



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 20, 2024 – 10:00 AM EST

PDB ID : 4MTD  
Title : Zinc Uptake Regulator Complexed With Zinc AND DNA  
Authors : Gilston, B.A.; Mondragon, A.; O'Halloran, T.V.  
Deposited on : 2013-09-19  
Resolution : 2.50 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  
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

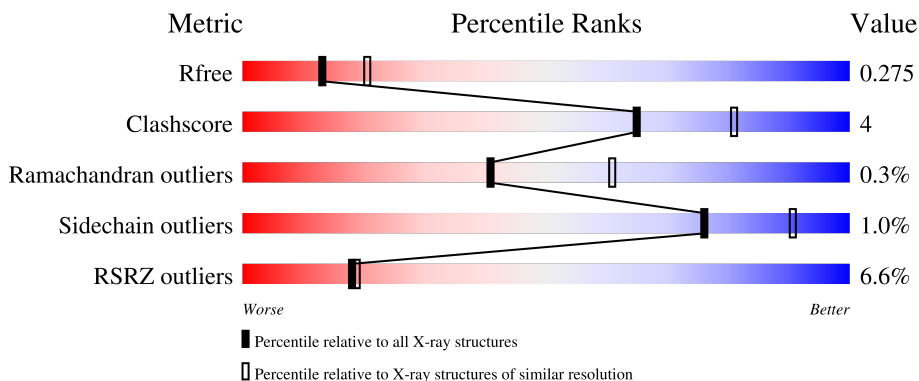
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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.



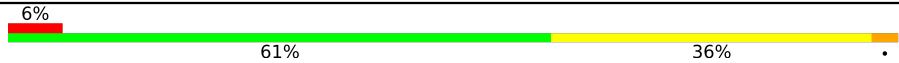
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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	A	171	 5% (red), 78% (green), 9% (yellow), 13% (grey)
1	B	171	 % (red), 77% (green), 11% (yellow), 12% (grey)
1	C	171	 5% (red), 81% (green), 5% (yellow), 13% (grey)
1	D	171	 11% (red), 81% (green), 8% (yellow), 12% (grey)
2	Y	33	 15% (red), 82% (green), 18% (yellow)

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Mol	Chain	Length	Quality of chain
3	Z	33	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into three segments: a small red segment on the left labeled '6%', a large green segment in the middle labeled '61%', and a yellow segment on the right labeled '36%'. A small black dot is visible at the far right end of the bar.</p>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 6003 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 Zinc uptake regulation protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	149	1161	726	204	219	12	0	1	0
1	B	150	1162	727	203	220	12	0	0	0
1	C	148	1146	717	200	217	12	0	0	0
1	D	151	1171	732	204	223	12	0	0	0

- Molecule 2 is a DNA chain called znuABC operator DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	Y	33	682	327	123	199	33	0	0	0

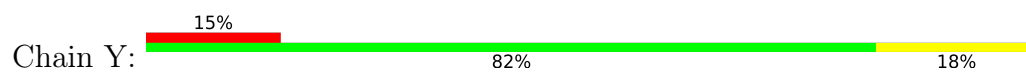
- Molecule 3 is a DNA chain called znuABC operator DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	Z	33	673	324	117	199	33	0	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Zn	0	0
			2	2		
4	B	2	Total	Zn	0	0
			2	2		
4	C	2	Total	Zn	0	0
			2	2		
4	D	2	Total	Zn	0	0
			2	2		





• Molecule 3: znuABC operator DNA



## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	193.32Å 80.47Å 98.77Å 90.00° 120.15° 90.00°	Depositor
Resolution (Å)	36.34 – 2.50 36.34 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.7 (36.34-2.50) 99.8 (36.34-2.50)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	0.05	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.36 (at 2.51Å)	Xtrriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.234 , 0.271 0.237 , 0.275	Depositor DCC
$R_{free}$ test set	2290 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	53.3	Xtrriage
Anisotropy	0.603	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 34.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.014 for -h-2*1,-k,l	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	6003	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.12% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section:  
ZN

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	0.35	0/1182	0.57	0/1600
1	B	0.36	0/1180	0.57	0/1597
1	C	0.32	0/1164	0.51	0/1576
1	D	0.32	0/1189	0.54	0/1609
2	Y	0.50	1/765 (0.1%)	0.85	0/1178
3	Z	0.50	1/753 (0.1%)	0.83	0/1157
All	All	0.38	2/6233 (0.0%)	0.64	0/8717

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	Y	1	DA	OP3-P	-10.16	1.49	1.61
3	Z	1	DT	OP3-P	-10.12	1.49	1.61

There are no bond angle outliers.

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	1161	0	1154	11	0
1	B	1162	0	1154	12	0
1	C	1146	0	1134	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1171	0	1160	7	0
2	Y	682	0	376	6	0
3	Z	673	0	376	10	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0
All	All	6003	0	5354	47	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 4.

All (47) 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:65[B]:ARG:HH11	1:A:65[B]:ARG:CG	1.84	0.89
1:A:65[B]:ARG:HH11	1:A:65[B]:ARG:HG2	1.41	0.85
1:B:9:LEU:HD11	1:B:87:LEU:HD21	1.72	0.70
2:Y:31:DA:H2'	2:Y:32:DT:C6	2.29	0.67
1:A:65[A]:ARG:NH2	3:Z:12:DT:OP2	2.28	0.66
2:Y:29:DC:H1'	2:Y:30:DT:OP1	2.00	0.60
1:B:17:CYS:O	1:B:20:ARG:O	2.20	0.59
2:Y:31:DA:H2''	2:Y:32:DT:O4'	2.04	0.58
1:D:70:LEU:O	1:D:73:GLN:O	2.23	0.57
1:D:135:ASN:HB3	1:D:137:ILE:HD11	1.87	0.56
1:A:65[B]:ARG:CG	1:A:65[B]:ARG:NH1	2.54	0.56
1:A:82:THR:O	1:A:84:SER:N	2.40	0.55
1:D:6:THR:HG23	1:D:36:SER:HB2	1.88	0.54
3:Z:29:DT:H2''	3:Z:30:DC:C6	2.43	0.54
3:Z:1:DT:H1'	3:Z:2:DA:C8	2.43	0.54
1:B:139:ALA:HB1	1:C:132:LEU:HD13	1.89	0.53
3:Z:4:DT:H2''	3:Z:5:DC:O5'	2.08	0.53
3:Z:7:DT:H2''	3:Z:8:DG:O5'	2.10	0.52
1:C:31:VAL:HG13	1:C:47:LEU:HD21	1.93	0.51
2:Y:30:DT:H2''	2:Y:31:DA:C8	2.46	0.50
1:B:117:VAL:HG11	1:B:137:ILE:HD13	1.94	0.49
2:Y:31:DA:C2'	2:Y:32:DT:O4'	2.60	0.49
1:B:139:ALA:HB1	1:C:132:LEU:CD1	2.42	0.48
3:Z:19:DA:C8	3:Z:20:DT:H72	2.49	0.47
1:A:120:ILE:HG22	1:A:124:LEU:HD12	1.95	0.47
1:D:125:ALA:O	1:D:128:MET:O	2.33	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:52:ARG:NH1	1:D:58:ALA:O	2.48	0.46
1:B:78:LYS:NZ	3:Z:16:DA:OP1	2.36	0.46
1:C:71:LEU:HD23	1:C:76:VAL:O	2.16	0.46
1:B:132:LEU:CD1	1:C:139:ALA:HB1	2.46	0.45
3:Z:29:DT:H2''	3:Z:30:DC:C5	2.52	0.44
1:B:116:GLY:O	1:B:120:ILE:HG12	2.16	0.44
1:A:65[B]:ARG:NH1	1:A:65[B]:ARG:HG3	2.34	0.43
1:A:79:VAL:O	1:A:82:THR:O	2.36	0.43
1:B:112:GLU:HG3	1:C:128:MET:HE1	2.02	0.42
3:Z:1:DT:H2''	3:Z:2:DA:OP2	2.19	0.42
1:C:32:LEU:CD1	1:C:87:LEU:HD11	2.50	0.42
1:D:101:PHE:O	1:D:109:VAL:HA	2.20	0.42
2:Y:28:DA:H2''	2:Y:29:DC:C6	2.55	0.42
1:D:128:MET:HG3	1:D:130:PHE:HB2	2.02	0.41
1:B:136:VAL:HB	1:C:138:GLU:HB2	2.02	0.41
1:A:135:ASN:HB3	1:A:137:ILE:HD11	2.02	0.41
1:B:105:ARG:HB3	1:B:146:CYS:SG	2.61	0.41
1:A:17:CYS:O	1:A:20:ARG:O	2.40	0.40
1:A:30:GLU:OE2	1:A:33:ARG:NH1	2.54	0.40
1:B:128:MET:HG3	1:B:130:PHE:HB2	2.04	0.40
3:Z:2:DA:C2	3:Z:3:DG:C5	3.10	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	148/171 (86%)	142 (96%)	5 (3%)	1 (1%)	22	39
1	B	148/171 (86%)	143 (97%)	4 (3%)	1 (1%)	22	39
1	C	146/171 (85%)	142 (97%)	4 (3%)	0	100	100
1	D	149/171 (87%)	141 (95%)	8 (5%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	591/684 (86%)	568 (96%)	21 (4%)	2 (0%)	41 61

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	94	PRO
1	A	91	PHE

### 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	126/147 (86%)	123 (98%)	3 (2%)	49 74
1	B	126/147 (86%)	125 (99%)	1 (1%)	81 93
1	C	124/147 (84%)	123 (99%)	1 (1%)	81 93
1	D	127/147 (86%)	127 (100%)	0	100 100
All	All	503/588 (86%)	498 (99%)	5 (1%)	76 90

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	VAL
1	A	95	THR
1	A	100	MET
1	B	118	GLU
1	C	132	LEU

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	27	GLN

### 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](#)

Of 8 ligands modelled in this entry, 8 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

### 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	149/171 (87%)	0.25	9 (6%) 21 22	30, 56, 100, 119	0
1	B	150/171 (87%)	0.16	2 (1%) 77 79	29, 56, 92, 129	0
1	C	148/171 (86%)	0.38	8 (5%) 25 27	39, 64, 111, 131	0
1	D	151/171 (88%)	0.67	18 (11%) 4 4	37, 64, 117, 128	0
2	Y	33/33 (100%)	0.42	5 (15%) 2 1	33, 54, 128, 138	0
3	Z	33/33 (100%)	0.28	2 (6%) 21 22	31, 63, 121, 155	0
All	All	664/750 (88%)	0.37	44 (6%) 18 19	29, 60, 111, 155	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	151	ALA	6.7
1	D	152	CYS	6.3
1	D	150	GLU	5.3
1	D	148	GLU	5.2
1	B	92	ASP	5.1
2	Y	33	DG	4.7
1	C	95	THR	4.6
1	D	149	VAL	4.2
1	D	95	THR	4.1
1	C	91	PHE	3.6
3	Z	1	DT	3.5
1	C	94	PRO	3.5
1	D	3	LYS	3.4
2	Y	32	DT	3.4
1	A	92	ASP	3.3
1	C	152	CYS	3.2
1	A	128	MET	3.2
3	Z	33	DA	3.1
1	A	130	PHE	3.0

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Mol	Chain	Res	Type	RSRZ
1	D	147	VAL	3.0
1	D	108	ALA	2.9
1	D	116	GLY	2.9
1	A	126	ALA	2.9
1	D	145	ALA	2.8
1	A	133	ARG	2.8
1	C	15	LYS	2.7
1	D	39	ASP	2.6
1	A	21	ASN	2.6
1	A	129	GLY	2.6
1	D	92	ASP	2.6
2	Y	31	DA	2.6
1	D	94	PRO	2.5
1	A	39	ASP	2.5
1	A	4	THR	2.5
1	D	142	LEU	2.4
1	C	20	ARG	2.4
1	B	105	ARG	2.4
1	D	107	GLY	2.4
1	C	133	ARG	2.3
1	C	11	ALA	2.2
1	D	144	ALA	2.1
2	Y	1	DA	2.1
1	D	40	GLY	2.0
2	Y	30	DT	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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	ZN	B	202	1/1	0.95	0.09	67,67,67,67	0
4	ZN	A	202	1/1	0.97	0.08	63,63,63,63	0
4	ZN	C	202	1/1	0.98	0.10	56,56,56,56	0
4	ZN	D	201	1/1	0.98	0.03	99,99,99,99	0
4	ZN	D	202	1/1	0.98	0.14	59,59,59,59	0
4	ZN	B	201	1/1	0.99	0.15	54,54,54,54	0
4	ZN	A	201	1/1	0.99	0.09	53,53,53,53	0
4	ZN	C	201	1/1	0.99	0.12	45,45,45,45	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.