



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 06:55 PM GMT

PDB ID : 4N72  
Title : Catalytic domain from dihydrolipoamide acetyltransferase of pyruvate dehydrogenase from Escherichia coli  
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Deposited on : 2013-10-14  
Resolution : 2.25 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  
<http://wwpdb.org/validation/2016/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 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

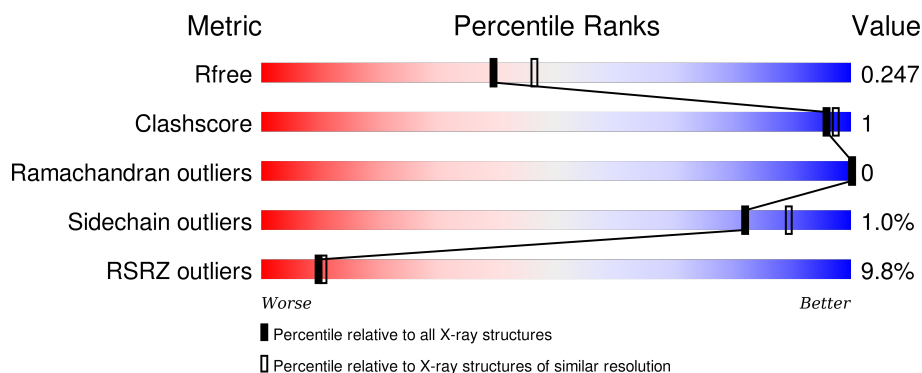
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.25 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))
$R_{free}$	91344	1640 (2.28-2.24)
Clashscore	102246	1095 (2.26-2.26)
Ramachandran outliers	100387	1063 (2.26-2.26)
Sidechain outliers	100360	1063 (2.26-2.26)
RSRZ outliers	91569	1647 (2.28-2.24)

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	249	<div> <div>12%</div> <div>95%</div> <div>• •</div> </div>
1	B	249	<div> <div>7%</div> <div>96%</div> <div>• •</div> </div>
1	C	249	<div> <div>10%</div> <div>90%</div> <div>8% •</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6043 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 Pyruvate dehydrogenase (Dihydrolipoyltransacetylase component).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	246	Total	C	N	O	S	0	0	0
			1908	1219	332	348	9			
1	B	245	Total	C	N	O	S	0	0	0
			1901	1214	331	347	9			
1	C	247	Total	C	N	O	S	0	0	0
			1916	1224	333	349	10			

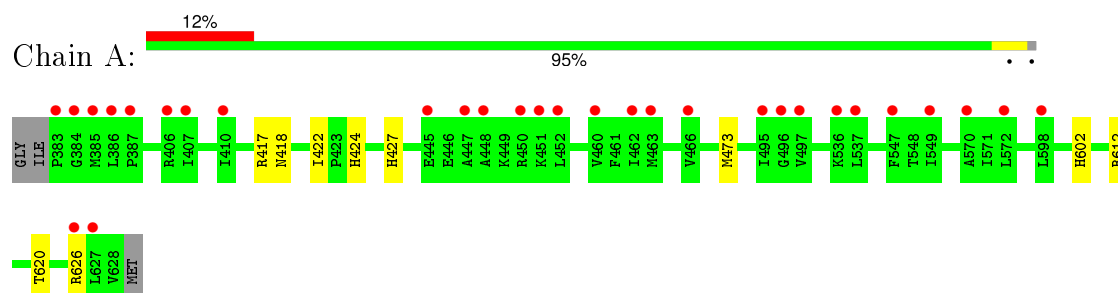
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	110	Total	O	0	0
			110	110		
2	B	113	Total	O	0	0
			113	113		
2	C	95	Total	O	0	0
			95	95		

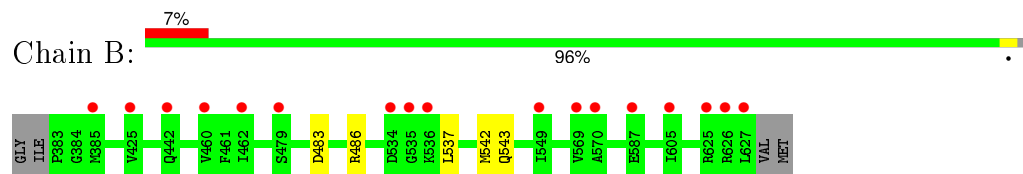
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

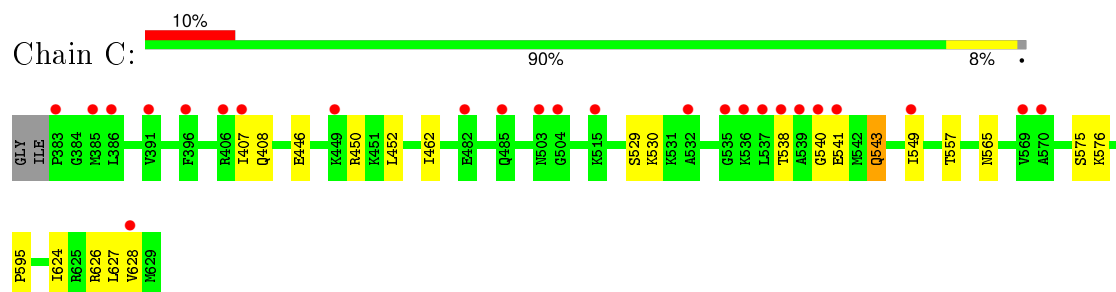
- Molecule 1: Pyruvate dehydrogenase (Dihydrolipoyltransacetylase component)



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## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.56Å 92.83Å 110.54Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.40 – 2.25 23.15 – 2.25	Depositor EDS
% Data completeness (in resolution range)	98.1 (21.40-2.25) 98.1 (23.15-2.25)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.85 (at 2.26Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, $R_{free}$	0.208 , 0.247 0.206 , 0.247	Depositor DCC
$R_{free}$ test set	1884 reflections (4.99%)	DCC
Wilson B-factor (Å <sup>2</sup> )	52.6	Xtriage
Anisotropy	0.072	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 42.2	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Outliers	1 of 37796 reflections (0.003%)	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6043	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.23% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

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	0.23	0/1943	0.41	0/2623
1	B	0.23	0/1936	0.42	0/2613
1	C	0.24	0/1951	0.43	0/2633
All	All	0.23	0/5830	0.42	0/7869

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

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	1908	0	1976	4	0
1	B	1901	0	1967	2	0
1	C	1916	0	1985	11	0
2	A	110	0	0	0	0
2	B	113	0	0	0	0
2	C	95	0	0	0	0
All	All	6043	0	5928	17	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 1.

All (17) 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:473:MET:HE1	1:A:612:ARG:HB3	1.90	0.52
1:C:538:THR:HG23	1:C:541:GLU:H	1.77	0.49
1:C:624:ILE:HD13	1:C:626:ARG:HH12	1.78	0.49
1:C:462:ILE:HG22	1:C:549:ILE:HD13	1.94	0.48
1:B:483:ASP:OD2	1:B:486:ARG:NH2	2.47	0.48
1:A:620:THR:HA	1:A:626:ARG:HD2	1.96	0.48
1:C:628:VAL:HG12	1:C:628:VAL:O	2.14	0.46
1:C:407:ILE:HG23	1:C:408:GLN:N	2.30	0.46
1:C:450:ARG:HD2	1:C:452:LEU:HD11	2.01	0.43
1:A:422:ILE:O	1:A:424:HIS:ND1	2.51	0.42
1:C:540:GLY:HA2	1:C:543:GLN:HE21	1.84	0.42
1:C:575:SER:HB2	1:C:595:PRO:HG2	2.01	0.42
1:A:417:ARG:NH1	1:A:418:ASN:OD1	2.50	0.41
1:B:537:LEU:HD23	1:B:542:MET:CE	2.51	0.41
1:C:446:GLU:O	1:C:450:ARG:HG2	2.20	0.41
1:C:529:SER:OG	1:C:530:LYS:N	2.54	0.40
1:C:557:THR:O	1:C:576:LYS:HG2	2.21	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	244/249 (98%)	239 (98%)	5 (2%)	0	100	100
1	B	243/249 (98%)	237 (98%)	6 (2%)	0	100	100
1	C	245/249 (98%)	238 (97%)	7 (3%)	0	100	100
All	All	732/747 (98%)	714 (98%)	18 (2%)	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	210/212 (99%)	208 (99%)	2 (1%)	82	89
1	B	209/212 (99%)	208 (100%)	1 (0%)	92	95
1	C	211/212 (100%)	208 (99%)	3 (1%)	74	84
All	All	630/636 (99%)	624 (99%)	6 (1%)	82	89

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

Mol	Chain	Res	Type
1	A	427	HIS
1	A	602	HIS
1	B	543	GLN
1	C	543	GLN
1	C	565	ASN
1	C	627	LEU

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 carbohydrates in this entry.



## 5.6 Ligand geometry

There are no ligands in this entry.

## 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 ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

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	246/249 (98%)	0.58	30 (12%) 5 5	35, 53, 88, 105	0
1	B	245/249 (98%)	0.41	17 (6%) 20 22	36, 55, 78, 97	0
1	C	247/249 (99%)	0.68	25 (10%) 9 10	36, 57, 90, 105	0
All	All	738/747 (98%)	0.56	72 (9%) 10 10	35, 55, 88, 105	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	540	GLY	6.7
1	A	451	LYS	5.7
1	A	452	LEU	5.3
1	C	532	ALA	5.3
1	A	384	GLY	5.3
1	A	627	LEU	5.1
1	C	541	GLU	5.0
1	C	537	LEU	4.8
1	A	385	MET	4.5
1	A	406	ARG	4.5
1	C	515	LYS	4.2
1	B	569	VAL	4.2
1	A	383	PRO	4.1
1	C	538	THR	4.0
1	B	626	ARG	4.0
1	A	450	ARG	3.8
1	C	569	VAL	3.8
1	A	547	PHE	3.6
1	C	407	ILE	3.6
1	C	504	GLY	3.5
1	A	495	ILE	3.5
1	A	407	ILE	3.4
1	A	466	VAL	3.3

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Mol	Chain	Res	Type	RSRZ
1	C	539	ALA	3.2
1	A	462	ILE	3.1
1	A	626	ARG	3.1
1	B	625	ARG	3.1
1	C	503	ASN	3.1
1	A	549	ILE	3.1
1	B	570	ALA	3.0
1	A	386	LEU	3.0
1	A	572	LEU	3.0
1	C	536	LYS	3.0
1	C	383	PRO	2.9
1	C	449	LYS	2.8
1	B	385	MET	2.8
1	A	460	VAL	2.7
1	C	535	GLY	2.7
1	A	598	LEU	2.7
1	B	425	VAL	2.7
1	B	627	LEU	2.7
1	C	396	PHE	2.7
1	A	387	PRO	2.6
1	C	570	ALA	2.6
1	A	463	MET	2.6
1	A	570	ALA	2.5
1	B	442	GLN	2.5
1	B	462	ILE	2.5
1	C	482	GLU	2.5
1	B	534	ASP	2.5
1	A	496	GLY	2.4
1	A	497	VAL	2.4
1	B	549	ILE	2.4
1	B	479	SER	2.4
1	C	628	VAL	2.3
1	B	587	GLU	2.3
1	C	549	ILE	2.3
1	A	536	LYS	2.3
1	A	447	ALA	2.3
1	B	536	LYS	2.3
1	B	605	ILE	2.2
1	A	537	LEU	2.1
1	C	385	MET	2.1
1	C	386	LEU	2.1
1	A	448	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	C	485	GLN	2.1
1	A	410	ILE	2.1
1	C	406	ARG	2.1
1	B	535	GLY	2.0
1	B	460	VAL	2.0
1	C	391	VAL	2.0
1	A	445	GLU	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.