



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2018 – 07:04 pm GMT

PDB ID : 2Y1T  
Title : Bacillus subtilis prophage dUTPase in complex with dUDP  
Authors : Garcia-Nafria, J.; Harkiolaki, M.; Persson, R.; Fogg, M.J.; Wilson, K.S.  
Deposited on : 2010-12-10  
Resolution : 1.89 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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  
Mogul : 1.7.3 (157068), CSD as539be (2018)  
Xtriage (Phenix) : 1.13  
EDS : trunk30967  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Refmac : 5.8.0158  
CCP4 : 7.0 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk30967

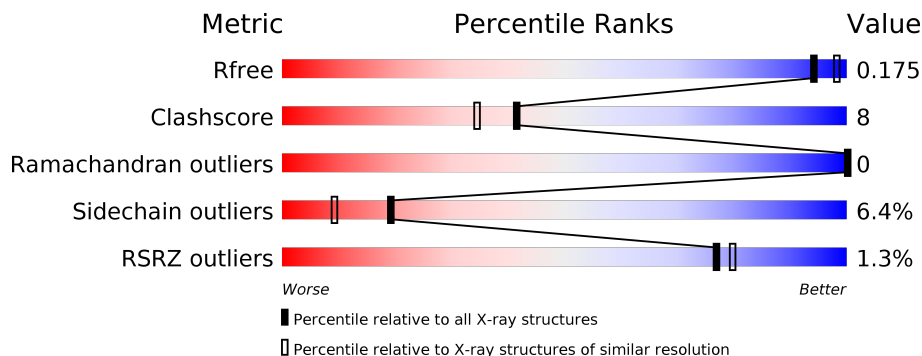
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.89 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))
$R_{free}$	111664	5502 (1.90-1.90)
Clashscore	122126	6115 (1.90-1.90)
Ramachandran outliers	120053	6048 (1.90-1.90)
Sidechain outliers	120020	6048 (1.90-1.90)
RSRZ outliers	108989	5379 (1.90-1.90)

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. 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	142	<div> <div>2%</div> <div> <div></div> <div>70%</div> <div>18%</div> <div>•</div> <div>10%</div> </div> </div>
1	B	142	<div> <div>%</div> <div> <div></div> <div>77%</div> <div>11%</div> <div>•</div> <div>10%</div> </div> </div>
1	C	142	<div> <div>%</div> <div> <div></div> <div>74%</div> <div>11%</div> <div>•</div> <div>12%</div> </div> </div>
1	D	142	<div> <div>%</div> <div> <div></div> <div>74%</div> <div>14%</div> <div>•</div> <div>10%</div> </div> </div>
1	E	142	<div> <div></div> <div> <div></div> <div>77%</div> <div>12%</div> <div>•</div> <div>11%</div> </div> </div>
1	F	142	<div> <div>%</div> <div> <div></div> <div>73%</div> <div>15%</div> <div>•</div> <div>11%</div> </div> </div>

## 2 Entry composition [i](#)

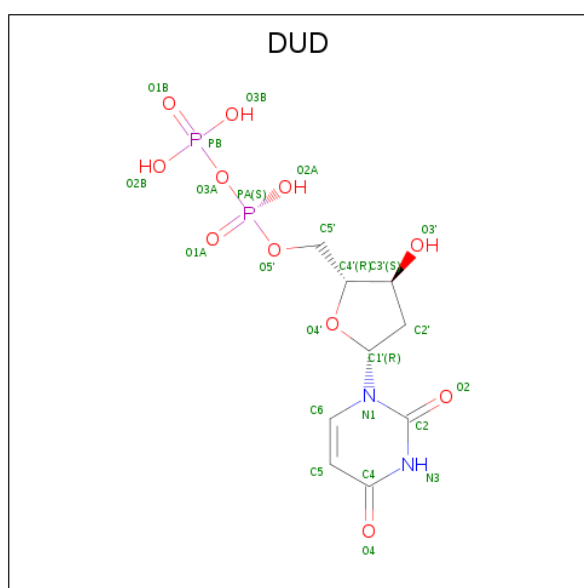
There are 3 unique types of molecules in this entry. The entry contains 6896 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 SPBC2 PROPHAGE-DERIVED DEOXYURIDINE 5'-TRIPHOSPHATE NUCLEOTIDOHYDROLASE YOSS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	128	Total	C	N	O	S	12	3	0
			1058	678	179	194	7			
1	B	128	Total	C	N	O	S	26	2	0
			1051	672	178	194	7			
1	C	125	Total	C	N	O	S	6	2	0
			1028	659	174	189	6			
1	D	128	Total	C	N	O	S	12	1	0
			1049	671	178	193	7			
1	E	127	Total	C	N	O	S	25	1	0
			1037	665	174	191	7			
1	F	127	Total	C	N	O	S	22	2	0
			1046	670	177	193	6			

- Molecule 2 is DEOXYURIDINE-5'-DIPHOSPHATE (three-letter code: DUD) (formula:  $C_9H_{14}N_2O_{11}P_2$ ).

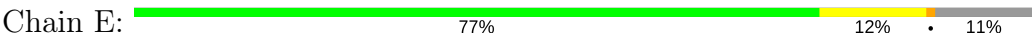


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	P	0	0
			24	9	2	11	2		
2	C	1	Total	C	N	O	P	0	0
			24	9	2	11	2		
2	D	1	Total	C	N	O	P	0	0
			24	9	2	11	2		
2	E	1	Total	C	N	O	P	0	0
			24	9	2	11	2		
2	E	1	Total	C	N	O	P	0	0
			24	9	2	11	2		

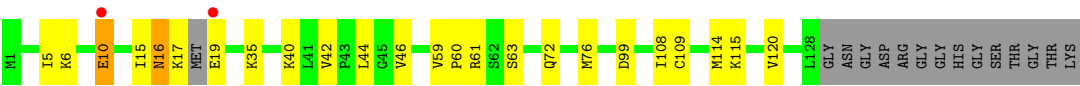
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	86	Total	O	0	0
			86	86		
3	B	92	Total	O	0	0
			92	92		
3	C	80	Total	O	0	0
			80	80		
3	D	75	Total	O	0	0
			75	75		
3	E	97	Total	O	0	0
			97	97		
3	F	77	Total	O	0	0
			77	77		





● Molecule 1: SPBC2 PROPHAGE-DERIVED DEOXYURIDINE 5'-TRIPHOSPHATE NUCLEOTIDOHYDROLASE YOSS



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	99.52Å 99.34Å 99.31Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	70.31 – 1.89 19.89 – 1.89	Depositor EDS
% Data completeness (in resolution range)	98.9 (70.31-1.89) 99.1 (19.89-1.89)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.21 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.6.0086	Depositor
R, $R_{free}$	0.140 , 0.166 0.150 , 0.175	Depositor DCC
$R_{free}$ test set	3943 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.2	Xtriage
Anisotropy	0.108	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 26.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.41$ , $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	0.078 for k,h,-l 0.077 for -l,-k,-h 0.077 for -h,l,k 0.279 for l,h,k 0.279 for k,l,h	Xtriage
Reported twinning fraction	0.555 for H, K, L 0.408 for -L, -H, K 0.037 for K, -L, -H	Depositor
Outliers	0 of 78442 reflections	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	6896	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.02% 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: DUD

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	1.32	3/1089 (0.3%)	1.05	4/1462 (0.3%)
1	B	1.23	1/1080 (0.1%)	1.00	1/1451 (0.1%)
1	C	1.31	2/1053 (0.2%)	1.09	3/1415 (0.2%)
1	D	1.29	1/1074 (0.1%)	1.10	3/1443 (0.2%)
1	E	1.38	3/1059 (0.3%)	1.11	4/1422 (0.3%)
1	F	1.23	0/1071	1.05	1/1438 (0.1%)
All	All	1.29	10/6426 (0.2%)	1.07	16/8631 (0.2%)

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	30	GLU	CD-OE1	-5.98	1.19	1.25
1	E	39	PHE	CD2-CE2	5.62	1.50	1.39
1	A	33	ALA	CA-CB	5.29	1.63	1.52
1	E	90	TRP	CB-CG	5.26	1.59	1.50
1	E	33	ALA	CA-CB	5.24	1.63	1.52

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	25	ASP	CB-CG-OD2	-5.86	113.03	118.30
1	C	112	ARG	NE-CZ-NH1	5.78	123.19	120.30
1	D	107	ARG	NE-CZ-NH1	5.76	123.18	120.30
1	F	99	ASP	CB-CG-OD1	5.74	123.47	118.30
1	A	61	ARG	NE-CZ-NH1	5.66	123.13	120.30

There are no chirality outliers.

There are no planarity outliers.



## 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	1058	0	1081	40	0
1	B	1051	0	1064	28	0
1	C	1028	0	1043	19	0
1	D	1049	0	1063	13	0
1	E	1037	0	1052	6	0
1	F	1046	0	1062	21	0
2	B	24	0	11	0	0
2	C	24	0	11	1	0
2	D	24	0	11	0	0
2	E	48	0	22	3	0
3	A	86	0	0	0	0
3	B	92	0	0	1	0
3	C	80	0	0	1	0
3	D	75	0	0	2	0
3	E	97	0	0	2	0
3	F	77	0	0	0	0
All	All	6896	0	6420	96	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 8.

The worst 5 of 96 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:B:65:TYR:CE2	1:C:39:PHE:CD1	2.40	1.09
1:B:65:TYR:HE2	1:C:39:PHE:CG	1.75	1.04
1:B:65:TYR:CE2	1:C:39:PHE:CG	2.57	0.93
1:A:126:ASP:C	1:A:127:ARG:HG3	1.89	0.91
1:B:65:TYR:OH	1:C:95:TYR:HD2	1.58	0.84

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	129/142 (91%)	124 (96%)	5 (4%)	0	100	100
1	B	128/142 (90%)	127 (99%)	1 (1%)	0	100	100
1	C	123/142 (87%)	120 (98%)	3 (2%)	0	100	100
1	D	127/142 (89%)	125 (98%)	2 (2%)	0	100	100
1	E	124/142 (87%)	121 (98%)	3 (2%)	0	100	100
1	F	125/142 (88%)	123 (98%)	2 (2%)	0	100	100
All	All	756/852 (89%)	740 (98%)	16 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	116/121 (96%)	110 (95%)	6 (5%)	25	15
1	B	115/121 (95%)	105 (91%)	10 (9%)	11	4
1	C	112/121 (93%)	106 (95%)	6 (5%)	24	14
1	D	114/121 (94%)	106 (93%)	8 (7%)	16	7
1	E	113/121 (93%)	106 (94%)	7 (6%)	20	10
1	F	114/121 (94%)	108 (95%)	6 (5%)	25	14
All	All	684/726 (94%)	641 (94%)	43 (6%)	19	9

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	122	LEU
1	D	20	GLN
1	F	17	LYS
1	C	126	ASP
1	C	127	ARG

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

Mol	Chain	Res	Type
1	B	2	GLN
1	C	16	ASN
1	D	87	ASN
1	F	16	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules 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 ⓘ

5 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	DUD	B	143	-	20,25,25	1.16	2 (10%)	25,38,38	2.67	5 (20%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	DUD	C	143	-	20,25,25	1.93	5 (25%)	25,38,38	1.88	3 (12%)
2	DUD	D	143	-	20,25,25	1.57	3 (15%)	25,38,38	2.74	5 (20%)
2	DUD	E	143	-	20,25,25	1.75	4 (20%)	25,38,38	2.25	3 (12%)
2	DUD	E	144	-	20,25,25	1.25	2 (10%)	25,38,38	2.26	6 (24%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	DUD	B	143	-	-	0/12/28/28	0/2/2/2
2	DUD	C	143	-	-	0/12/28/28	0/2/2/2
2	DUD	D	143	-	-	0/12/28/28	0/2/2/2
2	DUD	E	143	-	-	0/12/28/28	0/2/2/2
2	DUD	E	144	-	-	0/12/28/28	0/2/2/2

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	143	DUD	C2-N3	-4.20	1.29	1.38
2	E	143	DUD	C6-N1	-4.09	1.30	1.35
2	E	143	DUD	C2-N3	-3.91	1.30	1.38
2	D	143	DUD	PB-O3A	-3.22	1.55	1.60
2	C	143	DUD	O4'-C4'	-2.70	1.39	1.45

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	143	DUD	O5'-PA-O1A	-4.02	93.34	109.07
2	E	144	DUD	O4'-C1'-N1	-3.55	101.79	107.78
2	E	144	DUD	O4'-C4'-C3'	-2.89	98.81	105.69
2	C	143	DUD	O4'-C1'-N1	-2.50	103.57	107.78
2	B	143	DUD	O3A-PB-O1B	-2.50	96.41	111.48

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	143	DUD	1	0
2	E	143	DUD	2	0
2	E	144	DUD	1	0

## 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	128/142 (90%)	-0.16	3 (2%) 60 64	15, 23, 40, 51	3 (2%)
1	B	128/142 (90%)	-0.21	2 (1%) 72 75	16, 23, 40, 58	7 (5%)
1	C	125/142 (88%)	-0.28	2 (1%) 72 75	16, 23, 38, 54	2 (1%)
1	D	128/142 (90%)	-0.22	1 (0%) 86 87	15, 23, 40, 58	3 (2%)
1	E	127/142 (89%)	-0.27	0 100 100	14, 21, 36, 49	7 (5%)
1	F	127/142 (89%)	-0.13	2 (1%) 72 75	15, 24, 39, 58	6 (4%)
All	All	763/852 (89%)	-0.21	10 (1%) 77 80	14, 23, 40, 58	28 (3%)

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	18	MET	4.6
1	B	65	TYR	4.4
1	A	17	LYS	2.4
1	F	19	GLU	2.4
1	C	16	ASN	2.3

### 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 carbohydrates 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	DUD	C	143	24/24	0.82	0.13	19,31,63,68	0
2	DUD	E	143	24/24	0.86	0.12	22,34,54,56	0
2	DUD	E	144	24/24	0.92	0.10	22,28,49,49	0
2	DUD	B	143	24/24	0.98	0.09	20,23,30,32	0
2	DUD	D	143	24/24	0.98	0.10	20,25,32,38	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.