



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:02 PM UTC

PDB ID : 3PIM / pdb_00003pim
Title : Crystal structure of Mxr1 from *Saccharomyces cerevisiae* in unusual oxidized form
Authors : Ma, X.X.; Guo, P.C.; Shi, W.W.; Luo, M.; Tan, X.F.; Chen, Y.; Zhou, C.Z.
Deposited on : 2010-11-07
Resolution : 1.90 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

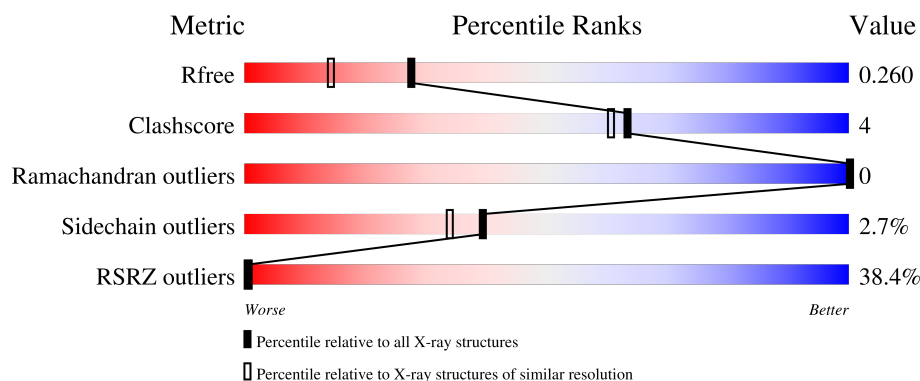
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	187	9% 86%7%7%
1	B	187	10% 87%6%5%
1	C	187	86% 71%14%13%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4421 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 Peptide methionine sulfoxide reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	173	Total	C	N	O	S	0	0	0
			1414	901	240	266	7			
1	B	177	Total	C	N	O	S	0	0	0
			1443	919	246	271	7			
1	C	163	Total	C	N	O	S	0	0	0
			1330	851	219	253	7			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	HIS	-	expression tag	UNP P40029
A	-1	HIS	-	expression tag	UNP P40029
A	0	HIS	-	expression tag	UNP P40029
A	1	GLY	-	expression tag	UNP P40029
B	-2	HIS	-	expression tag	UNP P40029
B	-1	HIS	-	expression tag	UNP P40029
B	0	HIS	-	expression tag	UNP P40029
B	1	GLY	-	expression tag	UNP P40029
C	-2	HIS	-	expression tag	UNP P40029
C	-1	HIS	-	expression tag	UNP P40029
C	0	HIS	-	expression tag	UNP P40029
C	1	GLY	-	expression tag	UNP P40029

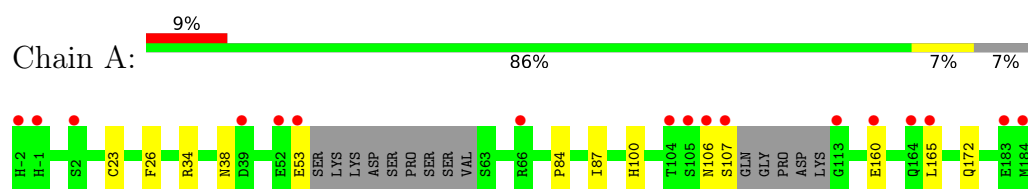
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	102	Total	O	0	0
			102	102		
2	B	119	Total	O	0	0
			119	119		
2	C	13	Total	O	0	0
			13	13		

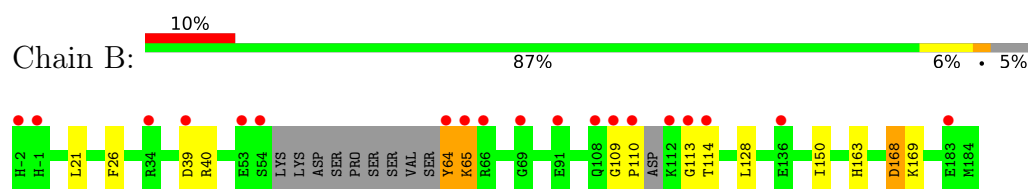
3 Residue-property plots [i](#)

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.

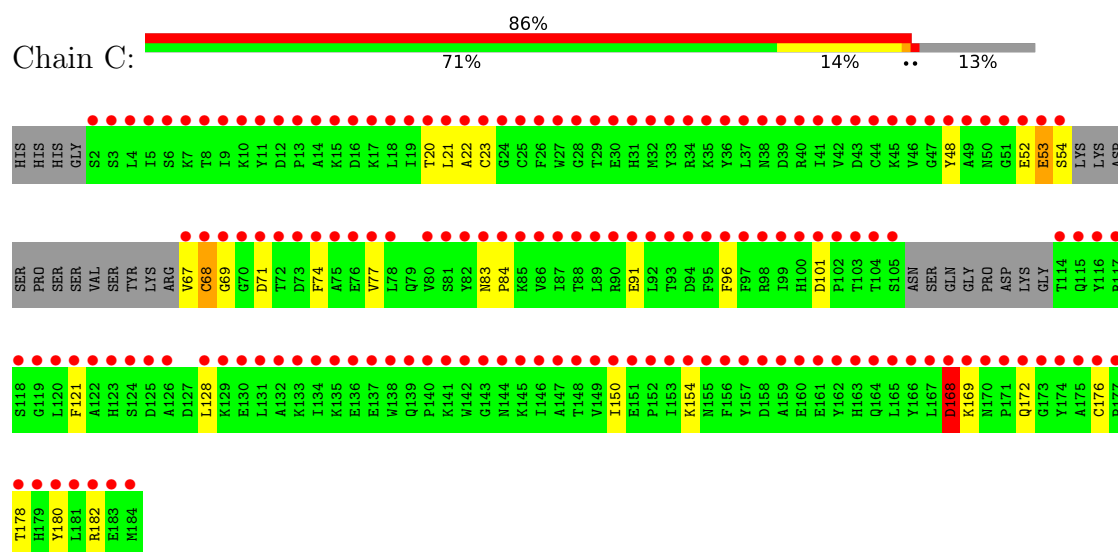
- Molecule 1: Peptide methionine sulfoxide reductase



- Molecule 1: Peptide methionine sulfoxide reductase



- Molecule 1: Peptide methionine sulfoxide reductase



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	111.89Å 111.89Å 108.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 1.90 50.00 – 1.90	Depositor EDS
% Data completeness (in resolution range)	95.3 (50.00-1.90) 95.3 (50.00-1.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.28 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.236 , 0.264 0.234 , 0.260	Depositor DCC
R_{free} test set	3003 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å ²)	23.5	Xtriage
Anisotropy	0.053	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 43.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.023 for -h,-k,l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4421	wwPDB-VP
Average B, all atoms (Å ²)	40.0	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 31.39 % 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 1.1157e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹ Intensities estimated from amplitudes.

² Theoretical 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	0.69	0/1451	0.80	1/1958 (0.1%)
1	B	0.68	0/1481	0.79	0/1998
1	C	0.47	0/1363	0.78	3/1841 (0.2%)
All	All	0.63	0/4295	0.79	4/5797 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	68	CYS	N-CA-C	6.43	120.70	112.86
1	C	168	ASP	CB-CA-C	-6.20	109.41	116.54
1	C	53	GLU	N-CA-C	5.58	117.44	111.36
1	A	165	LEU	N-CA-C	5.55	118.17	111.40

There are no chirality outliers.

There are no planarity outliers.

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	1414	0	1355	5	0
1	B	1443	0	1386	14	0
1	C	1330	0	1282	15	0
2	A	102	0	0	1	0
2	B	119	0	0	4	0
2	C	13	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	4421	0	4023	33	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 4.

All (33) 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:168:ASP:CG	1:B:169:LYS:H	1.57	1.03
1:B:168:ASP:CG	1:B:169:LYS:N	2.32	0.82
1:B:114:THR:HG23	2:B:199:HOH:O	1.83	0.79
1:B:109:GLY:H	1:B:110:PRO:HD3	1.50	0.77
1:C:68:CYS:N	1:C:69:GLY:HA2	2.01	0.76
1:C:53:GLU:N	1:C:54:SER:HA	2.03	0.72
1:A:106:ASN:HA	1:A:107:SER:HB2	1.72	0.71
1:C:22:ALA:HB2	1:C:77:VAL:HG12	1.79	0.64
1:B:109:GLY:N	1:B:110:PRO:HD3	2.12	0.63
1:A:172:GLN:HG2	2:A:266:HOH:O	1.98	0.63
1:C:23:CYS:HB3	1:C:96:PHE:CE1	2.37	0.59
1:C:48:TYR:OH	1:C:178:THR:HG21	2.03	0.58
1:B:168:ASP:OD2	1:B:169:LYS:N	2.23	0.57
1:C:67:VAL:C	1:C:69:GLY:HA2	2.30	0.56
1:C:52:GLU:HG2	1:C:154:LYS:HE3	1.89	0.53
1:B:40:ARG:NH2	1:C:91:GLU:CD	2.66	0.53
1:A:34:ARG:O	1:A:38:ASN:HB2	2.11	0.51
1:B:109:GLY:N	1:B:110:PRO:CD	2.74	0.50
1:C:176:CYS:SG	1:C:178:THR:HG22	2.53	0.49
1:C:71:ASP:HB2	1:C:74:PHE:CD2	2.48	0.48
1:B:128:LEU:HD12	1:B:150:ILE:HG22	1.98	0.46
1:B:39:ASP:OD2	1:B:40:ARG:HG3	2.16	0.46
1:A:23:CYS:HB2	1:A:100:HIS:CG	2.53	0.44
1:B:114:THR:HG22	2:B:273:HOH:O	2.17	0.43
1:B:163:HIS:HD2	2:B:244:HOH:O	2.02	0.43
1:C:20:THR:HB	1:C:121:PHE:HB2	2.01	0.43
1:B:64:TYR:HB3	1:B:65:LYS:H	1.52	0.42
1:C:168:ASP:HB3	1:C:169:LYS:H	1.43	0.42
1:C:172:GLN:O	1:C:182:ARG:HD3	2.20	0.42
1:C:128:LEU:HD12	1:C:150:ILE:HG22	2.02	0.42
1:A:84:PRO:HA	1:A:87:ILE:O	2.20	0.41
1:C:83:ASN:HA	1:C:84:PRO:HD3	1.92	0.41
1:B:113:GLY:HA3	2:B:202:HOH:O	2.21	0.41

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	167/187 (89%)	165 (99%)	2 (1%)	0	100	100
1	B	171/187 (91%)	166 (97%)	5 (3%)	0	100	100
1	C	157/187 (84%)	147 (94%)	10 (6%)	0	100	100
All	All	495/561 (88%)	478 (97%)	17 (3%)	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	152/165 (92%)	149 (98%)	3 (2%)	48	46
1	B	155/165 (94%)	150 (97%)	5 (3%)	34	27
1	C	144/165 (87%)	140 (97%)	4 (3%)	38	32
All	All	451/495 (91%)	439 (97%)	12 (3%)	39	34

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	26	PHE
1	A	53	GLU

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Mol	Chain	Res	Type
1	A	160	GLU
1	B	21	LEU
1	B	26	PHE
1	B	64	TYR
1	B	65	LYS
1	B	168	ASP
1	C	21	LEU
1	C	101	ASP
1	C	168	ASP
1	C	180	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	106	ASN
1	B	106	ASN
1	C	139	GLN

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 ⓘ

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	173/187 (92%)	0.38	17 (9%)	13 13	12, 21, 34, 48	0
1	B	177/187 (94%)	0.39	19 (10%)	11 11	11, 19, 39, 48	0
1	C	163/187 (87%)	5.09	161 (98%)	0 0	54, 80, 112, 125	0
All	All	513/561 (91%)	1.88	197 (38%)	1 0	11, 24, 102, 125	0

All (197) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	167	LEU	11.8
1	C	181	LEU	11.0
1	C	70	GLY	10.7
1	C	116	TYR	10.6
1	C	175	ALA	9.3
1	C	174	TYR	9.2
1	C	165	LEU	9.1
1	C	177	PRO	9.0
1	C	178	THR	8.8
1	C	105	SER	8.5
1	C	114	THR	8.5
1	C	180	TYR	8.3
1	C	179	HIS	8.3
1	C	103	THR	7.9
1	B	113	GLY	7.9
1	C	171	PRO	7.9
1	C	104	THR	7.8
1	C	86	VAL	7.8
1	C	99	ILE	7.6
1	C	96	PHE	7.5
1	C	78	LEU	7.3
1	C	69	GLY	7.3
1	C	14	ALA	7.2

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Mol	Chain	Res	Type	RSRZ
1	C	28	GLY	7.2
1	C	142	TRP	7.1
1	C	9	ILE	7.1
1	C	128	LEU	6.8
1	B	109	GLY	6.7
1	C	77	VAL	6.7
1	C	74	PHE	6.6
1	C	143	GLY	6.5
1	C	68	CYS	6.5
1	C	119	GLY	6.4
1	C	157	TYR	6.4
1	C	67	VAL	6.4
1	C	26	PHE	6.3
1	C	101	ASP	6.3
1	C	147	ALA	6.3
1	C	115	GLN	6.2
1	C	72	THR	6.1
1	C	166	TYR	6.0
1	C	169	LYS	6.0
1	C	8	THR	5.9
1	C	31	HIS	5.9
1	C	149	VAL	5.9
1	C	13	PRO	5.8
1	B	110	PRO	5.8
1	C	163	HIS	5.7
1	C	173	GLY	5.7
1	C	182	ARG	5.7
1	C	25	CYS	5.7
1	C	27	TRP	5.7
1	C	184	MET	5.6
1	C	172	GLN	5.6
1	C	152	PRO	5.6
1	C	146	ILE	5.6
1	C	183	GLU	5.5
1	C	170	ASN	5.5
1	C	24	GLY	5.5
1	C	150	ILE	5.5
1	C	153	ILE	5.5
1	C	50	ASN	5.5
1	B	-1	HIS	5.5
1	C	159	ALA	5.4
1	C	134	ILE	5.4

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Mol	Chain	Res	Type	RSRZ
1	C	162	TYR	5.4
1	C	168	ASP	5.3
1	C	16	ASP	5.3
1	C	100	HIS	5.3
1	C	22	ALA	5.3
1	C	35	LYS	5.3
1	B	64	TYR	5.2
1	C	36	TYR	5.2
1	C	131	LEU	5.2
1	C	102	PRO	5.1
1	C	73	ASP	5.1
1	C	10	LYS	5.1
1	C	12	ASP	5.1
1	C	39	ASP	5.1
1	C	139	GLN	5.1
1	C	4	LEU	5.1
1	C	29	THR	5.1
1	C	41	ILE	5.0
1	C	15	LYS	5.0
1	C	23	CYS	4.9
1	C	120	LEU	4.9
1	C	80	VAL	4.9
1	C	11	TYR	4.8
1	C	3	SER	4.8
1	C	130	GLU	4.7
1	C	176	CYS	4.7
1	C	95	PHE	4.6
1	C	117	ARG	4.6
1	C	49	ALA	4.6
1	A	-1	HIS	4.6
1	C	141	LYS	4.6
1	C	44	CYS	4.6
1	C	7	LYS	4.6
1	C	48	TYR	4.6
1	C	46	VAL	4.6
1	C	5	ILE	4.6
1	C	87	ILE	4.6
1	C	144	ASN	4.5
1	C	121	PHE	4.5
1	B	114	THR	4.5
1	C	156	PHE	4.5
1	C	126	ALA	4.5

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Mol	Chain	Res	Type	RSRZ
1	C	51	GLY	4.4
1	C	21	LEU	4.4
1	C	54	SER	4.3
1	C	97	PHE	4.3
1	C	145	LYS	4.3
1	C	140	PRO	4.3
1	B	108	GLN	4.3
1	C	158	ASP	4.3
1	C	118	SER	4.2
1	C	34	ARG	4.2
1	C	122	ALA	4.2
1	C	85	LYS	4.2
1	A	-2	HIS	4.1
1	C	47	GLY	4.1
1	C	138	TRP	4.1
1	C	132	ALA	4.1
1	C	37	LEU	4.1
1	C	75	ALA	4.0
1	C	154	LYS	4.0
1	B	-2	HIS	3.9
1	C	53	GLU	3.9
1	C	32	MET	3.9
1	C	164	GLN	3.7
1	C	88	THR	3.7
1	C	2	SER	3.7
1	C	124	SER	3.7
1	C	42	VAL	3.7
1	C	135	LYS	3.7
1	B	54	SER	3.6
1	C	18	LEU	3.6
1	C	93	THR	3.6
1	C	136	GLU	3.6
1	C	71	ASP	3.5
1	B	112	LYS	3.5
1	C	89	LEU	3.5
1	C	82	TYR	3.5
1	C	91	GLU	3.5
1	A	2	SER	3.4
1	C	76	GLU	3.4
1	A	160	GLU	3.4
1	C	137	GLU	3.4
1	C	148	THR	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	107	SER	3.3
1	C	19	ILE	3.2
1	A	164	GLN	3.2
1	C	43	ASP	3.2
1	C	20	THR	3.1
1	C	129	LYS	3.1
1	C	161	GLU	3.1
1	C	17	LYS	3.1
1	C	6	SER	3.1
1	C	133	LYS	3.1
1	C	52	GLU	3.1
1	A	113	GLY	3.0
1	C	84	PRO	3.0
1	A	106	ASN	3.0
1	C	33	TYR	3.0
1	C	45	LYS	2.9
1	C	98	ARG	2.9
1	B	53	GLU	2.8
1	B	39	ASP	2.8
1	C	94	ASP	2.8
1	A	184	MET	2.8
1	B	136	GLU	2.7
1	C	81	SER	2.7
1	C	90	ARG	2.7
1	C	160	GLU	2.7
1	A	105	SER	2.7
1	C	83	ASN	2.7
1	C	40	ARG	2.6
1	A	66	ARG	2.5
1	C	92	LEU	2.5
1	C	151	GLU	2.5
1	A	165	LEU	2.4
1	A	183	GLU	2.4
1	C	123	HIS	2.4
1	A	39	ASP	2.3
1	B	66	ARG	2.3
1	C	125	ASP	2.3
1	C	155	ASN	2.3
1	A	53	GLU	2.2
1	B	65	LYS	2.2
1	A	104	THR	2.2
1	C	38	ASN	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	91	GLU	2.1
1	B	183	GLU	2.1
1	C	30	GLU	2.1
1	A	52	GLU	2.1
1	B	34	ARG	2.1
1	B	69	GLY	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.