Full wwPDB X-ray Structure Validation Report ⓘ

May 3, 2025 – 09:38 AM EDT

PDB ID	:	3W4Q / pdb_00003w4q
Title	:	Crystal structure of PenA beta-lactamase from Burkholderia multivorans at pH4.2
Authors	:	Nukaga, M.; Ohuchi, N.; Papp-Wallace, K.M.; Taracila, M.A.; Bonomo, R.A.
Deposited on	:	2013-01-10
Resolution	:	1.20 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 ⓘ 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 ⓘ) were used in the production of this report:

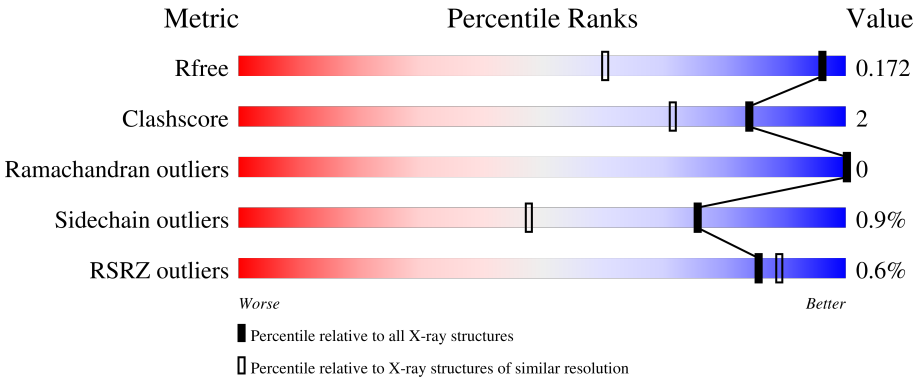
MolProbity	:	4-5-2 with Phenix2.0rc1
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

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 1.20 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}	164625	1079 (1.20-1.20)
Clashscore	180529	1183 (1.20-1.20)
Ramachandran outliers	177936	1146 (1.20-1.20)
Sidechain outliers	177891	1146 (1.20-1.20)
RSRZ outliers	164620	1078 (1.20-1.20)

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	258	90% 10%
1	B	258	% 89% 10%
1	C	258	% 93% 7%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 6968 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.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	S	0	19	0
			2019	1264	364	381	10			
1	B	258	Total	C	N	O	S	0	15	0
			2004	1253	366	376	9			
1	C	258	Total	C	N	O	S	0	18	0
			2016	1262	364	380	10			

- Molecule 2 is water.

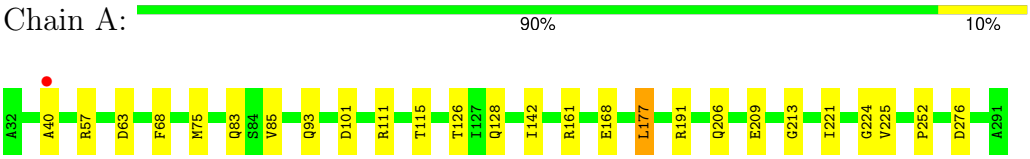
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	299	Total	O	0	0
			299	299		
2	B	312	Total	O	0	0
			312	312		
2	C	318	Total	O	0	0
			318	318		

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.

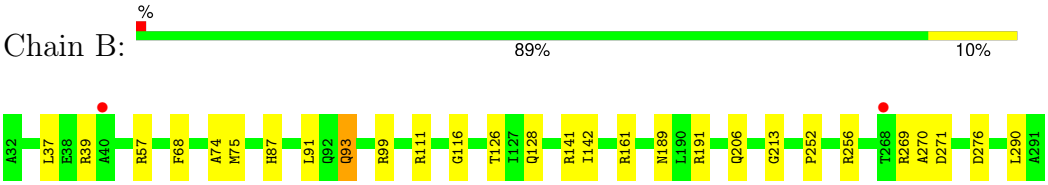
• Molecule 1: Beta-lactamase

Chain A:



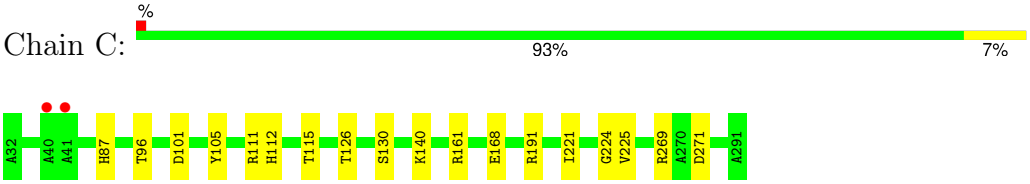
• Molecule 1: Beta-lactamase

Chain B:



• Molecule 1: Beta-lactamase

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	121.02Å 69.91Å 84.35Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 1.20 15.00 – 1.20	Depositor EDS
% Data completeness (in resolution range)	92.5 (15.00-1.20) 92.3 (15.00-1.20)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.30 (at 1.20Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.132 , 0.175 0.137 , 0.172	Depositor DCC
R_{free} test set	6189 reflections (3.02%)	wwPDB-VP
Wilson B-factor (Å^2)	10.7	Xtriage
Anisotropy	0.350	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 56.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.027 for -1/2*h-3/2*k,-1/2*h+1/2*k,-l 0.028 for -1/2*h+3/2*k,1/2*h+1/2*k,-l 0.488 for 1/2*h-3/2*k,-1/2*h-1/2*k,-l 0.489 for 1/2*h+3/2*k,1/2*h-1/2*k,-l 0.027 for -h,-k,l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	6968	wwPDB-VP
Average B, all atoms (Å^2)	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.92% of the height of the origin peak. No significant pseudotranslation is detected.*

[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	0.83	0/2096	1.39	19/2855 (0.7%)
1	B	0.83	0/2069	1.37	17/2819 (0.6%)
1	C	0.83	0/2093	1.31	13/2849 (0.5%)
All	All	0.83	0/6258	1.36	49/8523 (0.6%)

There are no bond length outliers.

All (49) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	93	GLN	OE1-CD-NE2	10.85	133.45	122.60
1	A	57	ARG	CD-NE-CZ	9.57	137.81	124.40
1	C	161	ARG	NE-CZ-NH1	-9.27	112.23	121.50
1	A	161	ARG	NE-CZ-NH1	-9.16	112.34	121.50
1	B	161	ARG	NE-CZ-NH1	-8.98	112.52	121.50
1	A	161	ARG	NH1-CZ-NH2	8.12	129.86	119.30
1	A	206	GLN	OE1-CD-NE2	7.64	130.24	122.60
1	B	161	ARG	NH1-CZ-NH2	7.25	128.73	119.30
1	B	111	ARG	CD-NE-CZ	6.89	134.05	124.40
1	C	161	ARG	NH1-CZ-NH2	6.63	127.92	119.30
1	A	252	PRO	CB-CA-C	-6.49	105.07	111.17
1	B	68	PHE	CA-CB-CG	6.24	120.03	113.80
1	A	115	THR	CA-C-O	6.18	125.59	118.97
1	A	224	GLY	CA-C-N	6.12	131.24	122.24
1	A	224	GLY	C-N-CA	6.12	131.24	122.24
1	A	93	GLN	OE1-CD-NE2	6.04	128.64	122.60
1	C	115	THR	CA-C-O	6.04	125.78	119.14
1	B	111	ARG	CA-C-O	5.96	126.49	119.28
1	B	189	ASN	OD1-CG-ND2	5.94	128.54	122.60
1	C	111	ARG	CA-C-O	5.94	126.47	119.28
1	C	115	THR	O-C-N	-5.92	114.56	122.49
1	B	99	ARG	CD-NE-CZ	5.91	132.68	124.40
1	B	252	PRO	CB-CA-C	-5.84	105.68	111.17
1	A	40	ALA	N-CA-C	5.81	117.70	111.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	85	VAL	CA-C-N	-5.79	110.29	121.58
1	A	85	VAL	C-N-CA	-5.79	110.29	121.58
1	B	276	ASP	CA-CB-CG	5.77	118.37	112.60
1	A	252	PRO	O-C-N	5.66	123.81	121.15
1	C	111	ARG	CD-NE-CZ	5.63	132.28	124.40
1	B	39	ARG	CA-C-O	5.63	126.39	120.42
1	A	111	ARG	CD-NE-CZ	5.55	132.17	124.40
1	B	142	ILE	N-CA-C	5.55	118.32	112.83
1	A	115	THR	O-C-N	-5.51	115.81	122.48
1	A	63	ASP	CA-CB-CG	-5.50	107.10	112.60
1	C	112	HIS	O-C-N	5.50	129.03	122.21
1	C	224	GLY	CA-C-N	5.32	131.97	122.13
1	C	224	GLY	C-N-CA	5.32	131.97	122.13
1	B	270	ALA	N-CA-C	5.29	117.05	111.28
1	C	140	LYS	CB-CG-CD	5.29	123.47	111.30
1	B	37	LEU	CA-C-O	5.27	126.35	120.82
1	B	206	GLN	OE1-CD-NE2	5.18	127.78	122.60
1	B	87	HIS	CA-C-O	-5.17	113.84	120.83
1	A	85	VAL	CA-C-O	-5.14	115.34	121.05
1	C	105	TYR	CA-CB-CG	-5.13	104.67	113.90
1	A	276	ASP	CA-CB-CG	5.11	117.71	112.60
1	B	57	ARG	NE-CZ-NH2	-5.11	114.60	119.20
1	C	87	HIS	CA-CB-CG	-5.11	108.69	113.80
1	A	68	PHE	CA-CB-CG	5.10	118.90	113.80
1	C	112	HIS	CA-C-O	-5.05	115.17	120.32

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	2019	0	2035	13	0
1	B	2004	0	2019	10	0
1	C	2016	0	2035	8	0
2	A	299	0	0	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	312	0	0	6	0
2	C	318	0	0	2	0
All	All	6968	0	6089	27	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.

All (27) 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:B:75[A]:MET:HG2	2:B:605:HOH:O	1.84	0.77
1:C:96[A]:THR:HG23	2:C:480:HOH:O	1.92	0.69
1:B:93:GLN:HB3	1:B:141[B]:ARG:NH1	2.09	0.66
1:A:191[A]:ARG:HD3	2:A:580:HOH:O	1.99	0.63
1:B:116:GLY:HA2	2:B:500:HOH:O	2.04	0.57
1:C:269:ARG:HH21	1:C:271:ASP:CG	2.13	0.56
1:B:191[B]:ARG:HD3	2:B:538:HOH:O	2.08	0.54
1:C:191[C]:ARG:HD3	2:C:608:HOH:O	2.07	0.52
1:A:221:ILE:O	1:A:225[B]:VAL:HG23	2.12	0.49
1:A:168:GLU:HG3	2:A:579:HOH:O	2.11	0.49
1:A:168:GLU:OE1	1:C:101:ASP:OD1	2.31	0.48
1:B:74:ALA:HB3	2:B:605:HOH:O	2.15	0.46
1:A:101:ASP:HA	1:C:168[A]:GLU:OE1	2.15	0.46
1:A:101:ASP:OD1	1:C:168[A]:GLU:OE1	2.35	0.45
1:A:209[A]:GLU:HG2	2:A:377:HOH:O	2.16	0.45
1:B:269:ARG:NH1	1:B:271:ASP:OD1	2.50	0.44
1:A:177:LEU:N	1:A:177:LEU:HD23	2.33	0.44
1:B:91:LEU:HG	2:B:415:HOH:O	2.19	0.43
1:A:83[B]:GLN:OE1	1:A:142:ILE:HG22	2.18	0.43
1:A:177:LEU:HD22	2:A:435:HOH:O	2.18	0.42
1:C:221:ILE:O	1:C:225[B]:VAL:HG23	2.20	0.42
1:B:256[A]:ARG:NH2	1:B:290:LEU:O	2.52	0.41
1:B:256[A]:ARG:NH1	2:B:541:HOH:O	2.49	0.41
1:A:168:GLU:OE1	1:C:101:ASP:HA	2.22	0.40
1:A:128[B]:GLN:NE2	1:A:213:GLY:HA3	2.36	0.40
1:B:128[B]:GLN:NE2	1:B:213:GLY:HA3	2.36	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	275/258 (107%)	271 (98%)	4 (2%)	0	100	100
1	B	271/258 (105%)	268 (99%)	3 (1%)	0	100	100
1	C	274/258 (106%)	271 (99%)	3 (1%)	0	100	100
All	All	820/774 (106%)	810 (99%)	10 (1%)	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	205/193 (106%)	203 (99%)	2 (1%)	73	43
1	B	202/193 (105%)	201 (100%)	1 (0%)	86	65
1	C	204/193 (106%)	202 (99%)	2 (1%)	73	43
All	All	611/579 (106%)	606 (99%)	5 (1%)	75	52

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	126	THR
1	A	177	LEU
1	B	126	THR
1	C	126	THR
1	C	130	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	170	ASN
1	A	203	GLN
1	A	206	GLN
1	A	267	GLN
1	B	87	HIS
1	B	203	GLN
1	B	206	GLN
1	C	203	GLN
1	C	206	GLN
1	C	267	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 oligosaccharides 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^{th} 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	258/258 (100%)	-0.68	1 (0%)	89	91	7, 15, 27, 39	19 (7%)
1	B	258/258 (100%)	-0.68	2 (0%)	82	86	7, 15, 27, 39	15 (5%)
1	C	258/258 (100%)	-0.68	2 (0%)	82	86	7, 15, 27, 37	18 (6%)
All	All	774/774 (100%)	-0.68	5 (0%)	85	89	7, 15, 27, 39	52 (6%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	40	ALA	8.0
1	B	40	ALA	5.4
1	A	40	ALA	4.8
1	C	41	ALA	2.4
1	B	268	THR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.