</p>
1	B	382	<div style="width: 86%; height: 10px; background-color: green; margin-right: 2px;"></div> <div style="width: 8%; height: 10px; background-color: yellow; margin-right: 2px;"></div> <div style="width: 5%; height: 10px; background-color: orange; margin-right: 2px;"></div> <div style="width: 2%; height: 10px; background-color: grey;"></div>

2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 11560 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 Methionine adenosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	365	2873	1828	482	551	12	0	0	0
1	B	361	2834	1803	475	545	11	0	0	0
1	C	363	2867	1826	481	549	11	0	2	0
1	D	359	2817	1791	472	543	11	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	377	HIS	-	expression tag	UNP B2NE58
A	378	HIS	-	expression tag	UNP B2NE58
A	379	HIS	-	expression tag	UNP B2NE58
A	380	HIS	-	expression tag	UNP B2NE58
A	381	HIS	-	expression tag	UNP B2NE58
A	382	HIS	-	expression tag	UNP B2NE58
B	377	HIS	-	expression tag	UNP B2NE58
B	378	HIS	-	expression tag	UNP B2NE58
B	379	HIS	-	expression tag	UNP B2NE58
B	380	HIS	-	expression tag	UNP B2NE58
B	381	HIS	-	expression tag	UNP B2NE58
B	382	HIS	-	expression tag	UNP B2NE58
C	377	HIS	-	expression tag	UNP B2NE58
C	378	HIS	-	expression tag	UNP B2NE58
C	379	HIS	-	expression tag	UNP B2NE58
C	380	HIS	-	expression tag	UNP B2NE58
C	381	HIS	-	expression tag	UNP B2NE58
C	382	HIS	-	expression tag	UNP B2NE58
D	377	HIS	-	expression tag	UNP B2NE58
D	378	HIS	-	expression tag	UNP B2NE58
D	379	HIS	-	expression tag	UNP B2NE58

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Chain	Residue	Modelled	Actual	Comment	Reference
D	380	HIS	-	expression tag	UNP B2NE58
D	381	HIS	-	expression tag	UNP B2NE58
D	382	HIS	-	expression tag	UNP B2NE58

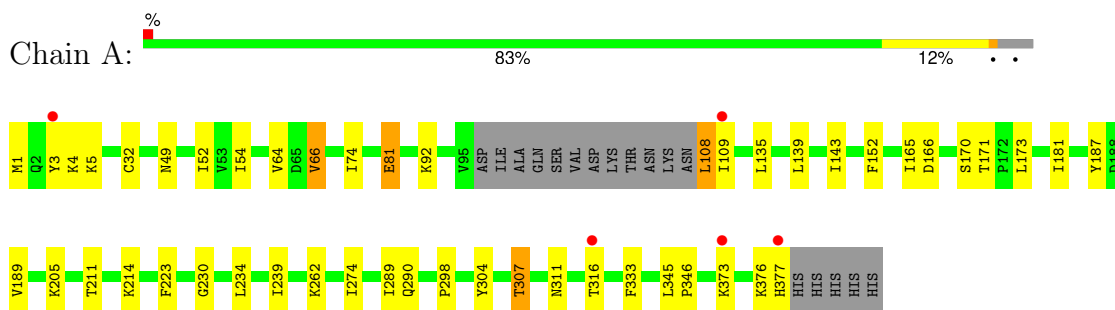
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	63	Total O 63 63	0	0
2	B	45	Total O 45 45	0	0
2	C	29	Total O 29 29	0	0
2	D	32	Total O 32 32	0	0

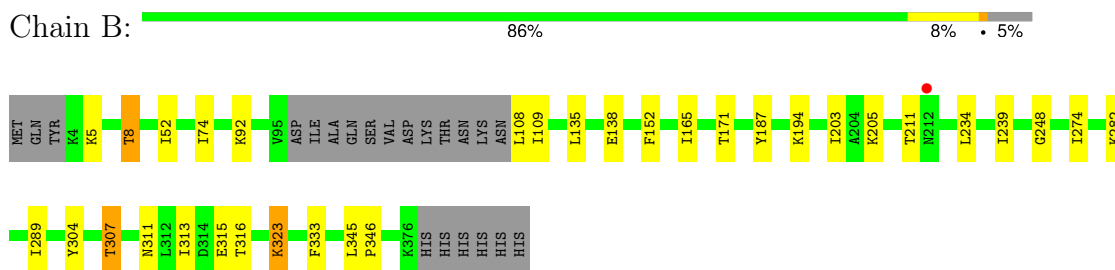
3 Residue-property plots [i](#)

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.

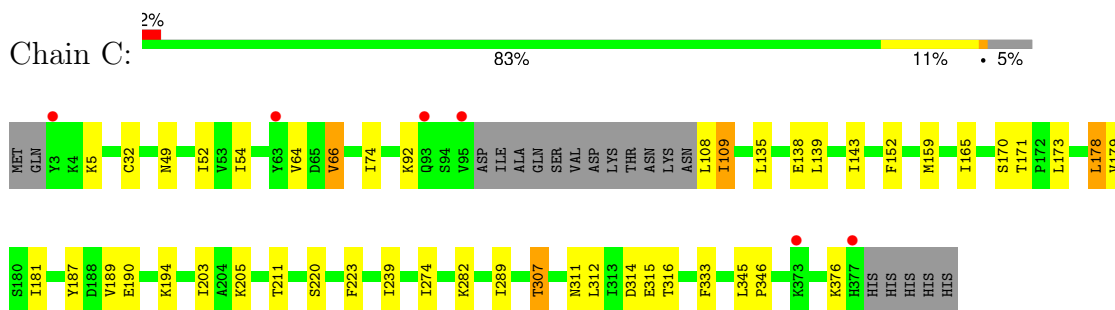
- Molecule 1: Methionine adenosyltransferase



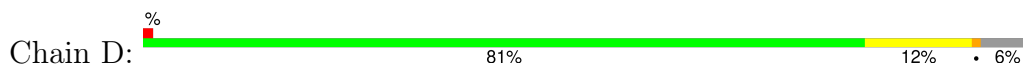
- Molecule 1: Methionine adenosyltransferase

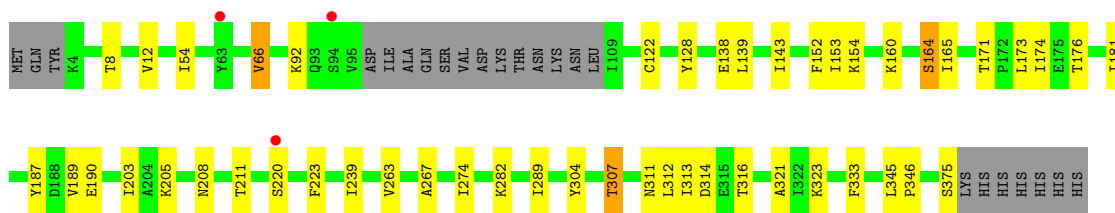


- Molecule 1: Methionine adenosyltransferase



- Molecule 1: Methionine adenosyltransferase





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	56.36Å 80.45Å 158.85Å 90.00° 94.46° 90.00°	Depositor
Resolution (Å)	47.60 – 2.60 47.60 – 2.60	Depositor EDS
% Data completeness (in resolution range)	95.5 (47.60-2.60) 96.6 (47.60-2.60)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.03 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.8.0253	Depositor
R, R_{free}	0.209 , 0.250 0.208 , 0.251	Depositor DCC
R_{free} test set	2187 reflections (5.17%)	wwPDB-VP
Wilson B-factor (Å ²)	30.0	Xtrriage
Anisotropy	0.430	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 29.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	11560	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.86% of the height of the origin peak. No significant pseudotranslation is detected.*

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

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	0.70	0/2926	0.87	0/3955
1	B	0.72	0/2885	0.87	0/3900
1	C	0.72	1/2926 (0.0%)	0.85	0/3955
1	D	0.71	0/2868	0.88	0/3878
All	All	0.71	1/11605 (0.0%)	0.87	0/15688

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	A	0	2
1	C	0	1
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	315	GLU	CD-OE1	9.05	1.35	1.25

There are no bond angle outliers.

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	230	GLY	Peptide
1	A	3	TYR	Peptide
1	C	109	ILE	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	2873	0	2872	22	0
1	B	2834	0	2836	17	0
1	C	2867	0	2871	18	0
1	D	2817	0	2812	18	0
2	A	63	0	0	1	0
2	B	45	0	0	1	0
2	C	29	0	0	0	0
2	D	32	0	0	0	0
All	All	11560	0	11391	65	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 3.

All (65) 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:B:307:THR:HG21	1:B:311:ASN:HB3	1.60	0.83
1:C:307:THR:HG21	1:C:311:ASN:HB3	1.62	0.82
1:A:307:THR:HG21	1:A:311:ASN:HB3	1.66	0.76
1:D:307:THR:HG21	1:D:311:ASN:HB3	1.69	0.72
1:A:81:GLU:HG3	2:A:461:HOH:O	1.96	0.66
1:C:239:ILE:HD11	1:D:239:ILE:HD11	1.77	0.64
1:A:239:ILE:HD11	1:B:239:ILE:HD11	1.80	0.63
1:A:5:LYS:HG3	1:B:304:TYR:CE1	2.34	0.61
1:D:313:ILE:HG22	1:D:314:ASP:H	1.66	0.60
1:A:304:TYR:CE1	1:B:5:LYS:HG3	2.37	0.59
1:C:178:LEU:HD12	1:C:179:VAL:N	2.17	0.59
1:C:178:LEU:HD12	1:C:178:LEU:C	2.26	0.55
1:C:178:LEU:CD1	1:C:179:VAL:N	2.69	0.55
1:D:54:ILE:HD13	1:D:66:VAL:HG13	1.91	0.53
1:A:54:ILE:HD13	1:A:66:VAL:HG13	1.91	0.53
1:C:282:LYS:O	1:C:312:LEU:HD12	2.08	0.53
1:D:153:ILE:HD12	1:D:154:LYS:HG3	1.91	0.52
1:C:143:ILE:HG22	1:C:159:MET:CE	2.39	0.51
1:D:12:VAL:HG12	1:D:160:LYS:HG2	1.92	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:54:ILE:HD13	1:C:66:VAL:HG13	1.93	0.51
1:A:108:LEU:HD23	1:A:109:ILE:H	1.77	0.50
1:B:52:ILE:CD1	1:B:74:ILE:HD11	2.43	0.49
1:A:1:MET:HG3	1:B:323:LYS:HD3	1.94	0.49
1:A:234:LEU:HD23	1:B:234:LEU:HD23	1.96	0.48
1:C:178:LEU:C	1:C:178:LEU:CD1	2.82	0.48
1:A:1:MET:HG3	1:B:323:LYS:CB	2.44	0.47
1:A:345:LEU:N	1:A:346:PRO:CD	2.78	0.47
1:D:138:GLU:HB3	1:D:203:ILE:HD12	1.97	0.47
1:D:345:LEU:N	1:D:346:PRO:CD	2.77	0.47
1:A:52:ILE:HD13	1:A:74:ILE:HD11	1.97	0.47
1:C:345:LEU:N	1:C:346:PRO:CD	2.78	0.47
1:C:5:LYS:HE2	1:D:304:TYR:CE1	2.50	0.46
1:A:52:ILE:CD1	1:A:74:ILE:HD11	2.46	0.46
1:A:290:GLN:HE22	1:B:8:THR:H	1.62	0.46
1:D:143:ILE:HD13	1:D:181:ILE:HD11	1.98	0.46
1:B:345:LEU:N	1:B:346:PRO:CD	2.79	0.46
1:D:165:ILE:HD13	1:D:174:ILE:HA	1.96	0.46
1:A:1:MET:HG3	1:B:323:LYS:CD	2.46	0.45
1:B:52:ILE:HD13	1:B:74:ILE:HD11	1.99	0.44
1:A:135:LEU:HD12	1:A:165:ILE:HD11	1.99	0.44
1:A:274:ILE:CG2	1:A:289:ILE:HD12	2.48	0.44
1:B:135:LEU:HD12	1:B:165:ILE:HD11	1.99	0.44
1:D:164:SER:OG	1:D:176:THR:HB	2.16	0.44
1:A:4:LYS:HD2	1:A:166:ASP:OD2	2.18	0.44
1:A:143:ILE:HD13	1:A:181:ILE:HD11	1.99	0.44
1:C:135:LEU:HD12	1:C:165:ILE:HD11	2.00	0.43
1:A:108:LEU:HD22	1:A:298:PRO:HB3	2.00	0.43
1:B:248:GLY:O	2:B:401:HOH:O	2.21	0.43
1:C:138:GLU:HB3	1:C:203:ILE:HD12	2.00	0.43
1:A:32:CYS:SG	1:A:64:VAL:HG21	2.59	0.42
1:C:179:VAL:HG12	1:C:181:ILE:HG13	2.00	0.42
1:D:321:ALA:HB2	1:D:375:SER:HB3	2.02	0.42
1:B:307:THR:HB	1:B:315:GLU:OE2	2.19	0.41
1:C:314:ASP:OD2	1:C:316:THR:OG1	2.34	0.41
1:D:282:LYS:O	1:D:312:LEU:HD12	2.20	0.41
1:B:138:GLU:HB3	1:B:203:ILE:HD12	2.01	0.41
1:D:139:LEU:HD12	1:D:139:LEU:HA	1.90	0.41
1:C:32:CYS:SG	1:C:64:VAL:HG21	2.61	0.41
1:D:274:ILE:CG2	1:D:289:ILE:HD12	2.51	0.41
1:B:274:ILE:CG2	1:B:289:ILE:HD12	2.51	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:263:VAL:O	1:D:267:ALA:HB3	2.21	0.40
1:C:52:ILE:CD1	1:C:74:ILE:HD11	2.52	0.40
1:A:108:LEU:HD23	1:A:109:ILE:N	2.36	0.40
1:C:274:ILE:CG2	1:C:289:ILE:HD12	2.52	0.40
1:D:122:CYS:O	1:D:128:TYR:HA	2.22	0.40

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	361/382 (94%)	345 (96%)	16 (4%)	0	100	100
1	B	357/382 (94%)	345 (97%)	12 (3%)	0	100	100
1	C	361/382 (94%)	348 (96%)	13 (4%)	0	100	100
1	D	355/382 (93%)	344 (97%)	11 (3%)	0	100	100
All	All	1434/1528 (94%)	1382 (96%)	52 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	316/332 (95%)	293 (93%)	23 (7%)	14	28

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	312/332 (94%)	296 (95%)	16 (5%)	24	46
1	C	316/332 (95%)	294 (93%)	22 (7%)	15	30
1	D	310/332 (93%)	291 (94%)	19 (6%)	18	38
All	All	1254/1328 (94%)	1174 (94%)	80 (6%)	17	35

All (80) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	49	ASN
1	A	66	VAL
1	A	81	GLU
1	A	92	LYS
1	A	108	LEU
1	A	139	LEU
1	A	152	PHE
1	A	170	SER
1	A	171	THR
1	A	173	LEU
1	A	187	TYR
1	A	189	VAL
1	A	205	LYS
1	A	211	THR
1	A	214	LYS
1	A	223	PHE
1	A	262	LYS
1	A	307	THR
1	A	316	THR
1	A	333	PHE
1	A	373	LYS
1	A	376	LYS
1	A	377	HIS
1	B	8	THR
1	B	92	LYS
1	B	108	LEU
1	B	109	ILE
1	B	152	PHE
1	B	171	THR
1	B	187	TYR
1	B	194	LYS
1	B	205	LYS
1	B	211	THR

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Mol	Chain	Res	Type
1	B	282	LYS
1	B	307	THR
1	B	313	ILE
1	B	316	THR
1	B	323	LYS
1	B	333	PHE
1	C	49	ASN
1	C	66	VAL
1	C	92	LYS
1	C	108	LEU
1	C	109	ILE
1	C	139	LEU
1	C	152	PHE
1	C	170	SER
1	C	171	THR
1	C	173	LEU
1	C	178	LEU
1	C	187	TYR
1	C	189	VAL
1	C	190	GLU
1	C	194	LYS
1	C	205	LYS
1	C	211	THR
1	C	220	SER
1	C	223	PHE
1	C	307	THR
1	C	333	PHE
1	C	376	LYS
1	D	8	THR
1	D	66	VAL
1	D	92	LYS
1	D	152	PHE
1	D	164	SER
1	D	171	THR
1	D	173	LEU
1	D	187	TYR
1	D	189	VAL
1	D	190	GLU
1	D	205	LYS
1	D	208	ASN
1	D	211	THR
1	D	220	SER

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Mol	Chain	Res	Type
1	D	223	PHE
1	D	307	THR
1	D	316	THR
1	D	323	LYS
1	D	333	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	49	ASN
1	A	193	ASN
1	A	290	GLN
1	A	374	ASN
1	B	89	ASN
1	B	193	ASN
1	B	212	ASN
1	B	374	ASN
1	C	49	ASN
1	C	193	ASN
1	C	202	GLN
1	C	290	GLN
1	C	374	ASN
1	D	16	HIS
1	D	89	ASN
1	D	193	ASN
1	D	374	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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	365/382 (95%)	-0.36	5 (1%) 75 71	16, 29, 57, 98	0
1	B	361/382 (94%)	-0.47	1 (0%) 94 93	17, 28, 51, 68	0
1	C	363/382 (95%)	-0.26	6 (1%) 70 66	21, 36, 61, 87	0
1	D	359/382 (93%)	-0.40	3 (0%) 86 84	21, 34, 52, 70	0
All	All	1448/1528 (94%)	-0.37	15 (1%) 82 80	16, 32, 56, 98	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	377	HIS	6.0
1	A	3	TYR	4.9
1	A	377	HIS	4.6
1	C	373	LYS	3.3
1	C	95	VAL	3.1
1	A	316	THR	2.9
1	C	63	TYR	2.7
1	A	373	LYS	2.7
1	D	94	SER	2.6
1	C	3	TYR	2.5
1	D	220	SER	2.3
1	C	93	GLN	2.3
1	A	109	ILE	2.2
1	D	63	TYR	2.2
1	B	212	ASN	2.1

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

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.