



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 25, 2020 – 12:43 pm BST

PDB ID : 3AHC  
Title : Resting form of Phosphoketolase from Bifidobacterium Breve  
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Deposited on : 2010-04-22  
Resolution : 1.70 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	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
buster-report	:	1.1.7 (2018)
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)	:	2.11

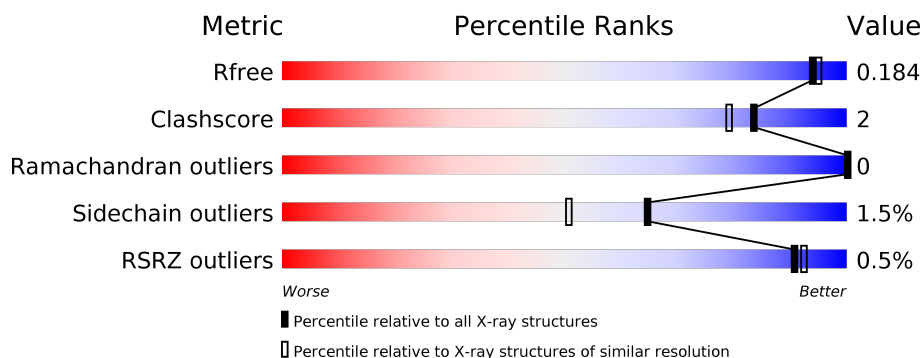
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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	845	 78% 14% 5%

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 7365 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 Xylulose 5-phosphate/fructose 6-phosphate phosphoketolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	802	Total	C	N	O	S	0	0	0
			6379	4053	1085	1217	24			

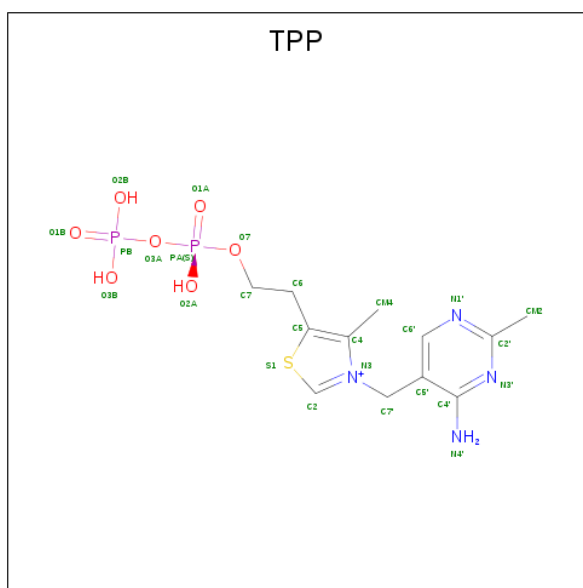
There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	EXPRESSION TAG	UNP D6PAH1
A	-18	GLY	-	EXPRESSION TAG	UNP D6PAH1
A	-17	SER	-	EXPRESSION TAG	UNP D6PAH1
A	-16	SER	-	EXPRESSION TAG	UNP D6PAH1
A	-15	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-14	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-13	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-12	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-11	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-10	HIS	-	EXPRESSION TAG	UNP D6PAH1
A	-9	SER	-	EXPRESSION TAG	UNP D6PAH1
A	-8	SER	-	EXPRESSION TAG	UNP D6PAH1
A	-7	GLY	-	EXPRESSION TAG	UNP D6PAH1
A	-6	LEU	-	EXPRESSION TAG	UNP D6PAH1
A	-5	VAL	-	EXPRESSION TAG	UNP D6PAH1
A	-4	PRO	-	EXPRESSION TAG	UNP D6PAH1
A	-3	ARG	-	EXPRESSION TAG	UNP D6PAH1
A	-2	GLY	-	EXPRESSION TAG	UNP D6PAH1
A	-1	SER	-	EXPRESSION TAG	UNP D6PAH1
A	0	HIS	-	EXPRESSION TAG	UNP D6PAH1

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

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

- Molecule 3 is THIAMINE DIPHOSPHATE (three-letter code: TPP) (formula:  $C_{12}H_{19}N_4O_7P_2S$ ).

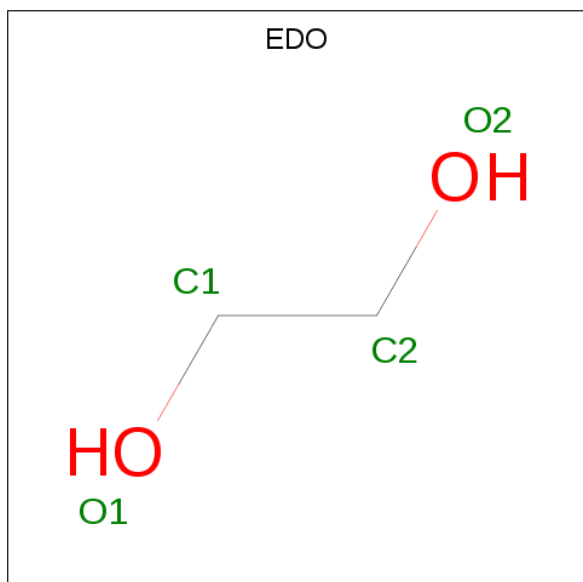


Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

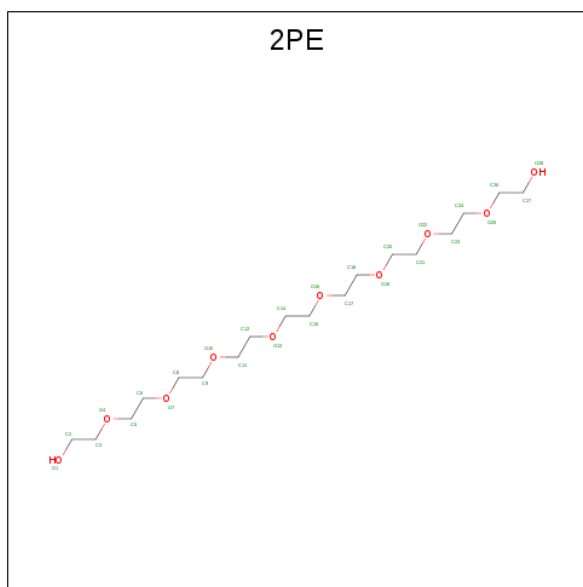
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Na	0	0
			1	1		

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula:  $C_2H_6O_2$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0
5	A	1	Total C O 4 2 2	0	0

- Molecule 6 is NONAETHYLENE GLYCOL (three-letter code: 2PE) (formula: C<sub>18</sub>H<sub>38</sub>O<sub>10</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 28 18 10	0	0

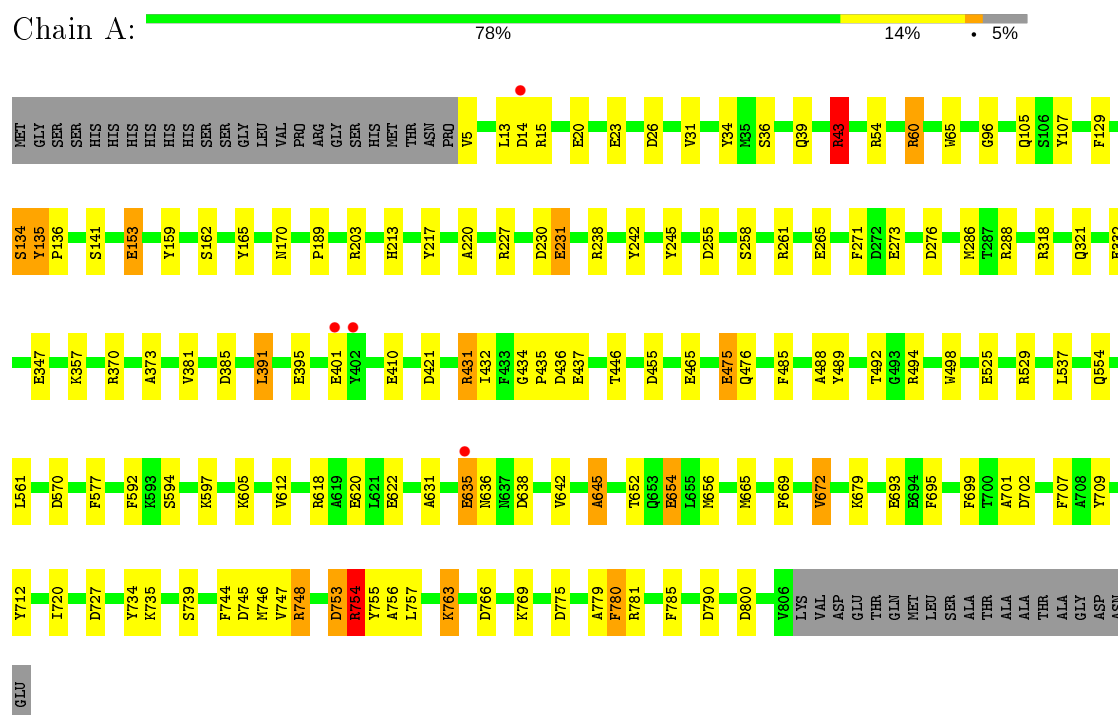
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	886	Total 886	O 886	0	0

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Xylulose 5-phosphate/fructose 6-phosphate phosphoketolase



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	174.77Å 174.77Å 163.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.18 – 1.70 34.18 – 1.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (34.18-1.70) 100.0 (34.18-1.70)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	7.37 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.150 , 0.181 0.154 , 0.184	Depositor DCC
$R_{free}$ test set	6904 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	15.5	Xtriage
Anisotropy	0.057	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	7365	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.38% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NA, MG, 2PE, EDO, TPP

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	1.73	77/6553 (1.2%)	1.56	67/8909 (0.8%)

The worst 5 of 77 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	739	SER	CB-OG	10.78	1.56	1.42
1	A	754	ARG	CD-NE	-9.29	1.30	1.46
1	A	622	GLU	CG-CD	9.08	1.65	1.51
1	A	134	SER	CB-OG	-8.32	1.31	1.42
1	A	779	ALA	CA-CB	7.97	1.69	1.52

The worst 5 of 67 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	43	ARG	NE-CZ-NH2	-25.12	107.74	120.30
1	A	754	ARG	NE-CZ-NH2	-24.84	107.88	120.30
1	A	43	ARG	NE-CZ-NH1	24.41	132.50	120.30
1	A	618	ARG	NE-CZ-NH1	20.05	130.32	120.30
1	A	618	ARG	NE-CZ-NH2	-17.02	111.79	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	6379	0	6085	27	0
2	A	1	0	0	0	0
3	A	26	0	16	3	0
4	A	1	0	0	0	0
5	A	44	0	66	4	0
6	A	28	0	38	1	0
7	A	886	0	0	6	0
All	All	7365	0	6205	31	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.

The worst 5 of 31 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:654:GLU:OE1	1:A:754:ARG:HD3	1.66	0.94
1:A:60:ARG:NH1	7:A:1398:HOH:O	2.08	0.85
1:A:654:GLU:OE1	1:A:754:ARG:CD	2.28	0.81
1:A:273:GLU:OE1	7:A:1347:HOH:O	2.02	0.77
3:A:827:TPP:HN42	3:A:827:TPP:C2	2.00	0.75

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	800/845 (95%)	774 (97%)	26 (3%)	0	<a href="#">100</a> <a href="#">100</a>

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	677/712 (95%)	667 (98%)	10 (2%)	65 51

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	391	LEU
1	A	561	LEU
1	A	635	GLU
1	A	213	HIS
1	A	605	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	408	GLN
1	A	554	GLN
1	A	441	ASN
1	A	170	ASN
1	A	472	GLN

### 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

Of 15 ligands modelled in this entry, 2 are monoatomic - leaving 13 for Mogul analysis.

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
5	EDO	A	838	-	3,3,3	0.96	0	2,2,2	0.62	0
5	EDO	A	834	-	3,3,3	0.25	0	2,2,2	1.25	0
5	EDO	A	829	-	3,3,3	0.99	0	2,2,2	0.35	0
5	EDO	A	832	-	3,3,3	0.59	0	2,2,2	0.81	0
5	EDO	A	830	-	3,3,3	0.72	0	2,2,2	0.21	0
5	EDO	A	839	-	3,3,3	0.51	0	2,2,2	0.60	0
6	2PE	A	840	-	27,27,27	2.23	13 (48%)	26,26,26	1.51	4 (15%)
5	EDO	A	835	-	3,3,3	0.53	0	2,2,2	1.47	0
5	EDO	A	831	-	3,3,3	0.78	0	2,2,2	0.87	0
5	EDO	A	836	-	3,3,3	0.40	0	2,2,2	0.89	0
5	EDO	A	837	-	3,3,3	0.26	0	2,2,2	0.87	0
3	TPP	A	827	2	22,27,27	2.74	6 (27%)	29,40,40	1.56	4 (13%)
5	EDO	A	833	-	3,3,3	0.91	0	2,2,2	1.09	0

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
5	EDO	A	838	-	-	0/1/1/1	-
5	EDO	A	834	-	-	1/1/1/1	-
5	EDO	A	829	-	-	0/1/1/1	-
5	EDO	A	832	-	-	1/1/1/1	-
5	EDO	A	830	-	-	0/1/1/1	-
5	EDO	A	839	-	-	0/1/1/1	-
6	2PE	A	840	-	-	13/25/25/25	-
5	EDO	A	835	-	-	0/1/1/1	-
5	EDO	A	831	-	-	1/1/1/1	-
5	EDO	A	836	-	-	0/1/1/1	-
5	EDO	A	837	-	-	0/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	TPP	A	827	2	-	6/16/17/17	0/2/2/2
5	EDO	A	833	-	-	0/1/1/1	-

The worst 5 of 19 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	827	TPP	C6-C5	8.80	1.54	1.50
3	A	827	TPP	C2-N3	6.50	1.49	1.36
6	A	840	2PE	O7-C6	4.16	1.60	1.42
3	A	827	TPP	C5'-C4'	3.36	1.48	1.42
6	A	840	2PE	O10-C11	3.21	1.56	1.42

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	827	TPP	N4'-C4'-N3'	4.38	123.22	117.03
6	A	840	2PE	O4-C5-C6	3.72	127.18	110.39
6	A	840	2PE	O4-C3-C2	-3.15	96.24	110.07
6	A	840	2PE	C17-O16-C15	2.84	125.59	113.29
6	A	840	2PE	O10-C11-C12	-2.76	97.96	110.39

There are no chirality outliers.

5 of 22 torsion outliers are listed below:

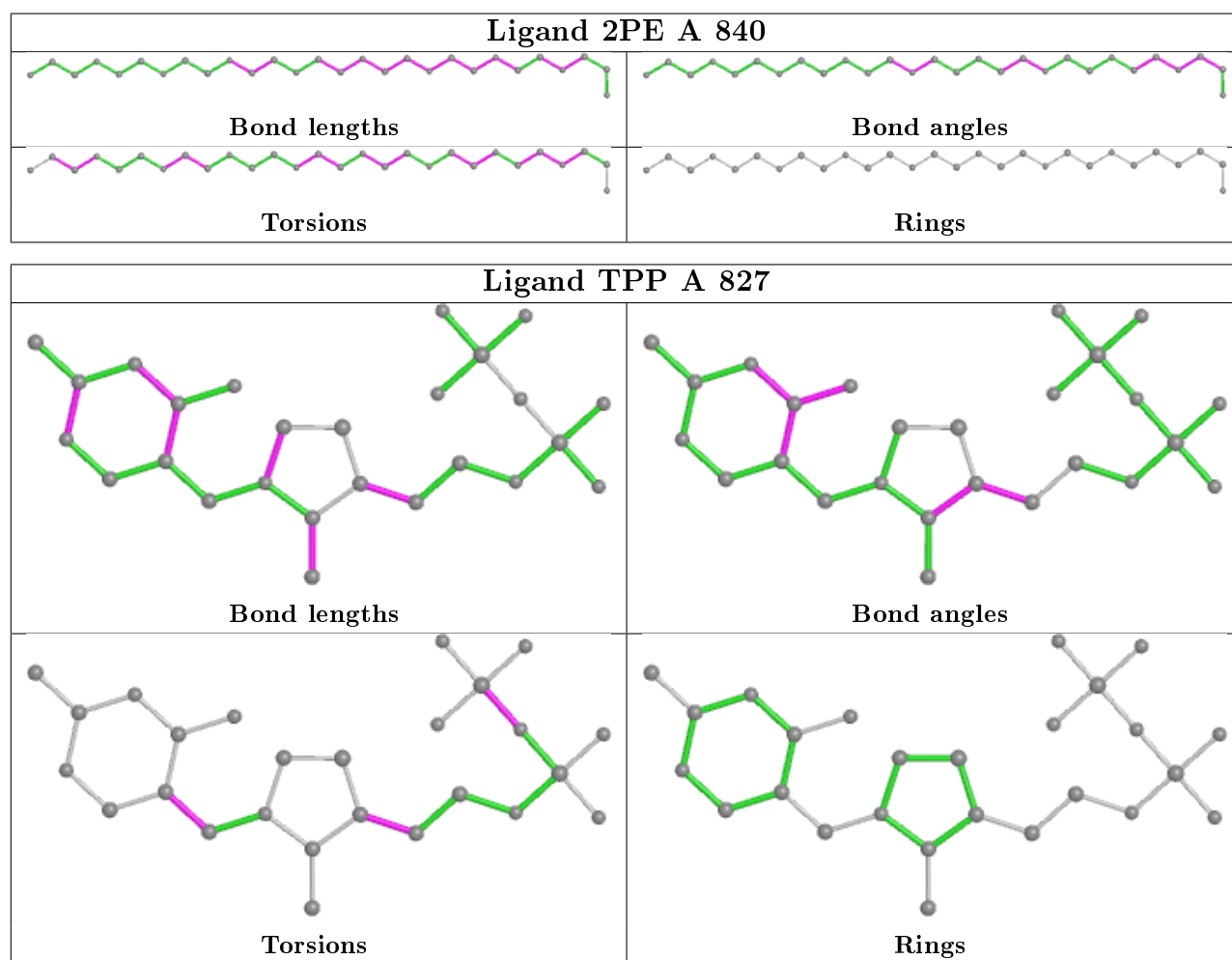
Mol	Chain	Res	Type	Atoms
3	A	827	TPP	C4'-C5'-C7'-N3
6	A	840	2PE	O4-C5-C6-O7
6	A	840	2PE	O19-C20-C21-O22
6	A	840	2PE	C11-C12-O13-C14
6	A	840	2PE	O7-C8-C9-O10

There are no ring outliers.

6 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	829	EDO	1	0
5	A	832	EDO	1	0
5	A	830	EDO	1	0
6	A	840	2PE	1	0
5	A	837	EDO	1	0
3	A	827	TPP	3	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

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	802/845 (94%)	-0.43	4 (0%) 91 92	11, 17, 28, 46	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	14	ASP	2.8
1	A	402	TYR	2.7
1	A	635	GLU	2.7
1	A	401	GLU	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
6	2PE	A	840	28/28	0.56	0.21	23,39,53,53	0
5	EDO	A	831	4/4	0.85	0.20	36,43,50,53	0
5	EDO	A	832	4/4	0.88	0.19	37,42,42,43	0

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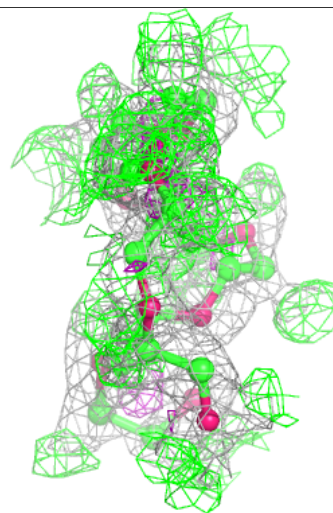
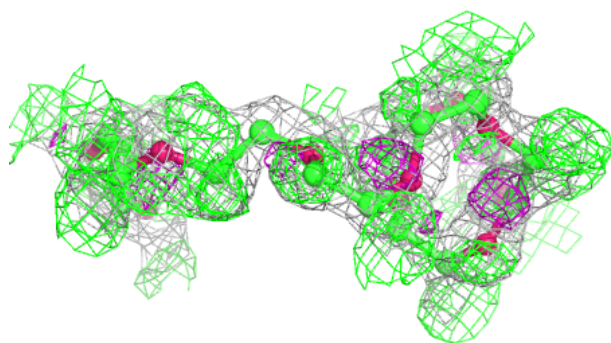
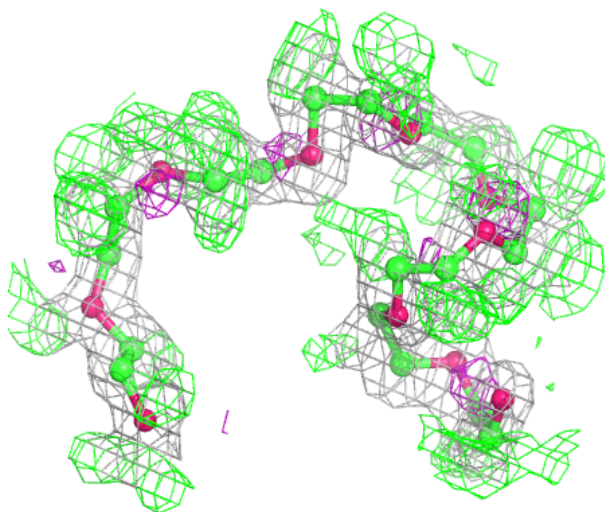
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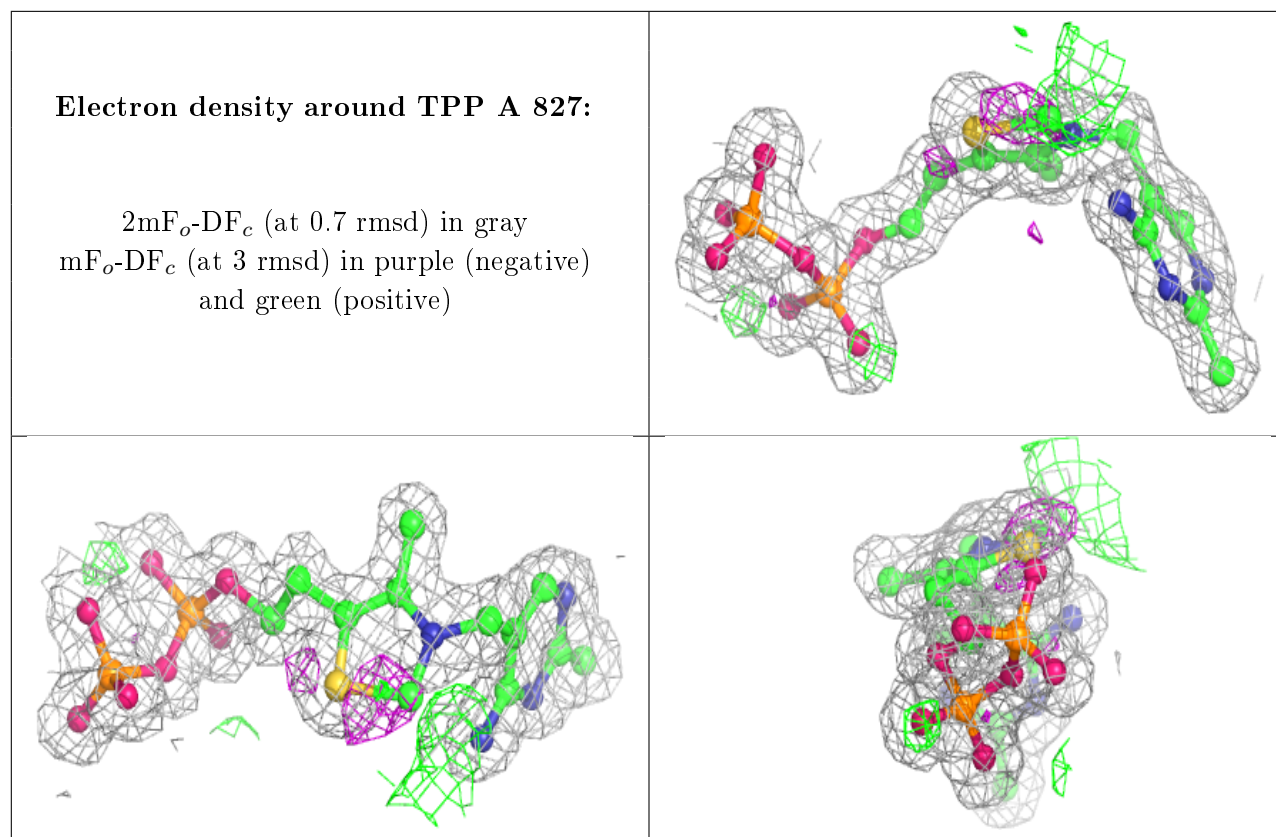
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	EDO	A	830	4/4	0.91	0.10	41,42,45,46	0
5	EDO	A	836	4/4	0.91	0.12	32,38,39,41	0
5	EDO	A	835	4/4	0.92	0.09	27,28,33,38	0
5	EDO	A	837	4/4	0.92	0.12	30,33,37,37	0
5	EDO	A	829	4/4	0.93	0.13	26,28,30,33	0
4	NA	A	828	1/1	0.95	0.16	32,32,32,32	1
5	EDO	A	834	4/4	0.96	0.11	25,30,32,32	0
5	EDO	A	833	4/4	0.96	0.08	25,27,28,33	0
5	EDO	A	839	4/4	0.97	0.06	23,23,25,26	0
5	EDO	A	838	4/4	0.98	0.06	14,15,17,19	0
3	TPP	A	827	26/26	0.99	0.05	11,15,20,34	0
2	MG	A	826	1/1	0.99	0.07	13,13,13,13	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

**Electron density around 2PE A 840:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.