



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 10, 2024 – 12:52 PM JST

PDB ID : 8YJ5  
Title : Characterization of a novel format scFvXVHH single-chain Biparatopic antibody against a metal binding protein, MtsA  
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Deposited on : 2024-03-01  
Resolution : 3.66 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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 : 2.36.2  
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) : 2.36.2

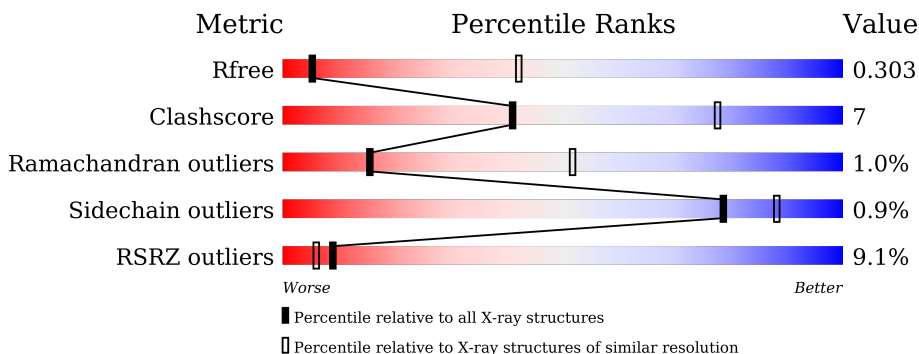
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.66 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	1557 (3.82-3.50)
Clashscore	141614	1037 (3.80-3.52)
Ramachandran outliers	138981	1004 (3.80-3.52)
Sidechain outliers	138945	1002 (3.80-3.52)
RSRZ outliers	127900	1441 (3.82-3.50)

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  $\geq 3$ , 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	C	134	
2	A	279	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3141 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 VHH43.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	C	127	955	592	167	191	5	0	0	0

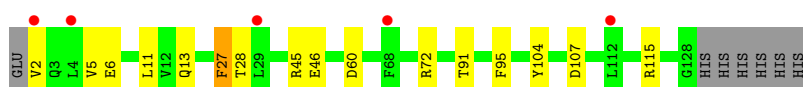
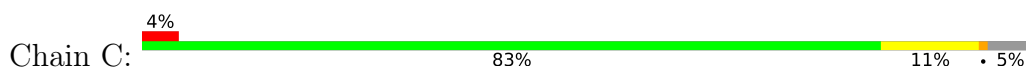
- Molecule 2 is a protein called Iron ABC transporter substrate-binding lipoprotein MtsA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	278	2186	1400	351	430	5	0	0	0

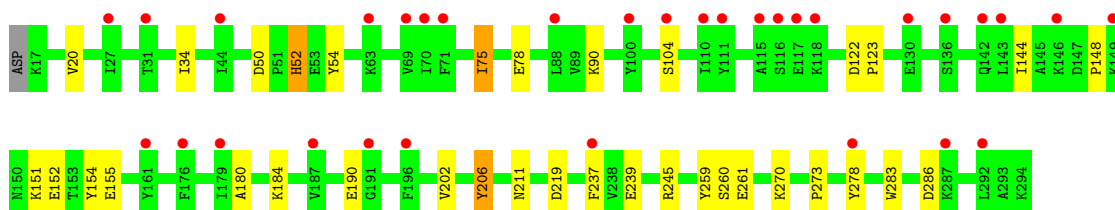
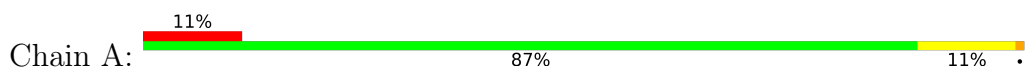
### 3 Residue-property plots [i](#)

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: VHH43



- Molecule 2: Iron ABC transporter substrate-binding lipoprotein MtsA



## 4 Data and refinement statistics i

Property	Value	Source
Space group	I 41	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	120.45Å 120.45Å 156.18Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.79 – 3.66 47.79 – 3.66	Depositor EDS
% Data completeness (in resolution range)	99.9 (47.79-3.66) 99.9 (47.79-3.66)	Depositor EDS
$R_{merge}$	0.18	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.06 (at 3.67Å)	Xtrriage
Refinement program	PHENIX 1.17_3644+SVN	Depositor
R, $R_{free}$	0.263 , 0.303 0.263 , 0.303	Depositor DCC
$R_{free}$ test set	582 reflections (4.71%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	156.5	Xtrriage
Anisotropy	0.152	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 94.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.42$ , $\langle L^2 \rangle = 0.24$	Xtrriage
Estimated twinning fraction	0.149 for -h,k,-l	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	3141	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	106.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% 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	C	1.15	5/975 (0.5%)	1.11	4/1323 (0.3%)
2	A	1.15	9/2229 (0.4%)	1.02	4/3006 (0.1%)
All	All	1.15	14/3204 (0.4%)	1.05	8/4329 (0.2%)

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	278	TYR	CB-CG	8.75	1.64	1.51
2	A	219	ASP	CB-CG	6.61	1.65	1.51
2	A	259	TYR	CB-CG	6.39	1.61	1.51
1	C	95	PHE	CB-CG	-6.17	1.40	1.51
2	A	78	GLU	CD-OE1	-6.13	1.19	1.25
1	C	13	GLN	CG-CD	-5.92	1.37	1.51
2	A	78	GLU	CG-CD	-5.77	1.43	1.51
1	C	104	TYR	CB-CG	5.70	1.60	1.51
2	A	239	GLU	CD-OE1	-5.52	1.19	1.25
2	A	190	GLU	CD-OE1	-5.49	1.19	1.25
1	C	46	GLU	CG-CD	5.48	1.60	1.51
2	A	78	GLU	CD-OE2	-5.38	1.19	1.25
1	C	60	ASP	CB-CG	5.09	1.62	1.51
2	A	245	ARG	NE-CZ	5.03	1.39	1.33

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	115	ARG	NE-CZ-NH2	-9.00	115.80	120.30
2	A	54	TYR	CB-CG-CD2	-8.15	116.11	121.00
2	A	206	TYR	CB-CG-CD2	-7.51	116.49	121.00
1	C	45	ARG	NE-CZ-NH2	-6.96	116.82	120.30
1	C	115	ARG	NE-CZ-NH1	6.56	123.58	120.30
2	A	154	TYR	CB-CG-CD2	-6.44	117.14	121.00
2	A	286	ASP	CB-CG-OD1	6.03	123.72	118.30
1	C	91	THR	CA-CB-CG2	-5.73	104.38	112.40

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	C	955	0	899	10	0
2	A	2186	0	2199	35	0
All	All	3141	0	3098	44	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 7.

All (44) 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:A:75:ILE:CD1	2:A:123:PRO:HA	1.64	1.26
2:A:75:ILE:HD11	2:A:123:PRO:CA	1.75	1.16
2:A:151:LYS:HE3	2:A:155:GLU:CD	1.79	1.01
2:A:151:LYS:HE3	2:A:155:GLU:OE2	1.68	0.93
2:A:50:ASP:OD1	2:A:52:HIS:HB2	1.73	0.89
2:A:75:ILE:HD11	2:A:123:PRO:HA	0.87	0.81
2:A:50:ASP:CG	2:A:52:HIS:HB2	2.10	0.72
2:A:75:ILE:HG21	2:A:104:SER:HB2	1.72	0.71
2:A:151:LYS:CE	2:A:155:GLU:OE2	2.39	0.71
2:A:75:ILE:CG2	2:A:104:SER:HB2	2.21	0.70
2:A:144:ILE:CG2	2:A:151:LYS:HD2	2.27	0.65
2:A:144:ILE:HG23	2:A:151:LYS:HD2	1.79	0.65
1:C:2:VAL:HG23	1:C:27:PHE:O	1.97	0.64
2:A:144:ILE:HG23	2:A:151:LYS:CD	2.27	0.64
2:A:75:ILE:CD1	2:A:123:PRO:CA	2.54	0.62
1:C:2:VAL:HG12	1:C:2:VAL:O	1.99	0.62
1:C:2:VAL:HG21	1:C:27:PHE:CE1	2.36	0.61
2:A:75:ILE:O	2:A:75:ILE:HD12	2.03	0.58
1:C:6:GLU:N	1:C:6:GLU:OE2	2.38	0.57
2:A:75:ILE:CD1	2:A:122:ASP:O	2.57	0.53
1:C:5:VAL:O	1:C:5:VAL:HG23	2.07	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:75:ILE:CG1	2:A:123:PRO:HA	2.35	0.53
2:A:75:ILE:HG21	2:A:104:SER:CB	2.38	0.52
2:A:180:ALA:O	2:A:184:LYS:HG3	2.11	0.50
1:C:11:LEU:C	1:C:11:LEU:HD12	2.32	0.49
2:A:260:SER:OG	2:A:261:GLU:N	2.47	0.48
2:A:202:VAL:O	2:A:202:VAL:HG13	2.14	0.47
1:C:2:VAL:O	1:C:2:VAL:CG1	2.63	0.47
1:C:107:ASP:OD1	2:A:270:LYS:NZ	2.34	0.46
2:A:144:ILE:HG21	2:A:151:LYS:HD2	1.97	0.46
2:A:151:LYS:NZ	2:A:155:GLU:OE2	2.49	0.46
2:A:75:ILE:HG23	2:A:104:SER:HB2	1.95	0.46
2:A:206:TYR:CD2	2:A:206:TYR:N	2.83	0.46
1:C:5:VAL:O	1:C:5:VAL:CG2	2.65	0.45
1:C:72:ARG:O	1:C:72:ARG:HG3	2.15	0.44
2:A:34:ILE:HD12	2:A:34:ILE:HA	1.74	0.44
2:A:90:LYS:HD3	2:A:90:LYS:HA	1.74	0.44
2:A:273:PRO:HB3	2:A:283:TRP:CE3	2.53	0.44
2:A:75:ILE:O	2:A:75:ILE:CG1	2.67	0.43
2:A:20:VAL:O	2:A:20:VAL:HG23	2.19	0.42
2:A:237:PHE:CD1	2:A:237:PHE:N	2.88	0.42
2:A:75:ILE:HD11	2:A:122:ASP:O	2.22	0.40
2:A:270:LYS:O	2:A:270:LYS:HG3	2.20	0.40
2:A:50:ASP:OD2	2:A:52:HIS:HB2	2.22	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	C	125/134 (93%)	121 (97%)	3 (2%)	1 (1%)	19 56
2	A	276/279 (99%)	257 (93%)	16 (6%)	3 (1%)	14 51

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	401/413 (97%)	378 (94%)	19 (5%)	4 (1%)	15 52

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	152	GLU
1	C	28	THR
2	A	211	ASN
2	A	148	PRO

### 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	C	102/109 (94%)	101 (99%)	1 (1%)	76 86
2	A	238/240 (99%)	236 (99%)	2 (1%)	81 89
All	All	340/349 (97%)	337 (99%)	3 (1%)	78 88

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	27	PHE
2	A	52	HIS
2	A	75	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	114	HIS

### 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 monosaccharides 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	C	127/134 (94%)	0.71	5 (3%) 39 27	44, 80, 128, 139	0
2	A	278/279 (99%)	0.82	32 (11%) 4 3	56, 113, 165, 191	0
All	All	405/413 (98%)	0.78	37 (9%) 9 6	44, 103, 161, 191	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	2	VAL	7.6
2	A	69	VAL	4.2
2	A	142	GLN	4.2
2	A	176	PHE	3.7
2	A	116	SER	3.3
2	A	115	ALA	3.2
2	A	143	LEU	3.1
2	A	149	LYS	3.0
2	A	63	LYS	2.8
2	A	117	GLU	2.7
2	A	31	THR	2.7
2	A	27	ILE	2.6
2	A	161	TYR	2.5
2	A	237	PHE	2.5
1	C	29	LEU	2.5
2	A	146	LYS	2.4
2	A	88	LEU	2.4
1	C	4	LEU	2.4
2	A	44	ILE	2.4
2	A	70	ILE	2.4
2	A	191	GLY	2.3
2	A	179	ILE	2.3
2	A	136	SER	2.3
2	A	130	GLU	2.2

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Mol	Chain	Res	Type	RSRZ
2	A	187	VAL	2.2
2	A	104	SER	2.2
1	C	112	LEU	2.1
2	A	110	ILE	2.1
2	A	111	TYR	2.1
1	C	68	PHE	2.1
2	A	100	TYR	2.1
2	A	278	TYR	2.1
2	A	118	LYS	2.1
2	A	71	PHE	2.1
2	A	292	LEU	2.0
2	A	196	PHE	2.0
2	A	287	LYS	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 monosaccharides 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.