



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:47 AM UTC

PDB ID : 6Z0W / pdb_00006z0w
Title : Crystal structure of the cytoplasmic domain of FlhB from *Shewanella putrefaciens*
Authors : Altegoer, F.; Bange, G.
Deposited on : 2020-05-11
Resolution : 2.10 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

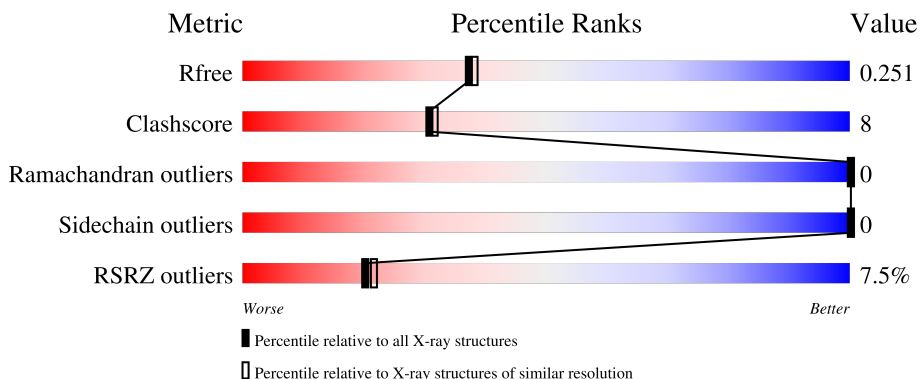
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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	134	2% 80% 11% 7%
1	B	134	10% 69% 20% 10%
1	C	134	9% 78% 16% • •
1	D	134	7% 80% 10% • 10%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4132 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 Flagellar biosynthetic protein FlhB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	124	Total	C	N	O	S	0	0	0
			996	642	182	170	2			
1	B	120	Total	C	N	O	S	0	0	0
			953	617	167	167	2			
1	C	129	Total	C	N	O	S	0	0	0
			1035	666	190	177	2			
1	D	121	Total	C	N	O	S	0	0	0
			946	609	168	167	2			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	249	MET	-	initiating methionine	UNP A4Y8K1
A	250	GLY	-	expression tag	UNP A4Y8K1
A	377	HIS	-	expression tag	UNP A4Y8K1
A	378	HIS	-	expression tag	UNP A4Y8K1
A	379	HIS	-	expression tag	UNP A4Y8K1
A	380	HIS	-	expression tag	UNP A4Y8K1
A	381	HIS	-	expression tag	UNP A4Y8K1
A	382	HIS	-	expression tag	UNP A4Y8K1
B	249	MET	-	initiating methionine	UNP A4Y8K1
B	250	GLY	-	expression tag	UNP A4Y8K1
B	377	HIS	-	expression tag	UNP A4Y8K1
B	378	HIS	-	expression tag	UNP A4Y8K1
B	379	HIS	-	expression tag	UNP A4Y8K1
B	380	HIS	-	expression tag	UNP A4Y8K1
B	381	HIS	-	expression tag	UNP A4Y8K1
B	382	HIS	-	expression tag	UNP A4Y8K1
C	249	MET	-	initiating methionine	UNP A4Y8K1
C	250	GLY	-	expression tag	UNP A4Y8K1
C	377	HIS	-	expression tag	UNP A4Y8K1
C	378	HIS	-	expression tag	UNP A4Y8K1
C	379	HIS	-	expression tag	UNP A4Y8K1

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Chain	Residue	Modelled	Actual	Comment	Reference
C	380	HIS	-	expression tag	UNP A4Y8K1
C	381	HIS	-	expression tag	UNP A4Y8K1
C	382	HIS	-	expression tag	UNP A4Y8K1
D	249	MET	-	initiating methionine	UNP A4Y8K1
D	250	GLY	-	expression tag	UNP A4Y8K1
D	377	HIS	-	expression tag	UNP A4Y8K1
D	378	HIS	-	expression tag	UNP A4Y8K1
D	379	HIS	-	expression tag	UNP A4Y8K1
D	380	HIS	-	expression tag	UNP A4Y8K1
D	381	HIS	-	expression tag	UNP A4Y8K1
D	382	HIS	-	expression tag	UNP A4Y8K1

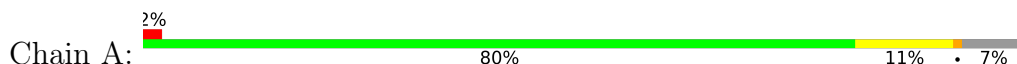
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	70	Total O 70 70	0	0
2	B	32	Total O 32 32	0	0
2	C	59	Total O 59 59	0	0
2	D	41	Total O 41 41	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.

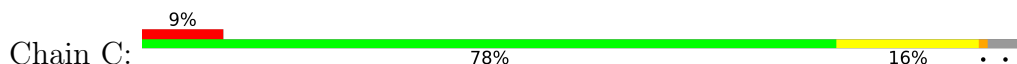
- Molecule 1: Flagellar biosynthetic protein FlhB



- Molecule 1: Flagellar biosynthetic protein FlhB



- Molecule 1: Flagellar biosynthetic protein FlhB



- Molecule 1: Flagellar biosynthetic protein FlhB



4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	152.44Å 152.44Å 126.89Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	46.44 – 2.10 46.44 – 2.10	Depositor EDS
% Data completeness (in resolution range)	100.0 (46.44-2.10) 99.9 (46.44-2.10)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.58 (at 2.10Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.210 , 0.247 0.213 , 0.251	Depositor DCC
R_{free} test set	2000 reflections (5.60%)	wwPDB-VP
Wilson B-factor (Å ²)	41.2	Xtriage
Anisotropy	0.234	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 49.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4132	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.73% 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	0.52	1/1021 (0.1%)	0.71	3/1389 (0.2%)
1	B	0.45	0/972	0.71	2/1322 (0.2%)
1	C	0.49	0/1061	0.67	2/1442 (0.1%)
1	D	0.48	0/964	0.72	4/1310 (0.3%)
All	All	0.49	1/4018 (0.0%)	0.70	11/5463 (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	A	0	1
1	C	0	3
All	All	0	4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	351	ARG	CB-CG	-5.98	1.34	1.52

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	351	ARG	CG-CD-NE	-8.57	93.15	112.00
1	B	351	ARG	NE-CZ-NH1	-7.34	114.16	121.50
1	D	357	ARG	CA-C-N	-6.39	116.48	122.17
1	D	357	ARG	C-N-CA	-6.39	116.48	122.17
1	A	268	VAL	CA-C-N	5.67	131.90	121.70
1	A	268	VAL	C-N-CA	5.67	131.90	121.70
1	C	268	VAL	CA-C-N	5.56	131.71	121.70
1	C	268	VAL	C-N-CA	5.56	131.71	121.70
1	D	268	VAL	CA-C-N	5.27	131.18	121.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	268	VAL	C-N-CA	5.27	131.18	121.70
1	A	351	ARG	CB-CA-C	-5.08	99.66	109.76

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	268	VAL	Peptide
1	C	268	VAL	Peptide
1	C	271	GLU	Peptide
1	C	355	LYS	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	996	0	1008	17	0
1	B	953	0	985	26	0
1	C	1035	0	1051	16	0
1	D	946	0	973	12	0
2	A	70	0	0	6	0
2	B	32	0	0	2	0
2	C	59	0	0	0	0
2	D	41	0	0	5	0
All	All	4132	0	4017	66	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 8.

All (66) 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:C:352:GLN:O	1:C:357:ARG:N	2.09	0.79
1:C:257:MET:HE2	1:C:300:LYS:HG3	1.65	0.76
1:B:354:GLN:NE2	2:B:401:HOH:O	2.00	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:273:TYR:O	2:D:402:HOH:O	2.11	0.68
1:B:251:LEU:HD23	1:B:254:ARG:HG3	1.75	0.68
1:C:371:PRO:HG2	1:C:374:LEU:HD12	1.77	0.66
1:D:351:ARG:HG2	1:D:355:LYS:HE3	1.76	0.66
1:C:257:MET:HE1	1:C:301:ILE:HA	1.77	0.66
1:B:312:ILE:HG22	1:B:361:PRO:HB3	1.78	0.65
1:A:306:ARG:HH21	1:A:359:ARG:HH12	1.44	0.64
1:B:271:GLU:HB3	1:B:299:PHE:CZ	2.33	0.64
1:C:272:HIS:HB3	1:C:273:TYR:CD1	2.35	0.62
1:B:271:GLU:HB3	1:B:299:PHE:HZ	1.64	0.62
1:A:306:ARG:NH2	2:A:405:HOH:O	2.30	0.61
1:B:352:GLN:NE2	1:B:354:GLN:H	1.99	0.61
1:A:271:GLU:N	2:A:408:HOH:O	2.33	0.61
1:A:257:MET:HE1	1:A:301:ILE:HG13	1.83	0.59
1:A:364:ILE:O	2:A:402:HOH:O	2.15	0.58
1:B:317:PRO:HB2	1:B:370:ILE:HD11	1.85	0.58
1:B:352:GLN:HE22	1:B:354:GLN:H	1.53	0.57
1:C:327:LYS:HE2	1:C:328:LEU:HB2	1.88	0.56
1:B:268:VAL:O	1:B:269:ASN:HB2	2.06	0.55
1:D:302:ARG:NH1	2:D:401:HOH:O	2.04	0.52
1:A:306:ARG:HG3	2:A:469:HOH:O	2.09	0.52
1:B:267:VAL:HG12	1:B:319:ALA:HB2	1.91	0.51
1:B:311:ALA:HB2	1:B:353:TYR:CE1	2.46	0.51
1:B:354:GLN:HG3	1:B:359:ARG:HD2	1.94	0.50
1:C:278:LYS:HE3	1:C:280:ASP:HB2	1.93	0.50
1:C:351:ARG:HG2	1:C:351:ARG:HH11	1.77	0.49
1:B:251:LEU:HB3	1:C:308:TYR:OH	2.12	0.49
1:D:263:ALA:HB2	1:D:290:ILE:HD11	1.94	0.49
1:B:347:VAL:HG13	1:B:353:TYR:CE1	2.48	0.48
1:A:351:ARG:N	1:A:351:ARG:HD2	2.26	0.48
1:C:327:LYS:HE2	1:C:328:LEU:H	1.78	0.48
1:C:267:VAL:HG12	1:C:319:ALA:HB2	1.94	0.48
1:A:306:ARG:NH2	1:A:359:ARG:HH12	2.12	0.47
1:A:307:GLU:HG3	1:D:355:LYS:HD3	1.95	0.47
1:B:251:LEU:HA	1:B:254:ARG:HB2	1.95	0.47
1:B:347:VAL:HG13	1:B:353:TYR:HE1	1.79	0.47
1:B:251:LEU:O	1:B:255:ARG:HG3	2.14	0.47
1:A:267:VAL:HG12	1:A:319:ALA:HB2	1.96	0.47
1:D:261:PRO:HB3	1:D:308:TYR:CD1	2.50	0.47
1:D:302:ARG:NH2	2:D:404:HOH:O	2.48	0.46
1:B:254:ARG:NH2	1:B:257:MET:HG3	2.31	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:272:HIS:O	1:C:294:VAL:HA	2.15	0.46
1:D:367:ASN:ND2	2:D:408:HOH:O	2.49	0.45
1:A:280:ASP:OD1	1:A:282:LYS:HG2	2.16	0.45
1:A:306:ARG:NH1	1:D:357:ARG:HH22	2.13	0.45
1:B:255:ARG:HG3	1:B:255:ARG:HH11	1.81	0.45
1:A:346:TYR:OH	1:A:362:ILE:HD13	2.17	0.44
1:A:307:GLU:OE2	2:A:403:HOH:O	2.21	0.43
1:C:266:ILE:HD13	1:C:305:ALA:CB	2.48	0.43
1:B:317:PRO:HB2	1:B:370:ILE:CD1	2.48	0.43
1:B:359:ARG:HD3	1:B:359:ARG:HA	1.83	0.42
1:B:370:ILE:HD12	1:B:370:ILE:H	1.84	0.42
1:A:283:ARG:NH1	2:A:412:HOH:O	2.52	0.42
1:A:345:ALA:HA	1:C:362:ILE:HD12	2.01	0.42
1:B:330:GLN:HG2	1:B:331:GLN:N	2.34	0.42
1:C:266:ILE:HD13	1:C:305:ALA:HB2	2.00	0.42
1:D:327:LYS:HA	1:D:327:LYS:HD3	1.95	0.42
1:B:307:GLU:HG3	1:C:355:LYS:HD3	2.01	0.41
1:B:300:LYS:NZ	2:B:402:HOH:O	2.27	0.41
1:A:351:ARG:HD2	1:A:351:ARG:H	1.84	0.41
1:D:302:ARG:NE	2:D:409:HOH:O	2.54	0.41
1:B:368:GLN:HB2	1:B:369:PRO:HD2	2.03	0.40
1:D:257:MET:HE1	1:D:300:LYS:C	2.46	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	118/134 (88%)	117 (99%)	1 (1%)	0	100	100
1	B	114/134 (85%)	112 (98%)	2 (2%)	0	100	100
1	C	125/134 (93%)	122 (98%)	3 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	115/134 (86%)	111 (96%)	4 (4%)	0	100	100
All	All	472/536 (88%)	462 (98%)	10 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	105/112 (94%)	105 (100%)	0	100	100
1	B	101/112 (90%)	101 (100%)	0	100	100
1	C	108/112 (96%)	108 (100%)	0	100	100
1	D	99/112 (88%)	99 (100%)	0	100	100
All	All	413/448 (92%)	413 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	342	GLN
1	A	367	ASN
1	A	379	HIS
1	B	324	HIS
1	B	352	GLN
1	B	354	GLN
1	B	367	ASN
1	C	262	ASN
1	C	269	ASN
1	C	380	HIS

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	124/134 (92%)	0.20	3 (2%) 59 62	29, 40, 59, 84	0
1	B	120/134 (89%)	0.62	13 (10%) 11 11	31, 48, 83, 144	0
1	C	129/134 (96%)	0.35	12 (9%) 14 15	30, 41, 68, 83	0
1	D	121/134 (90%)	0.48	9 (7%) 20 22	30, 45, 76, 94	0
All	All	494/536 (92%)	0.41	37 (7%) 20 21	29, 43, 74, 144	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	358	GLY	6.3
1	B	350	LEU	5.5
1	B	353	TYR	5.3
1	C	269	ASN	5.1
1	B	354	GLN	4.2
1	B	251	LEU	4.0
1	B	351	ARG	4.0
1	D	374	LEU	3.8
1	A	351	ARG	3.7
1	D	358	GLY	3.6
1	B	252	ALA	3.4
1	A	269	ASN	3.4
1	C	356	GLY	3.4
1	D	269	ASN	3.3
1	D	359	ARG	3.1
1	C	357	ARG	3.0
1	D	281	VAL	2.9
1	B	272	HIS	2.8
1	C	271	GLU	2.8
1	B	271	GLU	2.7
1	B	352	GLN	2.6

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Mol	Chain	Res	Type	RSRZ
1	C	380	HIS	2.5
1	B	372	ASP	2.5
1	D	283	ARG	2.5
1	B	362	ILE	2.5
1	A	350	LEU	2.4
1	C	381	HIS	2.4
1	C	281	VAL	2.3
1	C	285	ALA	2.3
1	C	282	LYS	2.3
1	D	285	ALA	2.3
1	B	269	ASN	2.2
1	B	299	PHE	2.2
1	C	327	LYS	2.2
1	D	280	ASP	2.2
1	C	272	HIS	2.2
1	D	284	SER	2.2

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.