



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 09:02 AM UTC

PDB ID : 4GQ9 / pdb_00004gq9
Title : Chikungunya virus neutralizing antibody 9.8B Fab fragment
Authors : Sun, S.; Rossmann, M.G.
Deposited on : 2012-08-22
Resolution : 3.00 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

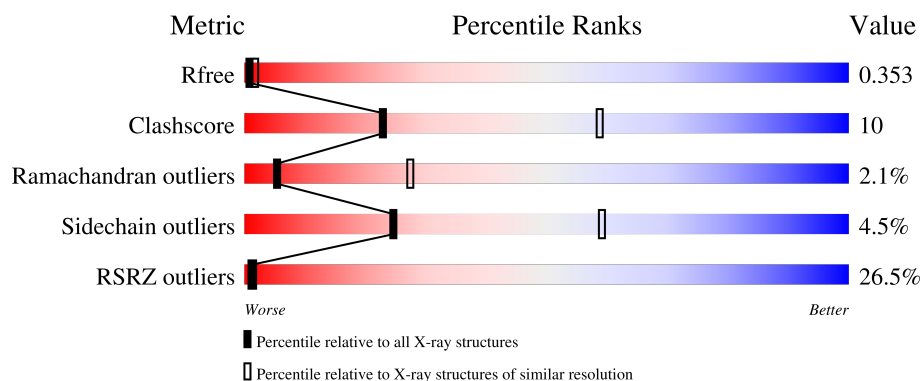
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	2672 (3.00-3.00)
Clashscore	190562	2977 (3.00-3.00)
Ramachandran outliers	187476	2877 (3.00-3.00)
Sidechain outliers	187428	2880 (3.00-3.00)
RSRZ outliers	180081	2671 (3.00-3.00)

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	L	212	
2	H	218	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3280 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 Chikungunya virus neutralizing antibody 9.8B Fab fragment light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	212	Total	C	N	O	S	0	0	0
			1633	1015	273	336	9			

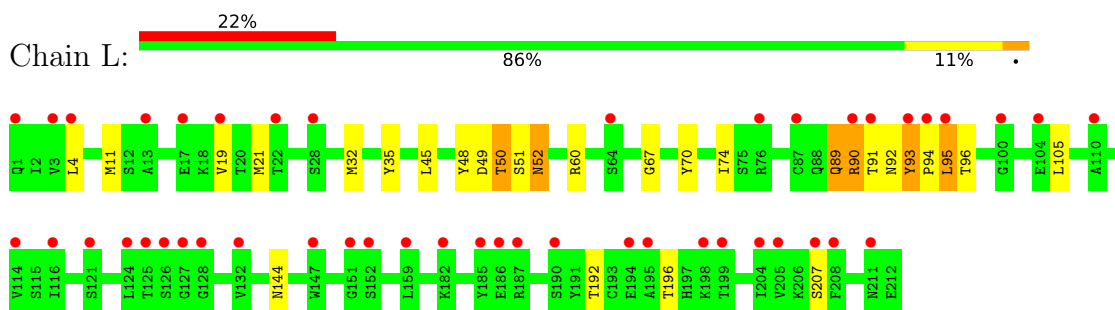
- Molecule 2 is a protein called Chikungunya virus neutralizing antibody 9.8B Fab fragment heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	218	Total	C	N	O	S	0	0	0
			1647	1039	275	326	7			

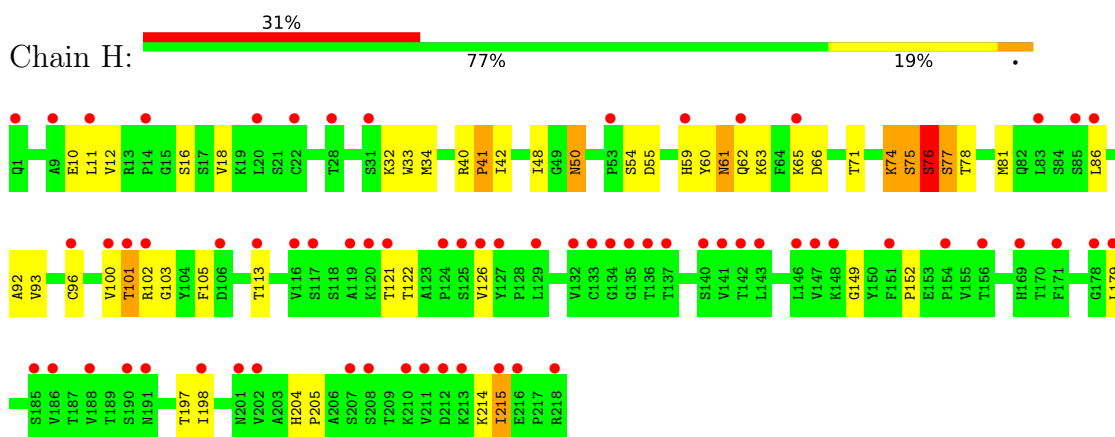
3 Residue-property plots [i](#)

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: Chikungunya virus neutralizing antibody 9.8B Fab fragment light chain



- Molecule 2: Chikungunya virus neutralizing antibody 9.8B Fab fragment heavy chain



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	87.86Å 57.73Å 118.11Å 90.00° 97.51° 90.00°	Depositor
Resolution (Å)	43.42 – 3.00 43.42 – 3.00	Depositor EDS
% Data completeness (in resolution range)	99.0 (43.42-3.00) 99.0 (43.42-3.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.79 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.323 , 0.359 0.314 , 0.353	Depositor DCC
R_{free} test set	568 reflections (4.72%)	wwPDB-VP
Wilson B-factor (Å ²)	57.5	Xtriage
Anisotropy	0.309	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 41.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.82	EDS
Total number of atoms	3280	wwPDB-VP
Average B, all atoms (Å ²)	82.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.95% 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	L	0.58	0/1669	0.74	0/2268
2	H	0.53	0/1689	0.76	0/2308
All	All	0.55	0/3358	0.75	0/4576

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
2	H	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	H	76	SER	Peptide

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	L	1633	0	1571	22	0
2	H	1647	0	1620	45	0
All	All	3280	0	3191	67	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 10.

All (67) 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:H:75:SER:HB2	2:H:76:SER:CB	1.53	1.39
2:H:75:SER:CB	2:H:76:SER:HB3	1.65	1.25
2:H:54:SER:HB2	2:H:55:ASP:HB3	1.41	1.03
2:H:75:SER:CB	2:H:76:SER:CB	2.29	0.97
2:H:50:ASN:ND2	2:H:59:HIS:HB2	1.89	0.88
1:L:52:ASN:N	1:L:52:ASN:HD22	1.70	0.87
2:H:76:SER:H	2:H:77:SER:HB3	1.44	0.82
2:H:76:SER:HA	2:H:77:SER:OG	1.79	0.82
2:H:76:SER:CA	2:H:77:SER:OG	2.29	0.81
2:H:75:SER:HB2	2:H:76:SER:HB3	0.81	0.80
2:H:75:SER:CB	2:H:76:SER:OG	2.30	0.79
2:H:74:LYS:O	2:H:74:LYS:HG3	1.83	0.78
2:H:50:ASN:HD21	2:H:59:HIS:HB2	1.48	0.78
2:H:76:SER:C	2:H:77:SER:OG	2.30	0.73
1:L:52:ASN:N	1:L:52:ASN:ND2	2.30	0.73
2:H:75:SER:CA	2:H:76:SER:CB	2.66	0.71
1:L:94:PRO:HA	1:L:95:LEU:CB	2.23	0.68
2:H:50:ASN:HD22	2:H:50:ASN:N	1.95	0.65
2:H:75:SER:N	2:H:76:SER:OG	2.30	0.65
2:H:62:GLN:HA	2:H:65:LYS:HE3	1.82	0.61
2:H:48:ILE:HD13	2:H:81:MET:HE1	1.83	0.60
1:L:52:ASN:ND2	1:L:52:ASN:H	1.98	0.60
2:H:34:MET:HE1	2:H:96:CYS:SG	2.41	0.60
2:H:54:SER:CB	2:H:55:ASP:HB3	2.25	0.60
2:H:61:ASN:HD22	2:H:63:LYS:H	1.48	0.59
1:L:4:LEU:HD11	1:L:89:GLN:HB3	1.86	0.58
2:H:76:SER:H	2:H:77:SER:CB	2.16	0.57
2:H:33:TRP:CD1	2:H:101:THR:HA	2.41	0.55
2:H:54:SER:HB2	2:H:55:ASP:CB	2.28	0.53
2:H:75:SER:CA	2:H:76:SER:OG	2.56	0.53
2:H:93:VAL:HG22	2:H:113:THR:HG22	1.91	0.53
1:L:144:ASN:HB3	1:L:196:THR:HB	1.91	0.53
2:H:76:SER:N	2:H:77:SER:HB3	2.18	0.52
2:H:76:SER:CA	2:H:77:SER:CB	2.87	0.51
2:H:76:SER:N	2:H:77:SER:CB	2.73	0.51
1:L:94:PRO:HA	1:L:95:LEU:HB2	1.91	0.50
1:L:90:ARG:HE	1:L:91:THR:H	1.59	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:H:121:THR:HG23	2:H:152:PRO:HD3	1.94	0.50
1:L:94:PRO:HA	1:L:95:LEU:HB3	1.94	0.49
1:L:94:PRO:HB2	1:L:96:THR:HG23	1.96	0.48
1:L:35:TYR:CZ	1:L:45:LEU:HD23	2.48	0.48
2:H:75:SER:OG	2:H:76:SER:OG	2.29	0.48
2:H:41:PRO:HB2	2:H:42:ILE:HD12	1.96	0.48
2:H:60:TYR:HB2	2:H:65:LYS:HE2	1.96	0.47
2:H:40:ARG:HG2	2:H:92:ALA:HB2	1.96	0.47
1:L:49:ASP:C	1:L:50:THR:OG1	2.58	0.47
1:L:11:MET:HE3	1:L:21:MET:HG2	1.98	0.45
2:H:198:ILE:HG22	2:H:215:ILE:HD11	1.98	0.45
2:H:65:LYS:HA	2:H:66:ASP:HA	1.66	0.45
1:L:90:ARG:HE	1:L:91:THR:N	2.15	0.44
1:L:45:LEU:HD11	1:L:48:TYR:HB3	1.99	0.44
1:L:89:GLN:NE2	1:L:92:ASN:HB3	2.32	0.44
2:H:197:THR:HG23	2:H:214:LYS:HE3	1.99	0.44
1:L:192:THR:HG23	1:L:207:SER:HB2	2.00	0.43
2:H:32:LYS:HD3	2:H:100:VAL:HG22	2.01	0.43
1:L:32:MET:HG3	1:L:70:TYR:CG	2.54	0.43
1:L:51:SER:HB2	1:L:52:ASN:ND2	2.34	0.43
2:H:149:GLY:HA2	2:H:179:LEU:HB3	2.00	0.42
1:L:19:VAL:HB	1:L:74:ILE:HB	2.02	0.41
2:H:50:ASN:ND2	2:H:50:ASN:N	2.67	0.41
2:H:10:GLU:HG2	2:H:18:VAL:HG13	2.03	0.41
2:H:12:VAL:HG21	2:H:18:VAL:HG22	2.02	0.41
2:H:102:ARG:HA	2:H:103:GLY:HA2	1.68	0.41
1:L:32:MET:HB2	1:L:50:THR:HG23	2.02	0.40
2:H:204:HIS:HA	2:H:205:PRO:HD3	1.88	0.40
1:L:92:ASN:O	1:L:93:TYR:C	2.64	0.40
2:H:100:VAL:O	2:H:101:THR:HG22	2.22	0.40

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	L	210/212 (99%)	196 (93%)	11 (5%)	3 (1%)	9	36
2	H	216/218 (99%)	190 (88%)	20 (9%)	6 (3%)	4	21
All	All	426/430 (99%)	386 (91%)	31 (7%)	9 (2%)	5	27

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	76	SER
1	L	93	TYR
2	H	101	THR
1	L	60	ARG
2	H	86	LEU
2	H	126	VAL
2	H	77	SER
2	H	41	PRO
1	L	67	GLY

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	L	187/187 (100%)	181 (97%)	6 (3%)	34	67
2	H	189/189 (100%)	178 (94%)	11 (6%)	18	51
All	All	376/376 (100%)	359 (96%)	17 (4%)	24	59

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

Mol	Chain	Res	Type
1	L	50	THR
1	L	52	ASN
1	L	89	GLN
1	L	90	ARG

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Mol	Chain	Res	Type
1	L	95	LEU
1	L	105	LEU
2	H	11	LEU
2	H	16	SER
2	H	50	ASN
2	H	61	ASN
2	H	71	THR
2	H	74	LYS
2	H	75	SER
2	H	78	THR
2	H	105	PHE
2	H	122	THR
2	H	215	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	L	37	GLN
1	L	52	ASN
1	L	88	GLN
1	L	137	ASN
2	H	35	HIS
2	H	39	GLN
2	H	50	ASN
2	H	61	ASN

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 oligosaccharides 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	L	212/212 (100%)	1.37	46 (21%) 2 1	22, 86, 165, 192	0
2	H	218/218 (100%)	1.66	68 (31%) 1 1	21, 77, 167, 195	0
All	All	430/430 (100%)	1.52	114 (26%) 1 1	21, 81, 167, 195	0

All (114) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	178	GLY	6.8
2	H	102	ARG	5.7
2	H	101	THR	5.5
2	H	134	GLY	5.0
2	H	137	THR	4.8
2	H	85	SER	4.7
1	L	90	ARG	4.6
2	H	125	SER	4.5
1	L	125	THR	4.3
2	H	154	PRO	4.3
1	L	93	TYR	4.2
1	L	28	SER	4.0
2	H	186	VAL	3.9
1	L	126	SER	3.8
2	H	132	VAL	3.7
2	H	31	SER	3.6
1	L	195	ALA	3.5
1	L	205	VAL	3.5
2	H	142	THR	3.5
2	H	53	PRO	3.5
2	H	127	TYR	3.5
1	L	151	GLY	3.4
2	H	202	VAL	3.4
2	H	136	THR	3.3

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Mol	Chain	Res	Type	RSRZ
1	L	94	PRO	3.3
2	H	208	SER	3.1
2	H	28	THR	3.1
2	H	121	THR	3.1
1	L	1	GLN	3.1
2	H	191	ASN	3.1
2	H	1	GLN	3.1
2	H	20	LEU	3.0
1	L	91	THR	3.0
1	L	124	LEU	3.0
2	H	65	LYS	2.9
1	L	127	GLY	2.9
2	H	146	LEU	2.9
2	H	210	LYS	2.9
1	L	208	PHE	2.8
1	L	152	SER	2.8
2	H	143	LEU	2.8
1	L	185	TYR	2.8
2	H	211	VAL	2.8
2	H	106	ASP	2.8
2	H	212	ASP	2.8
2	H	148	LYS	2.8
2	H	135	GLY	2.8
1	L	95	LEU	2.7
1	L	207	SER	2.7
1	L	116	ILE	2.7
2	H	86	LEU	2.7
1	L	198	LYS	2.7
2	H	100	VAL	2.6
2	H	120	LYS	2.6
2	H	140	SER	2.5
1	L	76	ARG	2.5
1	L	4	LEU	2.5
2	H	59	HIS	2.5
2	H	216	GLU	2.4
1	L	13	ALA	2.4
1	L	211	ASN	2.4
1	L	114	VAL	2.4
2	H	113	THR	2.4
2	H	133	CYS	2.4
1	L	132	VAL	2.3
1	L	110	ALA	2.3

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Mol	Chain	Res	Type	RSRZ
1	L	64	SER	2.3
2	H	117	SER	2.3
2	H	169	HIS	2.3
2	H	14	PRO	2.3
2	H	124	PRO	2.3
2	H	126	VAL	2.3
2	H	141	VAL	2.3
1	L	104	GLU	2.3
1	L	100	GLY	2.3
2	H	119	ALA	2.3
1	L	159	LEU	2.3
2	H	198	ILE	2.3
2	H	116	VAL	2.3
2	H	11	LEU	2.3
1	L	147	TRP	2.3
2	H	207	SER	2.3
2	H	218	ARG	2.3
1	L	22	THR	2.2
1	L	121	SER	2.2
1	L	128	GLY	2.2
2	H	171	PHE	2.2
2	H	83	LEU	2.2
2	H	62	GLN	2.2
1	L	199	THR	2.2
2	H	156	THR	2.2
1	L	186	GLU	2.2
2	H	201	ASN	2.2
1	L	19	VAL	2.2
1	L	17	GLU	2.2
1	L	87	CYS	2.1
2	H	213	LYS	2.1
2	H	129	LEU	2.1
1	L	187	ARG	2.1
1	L	190	SER	2.1
1	L	194	GLU	2.1
2	H	96	CYS	2.1
2	H	190	SER	2.1
1	L	3	VAL	2.1
1	L	182	LYS	2.1
1	L	204	ILE	2.1
2	H	188	VAL	2.0
2	H	215	ILE	2.0

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Mol	Chain	Res	Type	RSRZ
2	H	147	VAL	2.0
2	H	185	SER	2.0
2	H	22	CYS	2.0
2	H	179	LEU	2.0
2	H	151	PHE	2.0
2	H	9	ALA	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.