W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Oct 10, 2023 – 10:29 PM EDT

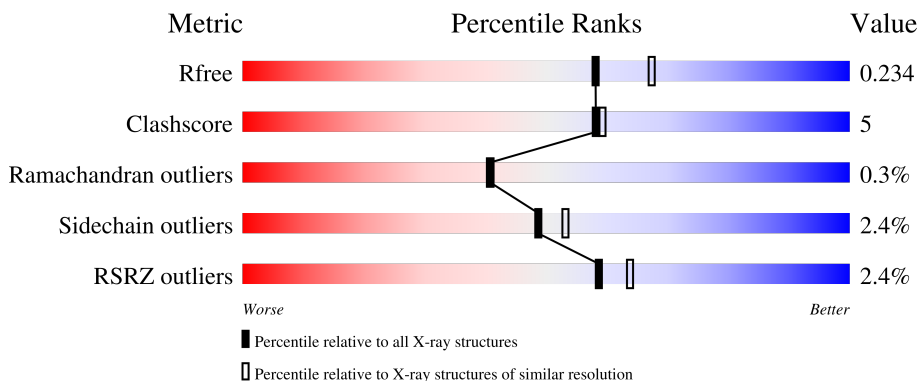|		
PDB ID	:	6WC2
Title	:	Crystal Structure of a Ternary MEF2 Chimera/NKX2-5/myocardin enhancer DNA Complex
Authors	:	Lei, X.; Chen, L.
Deposited on	:	2020-03-29
Resolution	:	2.10 Å(reported)

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

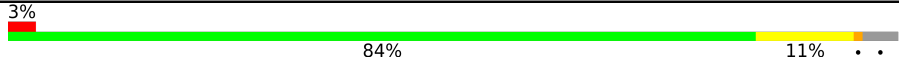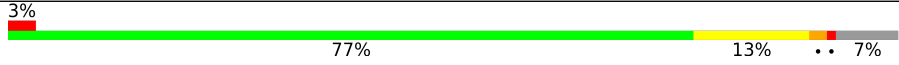The reported resolution of this entry is 2.10 Å.

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	Percentile Ranks	Value
Rfree		0.234
Clashscore		5
Ramachandran outliers		0.3%
Sidechain outliers		2.4%
RSRZ outliers		2.4%

Worse *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (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 <=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	95	3% / 84% / 11% ··
1	B	95	3% / 77% / 13% ·· 7%
1	C	95	6% / 82% / 11% · 6%
1	D	95	% / 83% / 14% ··
1	I	95	80% / 16% ·

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Mol	Chain	Length	Quality of chain
1	J	95	% 85% 12% •
2	E	21	81% 10% 10%
2	G	21	86% 14%
2	K	21	62% 24% 14%
3	F	21	67% 24% 10%
3	H	21	52% 48%
3	L	21	90% 10%
4	M	61	2% 75% 11% • 11%
4	N	61	2% 75% 11% 13%
4	O	61	7% 79% 8% 13%

2 Entity composition (i)

There are 5 unique types of molecules in this entry. The entry contains 8973 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 MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	91	Total	C	N	O	S	0	2	0
			772	487	138	142	5			
1	B	88	Total	C	N	O	S	0	0	0
			734	463	127	139	5			
1	C	89	Total	C	N	O	S	0	0	0
			738	466	129	138	5			
1	D	93	Total	C	N	O	S	0	1	0
			785	493	141	146	5			
1	I	91	Total	C	N	O	S	0	0	0
			758	477	134	142	5			
1	J	92	Total	C	N	O	S	0	1	0
			776	488	140	143	5			

- Molecule 2 is a DNA chain called Myocardin Enhancer DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	21	Total	C	N	O	P	0	0	0
			428	207	78	123	20			
2	G	21	Total	C	N	O	P	0	0	0
			428	207	78	123	20			
2	K	21	Total	C	N	O	P	0	0	0
			428	207	78	123	20			

- Molecule 3 is a DNA chain called Myocardin Enhancer DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	F	21	Total	C	N	O	P	0	0	0
			427	207	75	125	20			
3	H	21	Total	C	N	O	P	0	0	0
			427	207	75	125	20			
3	L	21	Total	C	N	O	P	0	0	0
			427	207	75	125	20			

- Molecule 4 is a protein called Homeobox protein Nkx-2.5.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	M	54	Total 478	C 304	N 93	O 81	0	1	0
4	N	53	Total 461	C 294	N 88	O 79	0	0	0
4	O	53	Total 461	C 294	N 88	O 79	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
M	193	SER	CYS	conflict	UNP P52952
N	193	SER	CYS	conflict	UNP P52952
O	193	SER	CYS	conflict	UNP P52952

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	32	Total 32	O 32	0	0
5	B	38	Total 38	O 38	0	0
5	C	24	Total 24	O 24	0	0
5	D	31	Total 31	O 31	0	0
5	E	40	Total 40	O 40	0	0
5	F	46	Total 46	O 46	0	0
5	G	26	Total 26	O 26	0	0
5	H	17	Total 17	O 17	0	0
5	I	43	Total 43	O 43	0	0
5	J	48	Total 48	O 48	0	0
5	K	17	Total 17	O 17	0	0
5	L	23	Total 23	O 23	0	0

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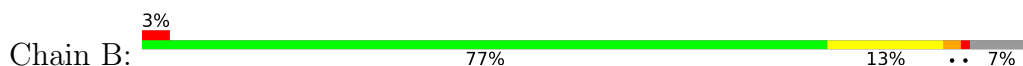| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	M	24	Total 24	O 24	0	0
5	N	25	Total 25	O 25	0	0
5	O	11	Total 11	O 11	0	0

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.
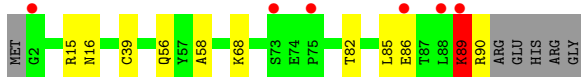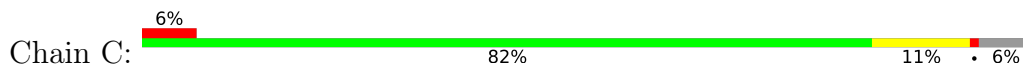
• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A

Chain A:

• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A
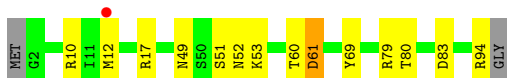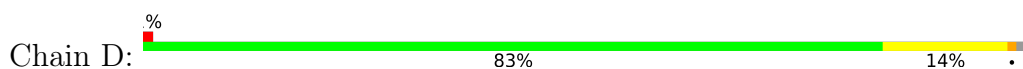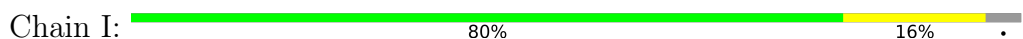
Chain B:

• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A

Chain C:

• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A

Chain D:

• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A

Chain I:

MET G2 R3 K4 D13 K23 Y33 E42 Q56 M62 K68 H76 T80 N81 L85 E86 R91 E92 HIS ARG GLY

• Molecule 1: MEF2 Chimera,Myocyte-specific enhancer factor 2B,Myocyte-specific enhancer factor 2A

Chain J:

%

85% 12% .

MET G2 R3 R15 K25 Y33 S51 N52 K53 Q56 M62 E77 K89 E92 H93 ARG GLY

• Molecule 2: Myocardin Enhancer DNA

Chain E:

81% 10% 10%

A1 A2 A5 C10 T11 G21

• Molecule 2: Myocardin Enhancer DNA

Chain G:

86% 14%

A1 T8 T9 C10 G21

• Molecule 2: Myocardin Enhancer DNA

Chain K:

62% 24% 14%

A1 A2 G3 C4 A5 C6 T7 C10 T11 T12 A13 A16 G21

• Molecule 3: Myocardin Enhancer DNA

Chain F:

67% 24% 10%

C1 T6 G12 A13 A14 A15 C19 T20 T21

• Molecule 3: Myocardin Enhancer DNA

Chain H:

52% 48%

C1 A2 T6 A10 A11 G12 A13 A14 A15 C19 T20 T21

• Molecule 3: Myocardin Enhancer DNA

Chain L:

90% 10%

C1 A13 T21

• Molecule 4: Homeobox protein Nkx-2.5

Chain M:

75%   11%   ·   11%

ARG ARG ARG LYS PRO R142 V143 E154 A165 P166 E167 R168 Q181 V182 K183 R195 GLN ARG

• Molecule 4: Homeobox protein Nkx-2.5

Chain N:

75%   11%   13%

ARG ARG ARG LYS PRO R142 R161 R168 S179 K183 S193 K194 ARG GLN ARG

• Molecule 4: Homeobox protein Nkx-2.5

Chain O:

7%

79%   8%   13%

ARG ARG ARG LYS PRO ARG V143 Y151 R155 R156 F157 K158 Q159 R168 V174 S179 K183 R195 GLN ARG

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	69.37Å 133.90Å 140.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	70.12 – 2.10 70.02 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (70.12-2.10) 99.8 (70.02-2.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.66 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0232	Depositor
R, R_{free}	0.186 , 0.225 0.196 , 0.234	Depositor DCC
R_{free} test set	3807 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	36.3	Xtriage
Anisotropy	0.479	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 43.7	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.000 for -h,l,k	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8973	wwPDB-VP
Average B, all atoms (Å^2)	47.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.48% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< \lvert L \rvert >$, $< L^2 >$ 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	0.84	1/787 (0.1%)	0.90	0/1049
1	B	0.86	3/743 (0.4%)	1.04	4/994 (0.4%)
1	C	0.79	1/747 (0.1%)	0.94	1/998 (0.1%)
1	D	0.81	0/798	1.01	2/1066 (0.2%)
1	I	0.78	0/767	0.96	1/1024 (0.1%)
1	J	0.87	2/789 (0.3%)	0.96	0/1053
2	E	0.88	0/480	1.30	6/739 (0.8%)
2	G	0.71	0/480	1.12	2/739 (0.3%)
2	K	0.88	1/480 (0.2%)	1.34	6/739 (0.8%)
3	F	0.83	0/478	1.20	6/736 (0.8%)
3	H	0.88	2/478 (0.4%)	1.25	5/736 (0.7%)
3	L	0.82	0/478	1.12	2/736 (0.3%)
4	M	0.80	0/489	0.90	0/653
4	N	0.77	0/469	0.92	0/627
4	O	0.69	0/469	0.82	0/627
All	All	0.82	10/8932 (0.1%)	1.05	35/12516 (0.3%)

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	K	2	DA	O3'-P	-9.11	1.50	1.61
1	J	77	GLU	CD-OE2	7.15	1.33	1.25
1	J	77	GLU	CD-OE1	6.58	1.32	1.25
1	A	42	GLU	CD-OE2	6.27	1.32	1.25
3	H	14	DA	P-OP2	5.96	1.59	1.49

The worst 5 of 35 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	H	12	DG	O5'-P-OP2	-12.83	94.15	105.70
2	E	5	DA	O5'-P-OP2	-11.03	95.77	105.70
2	K	7	DT	O5'-P-OP2	-10.77	96.01	105.70
2	K	3	DG	O5'-P-OP1	-10.42	96.32	105.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	K	13	DA	C5'-C4'-C3'	-8.90	98.08	114.10

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	772	0	808	8	0
1	B	734	0	753	11	0
1	C	738	0	763	14	0
1	D	785	0	808	10	0
1	I	758	0	782	14	0
1	J	776	0	802	12	0
2	E	428	0	240	2	0
2	G	428	0	240	1	0
2	K	428	0	240	5	0
3	F	427	0	241	5	0
3	H	427	0	241	3	0
3	L	427	0	241	1	0
4	M	478	0	498	12	0
4	N	461	0	477	5	0
4	O	461	0	477	2	0
5	A	32	0	0	0	0
5	B	38	0	0	1	0
5	C	24	0	0	0	0
5	D	31	0	0	0	0
5	E	40	0	0	1	0
5	F	46	0	0	2	0
5	G	26	0	0	0	0
5	H	17	0	0	0	0
5	I	43	0	0	0	0
5	J	48	0	0	1	0
5	K	17	0	0	0	0
5	L	23	0	0	1	0
5	M	24	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	N	25	0	0	0	0
5	O	11	0	0	0	0
All	All	8973	0	7611	77	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 5.

The worst 5 of 77 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:5:LYS:O	1:B:5:LYS:HD3	1.84	0.76
1:I:68:LYS:NZ	1:J:52:ASN:ND2	2.34	0.76
4:M:154:GLU:OE1	5:M:201:HOH:O	2.07	0.72
3:L:13:DA:N7	5:L:101:HOH:O	2.23	0.71
3:F:13:DA:N7	5:F:102:HOH:O	2.22	0.71

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	91/95 (96%)	90 (99%)	1 (1%)	0	100	100
1	B	86/95 (90%)	84 (98%)	1 (1%)	1 (1%)	13	8
1	C	87/95 (92%)	85 (98%)	2 (2%)	0	100	100
1	D	92/95 (97%)	90 (98%)	2 (2%)	0	100	100
1	I	89/95 (94%)	88 (99%)	1 (1%)	0	100	100
1	J	91/95 (96%)	88 (97%)	2 (2%)	1 (1%)	14	9
4	M	53/61 (87%)	53 (100%)	0	0	100	100
4	N	51/61 (84%)	51 (100%)	0	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	O	51/61 (84%)	50 (98%)	1 (2%)	0	100	100
All	All	691/753 (92%)	679 (98%)	10 (1%)	2 (0%)	41	41

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	J	92	GLU
1	B	6	ILE

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	88/89 (99%)	85 (97%)	3 (3%)	37	39
1	B	84/89 (94%)	82 (98%)	2 (2%)	49	53
1	C	84/89 (94%)	83 (99%)	1 (1%)	71	77
1	D	89/89 (100%)	88 (99%)	1 (1%)	73	79
1	I	86/89 (97%)	83 (96%)	3 (4%)	36	38
1	J	88/89 (99%)	86 (98%)	2 (2%)	50	55
4	M	52/58 (90%)	51 (98%)	1 (2%)	57	63
4	N	50/58 (86%)	49 (98%)	1 (2%)	55	60
4	O	50/58 (86%)	48 (96%)	2 (4%)	31	32
All	All	671/708 (95%)	655 (98%)	16 (2%)	49	53

5 of 16 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	O	155	ARG
4	N	179	SER
1	I	33	TYR
4	M	195	ARG
1	I	4	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	18	GLN
1	D	56	GLN
4	O	159	GLN
1	J	7	GLN
1	B	56	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

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	91/95 (95%)	0.29	3 (3%)	46	53	21, 44, 83, 104	0
1	B	88/95 (92%)	0.17	3 (3%)	45	51	23, 36, 63, 87	0
1	C	89/95 (93%)	0.47	6 (6%)	17	22	27, 47, 101, 116	0
1	D	93/95 (97%)	0.33	1 (1%)	80	84	30, 47, 75, 86	0
1	I	91/95 (95%)	0.20	0	100	100	24, 37, 83, 106	0
1	J	92/95 (96%)	0.22	1 (1%)	80	84	24, 38, 63, 87	0
2	E	21/21 (100%)	-0.48	0	100	100	27, 46, 53, 61	0
2	G	21/21 (100%)	-0.36	0	100	100	39, 48, 60, 95	0
2	K	21/21 (100%)	-0.37	0	100	100	33, 52, 63, 72	0
3	F	21/21 (100%)	-0.44	0	100	100	30, 38, 65, 77	0
3	H	21/21 (100%)	-0.00	0	100	100	35, 50, 96, 109	0
3	L	21/21 (100%)	-0.23	0	100	100	33, 49, 71, 98	0
4	M	54/61 (88%)	0.13	1 (1%)	66	71	25, 38, 77, 94	0
4	N	53/61 (86%)	0.12	1 (1%)	66	71	28, 41, 67, 93	0
4	O	53/61 (86%)	0.59	4 (7%)	14	18	34, 55, 81, 105	0
All	All	830/879 (94%)	0.19	20 (2%)	59	64	21, 44, 84, 116	0

The worst 5 of 20 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	O	151	TYR	5.1
4	M	143	VAL	4.1
1	C	88	LEU	3.5
1	C	75	PRO	3.4
1	B	6	ILE	3.4

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.