



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 03:22 PM GMT

PDB ID : 4C88  
Title : Esterase LpEst1 from Lactobacillus plantarum: native structure  
Authors : Alvarez, Y.; Esteban-Torres, M.; Cortes-Cabrera, A.; Gago, F.; Acebron, I.; Benavente, R.; Mardo, K.; de-las-Rivas, B.; Munoz, R.; Mancheno, J.M.  
Deposited on : 2013-09-30  
Resolution : 2.65 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  
<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

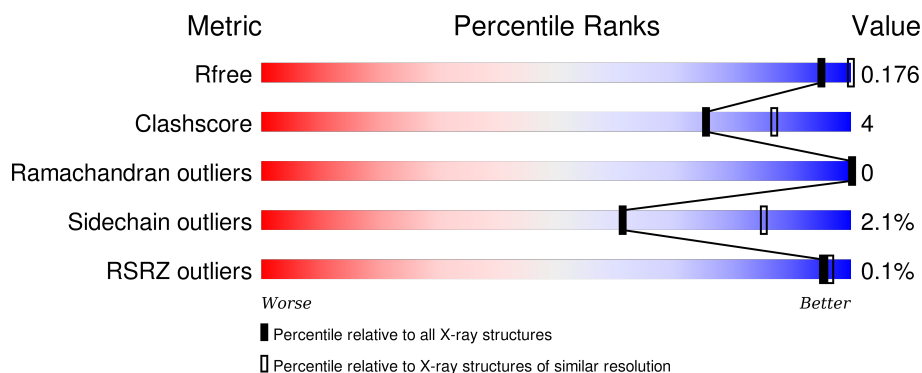
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.65 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	3152 (2.70-2.62)
Clashscore	102246	3524 (2.70-2.62)
Ramachandran outliers	100387	3469 (2.70-2.62)
Sidechain outliers	100360	3469 (2.70-2.62)
RSRZ outliers	91569	3161 (2.70-2.62)

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	354	<div> <div>88%</div> <div>8% 5%</div> </div>
1	B	354	<div> <div>86%</div> <div>9% 5%</div> </div>
1	C	354	<div> <div>84%</div> <div>11% . .</div> </div>
1	D	354	<div> <div>86%</div> <div>9% 5%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 12192 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 ESTERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	338	Total	C	N	O	S	0	2	0
			2610	1664	441	496	9			
1	B	337	Total	C	N	O	S	0	3	0
			2614	1666	442	497	9			
1	C	339	Total	C	N	O	S	0	4	0
			2638	1679	449	501	9			
1	D	338	Total	C	N	O	S	0	3	0
			2618	1668	443	498	9			

There are 68 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-16	GLY	-	EXPRESSION TAG	UNP Q88Y25
A	-15	GLY	-	EXPRESSION TAG	UNP Q88Y25
A	-14	SER	-	EXPRESSION TAG	UNP Q88Y25
A	-13	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-12	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-11	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-10	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-9	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-8	HIS	-	EXPRESSION TAG	UNP Q88Y25
A	-7	GLY	-	EXPRESSION TAG	UNP Q88Y25
A	-6	GLU	-	EXPRESSION TAG	UNP Q88Y25
A	-5	ASN	-	EXPRESSION TAG	UNP Q88Y25
A	-4	LEU	-	EXPRESSION TAG	UNP Q88Y25
A	-3	TYR	-	EXPRESSION TAG	UNP Q88Y25
A	-2	PHE	-	EXPRESSION TAG	UNP Q88Y25
A	-1	GLN	-	EXPRESSION TAG	UNP Q88Y25
A	0	GLY	-	EXPRESSION TAG	UNP Q88Y25
B	-16	GLY	-	EXPRESSION TAG	UNP Q88Y25
B	-15	GLY	-	EXPRESSION TAG	UNP Q88Y25
B	-14	SER	-	EXPRESSION TAG	UNP Q88Y25
B	-13	HIS	-	EXPRESSION TAG	UNP Q88Y25

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-12	HIS	-	EXPRESSION TAG	UNP Q88Y25
B	-11	HIS	-	EXPRESSION TAG	UNP Q88Y25
B	-10	HIS	-	EXPRESSION TAG	UNP Q88Y25
B	-9	HIS	-	EXPRESSION TAG	UNP Q88Y25
B	-8	HIS	-	EXPRESSION TAG	UNP Q88Y25
B	-7	GLY	-	EXPRESSION TAG	UNP Q88Y25
B	-6	GLU	-	EXPRESSION TAG	UNP Q88Y25
B	-5	ASN	-	EXPRESSION TAG	UNP Q88Y25
B	-4	LEU	-	EXPRESSION TAG	UNP Q88Y25
B	-3	TYR	-	EXPRESSION TAG	UNP Q88Y25
B	-2	PHE	-	EXPRESSION TAG	UNP Q88Y25
B	-1	GLN	-	EXPRESSION TAG	UNP Q88Y25
B	0	GLY	-	EXPRESSION TAG	UNP Q88Y25
C	-16	GLY	-	EXPRESSION TAG	UNP Q88Y25
C	-15	GLY	-	EXPRESSION TAG	UNP Q88Y25
C	-14	SER	-	EXPRESSION TAG	UNP Q88Y25
C	-13	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-12	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-11	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-10	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-9	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-8	HIS	-	EXPRESSION TAG	UNP Q88Y25
C	-7	GLY	-	EXPRESSION TAG	UNP Q88Y25
C	-6	GLU	-	EXPRESSION TAG	UNP Q88Y25
C	-5	ASN	-	EXPRESSION TAG	UNP Q88Y25
C	-4	LEU	-	EXPRESSION TAG	UNP Q88Y25
C	-3	TYR	-	EXPRESSION TAG	UNP Q88Y25
C	-2	PHE	-	EXPRESSION TAG	UNP Q88Y25
C	-1	GLN	-	EXPRESSION TAG	UNP Q88Y25
C	0	GLY	-	EXPRESSION TAG	UNP Q88Y25
D	-16	GLY	-	EXPRESSION TAG	UNP Q88Y25
D	-15	GLY	-	EXPRESSION TAG	UNP Q88Y25
D	-14	SER	-	EXPRESSION TAG	UNP Q88Y25
D	-13	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-12	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-11	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-10	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-9	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-8	HIS	-	EXPRESSION TAG	UNP Q88Y25
D	-7	GLY	-	EXPRESSION TAG	UNP Q88Y25
D	-6	GLU	-	EXPRESSION TAG	UNP Q88Y25
D	-5	ASN	-	EXPRESSION TAG	UNP Q88Y25

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-4	LEU	-	EXPRESSION TAG	UNP Q88Y25
D	-3	TYR	-	EXPRESSION TAG	UNP Q88Y25
D	-2	PHE	-	EXPRESSION TAG	UNP Q88Y25
D	-1	GLN	-	EXPRESSION TAG	UNP Q88Y25
D	0	GLY	-	EXPRESSION TAG	UNP Q88Y25


- Molecule 2 is water.

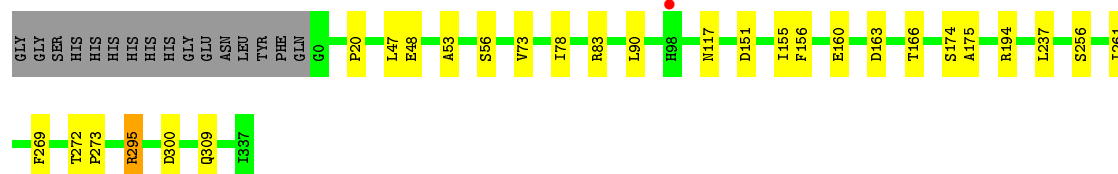
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	473	Total O 473 473	0	0
2	B	457	Total O 457 457	0	0
2	C	447	Total O 447 447	0	0
2	D	335	Total O 335 335	0	0

### 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 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.

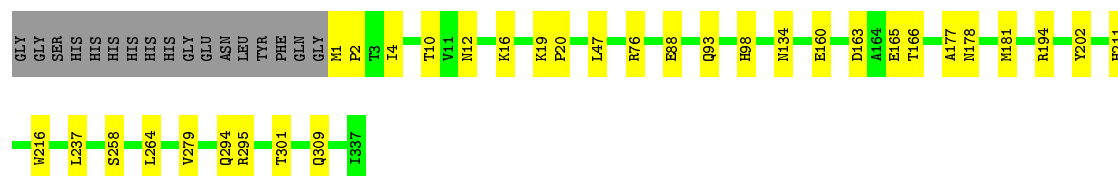
#### • Molecule 1: ESTERASE

Chain A: 




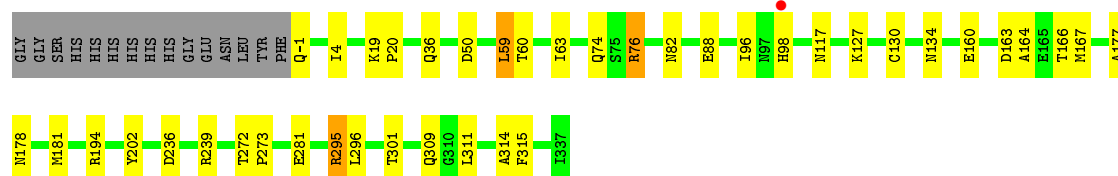
#### • Molecule 1: ESTERASE

Chain B: 



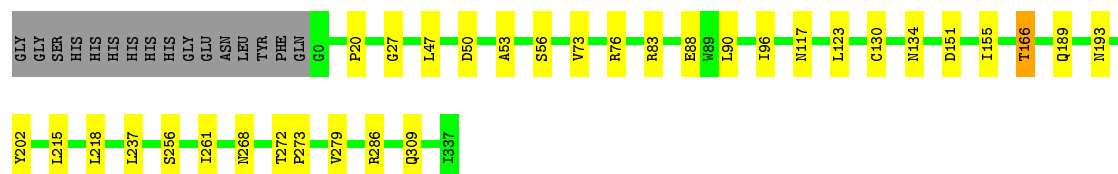
#### • Molecule 1: ESTERASE

Chain C: 



#### • Molecule 1: ESTERASE

Chain D: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	168.34Å 168.34Å 184.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	53.68 – 2.65 53.68 – 2.65	Depositor EDS
% Data completeness (in resolution range)	100.0 (53.68-2.65) 97.8 (53.68-2.65)	Depositor EDS
$R_{merge}$	0.16	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.21 (at 2.65Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, $R_{free}$	0.137 , 0.175 0.138 , 0.176	Depositor DCC
$R_{free}$ test set	3643 reflections (5.02%)	DCC
Wilson B-factor (Å <sup>2</sup> )	23.9	Xtriage
Anisotropy	0.428	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 52.7	EDS
Estimated twinning fraction	0.030 for -H,K,-L 0.029 for -h,k,-l	Xtriage
Reported twinning fraction	0.030 for -H,K,-L	Depositor
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 74256 reflections	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	12192	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.46% 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 [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	0.32	0/2675	0.49	0/3671
1	B	0.32	0/2679	0.49	0/3677
1	C	0.32	0/2703	0.49	0/3708
1	D	0.31	0/2683	0.48	0/3682
All	All	0.32	0/10740	0.49	0/14738

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	2610	0	2551	14	0
1	B	2614	0	2553	21	2
1	C	2638	0	2577	30	0
1	D	2618	0	2556	17	1
2	A	473	0	0	3	0
2	B	457	0	0	8	3
2	C	447	0	0	8	1
2	D	335	0	0	4	5
All	All	12192	0	10237	81	6

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 4.



The worst 5 of 81 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:C:166:THR:O	1:C:194[B]:ARG:NH1	2.05	0.89
1:C:163:ASP:O	1:C:194[B]:ARG:NH2	2.09	0.85
1:B:178:ASN:HA	1:B:181:MET:HE3	1.77	0.67
1:C:98:HIS:O	1:C:167:MET:N	2.28	0.66
1:B:47:LEU:HD13	1:B:237:LEU:HD11	1.78	0.65

The worst 5 of 6 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1:MET:N	2:D:2320:HOH:O[3_655]	2.15	0.05
2:C:2126:HOH:O	2:D:2113:HOH:O[8_454]	2.15	0.05
2:B:2083:HOH:O	2:D:2147:HOH:O[3_655]	2.16	0.04
1:B:93:GLN:O	2:D:2092:HOH:O[3_655]	2.18	0.02
1:D:50:ASP:OD2	2:B:2289:HOH:O[4_565]	2.19	0.01

## 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	338/354 (96%)	331 (98%)	7 (2%)	0	100	100
1	B	338/354 (96%)	333 (98%)	5 (2%)	0	100	100
1	C	341/354 (96%)	333 (98%)	8 (2%)	0	100	100
1	D	339/354 (96%)	332 (98%)	7 (2%)	0	100	100
All	All	1356/1416 (96%)	1329 (98%)	27 (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	280/291 (96%)	276 (99%)	4 (1%)	74	91
1	B	281/291 (97%)	277 (99%)	4 (1%)	74	91
1	C	283/291 (97%)	274 (97%)	9 (3%)	46	74
1	D	281/291 (97%)	275 (98%)	6 (2%)	61	85
All	All	1125/1164 (97%)	1102 (98%)	23 (2%)	61	86

5 of 23 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	50	ASP
1	C	76	ARG
1	D	215	LEU
1	C	59	LEU
1	C	117	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	268	ASN
1	C	198	GLN

### 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 [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	338/354 (95%)	-0.89	1 (0%) 94 95	11, 19, 43, 67	0
1	B	337/354 (95%)	-0.88	0 100 100	10, 19, 44, 89	0
1	C	339/354 (95%)	-0.82	1 (0%) 94 95	11, 20, 47, 85	0
1	D	338/354 (95%)	-0.71	0 100 100	11, 27, 58, 73	0
All	All	1352/1416 (95%)	-0.82	2 (0%) 95 96	10, 21, 50, 89	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	98	HIS	3.1
1	A	98	HIS	2.5

### 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.