



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 28, 2014 – 07:31 AM GMT

PDB ID : 2PS3  
Title : Structure and metal binding properties of ZnuA, a periplasmic zinc transporter from Escherichia coli  
Authors : Yatsunyk, L.A.; Kim, L.R.; Vorontsov, I.I.; Rosenzweig, A.C.  
Deposited on : 2007-05-04  
Resolution : 2.47 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

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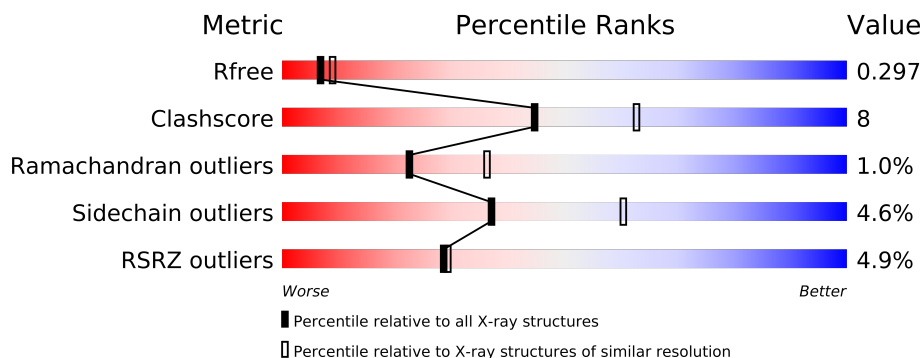
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.47 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))
$R_{free}$	66092	3277 (2.50-2.46)
Clashscore	79885	4136 (2.50-2.46)
Ramachandran outliers	78287	4052 (2.50-2.46)
Sidechain outliers	78261	4054 (2.50-2.46)
RSRZ outliers	66119	3279 (2.50-2.46)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	284	
1	B	284	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4115 atoms, of which 0 are hydrogen and 0 are deuterium.

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 High-affinity zinc uptake system protein znuA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	265	Total	C	N	O	S	3	0	0
			2038	1299	347	384	8			
1	B	264	Total	C	N	O	S	0	0	0
			2028	1293	344	383	8			

- Molecule 2 is water.

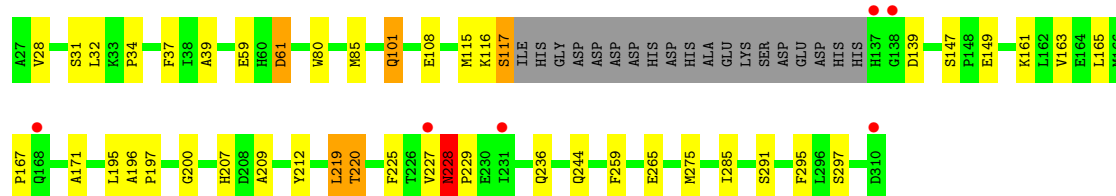
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	28	Total	O	0	0
			28	28		
2	B	21	Total	O	0	0
			21	21		

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

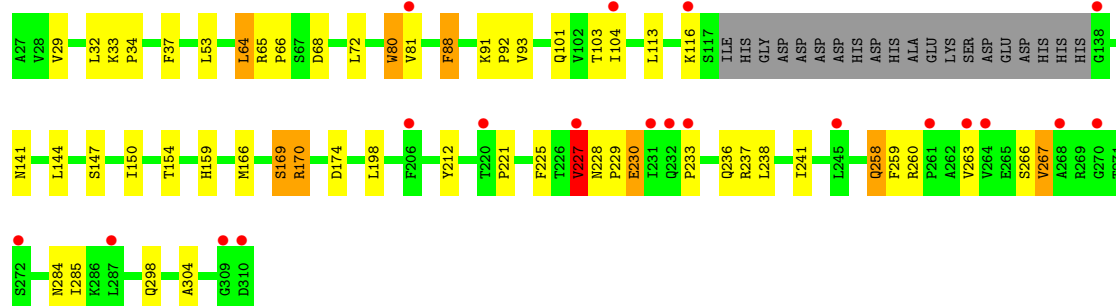
- Molecule 1: High-affinity zinc uptake system protein znuA

Chain A: 



- Molecule 1: High-affinity zinc uptake system protein znuA

Chain B: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.88Å 89.84Å 91.56Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.10 – 2.47 35.10 – 2.47	Depositor EDS
% Data completeness (in resolution range)	98.0 (35.10-2.47) 98.0 (35.10-2.47)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.19 (at 2.48Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.240 , 0.303 0.238 , 0.297	Depositor DCC
$R_{free}$ test set	1068 reflections (5.49%)	DCC
Wilson B-factor (Å <sup>2</sup> )	57.5	Xtriage
Anisotropy	0.058	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 33.1	EDS
Estimated twinning fraction	0.014 for -h,l,k	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	1 of 20515 reflections (0.005%)	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	4115	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.53% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 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	1/2081 (0.0%)	0.64	2/2820 (0.1%)
1	B	0.50	0/2070	0.61	0/2805
All	All	0.53	1/4151 (0.0%)	0.63	2/5625 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	149	GLU	CG-CD	-6.18	1.42	1.51

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	228	ASN	C-N-CD	-5.66	108.15	120.60
1	A	228	ASN	N-CA-C	5.08	124.73	111.00

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2038	0	2043	29	0
1	B	2028	0	2036	42	0
2	A	28	0	0	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	21	0	0	1	0
All	All	4115	0	4079	69	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 8.

All (69) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:229:PRO:HB2	1:A:259:PHE:HA	1.42	1.02
1:B:229:PRO:O	1:B:259:PHE:HB2	1.62	0.99
1:B:64:LEU:H	1:B:64:LEU:HD12	1.24	0.99
1:A:61:ASP:O	1:B:66:PRO:HD2	1.64	0.94
1:B:64:LEU:CD1	1:B:64:LEU:H	1.87	0.87
1:B:258:GLN:HG2	1:B:259:PHE:N	2.01	0.74
1:B:159:HIS:HE1	1:B:174:ASP:OD1	1.72	0.72
1:B:238:LEU:HD21	1:B:266:SER:HB3	1.73	0.71
1:B:64:LEU:N	1:B:64:LEU:HD12	2.03	0.70
1:B:241:ILE:CG2	1:B:267:VAL:HG11	2.27	0.65
1:A:34:PRO:HA	1:A:37:PHE:CD2	2.34	0.63
1:A:229:PRO:HB3	1:A:259:PHE:CD1	2.33	0.63
1:A:171:ALA:O	2:A:318:HOH:O	2.15	0.62
1:A:285:ILE:HD13	1:A:295:PHE:HA	1.82	0.60
1:A:229:PRO:CB	1:A:259:PHE:HA	2.24	0.60
1:A:59:GLU:HG3	1:A:85:MET:SD	2.42	0.59
1:B:159:HIS:CE1	1:B:174:ASP:OD1	2.53	0.58
1:A:165:LEU:O	1:A:167:PRO:HD3	2.04	0.58
1:A:229:PRO:HB3	1:A:259:PHE:CG	2.40	0.57
1:B:34:PRO:HA	1:B:37:PHE:CD2	2.41	0.55
1:B:225:PHE:CD1	1:B:241:ILE:HD12	2.42	0.55
1:B:230:GLU:O	1:B:260:ARG:HB2	2.08	0.53
1:B:233:PRO:HD3	1:B:263:VAL:HG13	1.91	0.52
1:B:241:ILE:HG22	1:B:267:VAL:HG11	1.91	0.52
1:A:236:GLN:NE2	2:A:330:HOH:O	2.43	0.51
1:B:228:ASN:HD22	1:B:230:GLU:H	1.59	0.51
1:B:147:SER:HB2	1:B:212:TYR:HB3	1.93	0.51
1:A:196:ALA:N	1:A:197:PRO:HD2	2.26	0.50
1:B:237:ARG:O	1:B:241:ILE:HG12	2.12	0.50
1:B:29:VAL:HG11	1:B:72:LEU:HD12	1.94	0.50
1:B:228:ASN:H	1:B:229:PRO:HA	1.78	0.49
1:A:116:LYS:O	1:A:117:SER:HB3	2.10	0.49
1:A:200:GLY:H	1:A:220:THR:HG21	1.77	0.48
1:B:144:LEU:HB3	1:B:150:ILE:HG21	1.97	0.47

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:115:MET:HB2	1:A:212:TYR:CE2	2.50	0.47
1:A:61:ASP:O	1:B:65:ARG:HB2	2.14	0.47
1:B:80:TRP:CE2	1:B:93:VAL:HG11	2.50	0.47
1:B:169:SER:O	1:B:170:ARG:C	2.52	0.47
1:A:227:VAL:HG12	1:A:228:ASN:H	1.80	0.47
1:A:37:PHE:CD1	1:A:291:SER:HB2	2.50	0.46
1:B:227:VAL:HB	1:B:228:ASN:H	1.53	0.46
1:B:241:ILE:HG21	1:B:267:VAL:HG11	1.97	0.46
1:B:104:ILE:HG12	1:B:154:THR:HG23	1.98	0.46
1:A:225:PHE:HE1	1:A:244:GLN:OE1	1.99	0.46
1:A:101:GLN:O	1:A:161:LYS:NZ	2.49	0.46
1:B:233:PRO:CD	1:B:263:VAL:HG13	2.46	0.45
1:A:31:SER:OG	1:A:32:LEU:HG	2.17	0.45
1:B:263:VAL:O	1:B:266:SER:HB2	2.17	0.44
1:B:101:GLN:NE2	1:B:103:THR:OG1	2.51	0.44
1:B:91:LYS:HB2	1:B:92:PRO:CD	2.47	0.43
1:A:265:GLU:HA	1:A:275:MET:SD	2.59	0.43
1:A:195:LEU:HD13	1:A:219:LEU:HD22	2.01	0.43
1:B:81:VAL:HG13	1:B:144:LEU:HD12	2.00	0.43
1:B:198:LEU:HD11	1:B:304:ALA:HA	2.00	0.43
1:B:33:LYS:HE3	1:B:285:ILE:O	2.19	0.43
1:A:200:GLY:H	1:A:220:THR:CG2	2.32	0.42
1:B:284:ASN:HD22	1:B:298:GLN:NE2	2.17	0.42
1:B:64:LEU:HG	1:B:88:PHE:O	2.19	0.42
1:B:141:ASN:HD22	1:B:212:TYR:HE1	1.68	0.42
1:A:147:SER:HB2	1:A:212:TYR:HB3	2.01	0.42
1:A:207:HIS:CE1	1:A:209:ALA:HB2	2.55	0.42
1:A:171:ALA:HB3	2:A:334:HOH:O	2.21	0.41
1:A:108:GLU:HB2	2:A:337:HOH:O	2.19	0.41
1:B:228:ASN:HD22	1:B:230:GLU:N	2.18	0.41
1:B:221:PRO:HD2	2:B:330:HOH:O	2.20	0.41
1:B:65:ARG:O	1:B:68:ASP:HB2	2.20	0.41
1:B:166:MET:HB3	1:B:169:SER:OG	2.21	0.40
1:A:28:VAL:HG11	1:A:39:ALA:HB1	2.02	0.40
1:B:263:VAL:O	1:B:267:VAL:HG23	2.21	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	A	261/284 (92%)	247 (95%)	13 (5%)	1 (0%)	43	64
1	B	260/284 (92%)	236 (91%)	20 (8%)	4 (2%)	15	24
All	All	521/568 (92%)	483 (93%)	33 (6%)	5 (1%)	22	36

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	170	ARG
1	B	230	GLU
1	B	88	PHE
1	B	227	VAL
1	A	228	ASN

### 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	219/236 (93%)	210 (96%)	9 (4%)	41	66
1	B	218/236 (92%)	207 (95%)	11 (5%)	34	56
All	All	437/472 (93%)	417 (95%)	20 (5%)	37	60

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

Mol	Chain	Res	Type
1	A	61	ASP
1	A	80	TRP
1	A	101	GLN
1	A	117	SER

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Mol	Chain	Res	Type
1	A	139	ASP
1	A	163	VAL
1	A	219	LEU
1	A	220	THR
1	A	297	SER
1	B	32	LEU
1	B	53	LEU
1	B	64	LEU
1	B	80	TRP
1	B	113	LEU
1	B	116	LYS
1	B	169	SER
1	B	227	VAL
1	B	236	GLN
1	B	258	GLN
1	B	267	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	73	GLN
1	A	90	GLN
1	A	101	GLN
1	A	159	HIS
1	A	236	GLN
1	B	60	HIS
1	B	73	GLN
1	B	90	GLN
1	B	101	GLN
1	B	141	ASN
1	B	159	HIS
1	B	228	ASN
1	B	284	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

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, 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	265/284 (93%)	0.38	6 (2%) 57 59	36, 54, 71, 78	2 (0%)
1	B	264/284 (92%)	0.61	20 (7%) 14 13	40, 59, 82, 93	1 (0%)
All	All	529/568 (93%)	0.50	26 (4%) 28 29	36, 56, 79, 93	3 (0%)

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	310	ASP	6.3
1	B	138	GLY	4.1
1	A	227	VAL	3.9
1	B	268	ALA	3.5
1	B	231	ILE	3.5
1	B	116	LYS	3.1
1	B	261	PRO	3.1
1	A	168	GLN	3.0
1	B	233	PRO	3.0
1	B	310	ASP	2.9
1	B	220	THR	2.9
1	B	227	VAL	2.8
1	A	137	HIS	2.6
1	B	232	GLN	2.6
1	B	309	GLY	2.5
1	B	104	ILE	2.5
1	B	287	LEU	2.5
1	B	264	VAL	2.4
1	B	245	LEU	2.3
1	B	206	PHE	2.3
1	B	263	VAL	2.2
1	B	81	VAL	2.2
1	A	231	ILE	2.1
1	B	270	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	272	SER	2.1
1	A	138	GLY	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

There are no ligands in this entry.

## 6.5 Other polymers ⓘ

There are no such residues in this entry.