



# Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 08:10 am BST

PDB ID : 4GQ9  
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](mailto: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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

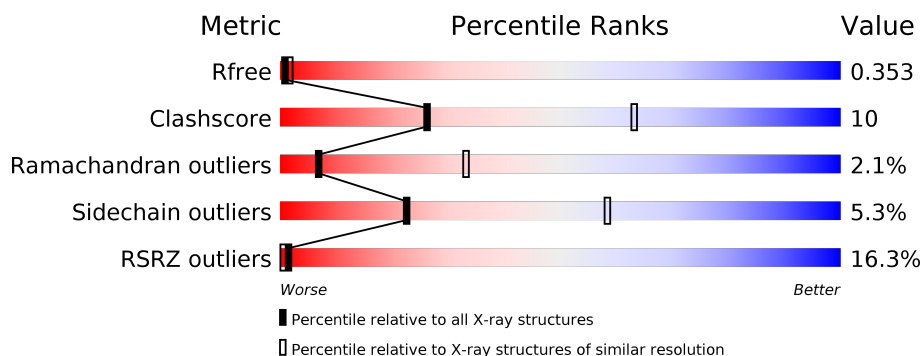
# 1 Overall quality at a glance

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))
$R_{free}$	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	<div> <div>14%</div> <div> <div></div> <div>85%</div> <div>13%</div> <div>.</div> </div> </div>
2	H	218	<div> <div>19%</div> <div> <div></div> <div>78%</div> <div>17%</div> <div>.</div> </div> </div>

## 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			

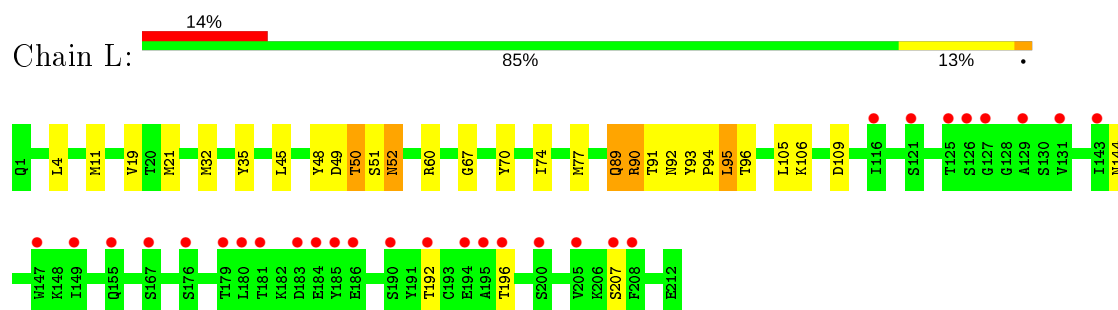
- Molecule 2 is a protein called Chikungunya virus neutralizing antibody 9.8B Fab fragment heavy chain.

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

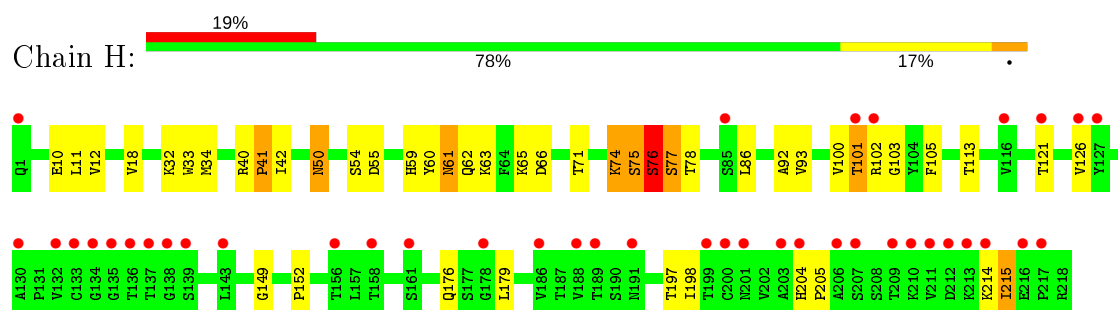
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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, $\alpha$ , $\beta$ , $\gamma$	87.86Å 57.73Å 118.11Å 90.00° 97.51° 90.00°	Depositor
Resolution (Å)	43.42 – 3.00 43.42 – 2.99	Depositor EDS
% Data completeness (in resolution range)	99.0 (43.42-3.00) 99.1 (43.42-2.99)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	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 (4.77%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	57.5	Xtriage
Anisotropy	0.309	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.27 , 34.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.43$ , $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.81	EDS
Total number of atoms	3280	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	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.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>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 [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	0.44	0/1669	0.51	0/2268
2	H	0.39	0/1689	0.51	0/2308
All	All	0.41	0/3358	0.51	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:HD22	1:L:52:ASN:N	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:HG3	2:H:74:LYS:O	1.83	0.78
2:H:50:ASN:HD21	2:H:59:HIS:HB2	1.48	0.78
2:H:75:SER:CA	2:H:76:SER:CB	2.66	0.74
1:L:52:ASN:ND2	1:L:52:ASN:N	2.30	0.73
2:H:76:SER:C	2:H:77:SER:OG	2.30	0.69
1:L:94:PRO:HA	1:L:95:LEU:CB	2.23	0.68
2:H:75:SER:CA	2:H:76:SER:HB3	2.25	0.67
2:H:50:ASN:N	2:H:50:ASN:HD22	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
1:L:52:ASN:ND2	1:L:52:ASN:H	1.98	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
2:H:121:THR:HG23	2:H:152:PRO:HD3	1.94	0.50

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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
2:H:75:SER:OG	2:H:76:SER:OG	2.29	0.48
1:L:35:TYR:CZ	1:L:45:LEU:HD23	2.48	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:HG1	2.20	0.45
2:H:198:ILE:HG22	2:H:215:ILE:HD11	1.98	0.45
2:H:34:MET:HB3	2:H:34:MET:HE2	1.73	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
2:H:197:THR:HG23	2:H:214:LYS:HE3	1.99	0.44
1:L:89:GLN:NE2	1:L:92:ASN:HB3	2.32	0.44
1:L:11:MET:HE3	1:L:21:MET:HG2	2.00	0.43
2:H:32:LYS:HD3	2:H:100:VAL:HG22	2.01	0.43
1:L:192:THR:HG23	1:L:207:SER:HB2	2.00	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:49:ASP:C	1:L:50:THR:OG1	2.58	0.42
1:L:19:VAL:HB	1:L:74:ILE:HB	2.02	0.41
2:H:50:ASN:N	2:H:50:ASN:ND2	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
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%)	11	43
2	H	216/218 (99%)	190 (88%)	20 (9%)	6 (3%)	5	25
All	All	426/430 (99%)	386 (91%)	31 (7%)	9 (2%)	7	33

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%)	178 (95%)	9 (5%)	25	62
2	H	189/189 (100%)	178 (94%)	11 (6%)	20	55
All	All	376/376 (100%)	356 (95%)	20 (5%)	22	58

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	L	50	THR
1	L	52	ASN
1	L	77	MET
1	L	89	GLN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	L	90	ARG
1	L	95	LEU
1	L	105	LEU
1	L	106	LYS
1	L	109	ASP
2	H	11	LEU
2	H	50	ASN
2	H	61	ASN
2	H	71	THR
2	H	74	LYS
2	H	75	SER
2	H	76	SER
2	H	78	THR
2	H	105	PHE
2	H	176	GLN
2	H	215	ILE

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

Mol	Chain	Res	Type
1	L	37	GLN
1	L	52	ASN
1	L	88	GLN
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 carbohydrates 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	L	212/212 (100%)	0.83	29 (13%) 3 1	22, 86, 165, 192	0
2	H	218/218 (100%)	1.10	41 (18%) 1 0	21, 77, 167, 195	0
All	All	430/430 (100%)	0.97	70 (16%) 1 0	21, 81, 167, 195	0

All (70) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	135	GLY	7.6
2	H	136	THR	7.1
2	H	137	THR	6.0
1	L	186	GLU	5.9
2	H	132	VAL	5.8
2	H	191	ASN	4.9
2	H	186	VAL	4.9
1	L	195	ALA	4.3
1	L	185	TYR	4.2
2	H	85	SER	4.1
2	H	210	LYS	4.1
2	H	199	THR	4.1
2	H	101	THR	4.0
1	L	190	SER	3.8
1	L	127	GLY	3.8
1	L	126	SER	3.7
2	H	207	SER	3.7
2	H	133	CYS	3.6
2	H	178	GLY	3.6
2	H	127	TYR	3.5
1	L	179	THR	3.4
2	H	216	GLU	3.4
2	H	143	LEU	3.4
2	H	201	ASN	3.3

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
2	H	138	GLY	3.3
1	L	131	VAL	3.2
1	L	121	SER	3.2
2	H	212	ASP	3.2
1	L	205	VAL	3.2
1	L	207	SER	3.1
1	L	147	TRP	3.1
1	L	143	ILE	3.1
2	H	209	THR	3.1
2	H	102	ARG	3.0
2	H	126	VAL	3.0
1	L	183	ASP	2.9
1	L	194	GLU	2.9
1	L	181	THR	2.8
2	H	206	ALA	2.8
2	H	217	PRO	2.8
2	H	204	HIS	2.8
2	H	214	LYS	2.7
2	H	189	THR	2.7
2	H	130	ALA	2.7
1	L	116	ILE	2.7
2	H	211	VAL	2.6
1	L	200	SER	2.6
2	H	161	SER	2.6
2	H	203	ALA	2.5
1	L	192	THR	2.5
1	L	155	GLN	2.5
2	H	200	CYS	2.5
2	H	134	GLY	2.5
2	H	188	VAL	2.4
1	L	208	PHE	2.4
1	L	184	GLU	2.3
2	H	213	LYS	2.3
1	L	180	LEU	2.3
2	H	121	THR	2.3
2	H	158	THR	2.2
1	L	176	SER	2.2
2	H	139	SER	2.2
2	H	156	THR	2.2
1	L	149	ILE	2.2
2	H	116	VAL	2.2
1	L	167	SER	2.1

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	L	129	ALA	2.1
2	H	1	GLN	2.1
1	L	125	THR	2.1
1	L	196	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 carbohydrates 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.