



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 02:28 PM UTC

PDB ID : 4B0M / pdb_00004b0m
Title : Complex of the Caf1AN usher domain, Caf1M chaperone and Caf1 subunit from *Yersinia pestis*
Authors : Dubnovitsky, A.; Yu, X.D.; Pudney, A.F.; MacIntyre, S.; Knight, S.D.; Zavalov, A.V.
Deposited on : 2012-07-03
Resolution : 1.80 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

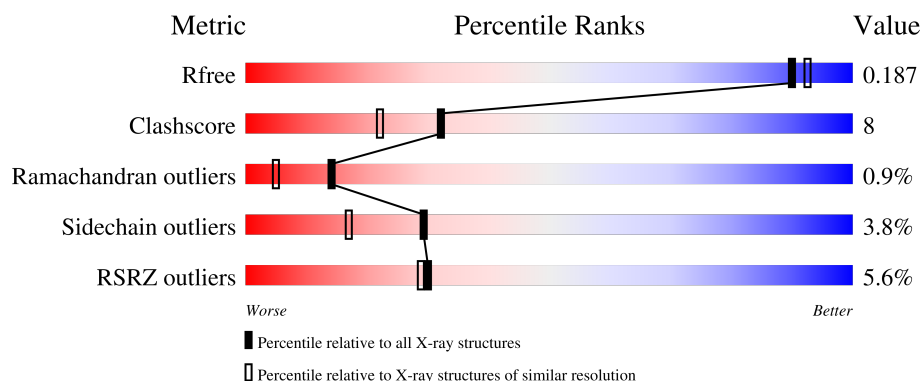
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	136	13% 73% 18% • • •
2	B	149	% 89% • 9%
3	M	235	3% 72% 15% • 10%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4104 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 F1 CAPSULE-ANCHORING PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	131	Total	C	N	O	S	0	3	0
			1028	666	163	194	5			

- Molecule 2 is a protein called F1 CAPSULE ANTIGEN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	135	Total	C	N	O	S	0	0	0
			993	617	162	212	2			

- Molecule 3 is a protein called CHAPERONE PROTEIN CAF1M.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	M	212	Total	C	N	O	S	0	1	0
			1654	1068	277	305	4			

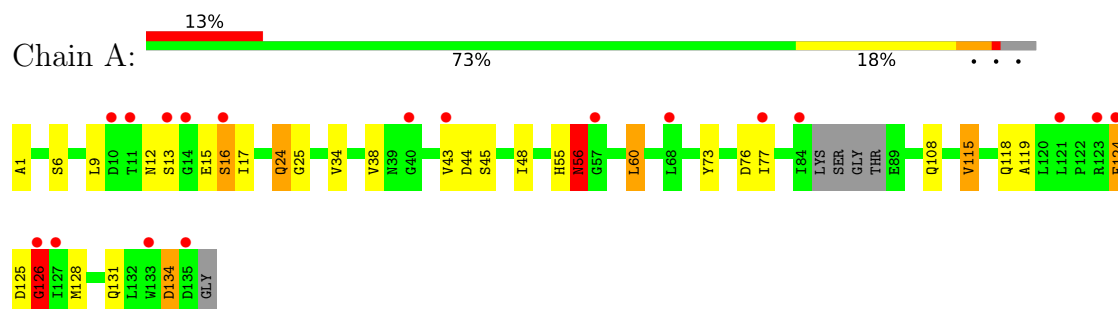
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	79	Total	O	0	0
			79	79		
4	B	164	Total	O	0	0
			164	164		
4	M	186	Total	O	0	0
			186	186		

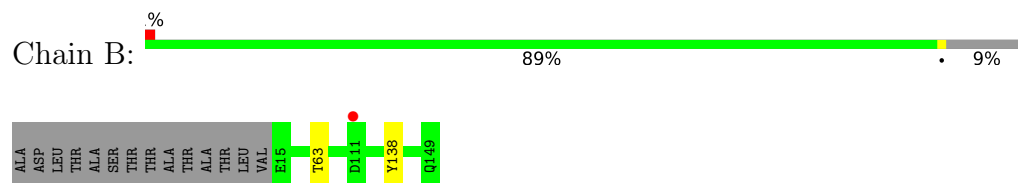
3 Residue-property plots [i](#)

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.

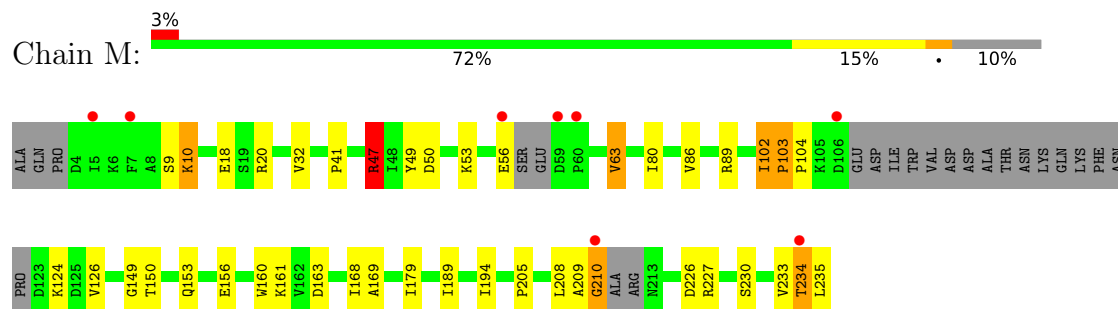
• Molecule 1: F1 CAPSULE-ANCHORING PROTEIN



• Molecule 2: F1 CAPSULE ANTIGEN



• Molecule 3: CHAPERONE PROTEIN CAF1M



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	35.28Å 77.44Å 95.86Å 90.00° 98.48° 90.00°	Depositor
Resolution (Å)	30.00 – 1.80 30.00 – 1.80	Depositor EDS
% Data completeness (in resolution range)	96.9 (30.00-1.80) 96.8 (30.00-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.01 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.183 , 0.237 0.179 , 0.187	Depositor DCC
R_{free} test set	2310 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	24.7	Xtriage
Anisotropy	0.440	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 53.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.038 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4104	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.36% 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	1.53	6/1068 (0.6%)	1.20	5/1453 (0.3%)
2	B	1.30	1/1007 (0.1%)	1.05	0/1368
3	M	1.31	6/1697 (0.4%)	1.11	5/2300 (0.2%)
All	All	1.37	13/3772 (0.3%)	1.12	10/5121 (0.2%)

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	24	GLN	C-N	33.78	1.72	1.33
3	M	210	GLY	C-O	14.82	1.53	1.23
3	M	210	GLY	CA-C	13.52	1.76	1.52
3	M	102	ILE	CA-CB	7.84	1.62	1.53
1	A	124	PHE	CG-CD2	7.75	1.55	1.38
3	M	189	ILE	CA-C	7.69	1.58	1.52
1	A	76	ASP	C-O	6.83	1.31	1.23
1	A	124	PHE	CE2-CZ	6.39	1.57	1.38
3	M	103	PRO	C-O	-6.22	1.19	1.24
1	A	126	GLY	C-N	5.80	1.41	1.33
1	A	76	ASP	C-N	5.52	1.40	1.34
3	M	47	ARG	CB-CG	-5.21	1.36	1.52
2	B	63	THR	N-CA	5.03	1.51	1.45

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	24	GLN	O-C-N	-15.23	100.78	122.41
3	M	210	GLY	CA-C-O	-10.96	97.79	120.80
1	A	24	GLN	CA-C-N	8.46	135.39	121.00
1	A	24	GLN	C-N-CA	8.46	135.39	121.00
3	M	102	ILE	CA-C-N	8.33	125.66	119.66
3	M	102	ILE	C-N-CA	8.33	125.66	119.66
3	M	63	VAL	CB-CA-C	-6.79	100.71	110.83
1	A	44	ASP	N-CA-C	5.65	116.84	108.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	134	ASP	N-CA-C	5.06	117.99	110.14
3	M	89	ARG	NE-CZ-NH1	-5.04	116.46	121.50

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	1028	0	983	26	0
2	B	993	0	958	1	0
3	M	1654	0	1645	32	0
4	A	79	0	0	5	0
4	B	164	0	0	0	0
4	M	186	0	0	6	0
All	All	4104	0	3586	58	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 (58) 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)
3:M:210:GLY:CA	3:M:210:GLY:C	1.76	1.55
1:A:24:GLN:C	1:A:25:GLY:N	1.72	1.46
1:A:125:ASP:HB3	1:A:126:GLY:HA3	1.43	0.98
1:A:125:ASP:HB3	1:A:126:GLY:CA	2.06	0.86
1:A:118:GLN:CD	1:A:134:ASP:HB2	2.14	0.72
1:A:115:VAL:HG13	1:A:119:ALA:HB3	1.72	0.71
3:M:63:VAL:HG13	3:M:80:ILE:CD1	2.20	0.71
3:M:150:THR:H	3:M:153:GLN:HE21	1.39	0.69
3:M:10:LYS:HE3	4:M:2012:HOH:O	1.94	0.68
1:A:15:GLU:O	1:A:16:SER:HB2	1.95	0.66
3:M:47:ARG:NH2	4:M:2051:HOH:O	2.29	0.65
3:M:210:GLY:CA	3:M:210:GLY:O	2.48	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:M:18:GLU:HG2	3:M:32:VAL:HG23	1.82	0.60
3:M:149:GLY:HA2	3:M:153:GLN:HE22	1.67	0.59
1:A:125:ASP:CB	1:A:126:GLY:CA	2.80	0.59
1:A:118:GLN:CG	1:A:134:ASP:HB2	2.33	0.59
1:A:24:GLN:O	1:A:25:GLY:N	2.29	0.59
3:M:205:PRO:HG2	3:M:208:LEU:HD13	1.85	0.58
1:A:38:VAL:HG21	1:A:73:TYR:HB3	1.85	0.57
3:M:63:VAL:HG13	3:M:80:ILE:HD13	1.85	0.57
3:M:156:GLU:HB2	4:M:2127:HOH:O	2.06	0.56
3:M:234:THR:OG1	3:M:235:LEU:N	2.38	0.54
3:M:160:TRP:CZ3	3:M:169:ALA:HB2	2.43	0.53
3:M:179:ILE:HD12	3:M:194:ILE:HD11	1.90	0.53
3:M:149:GLY:HA2	3:M:153:GLN:NE2	2.24	0.53
1:A:118:GLN:HG3	1:A:134:ASP:HB2	1.90	0.52
3:M:47:ARG:HG3	3:M:49:TYR:CE2	2.44	0.51
3:M:163:ASP:HB3	3:M:168:ILE:HD11	1.93	0.51
3:M:149:GLY:CA	3:M:153:GLN:NE2	2.74	0.51
3:M:209:ALA:HB2	4:M:2156:HOH:O	2.11	0.51
1:A:34:VAL:CG2	1:A:48:ILE:HD12	2.43	0.49
1:A:34:VAL:O	1:A:45:SER:HA	2.11	0.49
1:A:38:VAL:HG23	1:A:43:VAL:HG21	1.95	0.49
1:A:16:SER:HA	4:A:2029:HOH:O	2.12	0.48
3:M:10:LYS:HD2	4:M:2012:HOH:O	2.13	0.48
3:M:41:PRO:O	3:M:104:PRO:HD3	2.14	0.47
3:M:86:VAL:HG21	4:M:2183:HOH:O	2.15	0.47
3:M:210:GLY:C	3:M:210:GLY:N	2.62	0.47
1:A:9:LEU:HB3	1:A:17:ILE:HD12	1.98	0.46
1:A:55:HIS:HB2	1:A:60:LEU:HD21	1.98	0.46
1:A:115:VAL:CG1	1:A:119:ALA:HB3	2.41	0.46
3:M:169:ALA:HB3	3:M:194:ILE:HD12	1.98	0.46
1:A:56:ASN:C	1:A:56:ASN:HD22	2.24	0.46
1:A:1:ALA:N	4:A:2002:HOH:O	2.48	0.45
1:A:118:GLN:HG3	1:A:134:ASP:CB	2.47	0.45
3:M:102:ILE:HA	3:M:103:PRO:HD2	1.82	0.44
3:M:161:LYS:HA	3:M:233:VAL:HG13	2.00	0.44
1:A:134:ASP:HB3	4:A:2079:HOH:O	2.18	0.44
3:M:226:ASP:CG	3:M:227:ARG:H	2.25	0.44
1:A:131:GLN:N	1:A:131:GLN:CD	2.77	0.43
2:B:138:TYR:CD1	3:M:126:VAL:HG13	2.55	0.42
3:M:50:ASP:OD1	3:M:50:ASP:C	2.62	0.41
3:M:149:GLY:CA	3:M:153:GLN:HE22	2.32	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:M:234:THR:O	3:M:235:LEU:HB2	2.19	0.41
1:A:77:ILE:HG12	4:A:2067:HOH:O	2.21	0.41
3:M:50:ASP:HB3	3:M:56:GLU:HG3	2.03	0.40
1:A:12:ASN:HA	4:A:2026:HOH:O	2.21	0.40
1:A:24:GLN:CA	1:A:25:GLY:N	2.73	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	130/136 (96%)	123 (95%)	3 (2%)	4 (3%)	3	0
2	B	133/149 (89%)	131 (98%)	2 (2%)	0	100	100
3	M	205/235 (87%)	201 (98%)	4 (2%)	0	100	100
All	All	468/520 (90%)	455 (97%)	9 (2%)	4 (1%)	14	5

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	13	SER
1	A	56	ASN
1	A	16	SER
1	A	126	GLY

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	114/123 (93%)	106 (93%)	8 (7%)	14	4
2	B	109/121 (90%)	109 (100%)	0	100	100
3	M	179/204 (88%)	170 (95%)	9 (5%)	22	10
All	All	402/448 (90%)	385 (96%)	17 (4%)	29	14

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6[A]	SER
1	A	6[B]	SER
1	A	56	ASN
1	A	60	LEU
1	A	108	GLN
1	A	115	VAL
1	A	124	PHE
1	A	128	MET
3	M	9	SER
3	M	10	LYS
3	M	20	ARG
3	M	47	ARG
3	M	53	LYS
3	M	124	LYS
3	M	230[A]	SER
3	M	230[B]	SER
3	M	234	THR

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	24	GLN
1	A	35	ASN
1	A	56	ASN
1	A	109	GLN
2	B	77	GLN
2	B	80	ASN
2	B	82	HIS
2	B	83	GLN
3	M	153	GLN
3	M	178	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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	24:GLN	C	25:GLY	N	1.72

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	131/136 (96%)	0.89	18 (13%) 6 5	19, 49, 73, 91	3 (2%)
2	B	135/149 (90%)	-0.34	1 (0%) 84 85	15, 25, 41, 48	0
3	M	212/235 (90%)	-0.02	8 (3%) 44 44	14, 29, 52, 69	1 (0%)
All	All	478/520 (91%)	0.14	27 (5%) 30 29	14, 30, 65, 91	4 (0%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	11	THR	4.9
1	A	121	LEU	3.6
1	A	124	PHE	3.5
1	A	84	ILE	3.0
3	M	106	ASP	2.9
1	A	127	ILE	2.9
1	A	133	TRP	2.8
1	A	40	GLY	2.6
3	M	56	GLU	2.6
2	B	111	ASP	2.6
1	A	135	ASP	2.5
1	A	16	SER	2.5
1	A	57	GLY	2.4
1	A	123	ARG	2.3
1	A	14	GLY	2.2
3	M	59	ASP	2.2
1	A	43	VAL	2.2
3	M	60	PRO	2.2
1	A	68	LEU	2.2
1	A	10	ASP	2.2
3	M	7	PHE	2.1
1	A	126	GLY	2.1
1	A	13	SER	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	77	ILE	2.0
3	M	5	ILE	2.0
3	M	210	GLY	2.0
3	M	234	THR	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.