Full wwPDB X-ray Structure Validation Report (i)

Sep 2, 2023 – 11:25 AM EDT

PDB ID	:	3QKS
Title	:	Mre11 Rad50 binding domain bound to Rad50
Authors	:	Williams, G.J.; Williams, R.S.; Arvai, A.; Moncalian, G.; Tainer, J.A.
Deposited on	:	2011-02-01
Resolution	:	2.10 Å(reported)

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

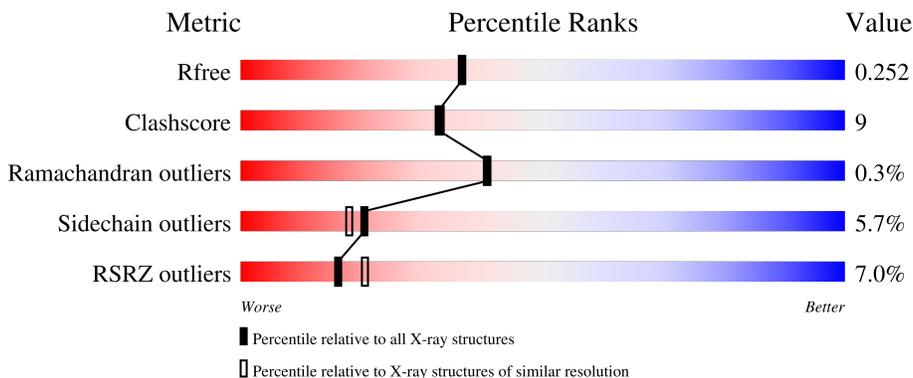|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 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 2.10 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	Percentile Ranks	Value
Rfree		0.252
Clashscore		9
Ramachandran outliers		0.3%
Sidechain outliers		5.7%
RSRZ outliers		7.0%

Worse *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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	203	7% ▬ 85% 11% • •
2	B	179	4% ▬ 77% 19% •
3	C	34	18% ▬ 41% 12% 9% 38%

WORLDWIDE PDB
PROTEIN DATA BANK

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 3481 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 DNA double-strand break repair rad50 ATPase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	199	Total	C	N	O	S	0	0	0
			1618	1034	284	297	3			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	196	GLY	-	expression tag	UNP P58301
A	197	GLY	-	expression tag	UNP P58301
A	198	HIS	-	expression tag	UNP P58301
A	199	HIS	-	expression tag	UNP P58301
A	200	HIS	-	expression tag	UNP P58301
A	201	HIS	-	expression tag	UNP P58301
A	202	HIS	-	expression tag	UNP P58301
A	203	HIS	-	expression tag	UNP P58301

- Molecule 2 is a protein called DNA double-strand break repair rad50 ATPase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	179	Total	C	N	O	S	0	0	0
			1445	923	246	274	2			

- Molecule 3 is a protein called DNA double-strand break repair protein mre11.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	21	Total	C	N	O	0	0	0
			174	119	22	33			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	143	Total	O	0	0
			143	143		

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W O R L D W I D E
wwPDB
PROTEIN DATA BANK

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| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	98	Total O 98 98		0	0
4	C	3	Total O 3 3		0	0

3 Residue-property plots ⓘ

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.
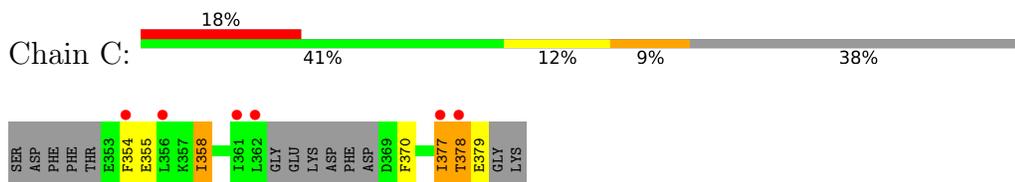
• Molecule 1: DNA double-strand break repair rad50 ATPase
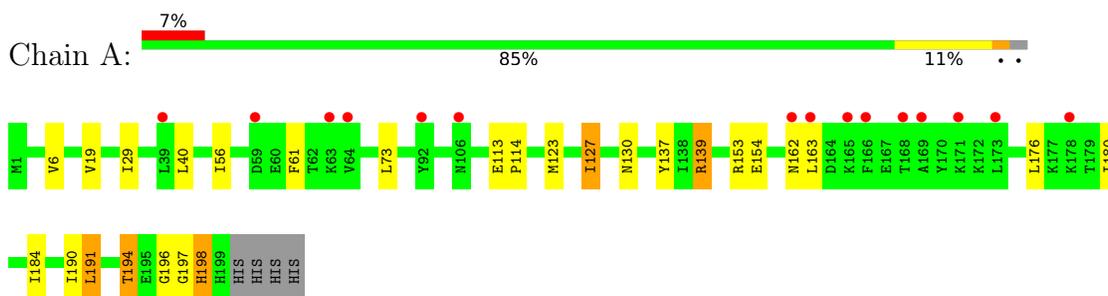
• Molecule 2: DNA double-strand break repair rad50 ATPase
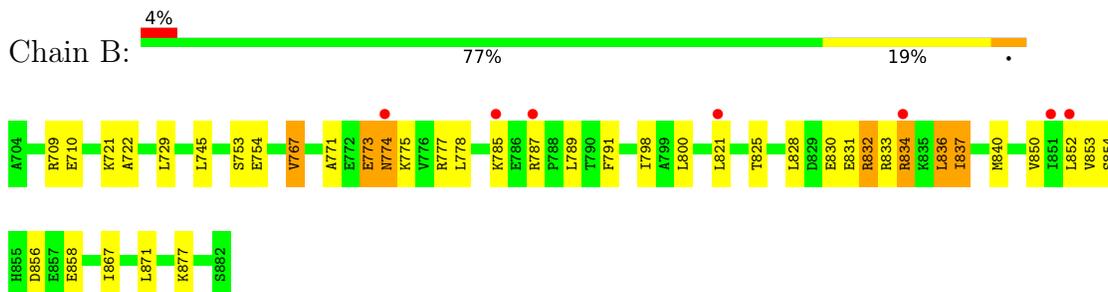
• Molecule 3: DNA double-strand break repair protein mre11

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	55.78Å 91.23Å 107.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.67 – 2.10 38.67 – 2.10	Depositor EDS
% Data completeness (in resolution range)	96.8 (38.67-2.10) 96.8 (38.67-2.10)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.92 (at 2.10Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, R_{free}	0.210 , 0.256 0.204 , 0.252	Depositor DCC
R_{free} test set	1602 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	46.6	Xtriage
Anisotropy	0.151	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 63.9	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	3481	wwPDB-VP
Average B, all atoms (Å^2)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.18% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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 ⓘ

5.1 Standard geometry ⓘ

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	0.24	0/1645	0.41	0/2206
2	B	0.24	0/1463	0.40	0/1961
3	C	0.24	0/175	0.40	0/235
All	All	0.24	0/3283	0.40	0/4402

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 ⓘ

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	1618	0	1666	25	0
2	B	1445	0	1506	38	0
3	C	174	0	172	6	0
4	A	143	0	0	1	0
4	B	98	0	0	3	0
4	C	3	0	0	0	0
All	All	3481	0	3344	57	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 9.

All (57) 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:194:THR:HG22	2:B:709:ARG:HH11	1.17	1.04
2:B:775:LYS:HD3	2:B:777:ARG:HH12	1.46	0.80
1:A:194:THR:HG22	2:B:709:ARG:NH1	2.01	0.73
2:B:833:ARG:O	2:B:837:ILE:HG23	1.91	0.70
2:B:745:LEU:HD12	2:B:771:ALA:HB2	1.75	0.68
2:B:745:LEU:CD1	2:B:771:ALA:HB2	2.30	0.62
2:B:785:LYS:HB2	2:B:787:ARG:NH2	2.15	0.61
2:B:710:GLU:HG3	4:B:103:HOH:O	2.01	0.61
1:A:130:ASN:HB3	4:A:332:HOH:O	2.02	0.59
2:B:825:THR:HG22	2:B:836:LEU:HD12	1.83	0.59
1:A:137:TYR:CE2	1:A:139:ARG:HG3	2.39	0.58
1:A:6:VAL:HG23	1:A:73:LEU:CD2	2.35	0.57
2:B:832:ARG:O	2:B:836:LEU:HB2	2.06	0.56
2:B:789:LEU:HD22	2:B:800:LEU:HD23	1.89	0.54
2:B:836:LEU:O	2:B:840:MET:HG3	2.07	0.54
2:B:831:GLU:HG3	2:B:832:ARG:N	2.23	0.54
2:B:722:ALA:CB	3:C:377:ILE:HG21	2.39	0.53
2:B:773:GLU:O	2:B:774:ASN:ND2	2.41	0.53
2:B:787:ARG:HG2	2:B:791:PHE:CG	2.44	0.53
1:A:40:LEU:HD11	2:B:853:VAL:HG21	1.91	0.53
1:A:196:GLY:HA3	1:A:198:HIS:ND1	2.24	0.53
2:B:785:LYS:HB2	2:B:787:ARG:HH21	1.73	0.52
2:B:775:LYS:HD3	2:B:777:ARG:NH1	2.21	0.51
2:B:753:SER:HA	2:B:767:VAL:HG13	1.92	0.51
2:B:836:LEU:HD13	2:B:840:MET:SD	2.50	0.50
2:B:774:ASN:ND2	2:B:775:LYS:HE3	2.26	0.50
2:B:833:ARG:HG2	2:B:833:ARG:HH21	1.76	0.50
2:B:856:ASP:OD2	2:B:858:GLU:HG2	2.13	0.49
2:B:877:LYS:HD2	4:B:63:HOH:O	2.11	0.49
1:A:154:GLU:HB2	2:B:775:LYS:HA	1.94	0.48
1:A:153:ARG:NH1	2:B:789:LEU:HD11	2.29	0.48
2:B:798:ILE:HG21	2:B:836:LEU:HG	1.95	0.48
1:A:6:VAL:HG23	1:A:73:LEU:HD23	1.96	0.47
2:B:830:GLU:OE2	2:B:834:ARG:HD3	2.14	0.47
1:A:19:VAL:HG13	2:B:867:ILE:HD13	1.95	0.47
1:A:56:ILE:HG21	1:A:61:PHE:HE1	1.80	0.46
1:A:176:LEU:HA	3:C:370:PHE:CD2	2.50	0.46
1:A:176:LEU:HA	3:C:370:PHE:HD2	1.81	0.46
1:A:194:THR:CG2	1:A:194:THR:O	2.63	0.46
2:B:850:VAL:HG12	2:B:852:LEU:HD13	1.98	0.46
1:A:191:LEU:HD12	1:A:191:LEU:HA	1.78	0.45
1:A:123:MET:HE3	1:A:127:ILE:HG13	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:858:GLU:HB3	4:B:183:HOH:O	2.15	0.44
3:C:354:PHE:O	3:C:358:ILE:HG22	2.17	0.44
1:A:190:ILE:O	1:A:194:THR:HB	2.18	0.44
1:A:29:ILE:HA	2:B:854:SER:O	2.18	0.44
1:A:162:ASN:HB3	1:A:163:LEU:CD2	2.48	0.43
1:A:180:ILE:O	1:A:184:ILE:HG13	2.19	0.43
2:B:798:ILE:HG13	2:B:832:ARG:HG2	2.00	0.43
2:B:778:LEU:HG	2:B:789:LEU:HD21	2.01	0.42
2:B:774:ASN:HD21	2:B:775:LYS:HE3	1.83	0.42
1:A:113:GLU:HA	1:A:114:PRO:HD3	1.86	0.42
1:A:191:LEU:O	2:B:709:ARG:NH1	2.46	0.42
3:C:355:GLU:O	3:C:358:ILE:HG23	2.20	0.42
2:B:721:LYS:HE3	3:C:378:THR:HB	2.02	0.42
1:A:196:GLY:HA2	1:A:197:GLY:HA3	1.94	0.41
1:A:162:ASN:HB3	1:A:163:LEU:HD23	2.02	0.40

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	197/203 (97%)	189 (96%)	8 (4%)	0	100	100
2	B	177/179 (99%)	174 (98%)	3 (2%)	0	100	100
3	C	17/34 (50%)	15 (88%)	1 (6%)	1 (6%)	1	0
All	All	391/416 (94%)	378 (97%)	12 (3%)	1 (0%)	41	41

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	C	378	THR

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	175/180 (97%)	170 (97%)	5 (3%)	42	46
2	B	156/156 (100%)	144 (92%)	12 (8%)	13	9
3	C	19/32 (59%)	16 (84%)	3 (16%)	2	1
All	All	350/368 (95%)	330 (94%)	20 (6%)	20	18

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	127	ILE
1	A	139	ARG
1	A	191	LEU
1	A	194	THR
1	A	198	HIS
2	B	729	LEU
2	B	754	GLU
2	B	767	VAL
2	B	773	GLU
2	B	774	ASN
2	B	821	LEU
2	B	828	LEU
2	B	832	ARG
2	B	834	ARG
2	B	836	LEU
2	B	837	ILE
2	B	871	LEU
3	C	358	ILE
3	C	377	ILE
3	C	379	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	A	134	ASN

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Mol	Chain	Res	Type
1	A	162	ASN

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 monosaccharides 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, 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(Å²)	Q<0.9
1	A	199/203 (98%)	0.23	15 (7%)	14	18	34, 54, 101, 164	0
2	B	179/179 (100%)	0.36	7 (3%)	39	45	32, 52, 86, 103	0
3	C	21/34 (61%)	1.57	6 (28%)	0	0	65, 95, 111, 124	0
All	All	399/416 (95%)	0.36	28 (7%)	16	20	32, 55, 101, 164	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	378	THR	5.4
1	A	92	TYR	5.0
3	C	377	ILE	4.8
1	A	162	ASN	4.0
1	A	168	THR	3.9
3	C	354	PHE	3.8
3	C	356	LEU	3.7
2	B	785	LYS	3.6
3	C	362	LEU	3.2
2	B	774	ASN	2.8
1	A	64	VAL	2.5
2	B	821	LEU	2.5
1	A	169	ALA	2.5
1	A	166	PHE	2.5
1	A	163	LEU	2.4
1	A	165	LYS	2.4
1	A	106	ASN	2.3
1	A	59	ASP	2.3
3	C	361	ILE	2.3
2	B	787	ARG	2.2
1	A	178	LYS	2.1
2	B	852	LEU	2.1
1	A	173	LEU	2.1

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Mol	Chain	Res	Type	RSRZ
2	B	834	ARG	2.1
2	B	851	ILE	2.0
1	A	39	LEU	2.0
1	A	171	LYS	2.0
1	A	63	LYS	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 ⓘ

There are no such residues in this entry.