



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 14, 2023 – 11:44 PM JST

PDB ID : 6IHS  
Title : Crystal structure of bacterial serine phosphatase with His-tag mutation  
Authors : Yang, C.-G.; yang, T.  
Deposited on : 2018-10-02  
Resolution : 1.40 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

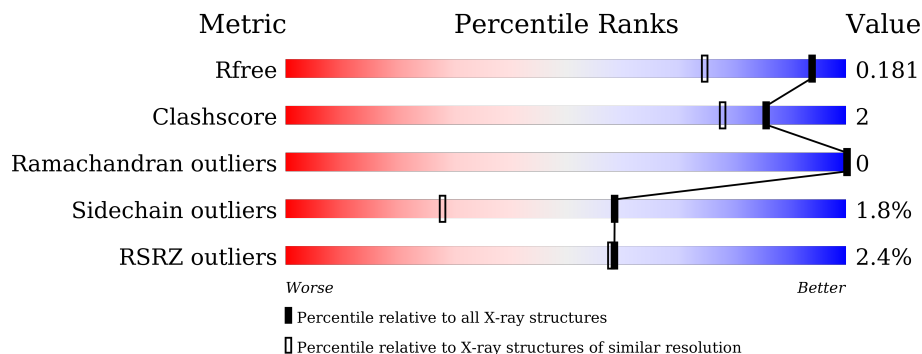
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.40 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	1714 (1.40-1.40)
Clashscore	141614	1812 (1.40-1.40)
Ramachandran outliers	138981	1763 (1.40-1.40)
Sidechain outliers	138945	1762 (1.40-1.40)
RSRZ outliers	127900	1674 (1.40-1.40)

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	266	

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2238 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 Phosphorylated protein phosphatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	254	2070	1297	362	402	9	0	7	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	initiating methionine	UNP Q9RL81
A	-19	GLY	-	expression tag	UNP Q9RL81
A	-18	SER	-	expression tag	UNP Q9RL81
A	-17	SER	-	expression tag	UNP Q9RL81
A	-16	HIS	-	expression tag	UNP Q9RL81
A	-15	HIS	-	expression tag	UNP Q9RL81
A	-14	HIS	-	expression tag	UNP Q9RL81
A	-13	HIS	-	expression tag	UNP Q9RL81
A	-12	HIS	-	expression tag	UNP Q9RL81
A	-11	HIS	-	expression tag	UNP Q9RL81
A	-10	SER	-	expression tag	UNP Q9RL81
A	-9	GLU	-	expression tag	UNP Q9RL81
A	-8	GLY	-	expression tag	UNP Q9RL81
A	-7	LEU	-	expression tag	UNP Q9RL81
A	-6	VAL	-	expression tag	UNP Q9RL81
A	-5	PRO	-	expression tag	UNP Q9RL81
A	-4	ARG	-	expression tag	UNP Q9RL81
A	-3	GLY	-	expression tag	UNP Q9RL81
A	-2	SER	-	expression tag	UNP Q9RL81
A	-1	HIS	-	expression tag	UNP Q9RL81
A	0	MET	-	expression tag	UNP Q9RL81

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	4	Total	Mg	0	0
			4	4		

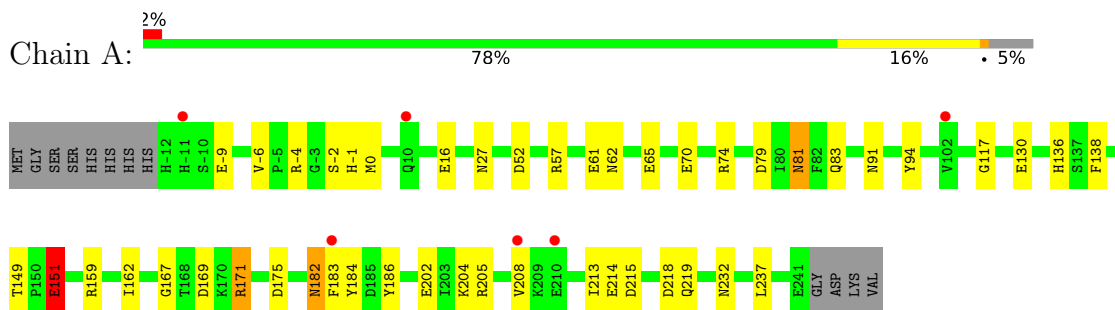
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	164	Total	O	0	0
			164	164		

### 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: Phosphorylated protein phosphatase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.79Å 86.36Å 38.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 1.40 28.90 – 1.40	Depositor EDS
% Data completeness (in resolution range)	99.1 (30.00-1.40) 99.2 (28.90-1.40)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.05 (at 1.40Å)	Xtrriage
Refinement program	PHENIX 5.8.0131	Depositor
R, $R_{free}$	0.130 , 0.168 0.147 , 0.181	Depositor DCC
$R_{free}$ test set	2610 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	17.5	Xtrriage
Anisotropy	0.042	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.44 , 46.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	2238	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	22.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.13% 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: MG

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	1.54	26/2118 (1.2%)	1.52	29/2860 (1.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	171[A]	ARG	CZ-NH2	9.74	1.45	1.33
1	A	171[B]	ARG	CZ-NH2	9.74	1.45	1.33
1	A	65	GLU	CD-OE1	9.02	1.35	1.25
1	A	-6	VAL	CB-CG2	-8.38	1.35	1.52
1	A	183	PHE	CG-CD1	8.26	1.51	1.38
1	A	70	GLU	CD-OE2	-7.95	1.17	1.25
1	A	159	ARG	CZ-NH2	7.87	1.43	1.33
1	A	202	GLU	CD-OE1	7.43	1.33	1.25
1	A	151	GLU	CG-CD	7.20	1.62	1.51
1	A	70	GLU	CD-OE1	6.91	1.33	1.25
1	A	65	GLU	CG-CD	6.65	1.61	1.51
1	A	162	ILE	CB-CG1	-6.13	1.36	1.54
1	A	27	ASN	CB-CG	-6.09	1.37	1.51
1	A	219	GLN	CG-CD	5.98	1.64	1.51
1	A	214	GLU	CG-CD	5.98	1.60	1.51
1	A	183	PHE	CE2-CZ	5.96	1.48	1.37
1	A	-1	HIS	CA-C	-5.70	1.38	1.52
1	A	184	TYR	CE2-CZ	-5.63	1.31	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	186	TYR	CG-CD2	-5.63	1.31	1.39
1	A	-9	GLU	CD-OE2	5.45	1.31	1.25
1	A	208	VAL	CB-CG2	5.43	1.64	1.52
1	A	91	ASN	CG-ND2	-5.32	1.19	1.32
1	A	61	GLU	CB-CG	-5.17	1.42	1.52
1	A	169	ASP	CG-OD2	-5.09	1.13	1.25
1	A	81	ASN	CG-OD1	5.03	1.35	1.24
1	A	151	GLU	CB-CG	5.02	1.61	1.52

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	171[A]	ARG	NE-CZ-NH1	-16.37	112.12	120.30
1	A	171[B]	ARG	NE-CZ-NH1	-16.37	112.12	120.30
1	A	57	ARG	NE-CZ-NH2	-14.40	113.10	120.30
1	A	171[A]	ARG	NE-CZ-NH2	13.13	126.87	120.30
1	A	171[B]	ARG	NE-CZ-NH2	13.13	126.87	120.30
1	A	74	ARG	NE-CZ-NH1	12.60	126.60	120.30
1	A	74	ARG	NE-CZ-NH2	-12.42	114.09	120.30
1	A	159	ARG	NE-CZ-NH1	-10.62	114.99	120.30
1	A	215	ASP	CB-CG-OD1	10.41	127.67	118.30
1	A	169	ASP	CB-CG-OD1	9.66	126.99	118.30
1	A	-1	HIS	CB-CA-C	-8.24	93.91	110.40
1	A	-6	VAL	CA-CB-CG2	7.47	122.11	110.90
1	A	159	ARG	NE-CZ-NH2	7.36	123.98	120.30
1	A	-6	VAL	CG1-CB-CG2	7.18	122.39	110.90
1	A	215	ASP	CB-CG-OD2	-6.75	112.22	118.30
1	A	94	TYR	CB-CG-CD1	6.45	124.87	121.00
1	A	151	GLU	CB-CG-CD	6.06	130.57	114.20
1	A	205	ARG	NE-CZ-NH1	6.05	123.33	120.30
1	A	138	PHE	CB-CG-CD1	-6.00	116.60	120.80
1	A	182	ASN	C-N-CA	-5.93	106.87	121.70
1	A	-4	ARG	NE-CZ-NH2	-5.86	117.37	120.30
1	A	130	GLU	OE1-CD-OE2	5.76	130.21	123.30
1	A	79	ASP	CB-CG-OD1	5.66	123.40	118.30
1	A	204	LYS	CD-CE-NZ	-5.66	98.69	111.70
1	A	52	ASP	CB-CG-OD1	5.49	123.24	118.30
1	A	218	ASP	CB-CG-OD1	5.33	123.10	118.30
1	A	0	MET	CA-CB-CG	-5.30	104.29	113.30
1	A	94	TYR	CZ-CE2-CD2	5.02	124.32	119.80
1	A	151	GLU	OE1-CD-OE2	5.01	129.31	123.30



There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	-2	SER	Mainchain

## 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	2070	0	2018	9	0
2	A	4	0	0	0	0
3	A	164	0	0	2	0
All	All	2238	0	2018	9	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 2.

All (9) 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:151:GLU:HG2	3:A:502:HOH:O	1.58	1.00
1:A:117:GLY:H	1:A:136:HIS:HD2	1.17	0.89
1:A:117:GLY:H	1:A:136:HIS:CD2	2.02	0.76
1:A:83:GLN:NE2	3:A:401:HOH:O	2.31	0.63
1:A:149:THR:OG1	1:A:151:GLU:HG3	2.07	0.55
1:A:81:ASN:ND2	1:A:167:GLY:H	2.05	0.55
1:A:16:GLU:H	1:A:232:ASN:ND2	2.05	0.54
1:A:213:ILE:HD11	1:A:237:LEU:O	2.18	0.44
1:A:136:HIS:HE1	1:A:175:ASP:OD2	2.01	0.43

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	259/266 (97%)	257 (99%)	2 (1%)	0	100 100

There are no Ramachandran outliers to report.

### 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	228/232 (98%)	223 (98%)	5 (2%)	52 19

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

Mol	Chain	Res	Type
1	A	62	ASN
1	A	151	GLU
1	A	171[A]	ARG
1	A	171[B]	ARG
1	A	182	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	81	ASN
1	A	136	HIS
1	A	147	GLN

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Mol	Chain	Res	Type
1	A	232	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 4 ligands modelled in this entry, 4 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	254/266 (95%)	-0.20	6 (2%) 59 58	13, 19, 38, 59	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	-11	HIS	3.2
1	A	210	GLU	3.2
1	A	10	GLN	3.0
1	A	208	VAL	2.5
1	A	183	PHE	2.5
1	A	102	VAL	2.1

### 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(Å <sup>2</sup> )	Q<0.9
2	MG	A	304	1/1	0.99	0.06	19,19,19,19	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
2	MG	A	302	1/1	1.00	0.06	14,14,14,14	0
2	MG	A	303	1/1	1.00	0.04	14,14,14,14	0
2	MG	A	301	1/1	1.00	0.06	16,16,16,16	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.