



Full wwPDB X-ray Structure Validation Report ⓘ

May 20, 2026 – 08:08 PM EDT

PDB ID : 9ZM8 / pdb_00009zm8
Title : Crystal structure of 7160 in complex with minor repeat region from circumsporozoite protein
Authors : Jain, M.; Wilson, I.A.
Deposited on : 2025-12-09
Resolution : 2.27 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

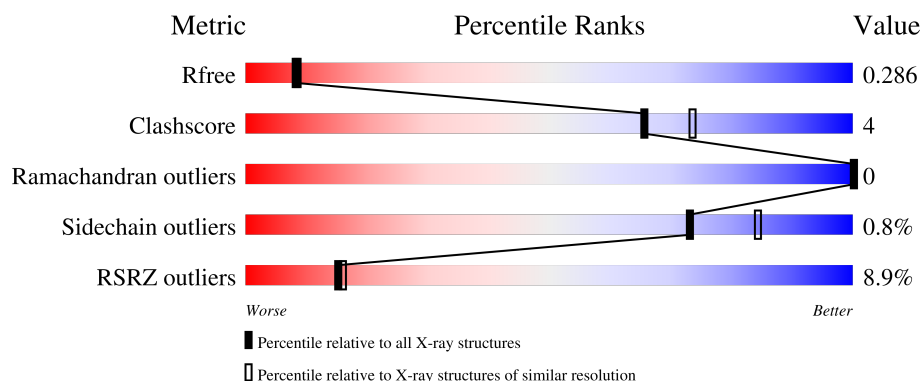
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.27 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	9078 (2.30-2.26)
Clashscore	190562	9802 (2.30-2.26)
Ramachandran outliers	187476	9690 (2.30-2.26)
Sidechain outliers	187428	9691 (2.30-2.26)
RSRZ outliers	180081	9085 (2.30-2.26)

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	230	<div> <div>8%</div> <div>86%</div> <div>10%</div> <div>.</div> </div>
1	H	230	<div> <div>15%</div> <div>87%</div> <div>9%</div> <div>.</div> </div>
2	B	219	<div> <div>5%</div> <div>89%</div> <div>11%</div> </div>
2	G	219	<div> <div>5%</div> <div>91%</div> <div>8%</div> </div>
3	C	20	<div> <div>5%</div> <div>50%</div> <div>10%</div> <div>40%</div> </div>

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Mol	Chain	Length	Quality of chain
3	D	20	 A horizontal bar chart showing the quality of chain D. The bar is divided into three segments: a red segment labeled '10%', a green segment labeled '60%', and a grey segment labeled '40%'. The total length of the bar represents 100%.

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6987 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 Heavy Chain of Fab 7160.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	222	Total	C	N	O	S	0	0	0
			1655	1047	278	324	6			
1	H	220	Total	C	N	O	S	0	0	0
			1645	1042	276	321	6			

- Molecule 2 is a protein called Ligh Chain of Fab 7160.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	218	Total	C	N	O	S	0	0	0
			1697	1067	284	340	6			
2	G	218	Total	C	N	O	S	0	0	0
			1697	1067	284	340	6			

- Molecule 3 is a protein called Circumsporozoite protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	12	Total	C	N	O	0	0	0
			88	52	16	20			
3	D	12	Total	C	N	O	0	0	0
			88	52	16	20			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	33	Total	O	0	0
			33	33		
4	B	24	Total	O	0	0
			24	24		
4	C	2	Total	O	0	0
			2	2		
4	D	2	Total	O	0	0
			2	2		

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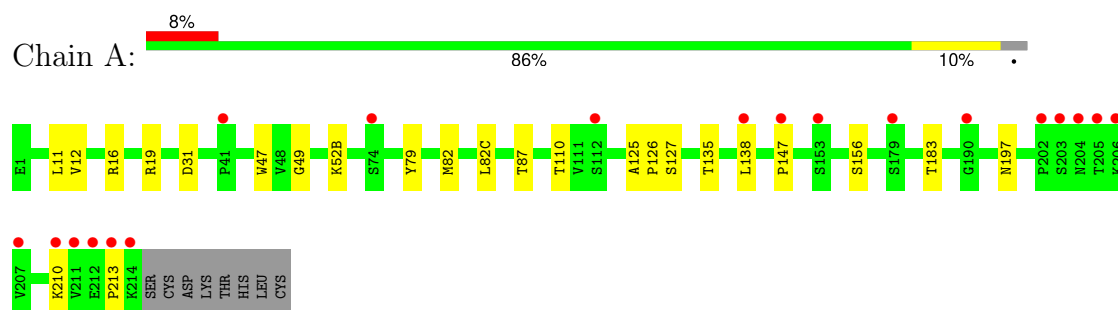
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	G	31	Total 31	O 31	0	0
4	H	25	Total 25	O 25	0	0

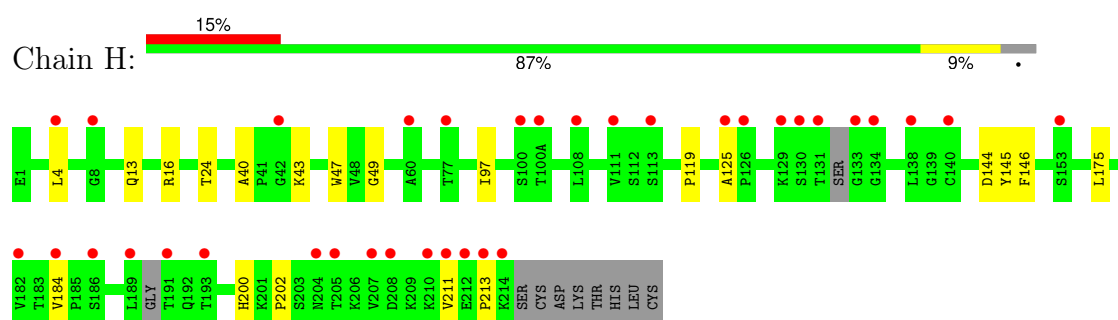
3 Residue-property plots [i](#)

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.

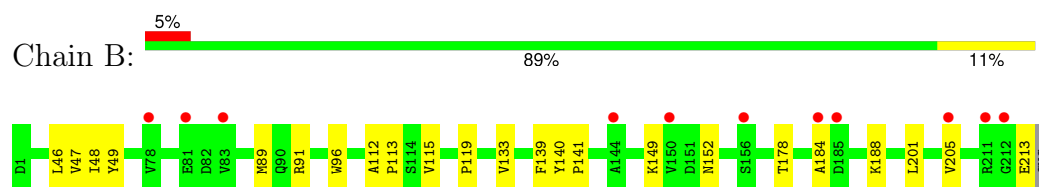
• Molecule 1: Heavy Chain of Fab 7160



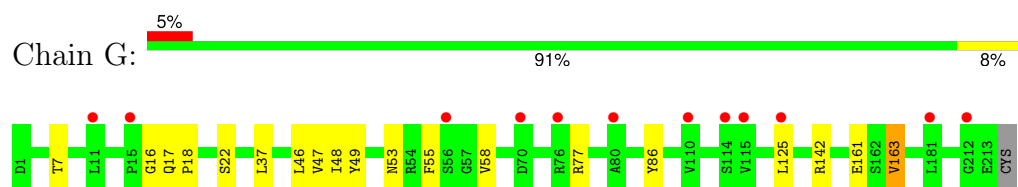
• Molecule 1: Heavy Chain of Fab 7160



• Molecule 2: Ligh Chain of Fab 7160



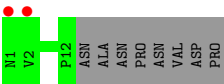
• Molecule 2: Ligh Chain of Fab 7160



• Molecule 3: Circumsporozoite protein



● Molecule 3: Circumsporozoite protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	87.00Å 101.04Å 104.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.53 – 2.27 46.53 – 2.27	Depositor EDS
% Data completeness (in resolution range)	97.2 (46.53-2.27) 93.1 (46.53-2.27)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.16	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.95 (at 2.27Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.253 , 0.286 0.253 , 0.286	Depositor DCC
R_{free} test set	2007 reflections (4.76%)	wwPDB-VP
Wilson B-factor (Å ²)	31.1	Xtriage
Anisotropy	0.899	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 21.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	0.028 for -h,l,k	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	6987	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.17% 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 [i](#)

5.1 Standard geometry [i](#)

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	0.10	0/1695	0.28	0/2307
1	H	0.11	0/1683	0.29	0/2288
2	B	0.08	0/1734	0.27	0/2354
2	G	0.09	0/1734	0.27	0/2354
3	C	0.08	0/90	0.24	0/126
3	D	0.12	0/90	0.23	0/126
All	All	0.09	0/7026	0.28	0/9555

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	1655	0	1637	16	0
1	H	1645	0	1627	11	0
2	B	1697	0	1659	14	0
2	G	1697	0	1659	11	0
3	C	88	0	78	2	0
3	D	88	0	78	0	0
4	A	33	0	0	0	0
4	B	24	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	G	31	0	0	1	0
4	H	25	0	0	0	0
All	All	6987	0	6738	51	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 (51) 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)
2:B:119:PRO:HG2	2:B:213:GLU:HG2	1.66	0.77
2:G:16:GLY:HA2	2:G:77:ARG:HG3	1.67	0.77
1:A:126:PRO:HG3	1:A:138:LEU:HD12	1.72	0.71
1:A:156:SER:H	1:A:197:ASN:HD21	1.42	0.68
1:A:125:ALA:HB1	1:A:213:PRO:HD3	1.76	0.68
1:H:40:ALA:HB3	1:H:43:LYS:HD2	1.82	0.61
2:G:46:LEU:HD21	2:G:49:TYR:HB3	1.83	0.61
1:H:119:PRO:HB3	1:H:145:TYR:HB3	1.84	0.60
2:B:46:LEU:HD21	2:B:49:TYR:HB3	1.83	0.59
2:B:133:VAL:HG22	2:B:178:THR:HG22	1.84	0.59
1:A:138:LEU:HG	1:A:210:LYS:HZ2	1.67	0.58
1:A:12:VAL:HG13	1:A:16:ARG:HB2	1.86	0.58
1:A:31:ASP:HB3	1:H:97:ILE:HD12	1.87	0.55
1:A:87:THR:HG23	1:A:110:THR:HA	1.88	0.55
1:A:138:LEU:HG	1:A:210:LYS:NZ	2.22	0.54
1:H:4:LEU:HG	1:H:24:THR:HG22	1.90	0.54
1:H:146:PHE:HB2	1:H:175:LEU:HD23	1.88	0.54
1:A:127:SER:HB3	1:A:213:PRO:HG2	1.89	0.53
1:H:144:ASP:HB3	1:H:175:LEU:HD13	1.91	0.53
2:B:89:MET:HE3	2:B:96:TRP:HB3	1.92	0.51
1:H:13:GLN:HB2	1:H:16:ARG:HG3	1.93	0.50
2:G:7:THR:HG23	2:G:22:SER:HB3	1.94	0.50
2:G:47:VAL:HG13	2:G:58:VAL:HG21	1.94	0.50
2:G:47:VAL:HG12	2:G:48:ILE:HG12	1.94	0.49
1:A:138:LEU:HD21	1:A:210:LYS:HG3	1.94	0.49
2:B:91:ARG:HH11	2:B:91:ARG:HG2	1.77	0.48
2:B:91:ARG:NH1	3:C:7:ASN:HA	2.28	0.48
2:B:115:VAL:HG21	2:B:205:VAL:HG21	1.96	0.48
2:G:142:ARG:HH21	2:G:163:VAL:HG11	1.77	0.48
2:G:55:PHE:O	2:G:58:VAL:HG12	2.14	0.47
1:H:144:ASP:HA	1:H:175:LEU:HB3	1.95	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:G:17:GLN:HG3	2:G:18:PRO:HD2	1.97	0.46
1:H:125:ALA:HB1	1:H:213:PRO:HG2	1.98	0.45
1:H:200:HIS:CE1	1:H:202:PRO:HB2	2.52	0.44
1:H:47:TRP:CZ2	1:H:49:GLY:HA2	2.53	0.44
2:B:184:ALA:O	2:B:188:LYS:HG3	2.18	0.44
1:A:52(B):LYS:HA	1:A:52(B):LYS:HD2	1.83	0.44
2:B:113:PRO:HB3	2:B:139:PHE:HB3	1.99	0.44
1:A:47:TRP:CZ2	1:A:49:GLY:HA2	2.53	0.44
2:B:149:LYS:HE2	2:B:152:ASN:HA	2.01	0.43
2:B:47:VAL:HG23	2:B:48:ILE:HG12	1.99	0.43
2:B:112:ALA:HB1	2:B:201:LEU:HD23	2.01	0.43
1:A:126:PRO:O	1:A:213:PRO:HD2	2.18	0.42
1:A:11:LEU:HD13	1:A:147:PRO:HG3	2.01	0.42
2:B:140:TYR:CG	2:B:141:PRO:HA	2.54	0.42
2:G:161:GLU:HG3	4:G:301:HOH:O	2.19	0.42
2:B:96:TRP:HZ2	3:C:8:PRO:HD3	1.85	0.41
2:G:49:TYR:O	2:G:53:ASN:HB2	2.20	0.41
1:A:19:ARG:HD3	1:A:79:TYR:HB3	2.03	0.41
1:A:82:MET:HB3	1:A:82(C):LEU:HD21	2.01	0.41
2:G:37:LEU:HD13	2:G:86:TYR:CZ	2.56	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	220/230 (96%)	213 (97%)	7 (3%)	0	100	100
1	H	214/230 (93%)	211 (99%)	3 (1%)	0	100	100
2	B	216/219 (99%)	207 (96%)	9 (4%)	0	100	100
2	G	216/219 (99%)	212 (98%)	4 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	C	10/20 (50%)	10 (100%)	0	0	100	100
3	D	10/20 (50%)	10 (100%)	0	0	100	100
All	All	886/938 (94%)	863 (97%)	23 (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	185/193 (96%)	183 (99%)	2 (1%)	65	79
1	H	184/193 (95%)	182 (99%)	2 (1%)	65	79
2	B	195/196 (100%)	195 (100%)	0	100	100
2	G	195/196 (100%)	193 (99%)	2 (1%)	68	81
3	C	11/18 (61%)	11 (100%)	0	100	100
3	D	11/18 (61%)	11 (100%)	0	100	100
All	All	781/814 (96%)	775 (99%)	6 (1%)	73	84

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	135	THR
1	A	183	THR
2	G	125	LEU
2	G	163	VAL
1	H	184	VAL
1	H	211	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	82(A)	ASN

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Mol	Chain	Res	Type
1	A	197	ASN
1	A	199	ASN
2	B	45	GLN
2	B	152	ASN
2	G	53	ASN
1	H	171	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 [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	222/230 (96%)	0.92	19 (8%) 16 17	27, 35, 45, 56	0
1	H	220/230 (95%)	1.10	35 (15%) 5 5	26, 38, 56, 64	0
2	B	218/219 (99%)	0.80	11 (5%) 34 35	28, 36, 48, 54	0
2	G	218/219 (99%)	0.85	12 (5%) 30 31	29, 37, 47, 66	0
3	C	12/20 (60%)	0.89	1 (8%) 17 18	33, 37, 48, 60	0
3	D	12/20 (60%)	1.47	2 (16%) 4 4	29, 35, 55, 57	0
All	All	902/938 (96%)	0.92	80 (8%) 15 16	26, 36, 50, 66	0

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	191	THR	5.1
1	A	211	VAL	4.6
1	H	211	VAL	4.6
1	A	204	ASN	4.5
1	H	213	PRO	4.4
2	G	76	ARG	4.1
3	D	1	ASN	4.1
1	A	212	GLU	3.7
1	H	133	GLY	3.6
2	B	212	GLY	3.6
1	H	182	VAL	3.5
1	H	113	SER	3.4
2	G	125	LEU	3.3
3	C	1	ASN	3.3
1	A	210	LYS	3.3
1	A	207	VAL	3.2
1	H	204	ASN	3.0
1	H	184	VAL	2.9
1	H	210	LYS	2.9

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Mol	Chain	Res	Type	RSRZ
2	G	110	VAL	2.9
1	H	131	THR	2.9
1	H	134	GLY	2.9
1	H	125	ALA	2.9
1	H	214	LYS	2.8
1	A	213	PRO	2.8
1	H	138	LEU	2.7
1	H	189	LEU	2.7
1	H	42	GLY	2.7
1	A	138	LEU	2.7
1	H	207	VAL	2.6
3	D	2	VAL	2.6
2	B	150	VAL	2.6
1	H	153	SER	2.6
1	A	205	THR	2.6
1	A	179	SER	2.6
2	B	144	ALA	2.6
2	B	184	ALA	2.6
2	G	115	VAL	2.6
1	A	153	SER	2.6
1	A	203	SER	2.6
1	H	212	GLU	2.5
2	G	15	PRO	2.5
1	H	208	ASP	2.5
2	G	80	ALA	2.5
2	B	156	SER	2.4
1	H	108	LEU	2.4
2	G	70	ASP	2.4
1	A	190	GLY	2.4
1	H	126	PRO	2.4
1	A	214	LYS	2.4
1	A	74	SER	2.4
2	G	212	GLY	2.3
1	H	129	LYS	2.3
1	H	205	THR	2.3
1	H	193	THR	2.2
1	A	147	PRO	2.2
1	A	206	LYS	2.2
1	H	60	ALA	2.2
1	H	100	SER	2.2
2	B	205	VAL	2.2
1	A	41	PRO	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	202	PRO	2.2
1	H	8	GLY	2.2
2	G	11	LEU	2.1
2	B	78	VAL	2.1
2	B	83	VAL	2.1
1	H	140	CYS	2.1
2	B	211	ARG	2.1
1	H	111	VAL	2.1
1	H	77	THR	2.1
1	H	100(A)	THR	2.1
1	H	130	SER	2.1
2	B	185	ASP	2.1
1	A	112	SER	2.1
2	G	56	SER	2.1
1	H	4	LEU	2.1
1	H	186	SER	2.0
2	B	81	GLU	2.0
2	G	114	SER	2.0
2	G	181	LEU	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.