



Full wwPDB X-ray Structure Validation Report

Feb 26, 2014 – 06:01 PM GMT

PDB ID : 4O43
Title : DNA Double-Strand Break Repair Pathway Choice Is Directed by Distinct MRE11 Nuclease Activities
Authors : Shibata, A.; Moiani, D.; Arvai, A.S.; Perry, J.; Harding, S.M.; Genois, M.; Maity, R.; Rossum-Fikkert, S.; Kertokalio, A.; Romoli, F.; Ismail, A.; Ismalaj, E.; Petricci, E.; Neale, M.J.; Bristow, R.G.; Masson, J.; Wyman, C.; Jeggo, P.A.; Tainer, J.A.
Deposited on : 2013-12-18
Resolution : 2.40 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

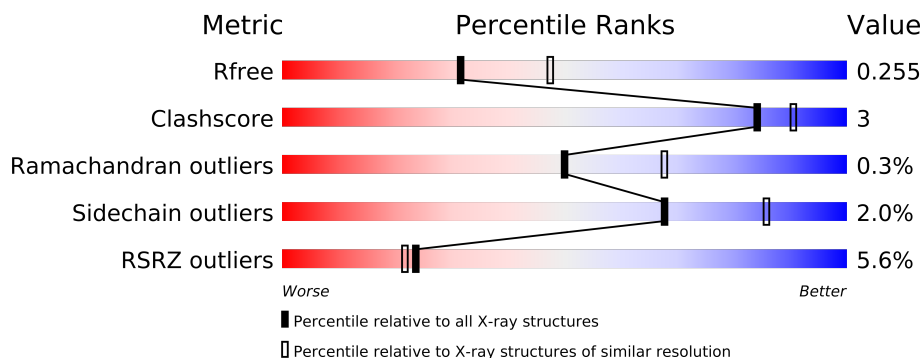
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance



The reported resolution of this entry is 2.40 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}	66092	2207 (2.40-2.40)
Clashscore	79885	2789 (2.40-2.40)
Ramachandran outliers	78287	2736 (2.40-2.40)
Sidechain outliers	78261	2737 (2.40-2.40)
RSRZ outliers	66119	2210 (2.40-2.40)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	336	
1	B	336	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	MN	B	401	-	X
2	MN	B	402	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5321 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Exonuclease, putative.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	331	Total	C	N	O	S	0	1	0
			2633	1694	449	484	6			
1	B	321	Total	C	N	O	S	0	0	0
			2524	1629	423	466	6			

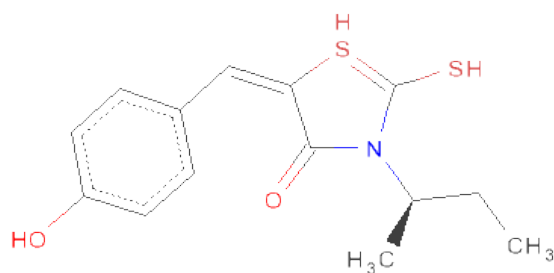
There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-10	GLY	-	EXPRESSION TAG	UNP Q9X1X0
A	-9	SER	-	EXPRESSION TAG	UNP Q9X1X0
A	-8	ASP	-	EXPRESSION TAG	UNP Q9X1X0
A	-7	LYS	-	EXPRESSION TAG	UNP Q9X1X0
A	-6	ILE	-	EXPRESSION TAG	UNP Q9X1X0
A	-5	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	-4	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	-3	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	-2	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	-1	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	0	HIS	-	EXPRESSION TAG	UNP Q9X1X0
A	1	VAL	-	EXPRESSION TAG	UNP Q9X1X0
B	-10	GLY	-	EXPRESSION TAG	UNP Q9X1X0
B	-9	SER	-	EXPRESSION TAG	UNP Q9X1X0
B	-8	ASP	-	EXPRESSION TAG	UNP Q9X1X0
B	-7	LYS	-	EXPRESSION TAG	UNP Q9X1X0
B	-6	ILE	-	EXPRESSION TAG	UNP Q9X1X0
B	-5	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	-4	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	-3	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	-2	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	-1	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	0	HIS	-	EXPRESSION TAG	UNP Q9X1X0
B	1	VAL	-	EXPRESSION TAG	UNP Q9X1X0

- Molecule 2 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	2	Total	Mn	0	0
			2	2		
2	A	2	Total	Mn	0	0
			2	2		

- Molecule 3 is (5E)-3-[(2R)-BUTAN-2-YL]-5-(4-HYDROXYBENZYLIDENE)-2-SULFANYL-3,5-DIHYDRO-4H-1LAMBDA 4 ,3-THIAZOL-4-ONE (three-letter code: 2PW) (formula: C₁₄H₁₇NO₂S₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			19	14	1	2	2		
3	A	1	Total	C	N	O	S	0	0
			19	14	1	2	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	69	Total	O	0	0
			69	69		
4	B	53	Total	O	0	0
			53	53		

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	48.06Å 113.94Å 81.57Å 90.00° 100.31° 90.00°	Depositor
Resolution (Å)	37.88 – 2.40 37.88 – 2.39	Depositor EDS
% Data completeness (in resolution range)	73.2 (37.88-2.40) 72.6 (37.88-2.39)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.66 (at 2.39Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.195 , 0.256 0.196 , 0.255	Depositor DCC
R_{free} test set	1237 reflections (5.00%)	DCC
Wilson B-factor (Å ²)	30.5	Xtriage
Anisotropy	0.343	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 33.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 26056 reflections (0.004%)	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5321	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.85% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MN, 2PW

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	0.20	0/2698	0.36	0/3655
1	B	0.23	0/2580	0.42	0/3495
All	All	0.21	0/5278	0.39	0/7150

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2633	0	0	9	0
1	B	2524	0	0	6	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	38	0	0	0	0
4	A	69	0	0	1	0
4	B	53	0	0	1	0
All	All	5321	0	0	15	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including

hydrogens) of the entry. The overall clashscore for this entry is 3.

All (15) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:246:GLU:O	1:B:264:ARG:NH2	2.24	0.70
1:A:253:GLU:OE1	1:A:261:ARG:NH1	2.35	0.59
1:B:139:TYR:OH	1:B:196:ARG:O	2.21	0.58
1:A:295:PHE:O	1:A:319:ASN:ND2	2.38	0.56
1:A:273:LYS:NZ	4:A:557:HOH:O	2.37	0.56
1:A:261:ARG:NH2	1:A:263:GLU:OE2	2.40	0.55
1:B:222:GLU:OE1	1:B:262:TYR:OH	2.27	0.52
1:A:219:SER:OG	1:A:245:ASP:OD2	2.32	0.48
1:A:177:PHE:O	1:A:213:ALA:N	2.49	0.46
1:A:222:GLU:OE2	1:A:262:TYR:OH	2.36	0.44
1:A:152:ASP:O	1:A:156:PHE:N	2.51	0.43
1:B:137:PHE:N	1:B:178:MET:O	2.51	0.42
1:A:26:ARG:NH2	1:A:314:MET:O	2.53	0.42
1:B:18:GLY:N	4:B:519:HOH:O	2.52	0.42
1:B:149:ASN:OD1	1:B:152:ASP:N	2.52	0.41

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

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	330/336 (98%)	311 (94%)	19 (6%)	0	100	100
1	B	319/336 (95%)	298 (93%)	19 (6%)	2 (1%)	33	47
All	All	649/672 (97%)	609 (94%)	38 (6%)	2 (0%)	50	68

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	315	GLY
1	B	312	ASP

5.3.2 Protein sidechains ⓘ

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	280/298 (94%)	276 (99%)	4 (1%)	78	92
1	B	265/298 (89%)	258 (97%)	7 (3%)	59	79
All	All	545/596 (91%)	534 (98%)	11 (2%)	68	86

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	ASN
1	A	81	MET
1	A	141	ASP
1	A	275	LEU
1	B	38	LEU
1	B	95	ASP
1	B	99	LEU
1	B	142	GLU
1	B	160	ARG
1	B	302	VAL
1	B	310	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
3	2PW	A	403	-	18,20,20	1.73	2 (11%)	22,28,28	3.85	6 (27%)
3	2PW	A	404	-	18,20,20	1.73	2 (11%)	22,28,28	3.74	4 (18%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	2PW	A	403	-	-	0/8/26/26	0/2/2/2
3	2PW	A	404	-	-	0/8/26/26	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	404	2PW	CAO-CAQ	-6.23	1.36	1.48
3	A	403	2PW	CAO-CAQ	-6.20	1.36	1.48
3	A	404	2PW	CAN-CAF	-2.97	1.41	1.46
3	A	403	2PW	CAN-CAF	-2.95	1.41	1.46

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	404	2PW	CAF-CAQ-CAO	12.19	135.93	117.89
3	A	403	2PW	CAF-CAQ-CAO	12.16	135.89	117.89
3	A	403	2PW	CAQ-CAO-NAS	11.77	114.48	110.05
3	A	404	2PW	CAQ-CAO-NAS	11.61	114.42	110.05
3	A	403	2PW	CAR-NAS-CAO	3.20	131.86	124.11
3	A	403	2PW	CAR-NAS-CAP	-2.96	116.27	123.20
3	A	403	2PW	CAO-NAS-CAP	-2.48	111.87	116.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	404	2PW	OAC-CAO-NAS	-2.46	119.94	124.72
3	A	403	2PW	OAC-CAO-NAS	-2.28	120.30	124.72
3	A	404	2PW	CAO-NAS-CAP	-2.16	112.52	116.80

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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, 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	331/336 (98%)	0.10	18 (5%) 25 23	21, 45, 106, 173	0
1	B	321/336 (95%)	0.30	19 (5%) 22 20	22, 49, 109, 218	0
All	All	652/672 (97%)	0.20	37 (5%) 24 21	21, 47, 109, 218	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	190	ALA	19.7
1	B	193	GLU	18.0
1	B	189	TYR	15.3
1	B	191	GLY	14.5
1	B	192	ILE	11.9
1	B	188	GLY	11.4
1	B	143	SER	9.9
1	B	194	GLN	7.9
1	B	187	ALA	7.8
1	A	145	ALA	7.6
1	A	193	GLU	7.4
1	A	192	ILE	7.3
1	A	146	LEU	7.1
1	A	195	GLY	6.1
1	A	191	GLY	5.7
1	B	142	GLU	5.4
1	B	145	ALA	5.1
1	A	-6	ILE	4.8
1	A	143	SER	4.6
1	A	187	ALA	4.5
1	B	195	GLY	4.4
1	B	144	GLU	4.4
1	A	189	TYR	4.3
1	A	142	GLU	3.8

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Mol	Chain	Res	Type	RSRZ
1	B	147	ARG	3.7
1	A	147	ARG	3.5
1	A	144	GLU	3.5
1	B	146	LEU	3.3
1	B	196	ARG	3.2
1	B	141	ASP	2.8
1	A	324	GLU	2.6
1	A	141	ASP	2.5
1	A	188	GLY	2.5
1	B	139	TYR	2.3
1	A	194	GLN	2.3
1	B	95	ASP	2.1
1	A	97	LYS	2.1

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 carbohydrates in this entry.

6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	MN	B	402	1/1	0.27	4.01	60,60,60,60	1
2	MN	B	401	1/1	0.16	2.13	73,73,73,73	1
3	2PW	A	403	19/19	0.23	1.88	58,73,98,130	0
2	MN	A	402	1/1	0.19	1.77	52,52,52,52	1
3	2PW	A	404	19/19	0.19	1.14	50,66,88,97	0
2	MN	A	401	1/1	0.17	0.65	57,57,57,57	1

6.5 Other polymers ⓘ

There are no such residues in this entry.