



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 22, 2020 – 06:47 pm BST

PDB ID : 5E5L  
Title : Crystal structure of Mycobacterium tuberculosis L,D-transpeptidase 1 at 1.89 Angstrom  
Authors : Kumar, P.; Lamichhane, G.; Ginell, S.L.  
Deposited on : 2015-10-08  
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  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
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

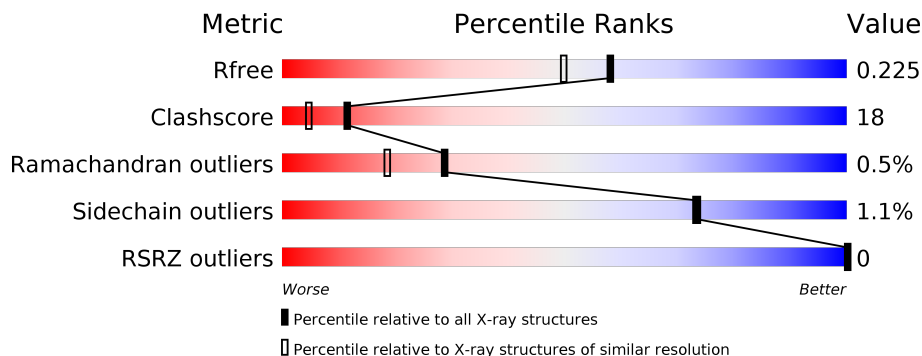
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.89 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))
$R_{free}$	130704	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (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 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	223	
1	B	223	
1	C	223	
1	D	223	

## 2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 6224 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 L,D-transpeptidase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	190	1445	913	263	265	4	0	0	0
1	B	200	1512	959	274	275	4	0	0	0
1	C	190	1440	910	259	267	4	0	0	0
1	D	192	1469	928	267	270	4	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	29	GLY	-	expression tag	UNP O53638
A	30	HIS	-	expression tag	UNP O53638
A	31	MET	-	expression tag	UNP O53638
B	29	GLY	-	expression tag	UNP O53638
B	30	HIS	-	expression tag	UNP O53638
B	31	MET	-	expression tag	UNP O53638
C	29	GLY	-	expression tag	UNP O53638
C	30	HIS	-	expression tag	UNP O53638
C	31	MET	-	expression tag	UNP O53638
D	29	GLY	-	expression tag	UNP O53638
D	30	HIS	-	expression tag	UNP O53638
D	31	MET	-	expression tag	UNP O53638

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	99	Total	O	0	0
			99	99		
2	B	67	Total	O	0	0
			67	67		

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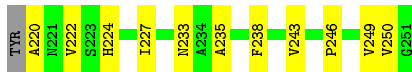
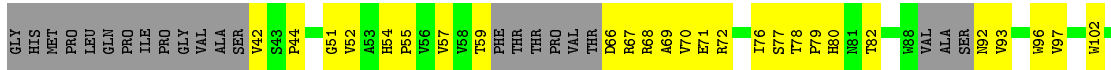
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>	<b>ZeroOcc</b>	<b>AltConf</b>
2	C	87	Total O 87 87	0	0
2	D	105	Total O 105 105	0	0





- Molecule 1: L,D-transpeptidase 1

Chain D: 56% 30% 14%



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	57.73Å 57.73Å 256.60Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	24.54 – 1.89 24.54 – 1.89	Depositor EDS
% Data completeness (in resolution range)	93.2 (24.54-1.89) 92.8 (24.54-1.89)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	8.34 (at 1.89Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, $R_{free}$	0.208 , 0.257 0.180 , 0.225	Depositor DCC
$R_{free}$ test set	1940 reflections (2.72%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	16.4	Xtriage
Anisotropy	0.101	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 46.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.33$ , $\langle L^2 \rangle = 0.16$	Xtriage
Estimated twinning fraction	0.478 for -h,-k,l 0.499 for h,-h-k,-l 0.478 for -k,-h,-l	Xtriage
Reported twinning fraction	0.500 for -h,-k,l	Depositor
Outliers	0 of 71320 reflections	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	6224	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	17.0	wwPDB-VP

Xtriage'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	0/1483	0.66	0/2030
1	B	0.48	0/1555	0.69	0/2131
1	C	0.51	0/1479	0.70	1/2026 (0.0%)
1	D	0.50	0/1509	0.71	0/2066
All	All	0.49	0/6026	0.69	1/8253 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	192	LEU	CA-CB-CG	5.29	127.47	115.30

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	1445	0	1408	52	0
1	B	1512	0	1471	55	0
1	C	1440	0	1397	50	0
1	D	1469	0	1421	52	0
2	A	99	0	0	10	3
2	B	67	0	0	6	3
2	C	87	0	0	12	1
2	D	105	0	0	16	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	6224	0	5697	203	4

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 18.

The worst 5 of 203 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:193:THR:H	1:B:81:ASN:HD21	1.18	0.92
1:D:92:ASN:ND2	2:D:301:HOH:O	1.90	0.90
1:D:207:VAL:HG22	1:D:227:ILE:HD11	1.57	0.84
1:C:49:VAL:HG22	1:C:120:GLU:HB3	1.61	0.83
1:D:92:ASN:OD1	2:D:303:HOH:O	1.99	0.80

All (4) 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)
2:B:358:HOH:O	2:D:334:HOH:O[1_455]	2.08	0.12
2:A:368:HOH:O	2:B:327:HOH:O[3_454]	2.11	0.09
2:A:336:HOH:O	2:B:308:HOH:O[3_454]	2.13	0.07
2:A:371:HOH:O	2:C:382:HOH:O[1_545]	2.14	0.06

## 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	182/223 (82%)	174 (96%)	7 (4%)	1 (0%)	29 18
1	B	188/223 (84%)	176 (94%)	11 (6%)	1 (0%)	29 18
1	C	182/223 (82%)	174 (96%)	7 (4%)	1 (0%)	29 18

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	182/223 (82%)	171 (94%)	10 (6%)	1 (0%)	29	18
All	All	734/892 (82%)	695 (95%)	35 (5%)	4 (0%)	29	18

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	101	TYR
1	B	224	HIS
1	D	250	VAL
1	C	250	VAL

### 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	157/186 (84%)	156 (99%)	1 (1%)	86	87
1	B	165/186 (89%)	164 (99%)	1 (1%)	86	87
1	C	158/186 (85%)	155 (98%)	3 (2%)	57	53
1	D	160/186 (86%)	158 (99%)	2 (1%)	69	68
All	All	640/744 (86%)	633 (99%)	7 (1%)	73	73

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	87	GLU
1	D	146	ARG
1	C	242	THR
1	B	106	THR
1	D	52	VAL

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

Mol	Chain	Res	Type
1	A	81	ASN
1	B	81	ASN
1	C	81	ASN
1	C	221	ASN

### 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	190/223 (85%)	-0.59	0 100 100	9, 16, 25, 37	0
1	B	200/223 (89%)	-0.55	0 100 100	9, 17, 32, 45	0
1	C	190/223 (85%)	-0.61	0 100 100	10, 16, 24, 41	0
1	D	192/223 (86%)	-0.58	0 100 100	9, 16, 29, 34	0
All	All	772/892 (86%)	-0.58	0 100 100	9, 16, 28, 45	0

There are no RSRZ outliers to report.

### 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.