



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:29 PM UTC

PDB ID : 4JIS / pdb_00004jis
Title : Crystal structure of ribitol 5-phosphate cytidylyltransferase (TarI) from *Bacillus subtilis*
Authors : Yang, C.S.; Chen, S.C.; Chen, Y.R.; Kuan, S.M.; Liu, Y.H.; Chen, Y.
Deposited on : 2013-03-06
Resolution : 1.77 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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
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

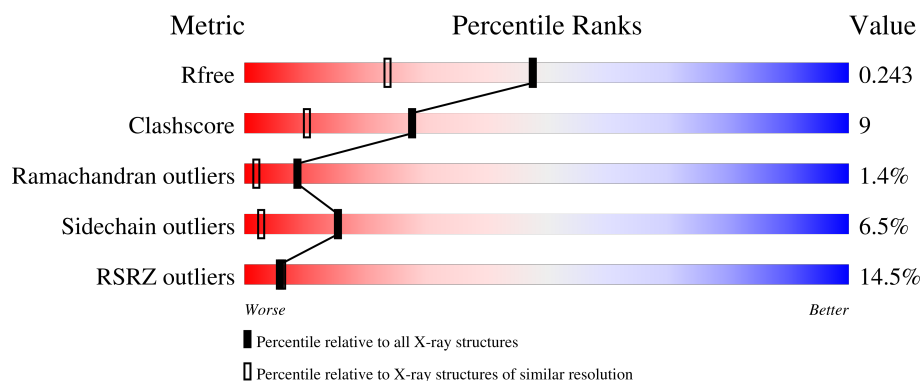
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.77 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	1365 (1.78-1.78)
Clashscore	190562	1395 (1.78-1.78)
Ramachandran outliers	187476	1382 (1.78-1.78)
Sidechain outliers	187428	1382 (1.78-1.78)
RSRZ outliers	180081	1365 (1.78-1.78)

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	247	15% 70% 15% • 11%
1	B	247	11% 70% 16% • 11%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3841 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 ribitol-5-phosphate cytidyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	221	Total	C	N	O	S	0	0	0
			1766	1130	296	334	6			
1	B	219	Total	C	N	O	S	0	0	0
			1750	1119	294	332	5			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	expression tag	UNP Q8RKI9
A	0	GLY	-	expression tag	UNP Q8RKI9
A	238	LEU	-	expression tag	UNP Q8RKI9
A	239	GLU	-	expression tag	UNP Q8RKI9
A	240	HIS	-	expression tag	UNP Q8RKI9
A	241	HIS	-	expression tag	UNP Q8RKI9
A	242	HIS	-	expression tag	UNP Q8RKI9
A	243	HIS	-	expression tag	UNP Q8RKI9
A	244	HIS	-	expression tag	UNP Q8RKI9
A	245	HIS	-	expression tag	UNP Q8RKI9
B	-1	MET	-	expression tag	UNP Q8RKI9
B	0	GLY	-	expression tag	UNP Q8RKI9
B	238	LEU	-	expression tag	UNP Q8RKI9
B	239	GLU	-	expression tag	UNP Q8RKI9
B	240	HIS	-	expression tag	UNP Q8RKI9
B	241	HIS	-	expression tag	UNP Q8RKI9
B	242	HIS	-	expression tag	UNP Q8RKI9
B	243	HIS	-	expression tag	UNP Q8RKI9
B	244	HIS	-	expression tag	UNP Q8RKI9
B	245	HIS	-	expression tag	UNP Q8RKI9

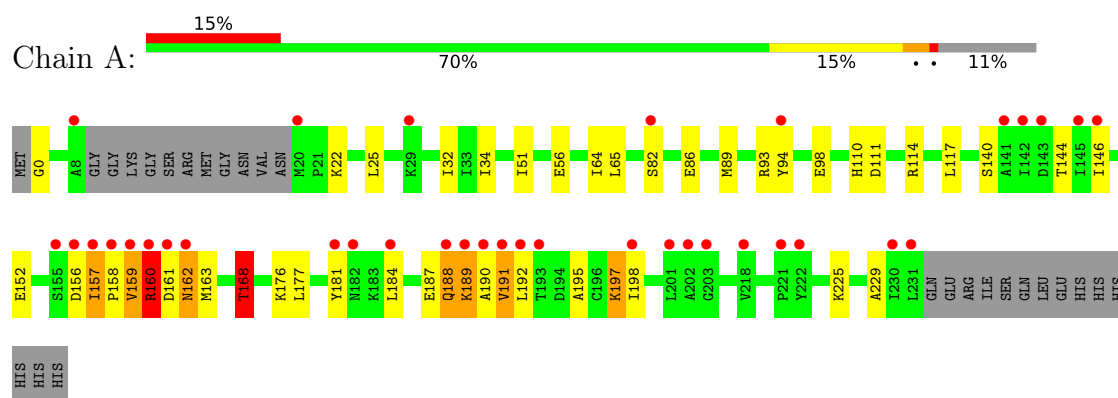
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	160	Total 160	O 160	0	0
2	B	165	Total 165	O 165	0	0

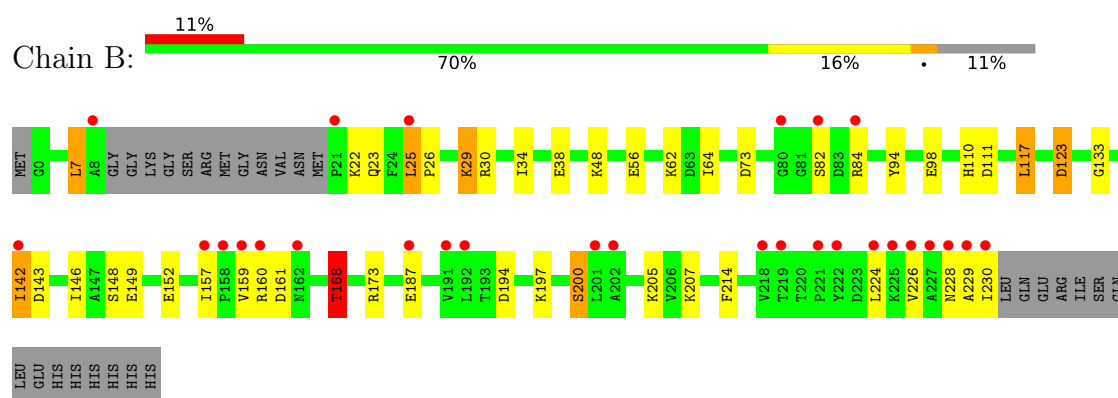
3 Residue-property plots

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: ribitol-5-phosphate cytidyltransferase



- Molecule 1: ribitol-5-phosphate cytidyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	103.75Å 60.98Å 91.81Å 90.00° 113.44° 90.00°	Depositor
Resolution (Å)	24.71 – 1.77 24.71 – 1.77	Depositor EDS
% Data completeness (in resolution range)	97.4 (24.71-1.77) 97.4 (24.71-1.77)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.19 (at 1.77Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, R_{free}	0.206 , 0.241 0.208 , 0.243	Depositor DCC
R_{free} test set	2534 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	25.6	Xtriage
Anisotropy	0.018	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 47.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.015 for $1/2^*h+3/2^*k, 1/2^*h-1/2^*k, -1/2^*h-1/2^*k-l$ 0.011 for $1/2^*h-3/2^*k, -1/2^*h-1/2^*k, -1/2^*h+1/2^*k-l$	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3841	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 6.23% 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	0.46	0/1793	0.83	1/2423 (0.0%)
1	B	0.49	0/1777	0.84	3/2401 (0.1%)
All	All	0.47	0/3570	0.84	4/4824 (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	A	0	2
1	B	0	1
All	All	0	3

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	161	ASP	N-CA-C	-7.73	99.60	110.50
1	A	190	ALA	N-CA-C	-5.96	105.50	112.89
1	B	168	THR	N-CA-CB	-5.61	101.64	111.17
1	B	168	THR	CB-CA-C	5.46	118.12	109.55

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	168	THR	Mainchain,Peptide
1	B	160	ARG	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	1766	0	1813	37	0
1	B	1750	0	1794	32	0
2	A	160	0	0	6	4
2	B	165	0	0	8	4
All	All	3841	0	3607	64	4

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 9.

All (64) 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:111:ASP:H	1:A:168:THR:HG21	1.39	0.88
1:B:205:LYS:NZ	2:B:448:HOH:O	1.97	0.86
1:A:159:VAL:O	2:A:376:HOH:O	1.96	0.84
1:B:111:ASP:H	1:B:168:THR:HG21	1.44	0.82
1:B:152:GLU:OE1	2:B:404:HOH:O	2.04	0.75
1:B:56:GLU:OE1	2:B:462:HOH:O	2.07	0.73
1:B:82:SER:HB2	2:B:394:HOH:O	1.89	0.73
1:A:22:LYS:NZ	2:A:394:HOH:O	2.23	0.71
1:A:184:LEU:HD11	1:A:198:ILE:HD12	1.72	0.70
1:B:133:GLY:HA2	1:B:173:ARG:HG3	1.72	0.70
1:B:142:ILE:HD12	1:B:143:ASP:H	1.56	0.69
1:A:51:ILE:HD12	1:A:65:LEU:HD11	1.79	0.64
1:A:160:ARG:O	2:A:335:HOH:O	2.15	0.64
1:A:157:ILE:HG21	1:B:197:LYS:HG2	1.80	0.64
1:B:197:LYS:HA	1:B:200:SER:HB2	1.79	0.63
1:A:86:GLU:OE2	1:A:181:TYR:OH	2.08	0.63
1:B:7:LEU:HD23	1:B:84:ARG:HE	1.65	0.61
1:A:160:ARG:O	1:A:162:ASN:N	2.34	0.61
1:B:29:LYS:NZ	2:B:438:HOH:O	2.01	0.60
1:A:191:VAL:HG13	1:A:192:LEU:HD12	1.85	0.59
1:A:34:ILE:HD11	1:A:64:ILE:HG22	1.85	0.58
1:A:157:ILE:HG13	1:A:160:ARG:HH22	1.69	0.57
1:B:30:ARG:HH12	1:B:38:GLU:CD	2.13	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:111:ASP:H	1:A:168:THR:CG2	2.16	0.57
1:B:111:ASP:H	1:B:168:THR:CG2	2.17	0.57
1:A:146:ILE:HD13	1:A:157:ILE:HB	1.88	0.56
1:A:93:ARG:NH1	2:A:449:HOH:O	2.38	0.55
1:A:195:ALA:HA	1:A:198:ILE:HG12	1.91	0.53
1:B:194:ASP:HB3	1:B:197:LYS:HG3	1.90	0.52
1:A:144:THR:HG23	1:A:160:ARG:HH21	1.74	0.52
1:B:94:TYR:CZ	1:B:98:GLU:HG3	2.45	0.52
1:A:189:LYS:HB2	2:A:371:HOH:O	2.09	0.51
1:B:123:ASP:HB3	2:B:393:HOH:O	2.09	0.51
1:A:89:MET:HE1	1:A:177:LEU:HG	1.93	0.51
1:B:48:LYS:NZ	1:B:73:ASP:O	2.33	0.51
1:B:110:HIS:HA	1:B:168:THR:HG23	1.93	0.50
1:A:144:THR:HG23	1:A:160:ARG:NH2	2.27	0.49
1:A:162:ASN:HB2	1:B:148:SER:O	2.12	0.49
1:A:0:GLY:O	2:A:301:HOH:O	2.20	0.48
1:B:110:HIS:CE1	1:B:117:LEU:HG	2.49	0.48
1:A:188:GLN:H	1:A:188:GLN:HG2	1.40	0.47
1:B:34:ILE:HD11	1:B:64:ILE:HG22	1.95	0.47
1:A:152:GLU:OE1	1:B:207:LYS:NZ	2.46	0.47
1:A:191:VAL:HG22	1:A:192:LEU:H	1.80	0.46
1:B:22:LYS:N	1:B:22:LYS:HD2	2.31	0.45
1:B:228:ASN:ND2	2:B:454:HOH:O	2.00	0.45
1:A:94:TYR:CZ	1:A:98:GLU:HG3	2.51	0.45
1:A:197:LYS:HA	1:B:157:ILE:HD12	1.98	0.45
1:B:214:PHE:HB2	1:B:230:ILE:HD13	1.98	0.45
1:B:197:LYS:HE2	1:B:197:LYS:HB3	1.70	0.45
1:A:229:ALA:HB2	1:B:229:ALA:HB2	1.99	0.44
1:B:25:LEU:HA	1:B:26:PRO:HD3	1.80	0.44
1:A:110:HIS:HA	1:A:168:THR:HG23	1.99	0.43
1:B:110:HIS:ND1	1:B:168:THR:CG2	2.82	0.43
1:A:114:ARG:HD2	1:A:168:THR:HG22	1.99	0.43
1:B:62:LYS:NZ	2:B:383:HOH:O	2.52	0.43
1:A:25:LEU:O	1:A:32:ILE:HG13	2.19	0.43
1:A:94:TYR:CE2	1:A:98:GLU:HG3	2.55	0.42
1:A:110:HIS:ND1	1:A:168:THR:CG2	2.83	0.42
1:A:158:PRO:HD2	1:A:160:ARG:HH12	1.84	0.42
1:A:160:ARG:HA	1:A:163:MET:HG3	2.00	0.42
1:A:110:HIS:ND1	1:A:168:THR:HG23	2.35	0.42
1:B:187:GLU:H	1:B:187:GLU:CD	2.23	0.42
1:A:56:GLU:CD	1:A:56:GLU:H	2.29	0.41

All (4) 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)
2:A:400:HOH:O	2:B:393:HOH:O[3_455]	1.56	0.64
2:A:428:HOH:O	2:B:435:HOH:O[3_455]	1.81	0.39
2:A:397:HOH:O	2:B:331:HOH:O[3_455]	2.01	0.19
2:A:431:HOH:O	2:B:437:HOH:O[3_455]	2.08	0.12

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	217/247 (88%)	205 (94%)	6 (3%)	6 (3%)	4	0
1	B	215/247 (87%)	208 (97%)	7 (3%)	0	100	100
All	All	432/494 (87%)	413 (96%)	13 (3%)	6 (1%)	9	2

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	161	ASP
1	A	162	ASN
1	A	189	LYS
1	A	191	VAL
1	A	187	GLU
1	A	160	ARG

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	200/222 (90%)	188 (94%)	12 (6%)	17	3
1	B	198/222 (89%)	184 (93%)	14 (7%)	13	2
All	All	398/444 (90%)	372 (94%)	26 (6%)	15	3

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	SER
1	A	117	LEU
1	A	140	SER
1	A	156	ASP
1	A	157	ILE
1	A	159	VAL
1	A	160	ARG
1	A	168	THR
1	A	176	LYS
1	A	188	GLN
1	A	197	LYS
1	A	225	LYS
1	B	7	LEU
1	B	23	GLN
1	B	25	LEU
1	B	29	LYS
1	B	117	LEU
1	B	123	ASP
1	B	142	ILE
1	B	146	ILE
1	B	149	GLU
1	B	159	VAL
1	B	168	THR
1	B	200	SER
1	B	224	LEU
1	B	226	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	60	HIS
1	A	125	ASN
1	B	151	GLN
1	B	215	ASN

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Mol	Chain	Res	Type
1	B	228	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 oligosaccharides 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

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	221/247 (89%)	0.95	36 (16%) 4 4	22, 38, 61, 75	0
1	B	219/247 (88%)	0.84	28 (12%) 7 8	21, 37, 56, 70	0
All	All	440/494 (89%)	0.90	64 (14%) 6 6	21, 37, 57, 75	0

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	226	VAL	7.2
1	A	192	LEU	6.5
1	B	159	VAL	6.1
1	A	159	VAL	6.1
1	B	158	PRO	4.8
1	A	162	ASN	4.3
1	B	230	ILE	4.3
1	A	191	VAL	4.3
1	A	160	ARG	4.2
1	A	190	ALA	4.2
1	B	142	ILE	4.1
1	B	228	ASN	4.0
1	A	193	THR	4.0
1	A	184	LEU	3.9
1	B	25	LEU	3.9
1	A	201	LEU	3.8
1	A	198	ILE	3.4
1	B	224	LEU	3.4
1	A	161	ASP	3.3
1	B	201	LEU	3.3
1	A	158	PRO	3.2
1	B	82	SER	3.2
1	B	160	ARG	3.1
1	B	227	ALA	3.1

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Mol	Chain	Res	Type	RSRZ
1	B	21	PRO	3.1
1	B	229	ALA	3.1
1	B	191	VAL	3.0
1	B	192	LEU	3.0
1	B	222	TYR	2.9
1	A	157	ILE	2.9
1	A	20	MET	2.9
1	B	8	ALA	2.9
1	B	202	ALA	2.8
1	A	188	GLN	2.8
1	A	142	ILE	2.8
1	A	222	TYR	2.8
1	A	189	LYS	2.7
1	B	225	LYS	2.7
1	A	29	LYS	2.7
1	A	202	ALA	2.7
1	B	221	PRO	2.6
1	A	230	ILE	2.5
1	A	94	TYR	2.5
1	A	221	PRO	2.4
1	A	181	TYR	2.4
1	A	156	ASP	2.4
1	A	146	ILE	2.4
1	A	145	ILE	2.3
1	A	155	SER	2.3
1	A	218	VAL	2.3
1	B	84	ARG	2.2
1	A	143	ASP	2.2
1	B	187	GLU	2.2
1	A	8	ALA	2.2
1	B	157	ILE	2.2
1	B	80	GLY	2.1
1	B	162	ASN	2.1
1	A	231	LEU	2.1
1	B	219	THR	2.1
1	A	182	ASN	2.1
1	A	141	ALA	2.0
1	B	218	VAL	2.0
1	A	203	GLY	2.0
1	A	82	SER	2.0

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 oligosaccharides 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.