



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 09:06 AM UTC

PDB ID : 2BE4 / pdb\_00002be4  
Title : X-RAY STRUCTURE AN EF-HAND PROTEIN FROM DANIO RERIO  
Dr.36843  
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Deposited on : 2005-10-21  
Resolution : 2.10 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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
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

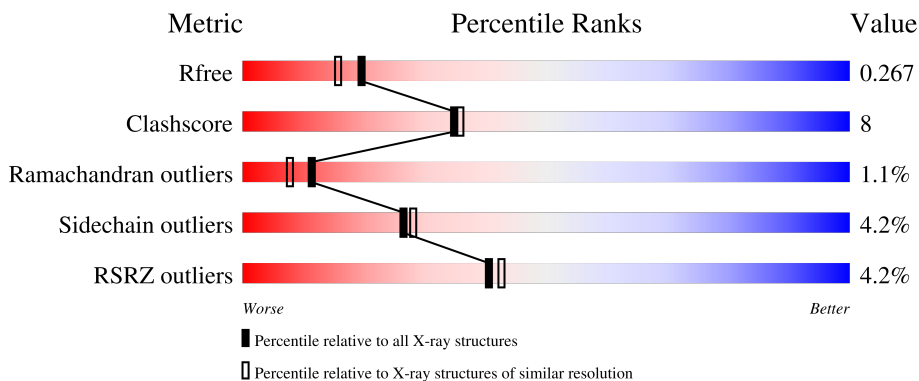
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

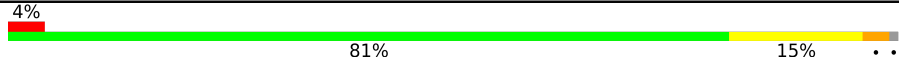
The reported resolution of this entry is 2.10 Å.

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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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	A	272	

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 2445 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 hypothetical protein LOC449832.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	270	2205	1403	374	414	4	10	0	1	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	cloning artifact	UNP Q5XJX1
A	40	MSE	MET	modified residue	UNP Q5XJX1
A	63	MSE	MET	modified residue	UNP Q5XJX1
A	82	MSE	MET	modified residue	UNP Q5XJX1
A	107	MSE	MET	modified residue	UNP Q5XJX1
A	153	MSE	MET	modified residue	UNP Q5XJX1
A	154	MSE	MET	modified residue	UNP Q5XJX1
A	186	MSE	MET	modified residue	UNP Q5XJX1
A	225	MSE	MET	modified residue	UNP Q5XJX1
A	226	MSE	MET	modified residue	UNP Q5XJX1
A	251	MSE	MET	modified residue	UNP Q5XJX1

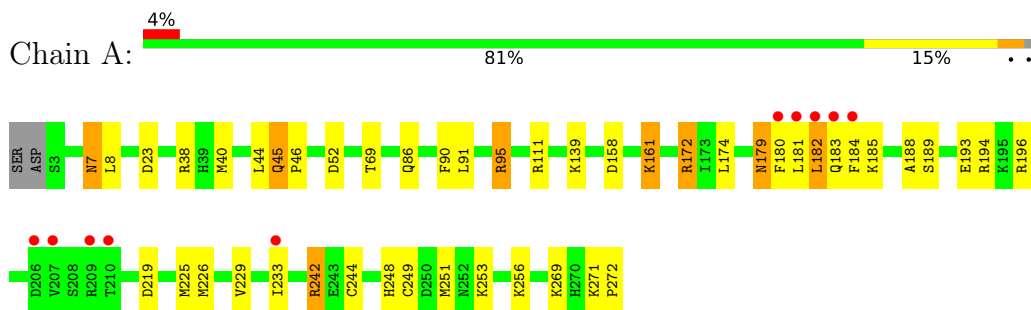
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	240	Total	O	0	0
			240	240		

### 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: hypothetical protein LOC449832



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	47.88Å 52.75Å 114.36Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	57.17 – 2.10 57.17 – 2.10	Depositor EDS
% Data completeness (in resolution range)	98.8 (57.17-2.10) 98.8 (57.17-2.10)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.35 (at 2.10Å)	Xtrriage
Refinement program	REFMAC refmac_5.2.0005	Depositor
R, $R_{free}$	0.175 , 0.253 0.195 , 0.267	Depositor DCC
$R_{free}$ test set	885 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	35.8	Xtrriage
Anisotropy	0.172	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 41.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2445	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.07% 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	A	1.03	3/2241 (0.1%)	1.07	6/2984 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	233	ILE	C-N	10.14	1.47	1.33
1	A	233	ILE	C-O	8.71	1.32	1.24
1	A	225	MSE	SE-CE	-5.64	1.78	1.95

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	45	GLN	CA-C-N	7.22	127.85	119.47
1	A	45	GLN	C-N-CA	7.22	127.85	119.47
1	A	233	ILE	O-C-N	6.87	130.52	122.83
1	A	95	ARG	NE-CZ-NH1	5.97	127.47	121.50
1	A	179	ASN	CA-C-N	5.33	127.95	120.28
1	A	179	ASN	C-N-CA	5.33	127.95	120.28

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	2205	0	2187	33	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	240	0	0	7	0
All	All	2445	0	2187	33	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 (33) 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)
1:A:244:CYS:SG	2:A:374:HOH:O	2.15	1.04
1:A:91:LEU:O	1:A:95:ARG:HG3	1.75	0.85
1:A:184:PHE:HB3	1:A:194:ARG:NH2	2.01	0.76
1:A:181:LEU:C	1:A:183:GLN:H	1.96	0.74
1:A:172:ARG:HA	1:A:182:LEU:HD11	1.71	0.70
1:A:111:ARG:HD3	1:A:251:MSE:HE1	1.73	0.70
1:A:256:LYS:HE3	2:A:433:HOH:O	1.99	0.63
1:A:38:ARG:NH2	1:A:52:ASP:OD1	2.32	0.62
1:A:44:LEU:C	1:A:46:PRO:HD3	2.25	0.61
1:A:95:ARG:HD2	1:A:174:LEU:O	2.00	0.61
1:A:7:ASN:HB2	2:A:444:HOH:O	2.01	0.59
1:A:181:LEU:O	1:A:183:GLN:N	2.35	0.59
1:A:111:ARG:CD	1:A:251:MSE:HE1	2.38	0.53
1:A:179:ASN:OD1	1:A:180:PHE:CD1	2.61	0.53
1:A:179:ASN:OD1	1:A:180:PHE:HD1	1.92	0.53
1:A:185:LYS:O	1:A:194:ARG:NH2	2.35	0.48
1:A:111:ARG:NH2	1:A:248:HIS:O	2.48	0.47
1:A:242:ARG:NH2	2:A:431:HOH:O	2.22	0.47
1:A:196:ARG:HG3	2:A:439:HOH:O	2.15	0.47
1:A:139:LYS:HD2	2:A:298:HOH:O	2.15	0.45
1:A:8:LEU:HD22	1:A:40:MSE:HG3	1.99	0.45
1:A:158:ASP:O	1:A:161:LYS:HG2	2.18	0.44
1:A:184:PHE:CE1	1:A:226:MSE:HE1	2.53	0.44
1:A:271:LYS:HD3	1:A:272:PRO:HD2	2.00	0.43
1:A:45:GLN:N	1:A:46:PRO:HD3	2.32	0.43
1:A:181:LEU:C	1:A:183:GLN:N	2.65	0.43
1:A:23:ASP:HB2	2:A:389:HOH:O	2.19	0.41
1:A:184:PHE:HB3	1:A:194:ARG:CZ	2.49	0.41
1:A:219:ASP:OD1	1:A:242:ARG:HD2	2.20	0.41
1:A:90:PHE:CD1	1:A:90:PHE:C	2.99	0.41
1:A:183:GLN:HB3	1:A:184:PHE:CE2	2.56	0.41
1:A:193:GLU:OE1	1:A:193:GLU:HA	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:197:ASP:HA	1:A:200:LYS:HE2	2.03	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	269/272 (99%)	259 (96%)	7 (3%)	3 (1%)	<b>11</b>   <b>8</b>

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	182	LEU
1	A	188	ALA
1	A	253	LYS

### 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	239/230 (104%)	229 (96%)	10 (4%)	<b>26</b>   <b>28</b>

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	ASN
1	A	69	THR
1	A	86	GLN
1	A	161	LYS
1	A	172	ARG
1	A	189	SER
1	A	229	VAL
1	A	242	ARG
1	A	249	CYS
1	A	269	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	A	260/272 (95%)	0.43	11 (4%) 40 42	26, 38, 59, 78	1 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	182	LEU	4.0
1	A	207	VAL	3.1
1	A	180	PHE	3.1
1	A	181	LEU	3.1
1	A	184	PHE	3.0
1	A	183	GLN	2.6
1	A	210	THR	2.6
1	A	203	ALA	2.3
1	A	206	ASP	2.1
1	A	233	ILE	2.1
1	A	209	ARG	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.