



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 9, 2020 – 11:02 PM BST

PDB ID : 6P4S  
Title : Salmonella typhi PltB Homopentamer T65I Mutant  
Authors : Nguyen, T.; Milano, S.K.; Hillpot, E.C.; Yang, Y.A.; Song, J.  
Deposited on : 2019-05-28  
Resolution : 2.00 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.

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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) : 1.13  
EDS : 2.13.1  
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) : 2.13.1

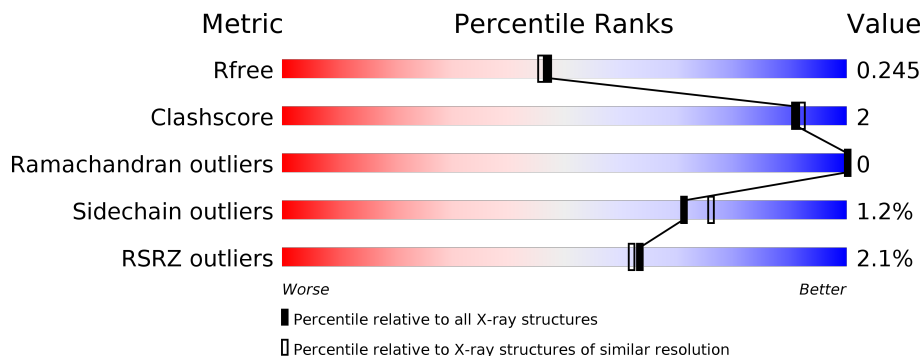
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 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	145	<p>3% 77% 21%</p>
1	B	145	<p>3% 75% 21%</p>
1	C	145	<p>3% 77% 21%</p>
1	D	145	<p>3% 74% 21%</p>
1	E	145	<p>3% 73% 6% 21%</p>

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 4838 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 Putative pertussis-like toxin subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	114	886	568	145	169	4	0	0	0
1	B	115	894	574	146	170	4	0	0	0
1	C	114	886	568	145	169	4	0	0	0
1	D	114	886	568	145	169	4	0	0	0
1	E	114	886	568	145	169	4	0	0	0

There are 45 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	65	ILE	THR	engineered mutation	UNP Q8Z6A3
A	138	LEU	-	expression tag	UNP Q8Z6A3
A	139	GLU	-	expression tag	UNP Q8Z6A3
A	140	HIS	-	expression tag	UNP Q8Z6A3
A	141	HIS	-	expression tag	UNP Q8Z6A3
A	142	HIS	-	expression tag	UNP Q8Z6A3
A	143	HIS	-	expression tag	UNP Q8Z6A3
A	144	HIS	-	expression tag	UNP Q8Z6A3
A	145	HIS	-	expression tag	UNP Q8Z6A3
B	65	ILE	THR	engineered mutation	UNP Q8Z6A3
B	138	LEU	-	expression tag	UNP Q8Z6A3
B	139	GLU	-	expression tag	UNP Q8Z6A3
B	140	HIS	-	expression tag	UNP Q8Z6A3
B	141	HIS	-	expression tag	UNP Q8Z6A3
B	142	HIS	-	expression tag	UNP Q8Z6A3
B	143	HIS	-	expression tag	UNP Q8Z6A3
B	144	HIS	-	expression tag	UNP Q8Z6A3
B	145	HIS	-	expression tag	UNP Q8Z6A3
C	65	ILE	THR	engineered mutation	UNP Q8Z6A3

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Chain	Residue	Modelled	Actual	Comment	Reference
C	138	LEU	-	expression tag	UNP Q8Z6A3
C	139	GLU	-	expression tag	UNP Q8Z6A3
C	140	HIS	-	expression tag	UNP Q8Z6A3
C	141	HIS	-	expression tag	UNP Q8Z6A3
C	142	HIS	-	expression tag	UNP Q8Z6A3
C	143	HIS	-	expression tag	UNP Q8Z6A3
C	144	HIS	-	expression tag	UNP Q8Z6A3
C	145	HIS	-	expression tag	UNP Q8Z6A3
D	65	ILE	THR	engineered mutation	UNP Q8Z6A3
D	138	LEU	-	expression tag	UNP Q8Z6A3
D	139	GLU	-	expression tag	UNP Q8Z6A3
D	140	HIS	-	expression tag	UNP Q8Z6A3
D	141	HIS	-	expression tag	UNP Q8Z6A3
D	142	HIS	-	expression tag	UNP Q8Z6A3
D	143	HIS	-	expression tag	UNP Q8Z6A3
D	144	HIS	-	expression tag	UNP Q8Z6A3
D	145	HIS	-	expression tag	UNP Q8Z6A3
E	65	ILE	THR	engineered mutation	UNP Q8Z6A3
E	138	LEU	-	expression tag	UNP Q8Z6A3
E	139	GLU	-	expression tag	UNP Q8Z6A3
E	140	HIS	-	expression tag	UNP Q8Z6A3
E	141	HIS	-	expression tag	UNP Q8Z6A3
E	142	HIS	-	expression tag	UNP Q8Z6A3
E	143	HIS	-	expression tag	UNP Q8Z6A3
E	144	HIS	-	expression tag	UNP Q8Z6A3
E	145	HIS	-	expression tag	UNP Q8Z6A3

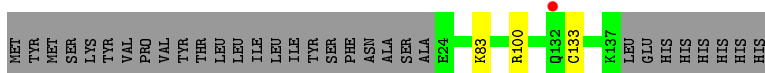
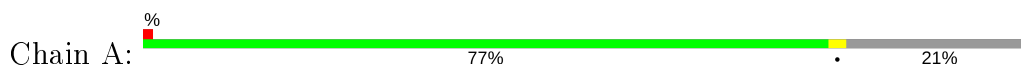
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	101	Total O 101 101	0	0
2	B	93	Total O 93 93	0	0
2	C	83	Total O 83 83	0	0
2	D	75	Total O 75 75	0	0
2	E	48	Total O 48 48	0	0

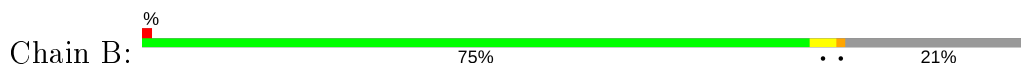
### 3 Residue-property plots [i](#)

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.

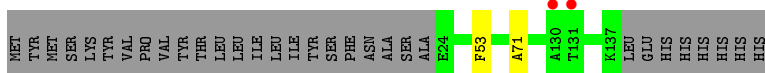
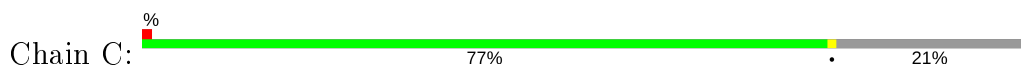
- Molecule 1: Putative pertussis-like toxin subunit



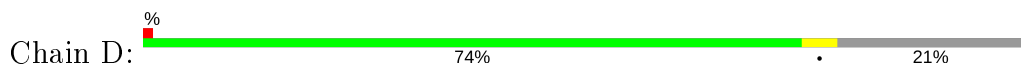
- Molecule 1: Putative pertussis-like toxin subunit



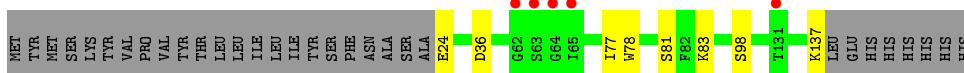
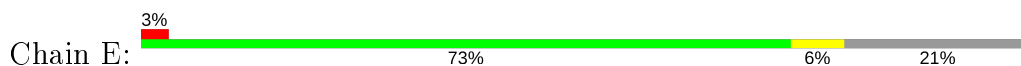
- Molecule 1: Putative pertussis-like toxin subunit



- Molecule 1: Putative pertussis-like toxin subunit



- Molecule 1: Putative pertussis-like toxin subunit



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	61.07Å 97.50Å 118.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	26.64 – 2.00 26.64 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.2 (26.64-2.00) 99.2 (26.64-2.00)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.35 (at 1.99Å)	Xtrriage
Refinement program	PHENIX 1.12-2829	Depositor
R, $R_{free}$	0.197 , 0.245 0.198 , 0.245	Depositor DCC
$R_{free}$ test set	1995 reflections (4.14%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	17.2	Xtrriage
Anisotropy	0.314	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 50.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	4838	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.40% 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](#)

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	0.47	0/910	0.59	0/1241
1	B	0.56	0/918	0.58	0/1252
1	C	0.43	0/910	0.57	0/1241
1	D	0.37	0/910	0.56	0/1241
1	E	0.38	0/910	0.57	0/1241
All	All	0.45	0/4558	0.57	0/6216

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 [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	886	0	850	1	0
1	B	894	0	861	5	0
1	C	886	0	850	1	0
1	D	886	0	850	2	0
1	E	886	0	850	7	0
2	A	101	0	0	0	0
2	B	93	0	0	0	0
2	C	83	0	0	0	0
2	D	75	0	0	0	0
2	E	48	0	0	0	0
All	All	4838	0	4261	15	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 (15) 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:E:24:GLU:HG3	1:E:77:ILE:HD13	1.66	0.78
1:B:110:TYR:HB2	1:B:113:PHE:HB3	1.71	0.71
1:E:77:ILE:HD11	1:E:78:TRP:CE2	2.39	0.58
1:E:77:ILE:C	1:E:77:ILE:HD12	2.25	0.56
1:E:24:GLU:HG3	1:E:77:ILE:CD1	2.35	0.56
1:B:75:GLN:OE1	1:B:110:TYR:OH	2.30	0.49
1:D:83:LYS:HE3	1:D:87:ASP:OD2	2.16	0.45
1:B:46:GLN:HB2	1:E:81:SER:OG	2.20	0.42
1:B:110:TYR:HB2	1:B:113:PHE:CB	2.44	0.42
1:B:53:PHE:CE1	1:B:71:ALA:HB3	2.55	0.42
1:A:100:ARG:CZ	1:A:133:CYS:HB2	2.51	0.41
1:D:128:CYS:HA	1:D:133:CYS:HA	2.02	0.41
1:E:36:ASP:HA	1:E:98:SER:OG	2.21	0.41
1:E:77:ILE:HD11	1:E:78:TRP:CD2	2.56	0.40
1:C:53:PHE:CE1	1:C:71:ALA:HB3	2.57	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	112/145 (77%)	106 (95%)	6 (5%)	0	100	100
1	B	113/145 (78%)	108 (96%)	5 (4%)	0	100	100
1	C	112/145 (77%)	109 (97%)	3 (3%)	0	100	100
1	D	112/145 (77%)	109 (97%)	3 (3%)	0	100	100
1	E	112/145 (77%)	108 (96%)	4 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	561/725 (77%)	540 (96%)	21 (4%)	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	98/127 (77%)	97 (99%)	1 (1%)	76	81
1	B	99/127 (78%)	98 (99%)	1 (1%)	76	81
1	C	98/127 (77%)	98 (100%)	0	100	100
1	D	98/127 (77%)	96 (98%)	2 (2%)	55	58
1	E	98/127 (77%)	96 (98%)	2 (2%)	55	58
All	All	491/635 (77%)	485 (99%)	6 (1%)	71	76

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	83	LYS
1	B	110	TYR
1	D	118	SER
1	D	137	LYS
1	E	83	LYS
1	E	137	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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](#)

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	114/145 (78%)	-0.39	1 (0%) 84 83	9, 13, 22, 31	0
1	B	115/145 (79%)	-0.23	2 (1%) 70 68	11, 16, 24, 45	0
1	C	114/145 (78%)	-0.31	2 (1%) 68 66	10, 15, 24, 38	0
1	D	114/145 (78%)	-0.06	2 (1%) 68 66	12, 20, 36, 39	0
1	E	114/145 (78%)	0.06	5 (4%) 34 33	15, 22, 40, 47	0
All	All	571/725 (78%)	-0.19	12 (2%) 63 62	9, 17, 32, 47	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	138	LEU	6.4
1	E	131	THR	4.6
1	E	65	ILE	2.9
1	C	131	THR	2.8
1	E	62	GLY	2.5
1	C	130	ALA	2.5
1	D	131	THR	2.5
1	E	64	GLY	2.4
1	E	63	SER	2.3
1	A	132	GLN	2.2
1	B	65	ILE	2.2
1	D	130	ALA	2.2

### 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](#)

There are no ligands in this entry.

### 6.5 Other polymers [i](#)

There are no such residues in this entry.