



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 30, 2024 – 11:33 PM EST

PDB ID : 1INO  
Title : RECOMBINANT INORGANIC PYROPHOSPHATASE FROM ES-  
CHERICHIA COLI  
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Deposited on : 1995-10-03  
Resolution : 2.20 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  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

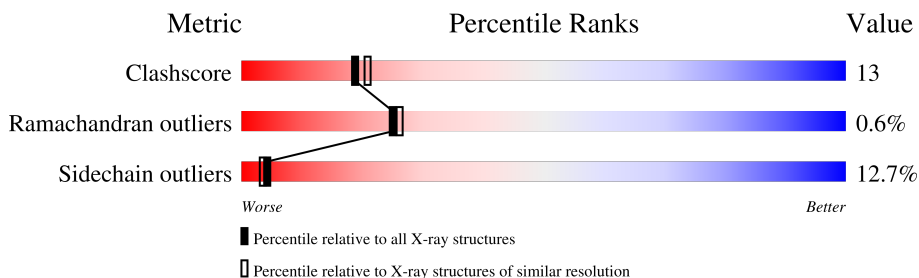
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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  $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	175	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1527 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 INORGANIC PYROPHOSPHATASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	175	1381	889	224	263	5	0	0	0

- Molecule 2 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mn	0	0
			1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	145	Total	O	0	0
			145	145		

### 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. 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. 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.

Note EDS was not executed.

- Molecule 1: INORGANIC PYROPHOSPHATASE



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	110.40Å 110.40Å 76.80Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	12.00 – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) (12.00-2.20)	Depositor
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, $R_{free}$	0.160 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	1527	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	20.0	wwPDB-VP

## 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: MN

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	0.84	0/1416	1.85	32/1923 (1.7%)

There are no bond length outliers.

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	171	ARG	NE-CZ-NH2	12.77	126.69	120.30
1	A	40	PHE	CB-CG-CD1	7.68	126.17	120.80
1	A	123	VAL	CB-CA-C	-6.86	98.36	111.40
1	A	117	TYR	CB-CG-CD1	-6.82	116.91	121.00
1	A	49	MET	CA-CB-CG	6.68	124.66	113.30
1	A	171	ARG	NH1-CZ-NH2	-6.55	112.20	119.40
1	A	88	ARG	NE-CZ-NH1	6.45	123.53	120.30
1	A	158	ALA	CA-C-N	6.35	131.16	117.20
1	A	150	VAL	CB-CA-C	-6.24	99.54	111.40
1	A	24	ASN	OD1-CG-ND2	6.05	135.83	121.90
1	A	140	HIS	CB-CA-C	-5.92	98.55	110.40
1	A	171	ARG	CA-CB-CG	5.86	126.28	113.40
1	A	57	TYR	CB-CG-CD1	5.85	124.51	121.00
1	A	140	HIS	N-CA-C	5.84	126.77	111.00
1	A	27	PRO	O-C-N	-5.83	113.37	122.70
1	A	16	TYR	CB-CG-CD2	-5.82	117.51	121.00
1	A	88	ARG	CG-CD-NE	5.79	123.95	111.80
1	A	50	PHE	CB-CG-CD1	5.79	124.85	120.80
1	A	148	LYS	CB-CA-C	5.77	121.94	110.40
1	A	156	GLU	OE1-CD-OE2	5.62	130.04	123.30
1	A	61	THR	N-CA-CB	5.58	120.89	110.30
1	A	134	ILE	O-C-N	-5.57	113.78	122.70
1	A	134	ILE	C-N-CA	5.56	135.59	121.70
1	A	156	GLU	O-C-N	-5.48	113.93	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	167	ALA	CB-CA-C	5.36	118.13	110.10
1	A	170	GLU	O-C-N	-5.32	114.19	122.70
1	A	128	GLU	CA-CB-CG	5.21	124.87	113.40
1	A	51	TYR	CB-CG-CD1	5.21	124.12	121.00
1	A	157	ASN	N-CA-CB	-5.17	101.29	110.60
1	A	22	PRO	O-C-N	-5.16	114.44	122.70
1	A	10	ASP	CB-CG-OD1	5.12	122.90	118.30
1	A	148	LYS	N-CA-CB	-5.04	101.53	110.60

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	1381	0	1369	36	0
2	A	1	0	0	0	0
3	A	145	0	0	2	0
All	All	1527	0	1369	36	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 13.

All (36) 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:73:VAL:HG11	1:A:85:ILE:HD13	1.68	0.76
1:A:92:VAL:HG13	1:A:156:GLU:HB2	1.65	0.75
1:A:22:PRO:HA	1:A:54:ASN:HD22	1.54	0.73
1:A:72:LEU:HD11	1:A:138:PHE:HE2	1.56	0.69
1:A:62:LEU:HD12	1:A:172:ALA:HA	1.76	0.68
1:A:79:LEU:HD11	1:A:85:ILE:HD12	1.76	0.67
1:A:8:GLY:HA3	1:A:15:ILE:HA	1.80	0.63
1:A:72:LEU:HD11	1:A:138:PHE:CE2	2.35	0.62
1:A:75:THR:HB	1:A:76:PRO:HD2	1.83	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:175:LYS:NZ	1:A:175:LYS:HB2	2.15	0.61
1:A:105:LEU:HD13	1:A:161:ALA:HB1	1.88	0.55
1:A:15:ILE:HD12	1:A:58:ILE:HD11	1.89	0.53
1:A:135:ALA:O	1:A:139:GLU:HG3	2.09	0.53
1:A:75:THR:HB	1:A:76:PRO:CD	2.39	0.52
1:A:91:GLY:HA3	1:A:123:VAL:HG13	1.91	0.52
1:A:45:MET:HG2	3:A:188:HOH:O	2.11	0.50
1:A:11:LEU:HD23	1:A:15:ILE:HG22	1.96	0.48
1:A:158:ALA:O	1:A:162:LYS:HG3	2.14	0.48
1:A:155:TRP:HB2	3:A:309:HOH:O	2.14	0.47
1:A:117:TYR:HD2	1:A:120:ILE:HD12	1.81	0.46
1:A:92:VAL:CG1	1:A:156:GLU:HB2	2.40	0.44
1:A:95:MET:HE3	1:A:152:VAL:HG22	2.00	0.44
1:A:15:ILE:HD12	1:A:58:ILE:CD1	2.48	0.44
1:A:30:TYR:CD1	1:A:39:LEU:HD21	2.53	0.44
1:A:92:VAL:HB	1:A:105:LEU:HD22	2.00	0.44
1:A:23:ALA:H	1:A:54:ASN:ND2	2.15	0.44
1:A:120:ILE:HA	1:A:125:ASP:HB3	2.00	0.43
1:A:94:LYS:CG	1:A:156:GLU:HG3	2.48	0.43
1:A:22:PRO:HA	1:A:54:ASN:ND2	2.28	0.43
1:A:87:CYS:HB3	1:A:107:ALA:HB1	2.00	0.43
1:A:31:GLU:HB3	1:A:42:ASP:OD2	2.20	0.41
1:A:162:LYS:HA	1:A:165:ILE:HD12	2.00	0.41
1:A:96:THR:HA	1:A:100:GLY:O	2.19	0.41
1:A:51:TYR:HA	1:A:52:PRO:HD3	1.90	0.41
1:A:34:LYS:HD2	1:A:34:LYS:N	2.36	0.41
1:A:94:LYS:HG3	1:A:156:GLU:HG3	2.02	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	173/175 (99%)	161 (93%)	11 (6%)	1 (1%)	25 26

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	153	GLU

### 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	150/150 (100%)	131 (87%)	19 (13%)	4 3

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	PRO
1	A	13	GLU
1	A	31	GLU
1	A	42	ASP
1	A	46	SER
1	A	64	LEU
1	A	69	VAL
1	A	98	GLU
1	A	104	LYS
1	A	111	SER
1	A	129	LEU
1	A	141	TYR
1	A	146	LYS
1	A	150	VAL
1	A	151	LYS
1	A	157	ASN
1	A	159	GLU
1	A	173	LYS
1	A	174	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	4	ASN
1	A	54	ASN
1	A	80	GLN
1	A	157	ASN

### 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 1 ligands modelled in this entry, 1 is 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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.