



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 12, 2017 – 10:36 pm GMT

PDB ID : 3FA8  
Title : Crystal structure of the apo R132K:Y134F:R111L:L121E mutant of cellular retinoic acid-binding protein II at 1.78 angstrom resolution  
Authors : Jia, X.; Geiger, J.H.  
Deposited on : 2008-11-16  
Resolution : 1.78 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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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) : 1.9-1692  
EDS : trunk28620  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : recalc28949

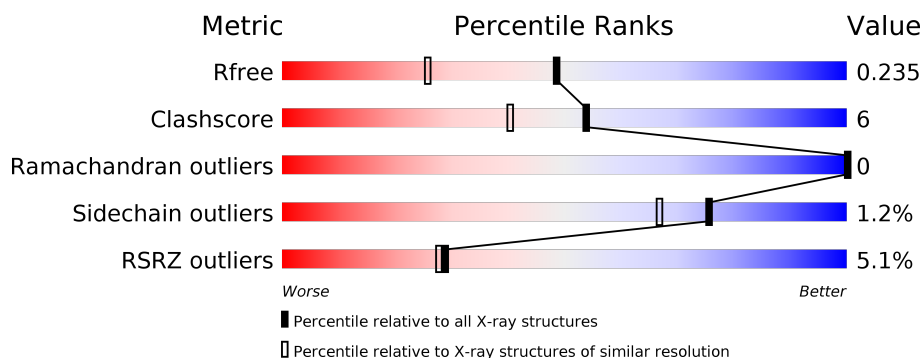
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.78 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))
$R_{free}$	100719	7172 (1.80-1.76)
Clashscore	112137	8247 (1.80-1.76)
Ramachandran outliers	110173	8154 (1.80-1.76)
Sidechain outliers	110143	8153 (1.80-1.76)
RSRZ outliers	101464	7262 (1.80-1.76)

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. 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	137	<div> <div></div> <div>91%</div> <div>9%</div> </div>
1	B	137	<div> <div>9%</div> <div>85%</div> <div>14%</div> <div>.</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2484 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 Cellular retinoic acid-binding protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	137	Total	C	N	O	S	0	5	0
			1110	704	181	218	7			
1	B	137	Total	C	N	O	S	0	1	0
			1090	690	179	215	6			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	111	LEU	ARG	ENGINEERED	UNP P29373
A	121	GLU	LEU	ENGINEERED	UNP P29373
A	132	LYS	ARG	ENGINEERED	UNP P29373
A	134	PHE	TYR	ENGINEERED	UNP P29373
B	111	LEU	ARG	ENGINEERED	UNP P29373
B	121	GLU	LEU	ENGINEERED	UNP P29373
B	132	LYS	ARG	ENGINEERED	UNP P29373
B	134	PHE	TYR	ENGINEERED	UNP P29373

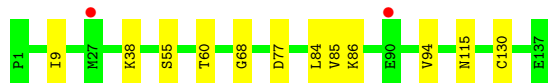
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	159	Total	O	0	8
			167	167		
2	B	115	Total	O	0	2
			117	117		

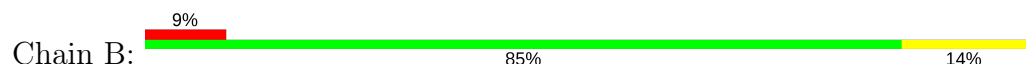
### 3 Residue-property plots [i](#)

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: Cellular retinoic acid-binding protein 2



- Molecule 1: Cellular retinoic acid-binding protein 2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	34.61Å 37.17Å 60.84Å 106.08° 106.47° 89.97°	Depositor
Resolution (Å)	19.42 – 1.78 19.42 – 1.50	Depositor EDS
% Data completeness (in resolution range)	96.7 (19.42-1.78) 85.8 (19.42-1.50)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.39 (at 1.50Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.179 , 0.234 0.180 , 0.235	Depositor DCC
$R_{free}$ test set	2582 reflections (11.11%)	DCC
Wilson B-factor (Å <sup>2</sup> )	17.9	Xtriage
Anisotropy	0.327	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.45 , 62.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.022 for h,-k,-h-l 0.022 for -h,k,-k-l 0.004 for -h,-k,h+k+l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	2484	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.78% 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

### 5.1 Standard geometry

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	0.55	0/1141	0.70	0/1536
1	B	0.47	0/1109	0.59	0/1494
All	All	0.51	0/2250	0.65	0/3030

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

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	1110	0	1138	14	0
1	B	1090	0	1108	13	1
2	A	167	0	0	4	1
2	B	117	0	0	0	0
All	All	2484	0	2246	27	1

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 6.

All (27) 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:68:GLY:HA2	1:A:86[A]:LYS:HE2	1.70	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:21:VAL:HG11	1:B:128:VAL:HG21	1.74	0.70
1:A:9:ILE:CG2	1:A:38:LYS:HG3	2.24	0.68
1:A:86[A]:LYS:HD2	2:A:305:HOH:O	1.96	0.65
1:A:77:ASP:OD2	2:A:314:HOH:O	2.15	0.63
1:B:1:PRO:HD3	1:B:91:ASN:OD1	1.98	0.62
1:B:82:LYS:O	1:B:98:LYS:HD2	2.00	0.62
1:A:9:ILE:HG21	1:A:38:LYS:HG3	1.85	0.59
1:A:85:VAL:O	1:A:86[A]:LYS:HD3	2.02	0.59
1:A:115:ASN:ND2	2:A:317:HOH:O	2.35	0.57
1:B:82:LYS:HG3	1:B:100:LEU:HD21	1.89	0.54
1:B:82:LYS:HG3	1:B:100:LEU:CD2	2.38	0.54
1:B:25:ASN:ND2	1:B:28:LEU:H	2.05	0.54
1:B:58:VAL:HG23	1:B:59:ARG:HB2	1.91	0.52
1:A:86[B]:LYS:HE3	1:A:94[B]:VAL:HG21	1.94	0.49
1:A:9:ILE:HG22	1:A:38:LYS:HG3	1.94	0.48
1:A:55:SER:OG	1:A:60:THR:HG23	2.13	0.48
1:A:60:THR:HG22	2:A:341:HOH:O	2.15	0.47
1:A:84:LEU:HG	1:A:86[A]:LYS:HE3	1.97	0.46
1:A:86[B]:LYS:CE	1:A:94[B]:VAL:HG21	2.46	0.46
1:A:77:ASP:OD1	1:A:77:ASP:N	2.50	0.45
1:B:83:SER:HB3	1:B:95:CYS:SG	2.57	0.45
1:B:100:LEU:HA	1:B:100:LEU:HD23	1.77	0.42
1:B:42:GLU:OE1	1:B:53:LYS:HE3	2.20	0.41
1:B:2:ASN:O	1:B:136:ARG:NH2	2.54	0.41
1:B:1:PRO:HG2	1:B:113:LEU:HD23	2.03	0.40
1:B:94[A]:VAL:HG23	1:B:110:THR:HG22	2.03	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:137:GLU:OE2	2:A:313:HOH:O[1_445]	2.18	0.02

## 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	140/137 (102%)	138 (99%)	2 (1%)	0	100	100
1	B	136/137 (99%)	134 (98%)	2 (2%)	0	100	100
All	All	276/274 (101%)	272 (99%)	4 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	A	128/123 (104%)	126 (98%)	2 (2%)	68	55
1	B	124/123 (101%)	122 (98%)	2 (2%)	68	55
All	All	252/246 (102%)	248 (98%)	4 (2%)	75	55

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	130[A]	CYS
1	A	130[B]	CYS
1	B	25	ASN
1	B	98	LYS

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

Mol	Chain	Res	Type
1	B	25	ASN

### 5.3.3 RNA ⓘ

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 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 [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	137/137 (100%)	-0.01	2 (1%) 74 74	10, 18, 29, 38	10 (7%)
1	B	137/137 (100%)	0.37	12 (8%) 11 10	12, 22, 38, 46	7 (5%)
All	All	274/274 (100%)	0.18	14 (5%) 29 28	10, 21, 33, 46	17 (6%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	115	ASN	5.0
1	B	101	LYS	4.2
1	B	102	GLY	3.7
1	B	100	LEU	3.7
1	A	27	MET	3.5
1	B	1	PRO	3.2
1	B	60	THR	3.1
1	B	127	ASP	3.0
1	B	90	GLU	2.2
1	B	103	GLU	2.2
1	B	106	LYS	2.1
1	B	111	LEU	2.1
1	B	126	ASP	2.0
1	A	90	GLU	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.