Full wwPDB X-ray Structure Validation Report (i)

Sep 19, 2023 – 08:29 PM EDT

PDB ID	:	5I52
Title	:	Crystal structure of TEM1 beta-lactamase mutant I263N
Authors	:	Roose, B.W.; Dmochowski, I.J.
Deposited on	:	2016-02-13
Resolution	:	1.75 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

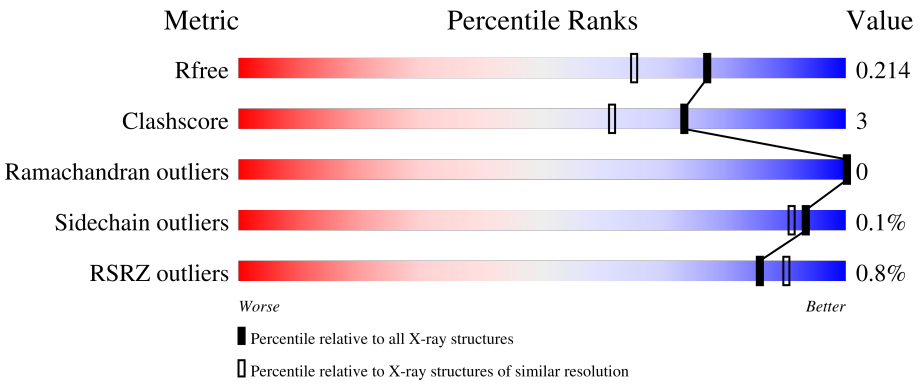
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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 of the lower bar indicate the fraction of residues that contain outliers for >=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 <=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	263	93% 7%
1	B	263	% 90% 10%
1	C	263	94% 5%
1	D	263	% 91% 9%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 8848 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 Beta-lactamase TEM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	263	2003	1250	355	388	10	0	1	0
1	B	263	2016	1255	359	392	10	0	2	0
1	C	263	2015	1258	358	389	10	0	2	0
1	D	263	2008	1251	358	389	10	0	2	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	182	THR	MET	engineered mutation	UNP P62593
A	263	ASN	ILE	engineered mutation	UNP P62593
B	182	THR	MET	engineered mutation	UNP P62593
B	263	ASN	ILE	engineered mutation	UNP P62593
C	182	THR	MET	engineered mutation	UNP P62593
C	263	ASN	ILE	engineered mutation	UNP P62593
D	182	THR	MET	engineered mutation	UNP P62593
D	263	ASN	ILE	engineered mutation	UNP P62593

- Molecule 2 is water.

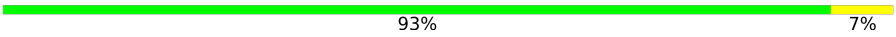
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	200	200	200	0	0
2	B	200	200	200	0	0
2	C	211	211	211	0	0
2	D	195	195	195	0	0

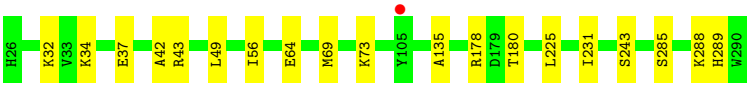
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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: Beta-lactamase TEM

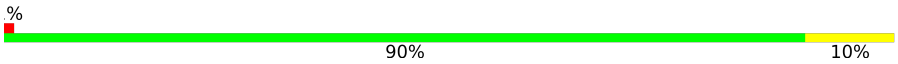
Chain A:





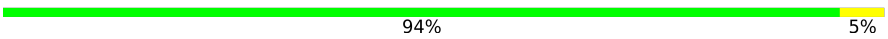
• Molecule 1: Beta-lactamase TEM

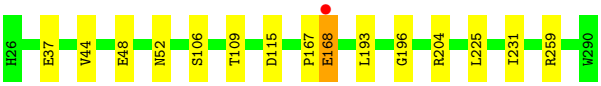
Chain B:



• Molecule 1: Beta-lactamase TEM

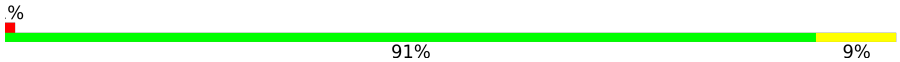
Chain C:

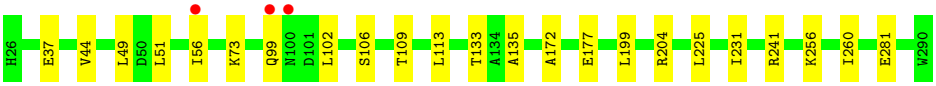




• Molecule 1: Beta-lactamase TEM

Chain D:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	59.99Å 83.51Å 95.78Å 90.00° 90.06° 90.00°	Depositor
Resolution (Å)	62.95 – 1.75 62.95 – 1.75	Depositor EDS
% Data completeness (in resolution range)	98.3 (62.95-1.75) 97.9 (62.95-1.75)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.29 (at 1.75Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.174 , 0.218 0.169 , 0.214	Depositor DCC
R_{free} test set	4643 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	11.9	Xtriage
Anisotropy	1.001	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 28.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.28$	Xtriage
Estimated twinning fraction	0.213 for h,-k,-l	Xtriage
Reported twinning fraction	0.210 for h,-k,-l	Depositor
Outliers	2 of 93461 reflections (0.002%)	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8848	wwPDB-VP
Average B, all atoms (Å^2)	14.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 41.05 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.4980e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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	0.34	0/2037	0.51	0/2764
1	B	0.45	1/2053 (0.0%)	0.62	2/2785 (0.1%)
1	C	0.35	0/2057	0.52	0/2788
1	D	0.47	4/2050 (0.2%)	0.54	0/2780
All	All	0.40	5/8197 (0.1%)	0.55	2/11117 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	281	GLU	CD-OE1	-8.36	1.16	1.25
1	B	204	ARG	CZ-NH1	-6.63	1.24	1.33
1	D	256	LYS	C-O	-5.29	1.13	1.23
1	D	177	GLU	C-O	-5.10	1.13	1.23
1	D	177	GLU	CD-OE2	-5.02	1.20	1.25

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	204	ARG	NE-CZ-NH2	13.80	127.20	120.30
1	B	204	ARG	NE-CZ-NH1	-6.74	116.93	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	82[A]	SER	Mainchain

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	2003	0	1975	10	0
1	B	2016	0	1997	20	0
1	C	2015	0	2006	9	0
1	D	2008	0	1989	14	0
2	A	200	0	0	1	0
2	B	200	0	0	3	0
2	C	211	0	0	0	0
2	D	195	0	0	0	0
All	All	8848	0	7967	52	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 3.

All (52) 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:D:99:GLN:HE22	1:D:113:LEU:HD13	0.96	1.07
1:D:99:GLN:NE2	1:D:113:LEU:HD13	1.80	0.96
1:D:99:GLN:HE22	1:D:113:LEU:CD1	1.81	0.92
1:D:49:LEU:HD22	1:D:56:ILE:HD12	1.74	0.68
1:B:32:LYS:HE2	1:B:281:GLU:HB3	1.78	0.65
1:B:32:LYS:HD2	1:B:32:LYS:O	1.97	0.64
1:B:47:ILE:HG21	1:B:187:ALA:HB2	1.79	0.62
1:D:172:ALA:O	1:D:241:ARG:HD2	2.01	0.60
1:D:99:GLN:NE2	1:D:113:LEU:CD1	2.56	0.54
1:A:225:LEU:HD11	1:A:231:ILE:HB	1.90	0.54
1:B:32:LYS:HD2	1:B:32:LYS:C	2.27	0.54
1:C:167:PRO:HD2	1:C:168:GLU:OE2	2.08	0.54
1:B:164:ARG:NH1	1:B:171:GLU:OE1	2.37	0.53
1:B:191:ARG:O	1:B:195:THR:HG22	2.09	0.52
1:D:102:LEU:HD23	1:D:133:THR:HG21	1.90	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:37:GLU:HG3	1:B:42:ALA:O	2.10	0.51
1:A:288:LYS:HD3	1:A:289:HIS:NE2	2.26	0.50
1:B:215:LYS:HE3	2:B:344:HOH:O	2.12	0.50
1:C:196:GLY:O	1:C:204:ARG:NH1	2.45	0.50
1:D:106:SER:HB3	1:D:109:THR:OG1	2.14	0.47
1:D:49:LEU:HD22	1:D:56:ILE:CD1	2.42	0.47
1:C:193:LEU:O	1:C:204:ARG:HG2	2.15	0.46
1:D:73:LYS:HE2	1:D:135:ALA:HB2	1.98	0.46
1:B:206:GLN:NE2	2:B:302:HOH:O	2.32	0.45
1:D:199:LEU:HB2	1:D:204:ARG:HG3	1.99	0.45
1:C:52:ASN:HD22	1:C:52:ASN:N	2.14	0.45
1:D:51:LEU:HD13	1:D:260:ILE:HG13	1.97	0.45
1:C:37:GLU:HG2	1:C:44:VAL:HG23	1.99	0.45
1:A:73:LYS:HE2	1:A:135:ALA:HB2	1.98	0.45
1:A:49:LEU:HD13	1:A:56:ILE:HD13	1.99	0.45
1:B:47:ILE:HG22	1:B:262:VAL:HB	1.98	0.44
1:B:243[B]:SER:HB3	1:B:266:THR:HG1	1.83	0.44
1:B:28:GLU:OE2	2:B:301:HOH:O	2.21	0.44
1:B:107:PRO:O	1:B:111:LYS:HE3	2.18	0.44
1:C:106:SER:HB3	1:C:109:THR:OG1	2.17	0.44
1:C:48:GLU:OE2	1:C:259:ARG:NH1	2.46	0.43
1:A:69:MET:SD	1:A:243[A]:SER:HB3	2.58	0.43
1:B:199:LEU:O	1:B:204:ARG:HD3	2.17	0.43
1:A:37:GLU:HG3	1:A:42:ALA:O	2.19	0.43
1:A:32:LYS:HG3	1:A:285:SER:HB2	2.00	0.43
1:A:43:ARG:HD2	1:A:64:GLU:OE1	2.18	0.43
1:D:225:LEU:HD11	1:D:231:ILE:HB	2.02	0.42
1:A:34:LYS:NZ	1:C:115:ASP:OD2	2.48	0.42
1:C:225:LEU:HD11	1:C:231:ILE:HB	2.02	0.41
2:A:464:HOH:O	1:B:153:HIS:HD2	2.03	0.41
1:B:47:ILE:HG21	1:B:187:ALA:CB	2.48	0.41
1:B:225:LEU:HA	1:B:226:PRO:HD3	1.92	0.41
1:B:26:HIS:HE1	1:B:28:GLU:HG2	1.85	0.41
1:D:37:GLU:HG2	1:D:44:VAL:HG23	2.03	0.41
1:B:32:LYS:HD2	1:B:32:LYS:HA	1.78	0.41
1:A:178:ARG:O	1:A:180:THR:HG23	2.21	0.40
1:B:51:LEU:HD13	1:B:260:ILE:HG12	2.03	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	262/263 (100%)	256 (98%)	6 (2%)	0	100	100
1	B	263/263 (100%)	259 (98%)	4 (2%)	0	100	100
1	C	263/263 (100%)	258 (98%)	5 (2%)	0	100	100
1	D	263/263 (100%)	257 (98%)	6 (2%)	0	100	100
All	All	1051/1052 (100%)	1030 (98%)	21 (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	209/217 (96%)	209 (100%)	0	100	100
1	B	214/217 (99%)	214 (100%)	0	100	100
1	C	213/217 (98%)	212 (100%)	1 (0%)	88	83
1	D	212/217 (98%)	212 (100%)	0	100	100
All	All	848/868 (98%)	847 (100%)	1 (0%)	93	91

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	168	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such

sidechains are listed below:

Mol	Chain	Res	Type
1	C	52	ASN
1	D	99	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 monosaccharides 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, 95th 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^2)	Q<0.9
1	A	263/263 (100%)	-0.12	1 (0%)	92	94	7, 13, 23, 32	0
1	B	263/263 (100%)	-0.13	3 (1%)	80	86	8, 13, 23, 43	0
1	C	263/263 (100%)	-0.19	1 (0%)	92	94	7, 12, 20, 32	0
1	D	263/263 (100%)	-0.11	3 (1%)	80	86	7, 12, 22, 42	0
All	All	1052/1052 (100%)	-0.14	8 (0%)	86	90	7, 13, 22, 43	0

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	99	GLN	4.5
1	B	100	ASN	3.7
1	D	100	ASN	2.9
1	B	105	TYR	2.4
1	D	56	ILE	2.1
1	A	105	TYR	2.1
1	B	198	LEU	2.1
1	C	168	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 monosaccharides 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.